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Buyers' Guide EDITION

AVIATION WEEK

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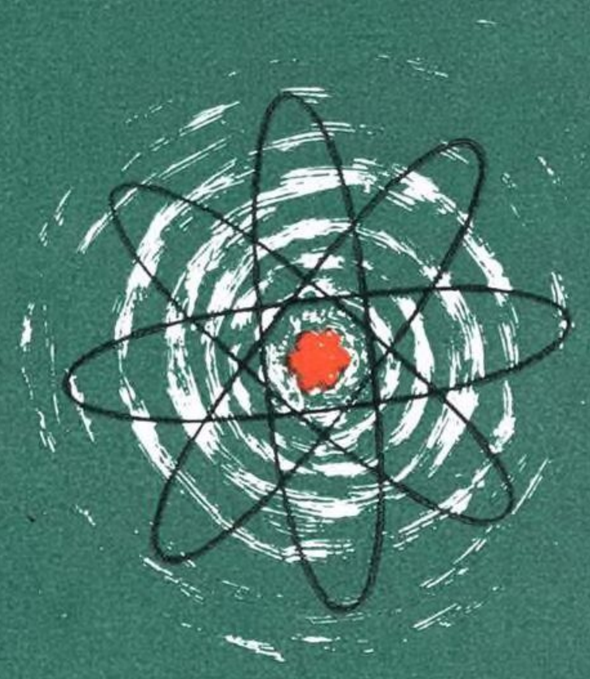

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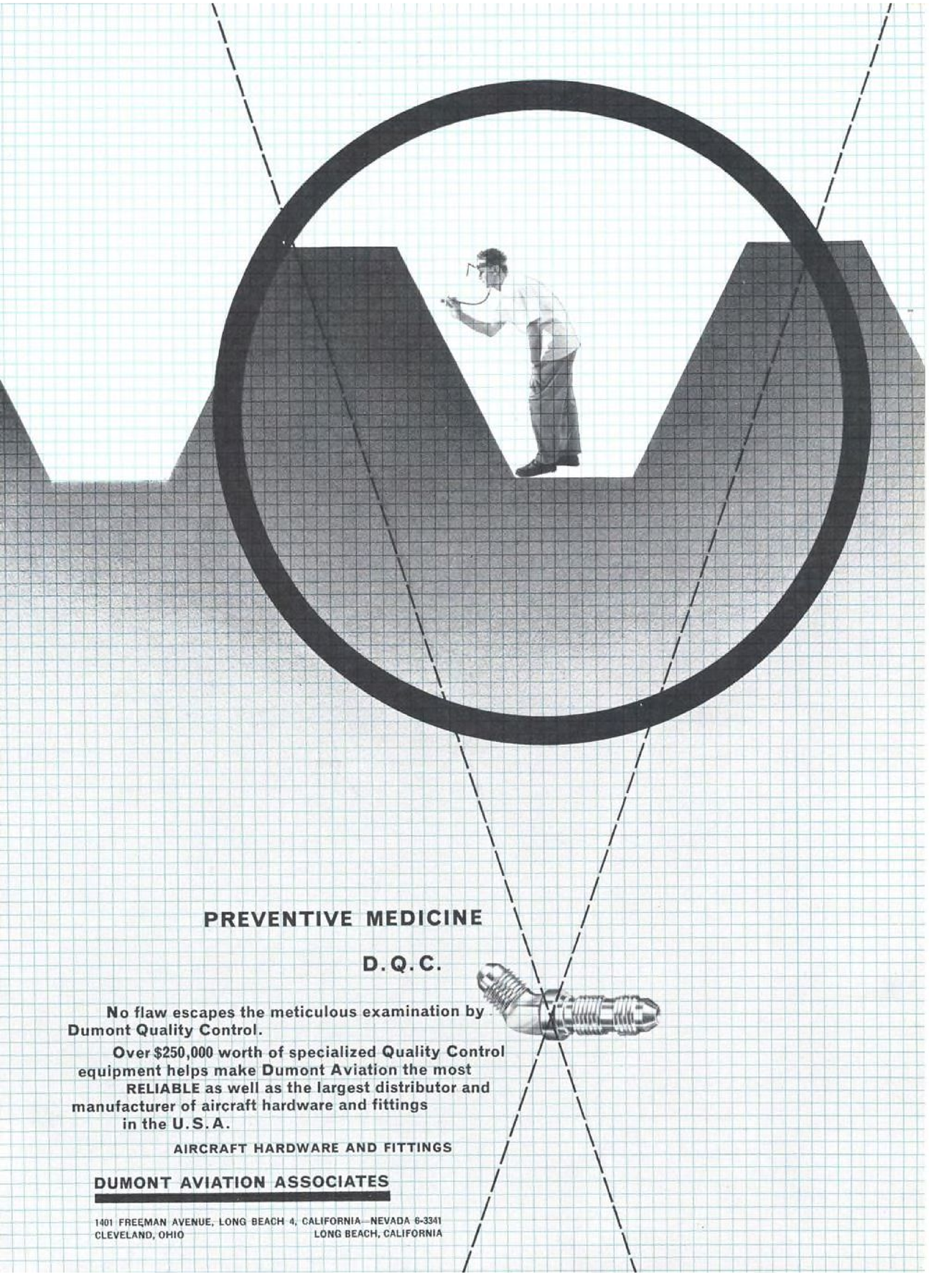

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Editorial Offices

New York 36—330 W. 42nd St., Phone LOngacre 4-3000 (NIght LO 4-3035)
Washington 4, D. C.—National Press Bldg., Phones: NAtional 8-3414, REpublic 7-6630
Los Angeles 17—1111 Wilshire Blvd., Phone MAdison 6-4323

PUBLISHER.....Robert W. Martin, Jr.
EDITOR.....Robert B. Hotz

MANAGING EDITOR.....Alpheus W. Jessup
ASST. MANAGING EDITOR (Technical) David A. Anderton
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SAN FRANCISCO 4.....68 Post St.
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The 1955-56 Aviation Week Buyers' Guide was compiled with the cooperation of almost 3,000 representatives of the aircraft and associated industries. It is intended to serve as a standard reference on the procurement and sales of aerial weapon systems.

Members of the staff of Aviation Week prepared the Buyers' Guide under the direction of David A. Anderton, Assistant Managing Editor (Technical).

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For New Weapon Systems . . .

Engineer Holds Buying and Selling Key

The 1955-56 Aviation Week Buyers' Guide is geared to keep pace with the revolutionary changes forced upon the aircraft industry by the introduction of the weapon system.

The key man in the buying and selling of weapons now is the engineer. To his major function as researcher, developer or designer, he has added two roles of equal importance; he is his own salesman and his own purchasing agent.

At the same time, the traditional tasks of salesmen and buyers have been extended to include new supporting functions in advising and aiding engineers in the many nuances of contract negotiations, prices and schedules.

Working together within the organizational framework of the weapon system, the sales, buying and design teams have achieved a technical unity that was impossible under the original scheme of separate departments.

This first Aviation Week Buyers' Guide was planned to help these teams in their major task of strengthening the air power of the free world during the age of peril.

Two major factors have placed responsibility for weapon system procurement squarely in the laps of the engineers:

- Technical complexity of new systems demands that they be sold by engineers to engineers. They have specialized knowledge necessary to buy or sell a computer-controlled system, a rocket motor injection head, or a magnetic amplifier.
- Time can be saved and the possibility of misunderstanding avoided by the engineering purchase or sales of engineered systems, rather than by following the old routes with salesmen or purchasing agents as middlemen.

But while the engineer has the design know-how, he doesn't know where to go or whom to see; the opposite is true for the salesman or the buyer.

In extreme cases, these people don't even know—let alone understand—each others' problems.

For those reasons, this Buyers' Guide is divided into three major groups of material: the first is a series of articles on the techniques of doing business with the military services and the airlines; the second is a detailed listing of the people who do the buying for the military services and the airlines; the third is a comprehensive listing of the myriad of manufactured items that make up the shiny interceptor, the colorful airliner and the black-and-white missile.

SECTIONS OF GUIDE

One of the many new features of the Aviation Week Buyers' Guide is the division of manufactured products listing into six separate sections.

This has been done for maximum convenience in finding any particular item. The six sections include:

- Section A: Aircraft. The products that are installed either complete or as major systems in an airplane are listed within this section. Powerplants, major components, such complete units as seats or control assemblies are to be found in Section A. But the section does not include fasteners, hardware, raw materials and other items that are common to airplanes, missiles, vehicles and avionic equipments; they are listed separately.
- Section B: Missiles. During the past decade, the guided missile has grown from an engineering toy to an operational field weapon system, and as such, is treated separately in a section of its own. Listings are similar to those in Section A, but are applicable specifically to missiles. Specialized supporting equipment, such as missile launchers, are also listed, but common support items are not included here.
- Section C: Avionics. The 100-fold growth of this new industry over the past fifteen years is reflected in the galaxy of specialized equipment listings in this section. The items include all the common parts—tubes, transistors, switches and rheostats—that are the building blocks of the complex equipments. Listed also are the large radars and computers, fire-control systems and specialized units that supplement and extend man's knowledge and control of a weapon.
- Section D: Supporting Equipment. In the development of a weapon system, one of the first things the manufacturer realizes is that he has to build or buy a lot more than an airplane or a missile. He may have to supply automotive equipment or special trainers or teach a seminar course. The increasing importance of the task of support of a weapon system is recognized by setting these items apart in a category of their own. These are the ". . . shoes and ships and sealing-wax . . ." items, from office furniture to explosive rivets, from machine tools to paint and lacquer. This section includes all the hardware items, fasteners, raw materials and services that go into supporting functions.
- Section E: Nuclear Systems. The aircraft industry is deeply involved with the atom and the energy in its nucleus. With almost every major aircraft company conducting studies of nuclear power, the next few years should see the completion of at least one nuclear engine for aircraft propulsion. This section lists not only certain tangible items related to nuclear systems, but also—in recognition of one of the major problems facing the industry—the academic and Government centers of training and education in this newest science.
- Section F: Airline and Airport Equipment. The burgeoning business of air transportation has far outstripped almost every prediction ever made for its growth. In this section are listed the hundreds of companies, small and large, that sell transportation of people or cargo; the manufacturers of large fixed items like hangars and runways and lighting systems; and the services of airport constructors.

SPEEDING DEVELOPMENT

The major aim of efficient buying is the same as that of efficient engineering: to reduce the development time lag between the prototype and production items. During the past few months, these changes have been made by the military in an attempt to cut months off the development cycle:

- Purchasing operations have been streamlined. Both the Air Force and the Navy have reorganized and redirected their purchasing efforts to eliminate unnecessary frills, and to make it easier for a prospective supplier to do business with them.
- Requirements are being shared with industry. In tackling the knotty problem of how best to buy research and development, USAF's Air Research and Development Command has set in motion a new plan for sharing its thoughts on future weapons needs with industry. In effect, ARDC is trading its long-secret studies of future requirements for time saved in the development cycle.

On the side of industry, some companies have developed special techniques for aiding their prospective subcontractors and suppliers. Among these is Boeing, whose symposium for subcontractors is described just at the start of Section A.

Airline buying follows a different pattern for each different operator. The procedures of four of the major carriers serving this country are detailed as an introduction to Section F.

The aircraft industry represents a $10-billion annual market for the next two or three years. It offers a prospective sale for almost every imaginable manufactured item or proffered service.

This Aviation Week Buyers' Guide is the first new approach to understanding and reaching that market.

HOW TO USE THE GUIDE

If you are designing . . .

You will find the names of prospective manufacturers and suppliers of the items you may require in six sections of product listings.

If you are selling . . .

You will find the names of the buyers of complete systems and components for the military services and the commercial airlines listed between pages 15 and 26. You will find manufacturers listed in six separate product sections.

If you are buying . . .

You will find many new names of prospective suppliers and subcontractors among the six product listing sections.

Advertisers in the 1955-56 Aviation Week Buyers' Guide are listed in bold face capital letters.

Sales Near $10 Billion Mark for 1956

By Robert Hotz

The aircraft industry will continue close to its post-war peak levels during 1956. Outlook is for a stable military production of airframes, gas turbine engines, missiles and avionic gear at about the 1955 level with an increase in commercial production of transport aircraft for the airlines and executive type planes for the growing business flying market.

Profits for 1955 will remain close to the 1954 level for the industry as a whole but with larger discrepancies between the net incomes of individual firms as results of the new military policy of selective buying become more pronounced. The profit picture for some firms will be clouded by effects of the Renegotiation Act. The Renegotiation Board has nearly completed its redeterminations of 1952 profits in the aircraft industry and will soon start checking the increased profits of 1953.

The industry will place heavy emphasis on research and development activity as the premiums in military business for technological breakthroughs on new aerial weapons systems become greater. Much of the industry's capital expenditures will be for new development facilities including supersonic wind tunnels, gas turbine engine laboratories, and missile test facilities.

Military customers—the Air Force, Navy and Army—will continue to take the largest slice of the aircraft industry output during 1956. The three services have about $25 billion available in funds, appropriated by Congress but not yet expended, for aerial weapons system hardware and support.

Military sales will continue at about the 8.5 billion level of the 1954-55 period during 1956 while commercial business including both the airline and executive plane market will run close to the billion dollar mark.

Three factors are the principal influences in the aircraft industry:

1. The rapid progress being made by the Russians in development of modern aerial weapons and atomic armament. There is no argument now in Pentagon, White House or Congress that the Russian rate of progress during the past three years in these fields had outstripped all our estimates. Nor is there much argument against accelerating the pace of our development effort and enlarging the scope of aeronautical research.

In addition, production of our most advanced weapons such as the supersonic Lockheed F-104 fighter, the McDonnell F-101 long-range interceptor and the Boeing B-52 strategic bomber will be accelerated during 1956.

2. The rapidly increasing pace of aviation technology. Trevor Gardner, Assistant Secretary of the Air Force for Research and Development, recently said:

"We are trying to make more technical progress in aviation during the next five years than we have in the whole previous fifty years of powered flight."

This rapid technological progress induces a swift rate of obsolescence among aerial weapons systems and requires a quick replacement factor.

AIRLINE RE-EQUIPMENT

3. The necessity of the world airlines to re-equip their fleets with gas turbine powered transports. During the last quarter of 1955 nearly $1 billion in orders for turboprop and turbojet transports were placed with U. S. manufacturers alone. Equipment purchases by airlines will reach an all-time peak during the next five years as airline passenger and cargo volume soar to new levels, stimulated by the high-efficiency, low cost operation possible with gas turbine powered transports.

Plant expansion will continue at a modest level confined principally to new guided missile facilities located in the Midwest and Southwest and the previously mentioned research and development facilities.

The military aviation market for the next five years will be dominated by four major new tasks confronting the Air Force.

These tasks are:

- Air defense system. The problem of building an adequate air defense system for the North American continent against attack by supersonic aircraft and guided missiles poses tremendous technical, production and logistics problems. Little more than a beginning has been made on this job.
- Air logistics system. The supersonic pace of modern air war cannot be tied to the snail's pace of surface transport. Air Force has already begun establishment of an air logistics system that now moves all high cost items such as jet engines and avionics gear from factories and depots directly to operating units. This means development of new type jet transports and widespread application of electronic computers to eliminate hand work.
- Nuclear power. Development of nuclear powered aircraft is a top priority military program embracing almost all engine manufacturers and large airframe builders. It will require special technical skills of an entirely new variety.
- Intercontinental ballistic missiles and space satellites. Two major programs are already under way to produce missiles reaching top speeds of Mach 20 with a range of 5,000 miles. A program to produce the first space satellites for launching in 1957 has also been organized.

MISSILE GROWTH

The guided missile business will grow during 1956 to the $1 billion level for the first time as one generation of missiles goes into large scale production and operational use while a second generation of more complex missiles emerges into the advanced development stage. Defensive missiles such as the Douglas Nike, Convair Terrier and Bendix Talos are in the production stage. Subsonic offensive missiles such as the Douglas Honest John, Firestone Corporal, Vought Regulus and Martin Matador are also in operational use. For offensive aerial armament the Hughes Falcon and Sperry Sparrow are in production.

Next generation of missiles includes more sophisticated concepts such as the Boeing Bomarc defensive missile system; the Fairchild Petrel, anti-submarine missile; the Northrop Snark and North American Navaho, both intercontinental cruise type missiles; and finally the long-range Convair and Martin ballistic missiles.

The market for commercial aircraft will boom during the next five years due to increasing demand for airline transports and executive type business planes. The total market for gas turbine powered airliners is estimated at about $9 billion but with the new route expansion and competitive encouragement policy of the Civil Aeronautics Board air traffic and equipment demands may exceed current forecasts. Business flying is a steadily growing market not only for new aircraft in the $800,000 price range on down to $15,000 four-place planes but also for avionic equipment, maintenance and special equipment. Business flying now pays an annual maintenance and operations bill of about $500 million.

AVIONIC AIRWAYS

Development of the military air defense system and air logistics system combined with the heavy growth of airline and business traffic volume is dictating development of a new federal electronic airways system to handle this rapidly increasing number of planes using the North American air space in all kinds of weather. Present programs call for expenditure of about $500 million on electronic ground equipment for this system during the next five years with a corresponding amount required for purchase of airborne equipment by commercial users of the airways system.

The helicopter market will grow slowly with the bulk of sales still being military. Major growth in the transport helicopter field of commuter and interurban service is still awaiting the appearance of the 35-40 passenger twin engine type helicopter.

AIRPORT CONSTRUCTION

Development of a new system of military and civil airports throughout the world to accomodate jet aircraft and the high traffic volume already in sight will mean continued high-level activity in this field. Military airport construction will continue close to the $1 billion annual level of the past year and civil airport building will run close to $150 million annually for the next few years with an increasing tempo of construction likely by 1958.

During the next two years aviation will register its largest growth in the commercial fields while maintaining the solid backlog of military business that has expanded its production capacity to the largest in history.

USAF Buying $10 Billion in 18 Months

By Claude Witze

The United States Air Force is the world's biggest business, which means it is the world's biggest single market.

• It has assets of $70 billion, or $12 billion more than the combined assets of the 24 largest corporations in America.

• It buys more than a million separate items each year. For these items, it spends more money than is laid out for all kinds of material and merchandise for the combined purchases of U. S. Steel, duPont, Standard Oil of New Jersey, American Telephone & Telegraph and General Motors.

• It will take delivery on $10 billion of supplies and equipment during the next 18 months.

Purchasing agent for most of this material is the Air Materiel Command, with headquarters at Wright-Patterson Air Force Base, near Dayton, Ohio. AMC controls nearly 43 per cent of USAF's assets, or about $30 billion. This is $6 billion more than the combined assets of the Metropolitan Life Insurance Co. and the Bell Telephone System.

One of the first things a businessman must learn about the Air Force and AMC, its monster purchasing organization, is that trips to the Pentagon in Washington or Wright-Patterson AFB are both unnecessary and impractical.

AMC is decentralized. This is done both for the convenience of the businessman and the efficient operation of AMC's procurement activities.

There are 18 Air Procurement Districts (APD) scattered over the United States from Boston to San Diego and Milwaukee to Atlanta. Almost without exception, these offices are in downtown locations. They provide the contractor's main contact with the Air Force, from the time he is exploring the possibility of making a sale to AMC until the office is administering the contract.

At the beginning of this cycle, the APD is prepared to give potential contractors all the necessary forms and information needed to make a proposal or submit a bid. The office is staffed to help the businessman solve labor, facility and material problems. It has available information on quality control, finances, plant security or any of the other great unknowns that loom for the first time when a manufacturer starts selling to the Air Force.

Each APD office has a bid board displaying copies of pending procurements. This includes both formally advertised purchases, to be bought from the most economical and reliable sources, and those negotiated procurements considered suitable for award to small business concerns.

With only two exceptions, actual awarding of USAF contracts is done domestically by eight Air Materiel Area headquarters, seven Air Force Depots and Headquarters, AMC. Both product and location are factors in determining where a contract is awarded.

A list of these offices is on page 15 along with the procurements over which they have responsibility.

AMC spokesmen emphasize that the prospective bidder should contact his APD, not the AMA or depot. It is both possible and likely that a contractor will be asked to visit an AMA or depot in the course of his negotiations, but he should not do this until requested. Once the contract is awarded, it is administered through the APD office.

Sources Listed

When an APD learns a new supplier in its district is interested in seeking an AMC contract, the first step is to place the firm, if eligible, on the Procurement Sources List. This serves the obvious double-barrelled purpose of giving AMC a list of potential suppliers and insuring that the contractors will be notified when an opportunity appears.

The potential supplier can get on the Sources List by paying a personal visit to his nearest APD office. An equally efficient method is to write a letter to the commanding officer of the APD. The request should be accompanied by pertinent information about the business, such as details of present activity, number of employees and products sold or manufactured.

In response to this, the company will be sent a Bidders Mailing List Application, Air Force Sources Lists and complete instructions. The instructions will explain how to select and mark the code numbers of products the firm can supply. The completed application and marked sources lists must be returned to the APD office.

As a result the company and its abilities will appear as tiny holes in the cards used by mechanized tabulating machines. The cards will be on file at AMC headquarters and the appropriate field buying installations for the products available from the plant.

While USAF discourages visits to Air Materiel Areas and depots at this stage, it does not discourage visits to APD offices. It encourages them. There are many advantages to discussing business problems and getting direct information from AMC experts located in APD offices.

One of the things that will be brought to a potential supplier's attention at this point is that separate commodity lists exist for each individual buying activity. There is one for the items bought at AMC headquarters and one for each of the AMA's and depots.

All commodity lists must be scanned for sales possibilities. The lists are, of course, available at the APD office.

Bids and Proposals

At this point, two more forms demand full attention from the would-be contractor: IFB and RFP. They stand for Invitations for Bid and Requests for Proposal.

Invitations for Bid (IFB) are mailed to firms on the Sources List by the procuring activity—AMC headquarters, the AMA or depot. They go out to all companies that expressed an interest in manufacturing a particular item to be purchased through formal advertising. The IFB can be obtained upon request even if a firm is not on the Sources List.

Requests for Proposal (RFP) are mailed to firms already established within the system who are known to be capable of producing a certain item. They are a preliminary to negotiated procurement.

Normally, procurements are advertised whenever and wherever possible; it is not necessary to be on a sources list to know about IFBs and RFPs when they are in circulation.

Partly because of the growing emphasis placed on the contribution of small business, the documents are posted in APD offices when the product sought is one suitable for production by a small business plant.

Business Listed

News of this future business also is published in trade and daily papers as well as the "Synopsis of U. S. Government Proposed Procurement and Contract Awards," published in Chicago by the Department of Commerce. It is a daily report that can be obtained by subscription.

USAF Purchase Requests, which are the internal documents authorizing AMC to start buying, usually are submitted directly to the buyer of that particular equipment. The buyer then refers to the sources system in order to find out which firms to contact.

AMC emphasizes that every effort is made to get in touch with all available sources whenever an item comes up for procurement. This is the way in which new contractors, who never did any business with USAF, get invitations to bid or submit a proposal for negotiation.

However, the only way a company can be sure of receiving IFBs or RFPs in ample time for submission of bids is to make sure it is listed in the Sources System for all items it is capable of producing.

Local Purchases

Like the other armed forces and branches of the government, USAF buys a vast amount of housekeeping items identical with goods on the commercial market for civilian use. Many of these come under the category of "Local Purchase" and are put there as part of USAF's effort to have its installations benefit local business where practical.

This buying, usually from nearby firms, is done by Headquarters, depot or base purchasing and contracting officers. A typical "Local Purchase" list is on page 20.

A Qualified Product, to the Air Force, is an item that has been tested and found to meet certain specifications as to quality and performance. There is a Qualified Products List of items that have met this test and the names of their makers.

USAF requires that an item be qualified prior to procurement when any of the following conditions prevail:

• **The time required** for testing after award will unduly delay delivery.

• **The cost** of repetitive testing is excessive.

• **The tests require** expensive or complicated testing apparatus not commonly available.

• **The interest** of the Government requires assurance, prior to award, that the product is satisfactory.

• **The determination** of acceptability requires performance data to supplement technical requirements contained in the specifications.

Under USAF regulations, only companies whose product is on the Qualified Product List are acceptable as suppliers for certain items.

Each specification for a qualified product tells where and how the product may be qualified, where to submit samples, etc. Qualification testing must be conducted at the expense of the manufacturer.

In the case of the Qualified Product, all roads lead to the APD office. Each APD has on file the "Index of Specifications and Publications". It includes a current list of the products which USAF feels must be proven before being bought. The list names laboratories whose qualification test results will be accepted by the Air Materiel Command.

Small Business

Of major importance in USAF procurement is the Small Business program. Under Congressional edict, a small business is one employing fewer than 500 persons. The Air Force is obligated to see that such firms get a fair share of its contracts.

To effect this, there is a Small Business Specialist and a staff at each APD office (see list on page 19). It is their job to steer defense work to small business wherever possible.

The first sifting of proposed purchases is made by a group of experts who decide whether an item is suitable for manufacture by small business. Obviously, an aircraft engine cannot be built in large quantities by a firm with fewer than 500 employees. But there are hundreds of items which are suitable and, in fact, may be made more economically by small business than large corporations.

Lists Circulated

The Small Business Specialist at each APD office keeps a list of these firms; it is circulated to all procurement areas and depots to insure full recognition of those firms capable of taking a contract.

While the growing complexity of weapons systems tends to reduce the small business potential from AMC, the Air Force effort to benefit these firms has increased their ability to win contracts for the items they are capable of making. These companies today probably make 75 per cent of the items they can build by virtue of their skill and facilities, as judged by USAF.

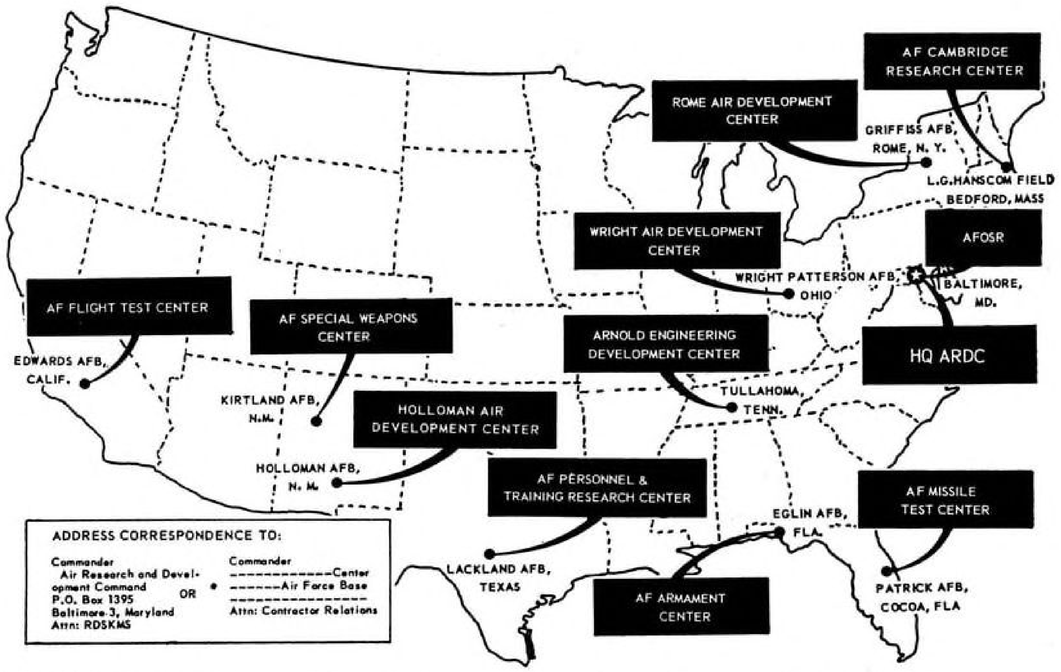
In practice, most small business sales ending up in USAF inventory are made to prime contractors. It is as subcontractors that most of their manufacturing is accomplished. Hence, the APD Small Business Specialist is armed to direct small business representatives to prime contractors in the region. He is prepared to advise and help small business in obtaining subcontracts from USAF prime contractors.

To put teeth in this program, prime contracts contain a clause requiring the weapons system manufacturer to utilize the facilities of small business.

Revisions of Specs

A final subject of major interest to the potential USAF contractor is specifications. These pieces of paper are undergoing continual revision. For this reason, USAF usually does not furnish them until procurement of an item has been initiated.

Specifications normally are mailed out with the IFB or RFP. The APD office maintains a file of them, even when outdated, and they can be examined by any interested party. Because printing of specifications and drawings is expensive, USAF discourages wide distribution and requests that copies be sought only in the interest of national defense.



ARDC CENTERS scattered throughout U. S. are prospective contractor entrances into weapons development cycle.

ARDC Trades Secrets for Progress

Baltimore—The United States Air Force buys research and development effort, a commodity that may be more important in 1956 than ever before in history.

Much of this effort is more or less intangible and what hardware comes out of it never goes to a combat unit. In the past, there has been a huge amount of the effort thrown away. Drastic corrective steps to halt this waste of talent and know-how have been taken in recent months.

Permeated as it is with uncertainties, the business of selling this R & D effort still should be easier in the future than it has been in the past. It is bought for USAF by the Air Research and Development Command, whose Baltimore headquarters here and its scattered centers were startled a few months ago by a Russian air display over Moscow. The aerial show did not betray anything about the actual size of the Soviet Air Force, but it most certainly was a jolting report on the status of the country's R & D effort. This much was sure: Russia has shortened its development cycle for weapon systems and the U. S. must do likewise.

The result is that ARDC is looking for "big jumps" and it is, by degrees, making available much previously classified material. The reason for this is simple enough. If the nation's industrial and institutional brains are going to help meet the Soviet challenge they have to know where they are going.

Need to Know

ARDC spokesmen at Baltimore would preface any further discussion of this topic with observations for the potential contractor who may not realize that a unique procurement organization and policy is vital to make possible the purchase of R & D effort. They want it clearly understood that the accepted maxims of traditional supply procurement, those followed, for example, by the Air Materiel Command, do not apply in this field of activity.

Examine a few of them in the light of ARDC's problems:

• **Always buy the best product.** R & D procurement often does not even involve a "product." What comes out of an exploratory research project may be nothing more than a report saying the project is a bad idea. Although a prototype is hardware, it does not come out of a production process. No R & D item or report, says ARDC, can be defined "at the time of negotiation with anything approaching the clarity possible in supply procurement."

• **Always get the best possible price.** This is a difficult problem in R & D procurement, largely because price rarely can be the all-important factor that it is in purchasing a production item. ARDC recognizes that the contractor cannot predict cost of materials, amount of work or quantity of production. His price is meaningless but his technical competency may be worth a lot of money. If he is the only competent contractor, no one will argue with the fee. Says the command: "Obviously negotiation rather than advertisement is the basis for pricing in research and development, and obviously too it is very often negotiation complicated by the relative absence of competition. When the need for new advances in a given area is sufficiently great, it is up to research and development procurement personnel to obtain them; this is the overriding consideration."

• **Always maintain adequate controls** to insure adherence to the contract. This is almost impossible in a case where ARDC may hire the brains of a mathematician who may spend six months

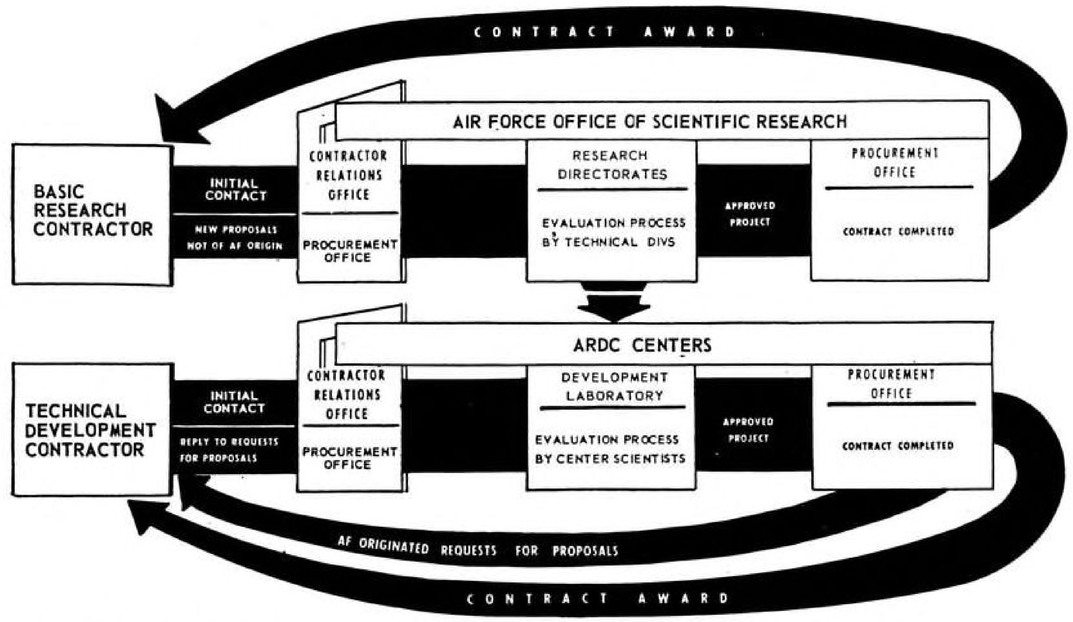


FIGURE 2: Regenerative circuits of research and development tie the contractor to the Office of Scientific Research.

thinking. This is an extreme example, as far as possible from the business of buying hardware, but it proves that ARDC cannot measure progress by production units or any other tangible. ARDC puts it this way: "Contractual controls and evaluation of progress must, in research and development procurement, be replaced to a large extent by faith in the contractor's ability and integrity."

• **Always have stringent criteria** for evaluating final acceptability of the product. If ARDC tried to do this it wouldn't be research or development. The government always has to protect its interests and there are ways of doing this, but scientific imagination also has to be given free rein. "There is a careful balance to be attained here," ARDC spokesmen say, "between the need for financial controls and the undesirability of technical controls. . . . It is in the area of research that this balance is most difficult to achieve. As the work becomes less abstract, more tangible, more within the state of the art, the need for freedom and the difficulty of imposing these controls decrease."

Documents Available

Having his approach tempered by the above declaration of the facts of life, so far as ARDC contracts are concerned, the prospective supplier of R & D capability next should know that new paths are being opened as swiftly as possible. This reverts back to the Russian threat and the priority given to "big jumps."

In the past the door was open, for the most part, only to contractors of proven capability. However, in the present situation ARDC is taking more people into its confidence.

Already, its secrets are being disclosed and a large number of ARDC's contractors are being given access to the Technical Program Planning Documents. These papers accomplish four important things:

• **They state and define** the military job USAF will have to do some 10 or 15 years in the future. Each document does this for one of 46 broad, functional areas, such as strategic bombing, communications, navigation and active bomber defense.

• **They evaluate present technical capability** in the area and point out the limitations of current materiel and techniques. In this sense, they show how far we are from solving the military problem.

• **They give pertinent research** summaries, proposed innovations and suggested approaches. This is mainly to save time for the contractor and stimulate his thought.

• **They present ARDC's technical** requirements and spell out performance objectives. There is an average of three requirements to each document.

Regular USAF contractors already are receiving these documents. What is more important is that early in 1956 they will become available to any potential contractor—company, laboratory or university—that can get proper security clearance. The aim here, according to Brig. Gen. Thomas L. Bryan, Jr., commander of the Wright Air Development Center, is to tap "the very roots of American science and technology."

Inquiries on the subject should be directed to the Commander, Air Research & Development Command, P. O. Box 1395, Baltimore, 3, Md. Attention: RDTD, Development Plans & Programs, Director of Development.

Process for Contractors

When it comes to getting an actual contract with ARDC to conduct basic research or technical development, a firm must first enter its name in the Master Source file at the Procurement Office in Baltimore. This is called the contractor's "point of entry."

In addition to headquarters, a list of industrial and scientific agencies qualified to participate in ARDC projects is maintained at various R & D centers in the U. S. (see Map, page 10).

There are two ways to obtain information on the process of being listed as a source. One is to write a letter to ARDC headquarters; the other is to visit the Contractor Relations Office at headquarters or one of the centers. A company that needs a security clearance can start action at the Office of the Provost Marshal at any ARDC installation.

ARDC purchases R & D effort in three general fields:

• **Basic research (see Fig. 2).** Primary

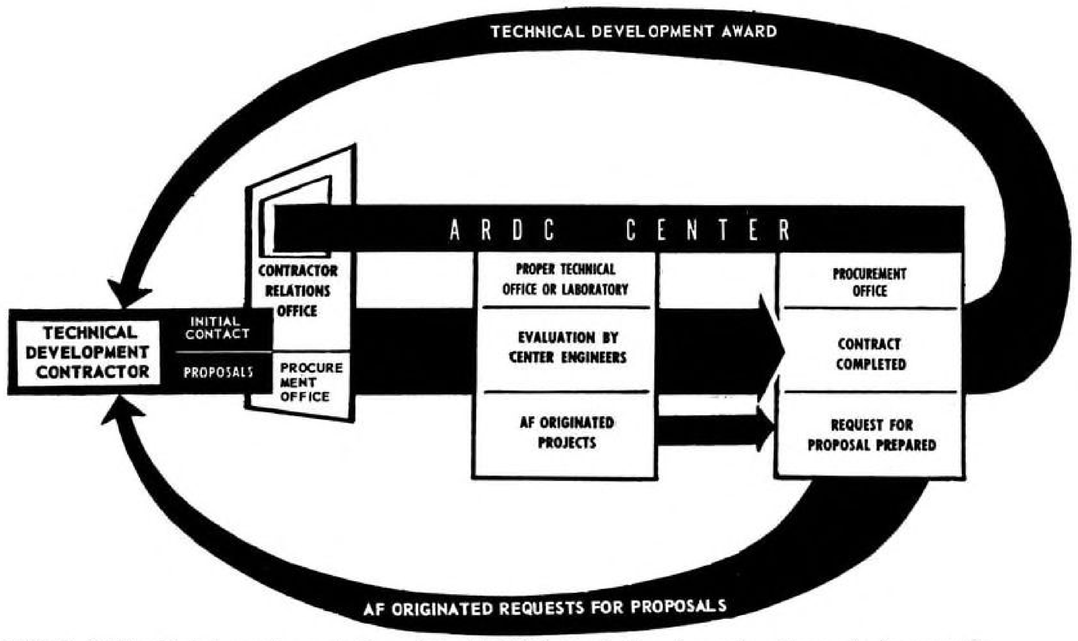


FIGURE 3: Relationship between the contractor and the ARDC Center is through awards and requests for proposals.

support is from the Air Force Office of Scientific Research, Baltimore. Work is concerned with "fundamental, theoretical or experimental investigation to increase man's knowledge and understanding of the natural world." From the Contractor Relations Office, firms are referred to OSR personnel. These scientists will discuss the proposed investigation with company representatives and then refer them to the proper people at the proper ARDC center. If the project is approved, the contract may be monitored by OSR or the center primarily concerned.

• **Technical development** (see Fig. 3). Primary support is from the cognizant ARDC center. Projects involve "exploration of existing knowledge, material and techniques to obtain an experimentally demonstrated capability to satisfy an existing or anticipated military requirement." The cognizant center will give advice on the project and do the procurement. A company with a development of its own that will meet a requirement may submit a proposal. If an item, old or new, meets operational and functional tests, it may be bought in production quantities by the Air Materiel Command.

• **Major systems proposals** (see Fig. 4). These are always handled by headquarters, ARDC, at Baltimore. It is here that USAF recognizes the complexity of modern weapon systems, puts its basic reliance on major prime contractors. What USAF needs comes out in the form of General Operational Requirements or Development Directives. A prime contractor with a new weapon system proposal submits it to ARDC. Separate sub-component systems such as propulsion, armament, communications navigation and automatic flight control, would be submitted to the cognizant center.

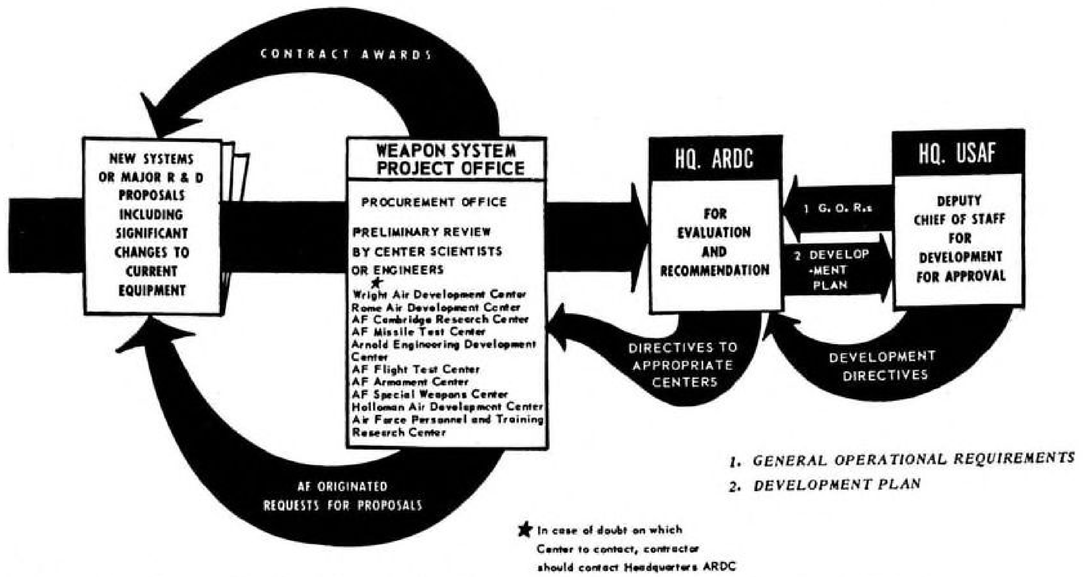


FIGURE 4: Systems proposals link USAF and ARDC Headquarters with ARDC Centers and technical contractors.

There is little doubt that the state of flux into which ARDC was plunged by the events of 1955 will continue for some months to come. Effective last Aug. 1, an internal realignment of responsibilities brought about the creation of new posts for Deputy Commanders in charge of Weapons Systems, Research & Development and Resources.

It was only the first step in a series of changes in organization, policy and approach designed to meet the critical need for weapons in the field before they become obsolescent. For the most part, the rest of the job is industry's.

Tradition and Logic Govern Navy Procurement of Air Items

The Navy buys about $2.5 billion worth of aircraft and related equipment annually, but not all of it through the Bureau of Aeronautics.

BuAer has cognizance over the weapon system when it is new, and follows it through design, development and production.

But BuAer doesn't buy aircraft spares, and it doesn't buy a lot of other aviation materiel that could be logically channeled through other offices.

Tradition as well as logic governs the procurement of some of the Navy's items. The Bureau of Aeronautics is young by Navy standards, much of the Navy's procurement earlier had been thrust upon people who had been in the business for a long time. The channels were established.

Here are some examples:

• **Missiles and fire control** equipment are bought by the Bureau of Ordnance, as well as BuAer.

• **Electronic equipment** is purchased by the Bureau of Ships, the Marine Quartermaster General, Aviation Supply Office, Electronic Supply Office, BuAer, and others.

• **Aircraft spare parts** are bought by the Aviation Supply Office.

• **Seaplane landing equipment,** such as pontoons designed for this purpose, fall in the jurisdiction of the Bureau of Yards and Docks.

There are many other instances. The breakdown of Navy procurement responsibilities is given in detail in an accompanying list of offices and their areas of interest.

General information on Navy procurement is best obtained from the Industry Co-operation Officers at the Navy's field inspection offices, particularly those in Atlanta, Boston, Chicago, Cleveland, Dallas, Kansas City, Minneapolis, New York, Los Angeles, Philadelphia, San Francisco and Seattle.

Recent reorganization of the Bureau of Aeronautics (AW, Sept. 5, p. 12) resulted in the creation of a new Assistant Chief for Procurement, a change of major importance to Navy weapon system contractors. Rear Admiral George F. Beardsley is in charge of the streamlined operation and provides a new point of entry for contractors through his Contracts Division.

The Navy has many procurement procedures that are similar to those of the Air Force.

Among these:

• **Each purchasing office** maintains source lists for the items it buys. To get on the list, apply to the appropriate purchasing office for the Bidder's Mailing List Application form.

• **Specifications** for an item under purchase ordinarily are included in the Invitation for Bids. For specifications not under current procurement, write to the Naval Supply Depot, Scotia 2, N. Y., except for those concerned only with the Bureau of Aeronautics. In this case, send the request to the Naval Air Development Center, Technical Records Division, Johnsville, Pa.

• **Navy uses** both advertised and negotiated contracts. In advertised procurement, the Contracting Officer sends out Invitations to Bid to firms on the bidder's list. In negotiated procurement, proposals are requested from firms on the same list.

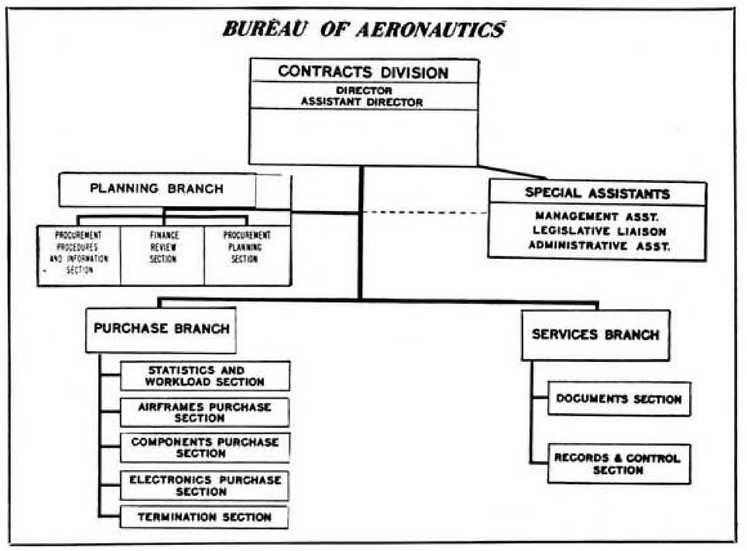
• **There is** a Qualified Products List. Each Navy purchasing office encourages manufacturers to submit their products for qualification.

Navy puts particular effort into the Small Business program.

BuAer has its own Small Business Office at headquarters in Washington, headed by Commander J. S. Paretsky. By personal visit or written inquiry, the small business operator can have his capabilities evaluated and, if qualified, be placed on the list.

Qualification in this case may include an inspection of the plant by a BuAer representative. As a rule, however, general plant inspection is not required for placement on the bidder's list for commercial type products, equipment, material or supplies, except when the financial or technical competency of a firm is questioned.

Navy also puts great emphasis on the opportunity of sub-contract work for its prime contractors. Alone of the services, Navy publishes a list of its prime contractors by location, along with the small business sub-contract representative of the company.



Services List Nine Contract Types Governing Buying of Military Items

One of the major responsibilities of the negotiator is the selection of the type of contract best suited to the procurement which he is conducting. His choice will have an important effect on the ultimate cost of the contract, on the incentive given the contractor to use materials and manpower efficiently, and on the nature of the supervision which must be exercised over the performance of the contract. While early agreement between the negotiator and the contractor is desirable, the negotiator should not hurry the decision on the contract type to be used. This decision will be based on a number of factors: the nature of the procurement, the contractor's production and cost experience, the degree of competition present, the availability of comparative cost data, the assumption of business risk, and the extent of the control which can and should be maintained over the contractor's operations. It is doubly important to avoid a premature decision, because the course of the negotiations will be considerably influenced by the type of contract contemplated for use.

Under certain circumstances it may be desirable to obtain greater flexibility in contract negotiations by asking the contractor to quote prices on more than one type. In such circumstances, if only one type of contract is considered and quoted upon and if, during negotiations, this proves unsatisfactory, a new contract proposal undoubtedly will be required, and much time and effort will have been wasted.

If it were always possible to establish firm prices which were fair both to the contractor and the purchaser, the determination of the most suitable type of contract would be no problem. A Firm Fixed Price contract would be used for all procurements. But the determination of fair prices for many items purchased is often a difficult, if not an impossible task. For this reason, several major types of contract have been authorized for use by negotiators, as well as a number of specialized types designed to meet specific situations.

I–1 Firm Fixed Price Contracts

A. Explanation
  (a) Supplies or services are furnished at a specified firm price regardless of actual cost of performance.
B. Use
  (a) When sound cost estimates are possible.
    (i) Commercial-type items available from competing sources.
    (ii) Military type equipment previously produced on which relevant production and cost experience are available.
  (b) When a contractor desires to share costs of a Research Contract.
C. Advantages
  (a) Places maximum risk and responsibility upon the contractor; consequently, results in the greatest incentive for cost reduction.
  (b) Easiest and least costly type of contract to administer.
D. Disadvantages
  (a) Price may include excessive allowance for contingencies.

I–2.A. Incentive Fixed Price

A. Explanation
  (a) Supplies are furnished at a tentative base price (target price). Upon completion of the work the price is redetermined based on the contractor's actual costs plus a sliding scale of profit which varies inversely with the cost. The redetermined price cannot exceed the ceiling price stated in the contract.
B. Use
  (a) When production is spread over a relatively long period.
  (b) When difficulty is encountered in negotiating a firm fixed price under the anticipated production conditions.
  (c) When target costs can be established initially or at an early interim point with substantial accuracy.
  (d) When reasonable opportunities for cost reduction through contractor efficiencies exist.
C. Advantages
  (a) Not necessary for contractor to include excessive allowances for contingencies.
  (b) Encourages cost reduction by contractor.
  (c) Government shares in contractor's cost reductions.
  (d) Government receives "after-the-fact" cost information valuable in negotiating follow-on procurements.
  (e) By varying the ceiling, the starting profit, and the profit sharing formula, contract can be adapted to fit many situations.
D. Disadvantages
  (a) Contractor has less incentive than under a firm fixed price contract.
  (b) More costly and difficult to administer than a firm fixed price contract.

I–2.B. Maximum Price

A. Explanation
  (a) Supplies are furnished at a maximum price which is redetermined downward only after a specified percentage of the work has been completed. The final price is based on actual costs incurred to point of redetermination plus estimated costs to complete.
B. Use
  (a) When sound cost estimates cannot be made at the beginning of the work, but can be made after a certain minimum percentage of the work has been completed.
    (i) Repetitive work so that cost experience on first portion permits accurate projection of completion costs.
    (ii) Work extended over a sufficient period of time to permit redetermination before completion of contract.
C. Advantages
  (a) Permits fixed price contracting even when sound cost estimates are not possible at the beginning of the work.
  (b) Final price is based on additional cost information.
D. Disadvantages
  (a) Up until the time of redetermination, contractor has little incentive to keep costs low.
  (b) Because of time lag between point of redetermination and redetermination negotiations, contractor not only has later cost information than negotiators but may have completed a very large percentage of the work.
  (c) More costly and difficult to administer than a firm fixed price contract.

I–2.C. Flexible Fixed Price

A. Explanation
  (a) Supplies are furnished at a tentative price which is redetermined upward (subject to a ceiling) or downward after a specified percentage of the work has been completed. The final price is based on actual costs incurred to point of redetermination plus estimated costs to complete.

B. Use
C. Advantages
D. Disadvantages

Identical to those listed for "Maximum Fixed Price Contract" since only difference is that price can be redetermined upward.

I–2.D. Fixed Price with Escalation

A. Explanation
  (a) Supplies are furnished at a fixed price which is subject to revision on the occurrence of specified contingencies. Applies to increases in material prices and labor rates and not to the quantity of material or labor required.
B. Use
  (a) When increases or decreases in specific costs such as material prices or labor rates are beyond the control of the contractor.
C. Advantages
  (a) Government avoids paying for contingencies that do not occur.
  (b) Permits fixed price contracting even if certain cost elements are not subject to accurate prediction.
D. Disadvantages
  (a) Government assumes part of contractor's risk.
  (b) Additional administrative problems.

II–1. Cost-Plus-Fixed-Fee

A. Explanation
  (a) Supplies or services are furnished at actual cost plus a fixed fee which is based on a negotiated percentage of the original estimated cost.
B. Use
  (a) When it is impossible to estimate costs with any degree of accuracy.
    (i) Research and development work.
    (ii) Specifications not firm.
C. Advantages
  (a) Government avoids paying for contingencies that do not occur.
  (b) Profit not based on costs so contractors have no incentive to pad costs.
D. Disadvantages
  (a) Contractors have little incentive to reduce costs.
  (b) Most costly type of contract to administer.

II–2. Cost-No-Fee

A. Explanation
  (a) Supplies or services furnished at actual cost with no fee or profit allowed.
B. Use
  (a) When it is impossible to estimate costs with any degree of accuracy. Primarily used with educational and nonprofit organizations.

C. Advantages
D. Disadvantages

Identical to Cost-Plus-Fixed-Fee Contracts.

III–Letters of Intent

A. Explanation
  (a) Supplies or services are furnished at an unspecified price. Pricing terms are negotiated when the letter of intent is converted into a definitive contract.
B. Use
  (a) When pricing terms cannot be agreed upon and the Government desires the contractor to commence work without delay.
    (i) Insufficient historical cost data.
    (ii) Unfirm specifications.
C. Advantages
  (a) Provides quick contractual coverage.
D. Disadvantages
  (a) Legally it is not a satisfactory contractual document.
  (b) Additional administrative work.
  (c) Danger of long time lag before conversion to a definitive contract.

IV–Notice of Award

A. Explanation
  (a) A TWX or letter form that specifies firm pricing terms, deliveries and specifications, but incorporates other clauses by reference. Must be superseded by a definitive contract.
B. Use
  (a) When prompt contractual coverage is required and all terms have been agreed upon.
C. Advantages
  (a) Prompt contractual coverage.
D. Disadvantages
  (a) Additional administrative work.
  (b) Not as satisfactory legally as a firm contract.

Military Sales: Where to Go, Whom to See

DEPARTMENT OF THE AIR FORCE

Commander, Air Materiel Command, Wright-Patterson Air Force Base, Ohio, Attn: Directorate of Procurement and Production, Procurement Division.

Complete aircraft; gliders; man-carrying power driven aerial targets; complete aircraft engines (combustion and jet); propellers and propeller accessories; towing equipment; gas turbines; aircraft wheels and brakes; aircraft tires and tubes; aircraft navigation, flight, and engine instruments; guided missiles; photographic equipment* (except motion and still picture sensitized materials and photographic chemicals and chemical preparations); airborne radio and radar equipment, aircraft fire and rescue units*; miscellaneous training devices; technical publications, posters, charts, and miscellaneous publications; Government-furnished property; items requiring extensive engineering, and initial spare parts for the foregoing. Research and development for end items.

Commander, Air Research and Development Command, P. O. Box 1395, Baltimore, Md., Attn: Directorate of Procurement.

Basic research. Also research and development for armament and certain other items.

Commander, Oklahoma City Air Materiel Area, Tinker Air Force Base, Oklahoma City, Okla., Attn: Directorate of Procurement and Production.

Aircraft miscellaneous accessories and maintenance parts (except belts—safety and shoulder harness); aircraft fuel, hydraulic vacuum, oil, and deicer systems.

Commander, Gadsden Air Force Depot, Gadsden, Ala., Attn: Directorate of Procurement and Production.

Air conditioning and refrigeration equipment; heating, ventilating, plumbing, and steam fitting equipment; packaging materials (except paper).

Gentile Air Force Depot, Wilmington Pike, Dayton, Ohio. Attn: Directorate of Procurement and Production.

Electrical lamps and fuses; electrical terminals, connectors, insulators, knobs, dials, capacitors, switches, circuit breakers, relays, contactors, solenoids, coils, transformers, vacuum tubes, and related items; radio crystals; laboratory and shop testing equipment; inspection gages.

Commander, Mallory Air Force Depot, Memphis, Tenn., Attn: Directorate of Procurement and Production.

Anti-friction bearings; special hand tools and tool kits; food services equipment and maintenance parts (except mess and galley utensils); live animals (for laboratory purposes); animal equipment and supplies (except saddlery, harness and whips).

Commander, Middletown Air Materiel Area, Olmstead Air Force Base, Middletown, Pa., Attn: Directorate of Procurement and Production.

Aircraft engine fuels and lubricants (except petroleum products); preventive compounds, survival equipment and parachutes; rigid airborne small craft (power sail and non-propelled—as related to marine life-saving); aircraft, training aids, and miscellaneous instruments and maintenance parts; electrical meters.

Commander, Mobile Air Materiel Area, Brookley Air Force Base, Mobile, Ala., Attn: Directorate of Procurement and Production.

Miscellaneous aircraft engine accessories and maintenance parts (except non-electrical starters); aircraft breathing oxygen equipment; rigid airborne life boats, power-propelled and related equipment (except as assigned to Army and Navy).

Commander, Ogden Air Materiel Area, Hill Air Force Base Ogden, Utah, Attn: Directorate of Procurement and Production.

Aircraft hydraulic struts and actuating cylinders.

Commander, Rome Air Force Depot, Griffis Air Force Base, Rome, N. Y., Attn: Directorate of Procurement and Production.

Commercial electrical equipment and supplies; flying field night-lighting equipment; electric wire and cable; photographic chemicals and chemical preparations*; motion and still picture sensitized materials*; ground radio, radar and navigational equipment; meteorological equipment and supplies; structural and installation parts for ground communication and electric equipment; telegraph, teletypewriter, and ground radio communications; telephone and wired audio equipment (except military field type wire equipment). Research and development for ground electronics equipment.

Commander, Sacramento Air Materiel Area, McClellan Air Force Base, Sacramento, Calif., Attn: Directorate of Procurement and Production.

Printing, reproduction, binding, and auxiliary equipment.

Commander, San Antonio Air Materiel Area, Kelly Air Force Base, San Antonio, Tex., Attn: Directorate of Procurement and Production.

Aircraft carburetor and ignition systems; explosive and warfare gases especially used by the Air Force.

Topeka Air Force Depot, Topeka, Kans., Attn: Di-

rectorate of Procurement and Production.
Commercial and aircraft hardware; fuel and oil handling equipment; composition materials (fiber, plastics, glass, etc.); ferrous and non-ferrous metals; chemicals; special tools and equipment.

Warner Robins Air Materiel Area, Robins Air Force Base, Macon, Ga., Attn: Directorate of Procurement and Production.
Shop machinery and accessories; shop equipment and maintenance parts; abrasives and abrasive materials.

Commander, Wilkins Air Force Depot, Shelby, Ohio., Attn: Directorate of Procurement and Production.
Rubber materials; electrically heated clothing, footwear, and blankets; flying field and hangar equipment; miscellaneous publications, periodicals, commercial technical books and catalogs, blank forms, decalcomanias.

Apply to the nearest Air Force Procurement District to have your firm placed on Bidders' lists. To obtain a copy of a specified bid of specifications, however, apply directly to the purchasing office. Copies of current Invitations for Bids and Requests for Proposals, with specifications, are available for reference at Air Procurement District offices. These offices are located at the following addresses: 760 West Peachtree Street, NW., Atlanta, Ga.; 14 Court Square, Boston, Mass.; 165 North Canal Street, Chicago, Ill.; Big Four Bldg., Cincinnati, Ohio (suboffice); 1279 West Third Street, Cleveland, Ohio; 1407 Ross Avenue, Dallas, Tex.; Building 70, Area C, Wright-Patterson Air Force Base, Ohio; West Warren Avenue and Lonyo Boulevard, Detroit, Mich.; 500 Capitol Avenue, Hartford, Conn. (suboffice); 54 Monument Circle, Indianapolis, Ind.; 2601 Walnut Street, Kansas City, Mo. (suboffice); 155 West Washington Boulevard, Los Angeles, Calif.; 770 North Plankinton Avenue, Milwaukee, Wis.; 920 Second Street, Minneapolis, Minn. (suboffice); 218 Market Street, Newark, N. J.; 780 Broadway, New York, N. Y.; 1411 Walnut Street, Philadelphia, Pa.; 133 West Monroe Street, Phoenix, Ariz.; 20 Symington Place, Rochester, N. Y.; 1114 Market Street, St. Louis, Mo.; 22 Southwest Temple Street, Salt Lake City, Utah (suboffice); 4325 Pacific Highway, San Diego, Calif.; 7755 East Marginal Way, c/o Boeing Aircraft Corporation, Seattle, Wash. (suboffice); 521 North Eclipse Street, South Bend, Ind. (suboffice); 449 West Oliver, Wichita, Kans.; 1515 Clay Street, Oakland, Calif.

* Purchased for all military departments in accordance with single service procurement assignments.

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BUYING DIVISION OF PROCUREMENT DIRECTORATE

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Executive: Col. I. F. Larkey, Rm. 103, Bldg. 16B, Ext. 32307, 32308.
Dep. Chief: Mr. L. R. Koepnick, Rm. 103, Bldg. 16B, Ext. 32307, 32308.
Admin. Exec.: 2d Lt. A. W. Frederick, Rm. 105, Bldg. 16B, Ext. 23132.
Management Improvement: Mrs. B. E. Roderick, Rm. 105, Bldg. 16B, Ext. 30276.
Chief, Procurement Office: Mr. J. B. Leist (CO), Rm. 102, Bldg. 16B, Ext. 27217; Mr. R. E. Wallace, Rm. 102, Bldg. 16B, Ext. 27217; Miss M. V. Wolfrom, Rm. 102, Bldg. 16B, Ext. 31366; 1st Lt. C. D. Taylor, Rm. 102, Bldg. 16B, Ext. 31366.
Training Equipment Officer: Major E. M. Ward, Rm. 102, Bldg. 16B, Ext. 23163; Captain R. Causa, Rm. 102, Bldg. 16B, Ext. 23163.
Price Analysts: Mr. J. N. Brown, Rm. 102, Bldg. 16B, Ext. 29224; Mr. R. C. Saxton, Rm. 102, Bldg. 16B, Ext. 29224; Lt. Col. W. K. Linnerooth, Rm. 102, Bldg. 16B, Ext. 39264; Mr. J. B. Cotner, Rm. 102, Bldg. 16B, Ext. 39264.
PS Control: Mrs. Sue Avey, Rm. 104, Bldg. 16B, Ext. 21144; Mrs. Joanne Guy, Rm. 104, Bldg. 16B, Ext. 21144.
Chief, Production Office: Lt. Col. R. D. Van Auken, Pm. 107, Bldg. 16B, Ext. 21100; Mr. E. J. Jackson, Rm. 107, Bldg. 16B, Ext. 25212.
Chief, Contractual: Mr. E. E. Sauser, Rm. 111, Bldg. 16B, Ext. 27200; Mr. P. E. Payne, Rm. 111, Bldg. 16B, Ext. 27200; Mr. L. Andrews, Rm. 111, Bldg. 16B, Ext. 27200; Mr. R. E. Best, Rm. 109, Bldg. 16B, Ext. 32362; 1st Lt. D. L. Kessler, Rm. 109, Bldg. 16B, Ext. 33289, 2d Lt. J. Q. Wesley, Rm. 109, Bldg. 16B, Ext. 32362.

Bombardment Branch

Chief: Col. M. J. Wetzel, Rm. 055, Bldg. 14, Ext. 31314, 31315.
Dep. Chief: Mr. E. L. Treat, Rm. 055, Bldg. 14, Ext. 31314, 31315.
Production Eng.: Mr. H. F. Weiler, Rm. 059, Bldg. 14, Ext. 32391.
Asst/Contracts: Mrs. H. W. Blakeslee (CO), Rm. 059, Bldg. 14, Ext. 23257.
B-57 Section: Lt. Col. M. L. Seccomb, Jr., Rm. 070, Bldg. 14, Ext. 24254; Acting Chief: Maj. Sidney W. Brewer, Rm. 070, Bldg. 14, Ext. 24254; Dep. Chief: Mr. H. L. Vogel, Rm. 070, Bldg. 14, Ext. 24254; Capt. W. Weniger, Rm. 070, Bldg. 14, Ext. 24254, (B-57 Proj. Officer); Mr. E. A. Schloeman, Rm. 070, Bldg. 14, Ext. 20275, (Act'g. TAC Recon Proj. Officer); Mr. J. H. McDonald, Rm. 058, Bldg. 14, Ext. 29290, (Contracts).
B-66 Section: Lt. Col. C. J. Chapman, Rm. 011, Bldg. 14, Ext. 26210; Acting Chief: Maj. C. T. Manlove, Rm. 011, Bldg. 14, Ext. 26210; Dept. Chief: Mr. J. E. McNally, Rm. 013, Bldg. 14, Ext. 26210; Mr. W. A. Seward (CO), Rm. 011, Bldg. 14, Ext. 33180; Capt. B. D. McCall, Rm. 015, Bldg. 14, Ext. 33182, (B-66 Proj. Officer); Capt. O. O. Benson, Rm. 011, Bldg. 14, Ext. 33180, (302A Proj. Officer).
B-47/B-58 Section: Lt. Col. G. K. O'Neil, Rm. 06, Bldg. 14, Ext. 25123/26254; Dep. Chief: Mr. G. E. Oster, Rm. 06, Bldg. 14, Ext. 26254; Capt. E. F. W. Elseman, Rm. 06, Bldg. 14, Ext. 30115, (B-47 Proj. Officer); Capt. Mark Farnum, Rm. 007, Bldg. 14, Ext. 34194, (B-58 Proj. Officer); Mr. J. F. Murphy (CO), Rm. 003, Bldg. 14, Ext. 32386.
B-52 Section: Lt. Col. E. F. O'Connor, Rm. 101A, Bldg. 14, Ext. 21156; Dep. Chief: Mr. D. J. Reagan, Rm. 101A, Bldg. 14, Ext. 21156; Maj. W. D. Bundy, Rm. 101A, Bldg. 14, Ext. 21156, (B-52 Proj. Officer); Capt. R. P. Whitfield, Rm. 105, Bldg. 14, Ext. 39102, (110A Proj. Officer); Mr. J. C. LaManna, Rm. 107, Bldg. 14, Ext. 26231.

Fighter Branch

Chief: Col. B. C. Downs (CO), Rm. 137, Bldg. 14, Ext. 27110.
Dep. Chief: Mr. R. L. Stanley (CO), Rm. 137, Bldg. 14, Ext. 20119.
Asst/Contracts: Mr. S. Loval (CO), Rm. 136, Bldg. 14, Ext. 33102.
Asst/Engrg: Mr. R. K. Walter, Rm. 136, Bldg. 14, Ext. 22161.
Asst for Production: Mr. H. J. Piasecki, Rm. 136, Bldg. 14, Ext. 22161.
F-89 Section: Maj. T. S. Swaim (CO), Rm. 146, Bldg. 14, Ext. 28178; Mr. E. W. Schuessler, Rm. 146, Bldg. 14, Ext. 30104; Mr. R. A. Gessaman (CO), Rm. 146, Bldg. 14, Ext. 33194.

Cargo and Special Aircraft Branch

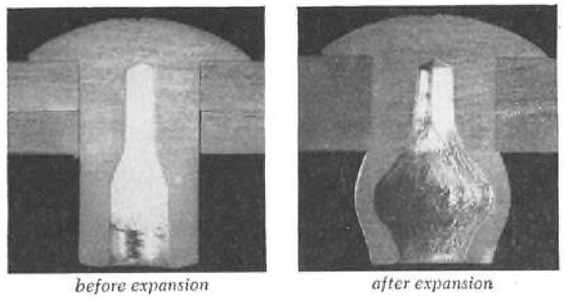
Chief: Col. J. S. Pirruccello, Rm. 114, Bldg. 16B, Ext. 22216.
Dep. Chief: Mr. Nate Silverston (CO), Rm. 114, Bldg. 16B, Ext. 22216.
Asst/Procurement: Mr. E. Ross Goodlett (CO), Rm. 114, Bldg. 16B, Ext. 20242.
Asst/Production: Mr. J. S. Vargo, Rm. 114, Bldg. 16B, Ext. 21203.
Medium Transport Section: C-119 All Series, R4Q, C-130, C-123, BLC and Pantobase: Major W. E. Livesay, Rm. 208, Bldg. 16B, Ext. 30210; Mr. W. W. Logvin, Rm. 208, Bldg. 16B, Ext. 33121; Mr. C. V. Burton (CO), Rm. 208, Bldg. 16B, Ext. 30210.
F-101 Section: Lt. Col. D. L. Sanxter (CO), Rm. 107, Bldg. 14, Ext. 25234; Mr. P. J. DiSalvo, Rm. 107, Bldg. 14, Ext. 25234.
F-102 Section: Maj. W. G. Price, III, Rm. 154, Bldg. 14, Ext. 33204; Mr. B. B. Mishkind, Rm. 154, Bldg. 14, Ext. 34140; Mr. T. Readnower (CO), Rm. 154, Bldg. 14, Ext. 34140.
F-84/F-105: Lt. Col. R. C. Chilton (CO), Rm. 128, Bldg. 14, Ext. 22237; Mr. H. J. Kuns, Rm. 128, Bldg. 14, Ext. 25272; Miss Alice Corkum (CO), Rm. 134, Bldg. 14, Ext. 34211.
F-86/F-100 Section: Lt. Col. J. R. Roche, Rm. 120, Bldg. 14, Ext. 26104; Mr. G. Brickman, Rm. 120, Bldg. 14, Ext. 26104; Mr. F. Thompson (CO), Rm. 120, Bldg. 14, Ext. 28135.
F-104/T-33 Section: Lt. Col. E. E. Gossett, Rm. 145, Bldg. 14, Ext. 20292; Mr. G. H. Nixon (CO), Rm. 145, Bldg. 14, Ext. 20292.
Heavy Transport Section: C-124A & C, YC-124B, C-133A, VC-118, C-118A, XC-132: Lt. Col. G. H. Stallings, Rm. 214, Bldg. 16B, Ext. 22206; Mr. V. L. Whiter (CO), Rm. 214, Bldg. 16B, Ext. 31360.
Trainer Section: T-28A, T-29, T-34, T-35, C-131, T-37, C-131D, P2V7, P2V5, R4Y: Major D. G. Anthony, Rm. 108, Bldg. 16B, Ext. 30117; Mr. W. Lankin (CO), Rm. 108, Bldg. 16B, Ext. 30192; Mr. R. E. Kelley (CO), Rm. 108, Bldg. 16B, Ext. 25140.
Tanker and Special Aircraft Section: SA-16, C-121, RC-121C&D, YC-121F, VC-121E, KC-97G, YC-97J, KC-135A, KC-X: Lt. Col. R. W. LaPlante, Rm. 222, Bldg. 16B, Ext. 22248; Mr. W. M. Grome (CO), Rm. 222, Bldg. 16B, Ext. 34219.
Electronic Training Devices Section: Radar, ECM, GCA, Gunnery and Bombing, Flight Instrument, Navigational Trainers, Guided Missile Trs., Radio Aids, Nuclear Munition Trainers: Mr. T. E. Shellabarger (CO), Post A-1, Bldg. 16, Ext. 33113; Mr. D. E. Ruble (CO), Post A-1, Bldg.

WHAT THEY ARE

Du Pont Aircraft Rivets are fast-acting, strong, one-piece fasteners similar in size and shape to ordinary solid rivets. However, there is one important difference:

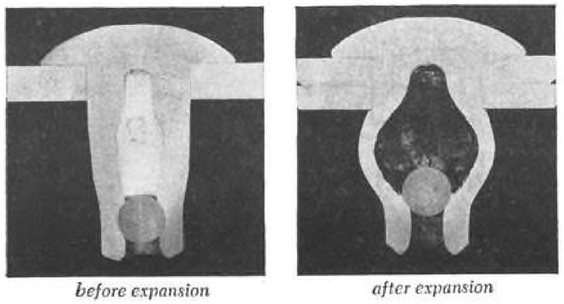
SECTIONAL VIEWS OF RIVETS

OPEN



before expansion *after expansion*

SEALED



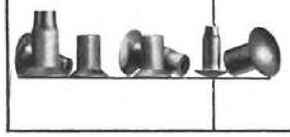
before expansion *after expansion*

Extending the full length of the shank of each rivet is a small, carefully centered cavity which contains a tiny chemical charge. The application of heat to the rivet head expands the shank in as little as one-half second, setting the rivet almost instantaneously. *(See photos left.)*

Du Pont Aircraft Rivets are specially designed and constructed to meet the rigid specifications of the aircraft and rotorcraft industries for both primary and secondary structural applications.

WHY THEY ARE USED

These rivets effect substantial savings of time and man power in production operations. One man can easily set 20 to 25 a minute, working only from the head side with an inexpensive, electrically heated Du Pont Riveting Iron, or a similar easy-to-operate tool. No bucking bar is ever needed—no buffing, trimming or cutting required. The expansion of the rivet shank fills the hole completely, insuring tight contact throughout the thickness of the joint and locking sheets securely together.

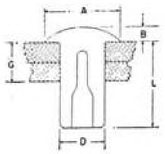


DU PONT AIRCRAFT RIVETS

DESIGNATION. For easy identification, Du Pont Aircraft Rivets are designated by a series of letters and numbers that positively describes the alloy, shank diameter in 1/1000 inch, kind of head and nominal grip length in 1/100 inch. The following tables give the dimensions, maximum and minimum grip lengths and proper designations of the entire line of Du Pont Aircraft Rivets.

ALUMINUM ALLOY OPEN TYPE (TABLE 1)

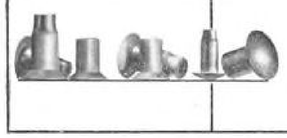
BRAZIER HEAD



Rivet Size "D"	Recommended Drill Size		Head		Shank Length "L"*	Rivet Color	2017-T Aluminum Alloy			5056 Aluminum Alloy		
							Grip Range		Rivet Number	Grip Range		Rivet Number
	Pilot	Finish	Diameter "A"	Thickness "B"			Min.	Max.		Min.	Max.	
1/8" .134" ±.001"	#30 or smaller	#29 .136"	.250" ±.010"	.050" ±.003"	.150"	Yellow	.025"	.045"	DR-134A-4	.005"	.045"	56S-134A-4
					.170"	Black	.045"	.065"	DR-134A-6			
					.190"	Red	.065"	.085"	DR-134A-8	.045"	.085"	56S-134A-8
					.210"	Blue	.085"	.105"	DR-134A-10			
					.230"	Brown	.105"	.125"	DR-134A-12	.085"	.125"	56S-134A-12
					.250"	Yellow	.125"	.145"	DR-134A-14			
					.270"	Black	.145"	.165"	DR-134A-16	.125"	.165"	56S-134A-16
					.290"	Red	.165"	.185"	DR-134A-18			
					.310"	Blue	.185"	.205"	DR-134A-20	.165"	.205"	56S-134A-20
					.330"	Brown	.205"	.225"	DR-134A-22			
					.350"	Yellow	.225"	.245"	DR-134A-24	.205"	.245"	56S-134A-24
					.370"	Black	.245"	.265"	DR-134A-26			
					.390"	Red	.265"	.285"	DR-134A-28	.245"	.285"	56S-134A-28
					.410"	Blue	.285"	.305"	DR-134A-30			
					.430"	Brown	.305"	.325"	DR-134A-32	.285"	.325"	56S-134A-32
					.450"	Yellow	.325"	.345"	DR-134A-34			
					.470"	Black	.345"	.365"	DR-134A-36	.325"	.365"	56S-134A-36
3/32" .171" ±.001"	#22 or smaller	#17 .173"	.312" ±.010"	.063" ±.004"	.215"	Black	.045"	.065"	DR-173A-6			
					.235"	Red	.065"	.085"	DR-173A-8	.025"	.085"	56S-173A-8
					.255"	Blue	.085"	.105"	DR-173A-10			
					.275"	Brown	.105"	.125"	DR-173A-12			
					.295"	Yellow	.125"	.145"	DR-173A-14	.085"	.145"	56S-173A-14
					.315"	Black	.145"	.165"	DR-173A-16			
					.335"	Red	.165"	.185"	DR-173A-18			
					.355"	Blue	.185"	.205"	DR-173A-20	.145"	.205"	56S-173A-20
					.375"	Brown	.205"	.225"	DR-173A-22			
					.395"	Yellow	.225"	.245"	DR-173A-24			
					.415"	Black	.245"	.265"	DR-173A-26	.205"	.265"	56S-173A-26
					.435"	Red	.265"	.285"	DR-173A-28			
					.455"	Blue	.285"	.305"	DR-173A-30			
					.475"	Brown	.305"	.325"	DR-173A-32	.265"	.325"	56S-173A-32
					.495"	Yellow	.325"	.345"	DR-173A-34			
					.515"	Black	.345"	.365"	DR-173A-36			
					.535"	Red	.365"	.385"	DR-173A-38	.325"	.385"	56S-173A-38
3/16" .202" ±.001"	#12 or smaller	#6 .204"	.375" ±.010"	.075" ±.005"	.270"	Red	.065"	.085"	DR-204A-8			
					.290"	Blue	.085"	.105"	DR-204A-10	.025"	.105"	56S-204A-10
					.310"	Brown	.105"	.125"	DR-204A-12			
					.330"	Yellow	.125"	.145"	DR-204A-14			
					.350"	Black	.145"	.165"	DR-204A-16	.085"	.165"	56S-204A-16
					.370"	Red	.165"	.185"	DR-204A-18			
					.390"	Blue	.185"	.205"	DR-204A-20			
					.410"	Brown	.205"	.225"	DR-204A-22			
					.430"	Yellow	.225"	.245"	DR-204A-24	.165"	.245"	56S-204A-24
					.450"	Black	.245"	.265"	DR-204A-26			
					.470"	Red	.265"	.285"	DR-204A-28			
					.490"	Blue	.285"	.305"	DR-204A-30			
					.510"	Brown	.305"	.325"	DR-204A-32	.245"	.325"	56S-204A-32
					.530"	Yellow	.325"	.345"	DR-204A-34			
					.550"	Black	.345"	.365"	DR-204A-36			
					.570"	Red	.365"	.385"	DR-204A-38			
					.590"	Blue	.385"	.405"	DR-204A-40	.325"	.405"	56S-204A-40
					.610"	Brown	.405"	.425"	DR-204A-42			
					.630"	Yellow	.425"	.445"	DR-204A-44			
					.650"	Black	.445"	.465"	DR-204A-46			
					.670"	Red	.465"	.485"	DR-204A-48	.405"	.485"	56S-204A-48
1/4" .263" ±.001"	#1 or smaller	H .266"	.500" ±.010"	.100" ±.005"	.360"	Blue				.025"	.105"	56S-263A-10
					.420"	Black				.085"	.165"	56S-263A-16
					.500"	Yellow				.165"	.245"	56S-263A-24
					.580"	Brown				.245"	.325"	56S-263A-32
					.660"	Blue				.325"	.405"	56S-263A-40
					.740"	Red				.405"	.485"	56S-263A-48

Note—1/4" diameter rivets should be expanded with Du Pont No. 9A Riveting Iron

*Tolerance +0.004" −0.000"



DU PONT AIRCRAFT RIVETS

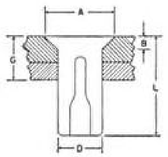
WHAT THEY ARE MADE OF

Du Pont Aircraft Rivets are available in 2017-T and 5056 (Du Pont Rivet designations DR and 56S respectively) aluminum alloys, nickel and A286 superalloy.

The aluminum rivets are alodized to meet non-corrosive requirements of military specifications. The standard head styles are modified brazier and 100° countersunk. They are manufactured in four diameters: .134", .171", .202", .263" and with a wide range of grip lengths. (See tables 1, 2, 3.)

ALUMINUM ALLOY OPEN TYPE (TABLE 2)

100° COUNTERSUNK HEAD



Rivet Size "D"	Recommended Drill Size		Head		Shank Length "L"*	Rivet Color	2017-T Aluminum Alloy			5056 Aluminum Alloy		
							Grip Range		Rivet Number	Grip Range		Rivet Number
	Pilot	Finish	Diameter "A"	Thickness "B"			Min.	Max.		Min.	Max.	
1/8" .134" ±.001"	#30 or smaller	#29 .136"	.216" ±.005"	.039" ±.002"	.180"	Black	.045"	.065"	DR-134-100-6			
					.190"	Red	.065"	.085"	DR-134-100-8	.045"	.085"	56S-134-100-8
					.210"	Blue	.085"	.105"	DR-134-100-10			
					.230"	Brown	.105"	.125"	DR-134-100-12	.085"	.125"	56S-134-100-12
					.250"	Yellow	.125"	.145"	DR-134-100-14			
					.270"	Black	.145"	.165"	DR-134-100-16	.125"	.165"	56S-134-100-16
					.290"	Red	.165"	.185"	DR-134-100-18			
					.310"	Blue	.185"	.205"	DR-134-100-20	.165"	.205"	56S-134-100-20
					.330"	Brown	.205"	.225"	DR-134-100-22			
					.350"	Yellow	.225"	.245"	DR-134-100-24	.205"	.245"	56S-134-100-24
					.370"	Black	.245"	.265"	DR-134-100-26			
					.390"	Red	.265"	.285"	DR-134-100-28	.245"	.285"	56S-134-100-28
					.410"	Blue	.285"	.305"	DR-134-100-30			
					.430"	Brown	.305"	.325"	DR-134-100-32	.285"	.325"	56S-134-100-32
					.450"	Yellow	.325"	.345"	DR-134-100-34			
					.470"	Black	.345"	.365"	DR-134-100-36	.325"	.365"	56S-134-100-36
3/32" .171" ±.001"	#22 or smaller	#17 .173"	.278" ±.005"	.049" ±.002"	.235"	Red	.065"	.085"	DR-173-100-8	.025"	.085"	56S-173-100-8
					.255"	Blue	.085"	.105"	DR-173-100-10			
					.275"	Brown	.105"	.125"	DR-173-100-12			
					.295"	Yellow	.125"	.145"	DR-173-100-14	.085"	.145"	56S-173-100-14
					.315"	Black	.145"	.165"	DR-173-100-16			
					.335"	Red	.165"	.185"	DR-173-100-18			
					.355"	Blue	.185"	.205"	DR-173-100-20	.145"	.205"	56S-173-100-20
					.375"	Brown	.205"	.225"	DR-173-100-22			
					.395"	Yellow	.225"	.245"	DR-173-100-24			
					.415"	Black	.245"	.265"	DR-173-100-26	.205"	.265"	56S-173-100-26
					.435"	Red	.265"	.285"	DR-173-100-28			
					.455"	Blue	.285"	.305"	DR-173-100-30			
					.475"	Brown	.305"	.325"	DR-173-100-32	.265"	.325"	56S-173-100-32
					.495"	Yellow	.325"	.345"	DR-173-100-34			
					.515"	Black	.345"	.365"	DR-173-100-36			
					.535"	Red	.365"	.385"	DR-173-100-38	.325"	.385"	56S-173-100-38
3/16" .202" ±.001"	#12 or smaller	#6 .204"	.344" ±.008"	.064" ±.003"	.290"	Blue	.085"	.105"	DR-204-100-10	.025"	.105"	56S-204-100-10
					.310"	Brown	.105"	.125"	DR-204-100-12			
					.330"	Yellow	.125"	.145"	DR-204-100-14			
					.350"	Black	.145"	.165"	DR-204-100-16	.085"	.165"	56S-204-100-16
					.370"	Red	.165"	.185"	DR-204-100-18			
					.390"	Blue	.185"	.205"	DR-204-100-20			
					.410"	Brown	.205"	.225"	DR-204-100-22			
					.430"	Yellow	.225"	.245"	DR-204-100-24	.165"	.245"	56S-204-100-24
					.450"	Black	.245"	.265"	DR-204-100-26			
					.470"	Red	.265"	.285"	DR-204-100-28			
					.490"	Blue	.285"	.305"	DR-204-100-30			
					.510"	Brown	.305"	.325"	DR-204-100-32	.245"	.325"	56S-204-100-32
					.530"	Yellow	.325"	.345"	DR-204-100-34			
					.550"	Black	.345"	.365"	DR-204-100-36			
					.570"	Red	.365"	.385"	DR-204-100-38			
					.590"	Blue	.385"	.405"	DR-204-100-40	.325"	.405"	56S-204-100-40
					.610"	Brown	.405"	.425"	DR-204-100-42			
					.630"	Yellow	.425"	.445"	DR-204-100-44			
					.650"	Black	.445"	.465"	DR-204-100-46			
					.670"	Red	.465"	.485"	DR-204-100-48	.405"	.485"	56S-204-100-48
1/4" .263" ±.001"	#1 or smaller	H .266"	.468" ±.010"	.090" ±.005"	.420"	Black				.085"	.165"	56S-263-100-16
					.500"	Yellow				.165"	.245"	56S-263-100-24
					.580"	Brown				.245"	.325"	56S-263-100-32
					.660"	Blue				.325"	.405"	56S-263-100-40
					.740"	Red				.405"	.485"	56S-263-100-48
					.820"	Black				.485"	.565"	56S-263-100-56

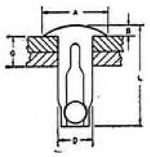
Note—1/4" diameter rivets should be expanded with Du Pont No. 9A Riveting Iron

*Tolerance +0.004" −0.000"

ALUMINUM ALLOY SEALED TYPE (TABLE 3)

5056 ALUMINUM

BRAZIER HEAD

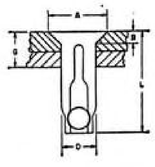


Rivet Size "D"	Recommended Drill Size: Pilot	Recommended Drill Size: Finish	Head: Diameter "A"	Head: Thickness "B"	Shank Length "L"*	Rivet Color	Grip Range: Min.	Grip Range: Max.	Rivet Number
1/8" .134" ±.001"	#30 or smaller	#29 .136"	.250" ±.010"	.050" ±.003"	.235"	Yellow	.005"	.045"	P56S-134A-4
					.275"	Red	.045"	.085"	P56S-134A-8
					.315"	Brown	.085"	.125"	P56S-134A-12
					.355"	Black	.125"	.165"	P56S-134A-16
					.395"	Blue	.165"	.205"	P56S-134A-20
					.435"	Yellow	.205"	.245"	P56S-134A-24
					.475"	Red	.245"	.285"	P56S-134A-28
					.515"	Brown	.285"	.325"	P56S-134A-32
5/32" .171" ±.001"	#22 or smaller	#17 .173"	.312" ±.010"	.063" ±.004"	.330"	Red	.025"	.085"	P56S-173A-8
					.390"	Yellow	.085"	.145"	P56S-173A-14
					.450"	Blue	.145"	.205"	P56S-173A-20
					.510"	Black	.205"	.265"	P56S-173A-26
					.570"	Brown	.265"	.325"	P56S-173A-32
3/16" .202" ±.001"	#12 or smaller	#6 .204"	.375" ±.010"	.075" ±.005"	.415"	Blue	.025"	.105"	P56S-204A-10
					.475"	Black	.085"	.165"	P56S-204A-16
					.555"	Yellow	.165"	.245"	P56S-204A-24
					.635"	Brown	.245"	.325"	P56S-204A-32
					.715"	Blue	.325"	.405"	P56S-204A-40
1/4" .263" ±.001"	#1 or smaller	H .266"	.500" ±.010"	.100" ±.005"	.485"	Blue	.025"	.105"	P56S-263A-10
					.545"	Black	.085"	.165"	P56S-263A-16
					.625"	Yellow	.165"	.245"	P56S-263A-24
					.705"	Brown	.245"	.325"	P56S-263A-32
					.785"	Blue	.325"	.405"	P56S-263A-40

Note—1/4" diameter rivets should be expanded with Du Pont No. 9A Riveting Iron

100° COUNTERSUNK HEAD

5056 ALUMINUM

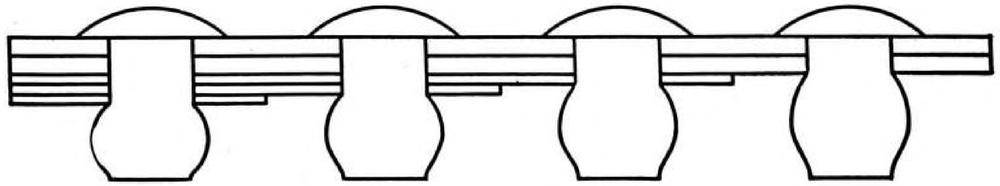


1/8" .134" ±.001"	#30 or smaller	#29 .136"	.216" ±.005"	.039" ±.002"	.275"	Red	.045"	.085"	P56S-134-100-8
					.315"	Brown	.085"	.125"	P56S-134-100-12
					.355"	Black	.125"	.165"	P56S-134-100-16
					.395"	Blue	.165"	.205"	P56S-134-100-20
					.435"	Yellow	.205"	.245"	P56S-134-100-24
					.475"	Red	.245"	.285"	P56S-134-100-28
					.515"	Brown	.285"	.325"	P56S-134-100-32
5/32" .171" ±.001"	#22 or smaller	#17 .173"	.278" ±.005"	.049" ±.002"	.330"	Red	.025"	.085"	P56S-173-100-8
					.390"	Yellow	.085"	.145"	P56S-173-100-14
					.450"	Blue	.145"	.205"	P56S-173-100-20
					.510"	Black	205"	.265"	P56S-173-100-26
					.570"	Brown	.265"	.325"	P56S-173-100-32
3/16" .202" ±.001"	#12 or smaller	#6 .204"	.344" ±.008"	.064" ±.003"	.415"	Blue	.025"	.105"	P56S-204-100-10
					.475"	Black	.085"	.165"	P56S-204-100-16
					.555"	Yellow	.165"	.245"	P56S-204-100-24
					.635"	Brown	.245"	.325"	P56S-204-100-32
					.715"	Blue	.325"	.405"	P56S-204-100-40
1/4" .263" ±.001"	#1 or smaller	H .266"	.468" ±.010"	.090" ±.005"	.545"	Black	.085"	.165"	P56S-263-100-16
					.625"	Yellow	.165"	.245"	P56S-263-100-24
					.705"	Brown	.245"	.325"	P56S-263-100-32
					.785"	Blue	.325"	.405"	P56S-263-100-40
					.865"	Red	.405"	.485"	P56S-263-100-48

Note—1/4" diameter rivets should be expanded with Du Pont No. 9A Riveting Iron

*Subject to variation due to swaging.

DU PONT AIRCRAFT RIVETS



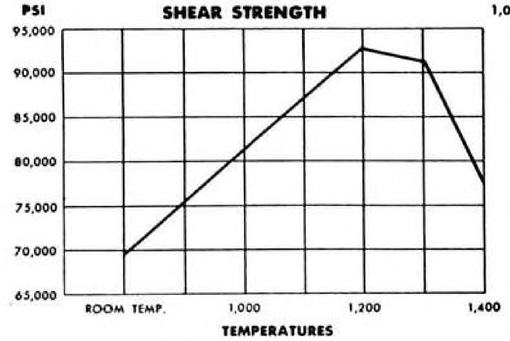
5056 aluminum alloy rivets are manufactured with unusually wide grip ranges so that each size rivet can be used for a wide range of material thickness. (See above.) This reduces the number of separate items needed for most jobs and simplifies stock inventory.

All sizes of 56S and nickel rivets are manufactured in the sealed type. These have a metal plug in the end of the cavity containing the chemical charge. They are widely used in honeycomb structures because they eliminate the blast which might possibly deform these delicate elements. Sealed rivets are practically noiseless when being set.

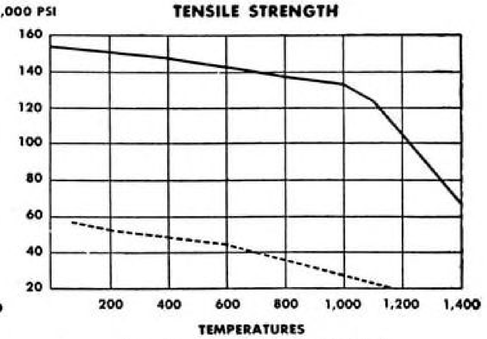
RIVETS FOR HIGH-TEMPERATURE APPLICATIONS

Nickel rivets (see table 4) are available in .134", .171" and .202" diameters. These were given general service approval on 7-26-50 Letter No. MCREX A71 and are currently being used in the manufacture of military aircraft.

The most recent addition to the Du Pont Aircraft Rivet line is the Du Pont A-286 Superalloy Aircraft Rivet for high-temperature applications. (See table 5.) This rivet retains its strength, both shear and tensile, up to 1,400°F. (See graphs below.)



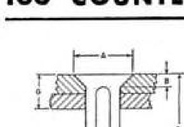
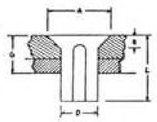
Shear strength of A-286 Rivet blanks after heat treatment from 1000 -1400 F. for eight hours at 4 cycles.



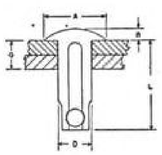
Comparison of ultimate tensile strength of Superalloy (solid line) and Nickel (dotted line)

HIGH-TEMPERATURE RIVETS (TABLE 4)

L NICKEL OPEN TYPE

	Rivet Size "D"*	Recommended Drill Size		Head		Nominal Grip "G"	Grip Range		Shank Length "L"*	Rivet Number L Nickel
		Pilot	Finish	Diameter "A"*	Thickness "B"*		Min.	Max.		
BRAZIER HEAD										
	1/8" .134"	#30 or smaller	#29 .136"	.250"	.050"	1/16" (.063")	.010"	.072"	.173"	N-134A x 1/16
						1/8" (.125")	.073"	.134"	.235"	N-134A x 1/8
						3/16" (.188")	.135"	.197"	.298"	N-134A x 3/16
						1/4" (.250")	.198"	.259"	.360"	N-134A x 1/4
	5/32" .171"	#22 or smaller	#17 .173"	.312"	.063"	1/16" (.063")	.010"	.072"	.218"	N-173A x 1/16
						1/8" (.125")	.010"	.134"	.280"	N-173A x 1/8
						3/16" (.188")	.073"	.197"	.343"	N-173A x 3/16
						1/4" (.250")	.135"	.259"	.405"	N-173A x 1/4
	3/16" .202"	#12 or smaller	#6 .204"	.375"	.075"	1/16" (.063")	.010"	.072"	.253"	N-204A x 1/16
						1/8" (.125")	.010"	.134"	.315"	N-204A x 1/8
						3/16" (.188")	.073"	.197"	.378"	N-204A x 3/16
						1/4" (.250")	.135"	.259"	.440"	N-204A x 1/4
100° COUNTER-SUNK HEAD										
	1/8" .134"	#30 or smaller	#29 .136"	.216"	.039"	1/8" (.125")	.073"	.134"	.235"	N-134-100 x 1/8
						3/16" (.188")	.135"	.197"	.298"	N-134-100 x 3/16
						1/4" (.250")	.198"	.259"	.360"	N-134-100 x 1/4
	5/32" .171"	#22 or smaller	#17 .173"	.278"	.049"	1/8" (.125")	.010"	.134"	.280"	N-173-100 x 1/8
						3/16" (.188")	.073"	.197"	.343"	N-173-100 x 3/16
						1/4" (.250")	.135"	.259"	.405"	N-173-100 x 1/4
	3/16" .202"	#12 or smaller	#6 .204"	.344"	.064"	1/8" (.125")	.010"	.134"	.315"	N-204-100 x 1/8
						3/16" (.188")	.073"	.197"	.378"	N-204-100 x 3/16
						1/4" (.250")	.135"	.259"	.440"	N-204-100 x 1/4

L NICKEL SEALED TYPE

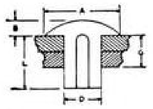
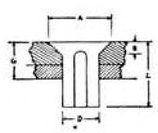
BRAZIER HEAD									**	
	1/8" .134"	#30 or smaller	#29 .136"	.250"	.050"	1/16" (.063")	.010"	.072"	.278"	PN-134A x 1/16
						1/8" (.125")	.073"	.134"	.340"	PN-134A x 1/8
						3/16" (.188")	.135"	.197"	.403"	PN-134A x 3/16
						1/4" (.250")	.198"	.259"	.465"	PN-134A x 1/4
	5/32" .171"	#22 or smaller	#17 .173"	.312"	.063"	1/16" (.063")	.010"	.072"	.353"	PN-173A x 1/16
						1/8" (.125")	.010"	.134"	.415"	PN-173A x 1/8
						3/16" (.188")	.073"	.197"	.478"	PN-173A x 3/16
						1/4" (.250")	.135"	.259"	.540"	PN-173A x 1/4
	3/16" .202"	#12 or smaller	#6 .204"	.375"	.075"	1/16" (.063")	.010"	.072"	.423"	PN-204A x 1/16
						1/8" (.125")	.010"	.134"	.485"	PN-204A x 1/8
						3/16" (.188")	.073"	.197"	.548"	PN-204A x 3/16
						1/4" (.250")	.135"	.259"	.610"	PN-204A x 1/4
100° COUNTER-SUNK HEAD									**	
	1/8" .134"	#30 or smaller	#29 .136"	.216"	.039"	1/8" (.125")	.073"	.134"	.340"	PN-134-100 x 1/8
						3/16" (.188")	.135"	.197"	.403"	PN-134-100 x 3/16
						1/4" (.250")	.198"	.259"	.465"	PN-134-100 x 1/4
	5/32" .171"	#22 or smaller	#17 .173"	.278"	.049"	1/8" (.125")	.010"	.134"	.415"	PN-173-100 x 1/8
						3/16" (.188")	.073"	.197"	.478"	PN-173-100 x 3/16
						1/4" (.250")	.135"	.259"	.540"	PN-173-100 x 1/4
	3/16" .202"	#12 or smaller	#6 .204"	.344"	.064"	1/8" (.125")	.010"	.134"	.485"	PN-204-100 x 1/8
						3/16" (.188")	.073"	.197"	.548"	PN-204-100 x 3/16
						1/4" (.250")	.135"	.259"	.610"	PN-204-100 x 1/4

*These dimensions are subject to small plus or minus tolerances. **Subject to variation due to swaging.

DU PONT AIRCRAFT RIVETS

HIGH-TEMPERATURE RIVETS (TABLE 5)

A-286 SUPERALLOY OPEN TYPE

	Rivet Size	Recommended Drill Size		Head		Shank Length	Grip Range		A-286 Superalloy Rivet Number
	"D"	Pilot	Finish	Diameter "A"	Thickness "B"	"L"*	Min.	Max.	
BRAZIER HEAD 	1/8" .134" ±.001"	#30 or smaller	#29 .136"	.250" ±.010"	.050" ±.003"	.150"	.025"	.045"	A-286-134A-4†
						.170"	.045"	.065"	A-286-134A-6†
						.190"	.065"	.085"	A-286-134A-8†
						.210"	.085"	.105"	A-286-134A-10†
						.230"	.105"	.125"	A-286-134A-12
						.250"	.125"	.145"	A-286-134A-14
						.270"	.145"	.165"	A-286-134A-16
						.290"	.165"	.185"	A-286-134A-18
						.310"	.185"	.205"	A-286-134A-20
						.330"	.205"	.225"	A-286-134A-22
						.350"	.225"	.245"	A-286-134A-24
						.370"	.245"	.265"	A-286-134A-26
	5/32" .171" ±.001"	#22 or smaller	#17 .173"	.312" ±.010"	.063" ±.004"	.215"	.045"	.065"	A-286-173A-6
						.235"	.065"	.085"	A-286-173A-8
						.255"	.085"	.105"	A-286-173A-10
						.275"	.105"	.125"	A-286-173A-12
						.295"	.125"	.145"	A-286-173A-14
						.313"	.145"	.165"	A-286-173A-16
						.335"	.165"	.185"	A-286-173A-18
						.355"	.185"	.205"	A-286-173A-20
						.375"	.205"	.225"	A-286-173A-22
						.395"	.225"	.245"	A-286-173A-24
						.415"	.245"	.265"	A-286-173A-26
	3/16" .202" ±.001"	#12 or smaller	#6 .204"	.375" ±.010"	.075" ±.005"	.270"	.065"	.085"	A-286-204A-8†
						.290"	.085"	.105"	A-286-204A-10†
						.310"	.105"	.125"	A-286-204A-12
						.330"	.125"	.145"	A-286-204A-14
						.350"	.145"	.165"	A-286-204A-16
						.370"	.165"	.185"	A-286-204A-18
						.390"	.185"	.205"	A-286-204A-20
						.410"	.205"	.225"	A-286-204A-22
						.430"	.225"	.245"	A-286-204A-24
						.450"	.245"	.265"	A-286-204A-26
100° COUNTER-SUNK HEAD 	1/8" .134" ±.001"	#30 or smaller	#29 .136"	.216" ±.010"	.039" ±.002"	.170"	.045"	.065"	A-286-134-100-6†
						.190"	.065"	.085"	A-286-134-100-8†
						.210"	.085"	.105"	A-286-134-100-10†
						.230"	.105"	.125"	A-286-134-100-12†
						.250"	.125"	.145"	A-286-134-100-14†
						.270"	.145"	.165"	A-286-134-100-16
						.290"	.165"	.185"	A-286-134-100-18
						.310"	.185"	.205"	A-286-134-100-20
						.330"	.205"	.225"	A-286-134-100-22
						.350"	.225"	.245"	A-286-134-100-24
						.370"	.245"	.265"	A-286-134-100-26
	5/32" .171" ±.001"	#22 or smaller	#17 .173"	.278" ±.010"	.049" ±.002"	.235"	.065"	.085"	A-286-173-100-8†
						.255"	.085"	.105"	A-286-173-100-10†
						.275"	.105"	.125"	A-286-173-100-12
						.295"	.125"	.145"	A-286-173-100-14
						.315"	.145"	.165"	A-286-173-100-16
						.335"	.165"	.185"	A-286-173-100-18
						.355"	.185"	.205"	A-286-173-100-20
						.375"	.205"	.225"	A-286-173-100-22
						.395"	.225"	.245"	A-286-173-100-24
						.415"	.245"	.265"	A-286-173-100-26
	3/16" .202" ±.001"	#12 or smaller	#6 .204"	.344" ±.010"	.064" ±.003"	.290"	.085"	.105"	A-286-204-100-10†
						.310"	.105"	.125"	A-286-204-100-12†
						.330"	.125"	.145"	A-286-204-100-14†
						.350"	.145"	.165"	A-286-204-100-16†
						.370"	.165"	.185"	A-286-204-100-18
						.390"	.185"	.205"	A-286-204-100-20
						.410"	.205"	.225"	A-286-204-100-22
						.430"	.225"	.245"	A-286-204-100-24
						.450"	.245"	.265"	A-286-204-100-26

* Tolerance + 0.004"—0.000"
† Experimental Items

DU PONT AIRCRAFT RIVETS

RIVET STRENGTH DATA

Aircraft Design Allowable loads for Du Pont Aircraft Rivets are listed in the latest revised issue of the ANC—5 Technical Sub-committee's publication, "Strength of Metal Aircraft Elements," dated June 1951. This publication may be obtained by writing to the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C.

Complete strength data on all Du Pont Aircraft Rivets may be obtained by writing to the address below.

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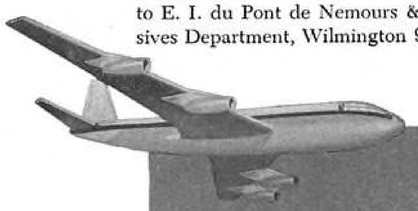

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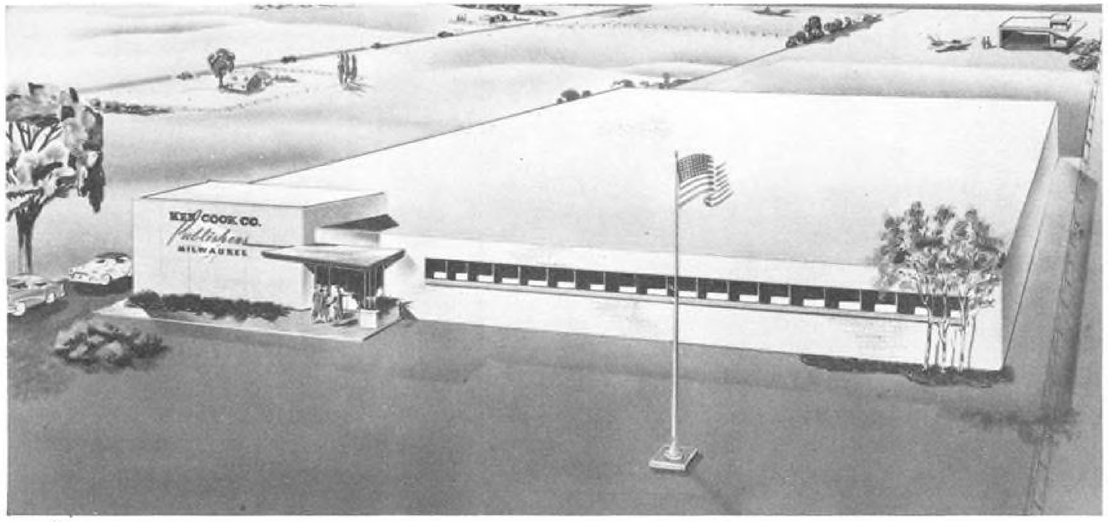

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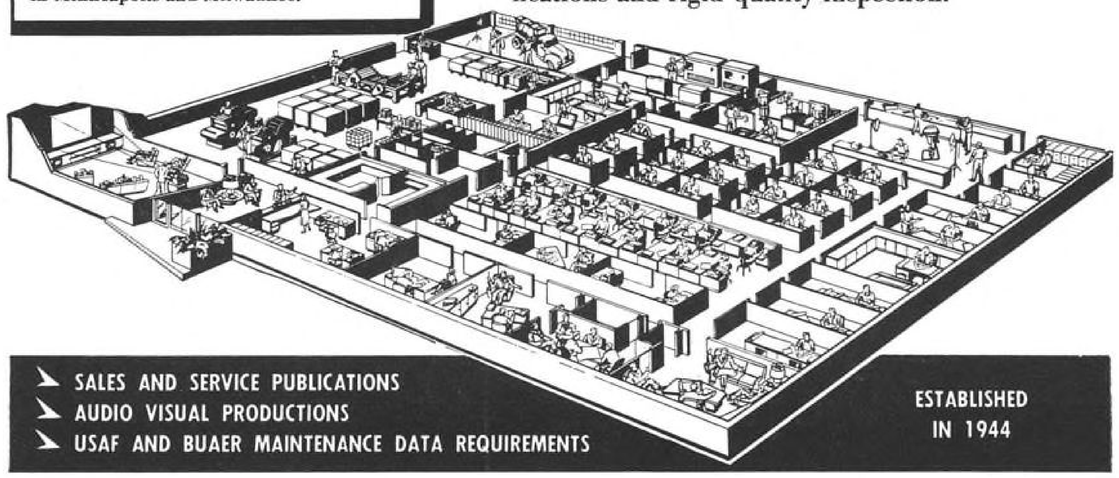

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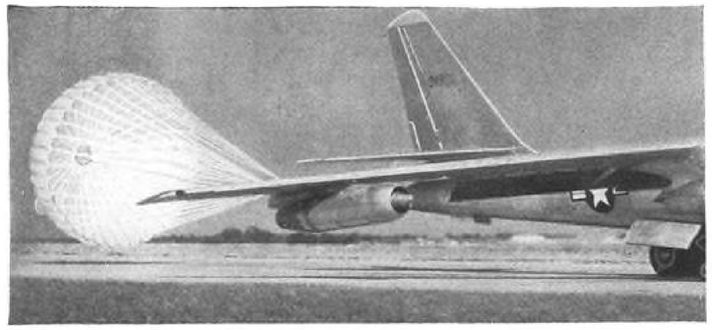

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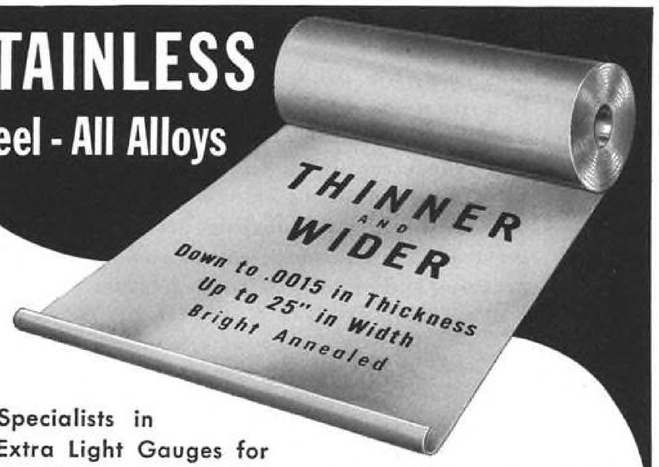

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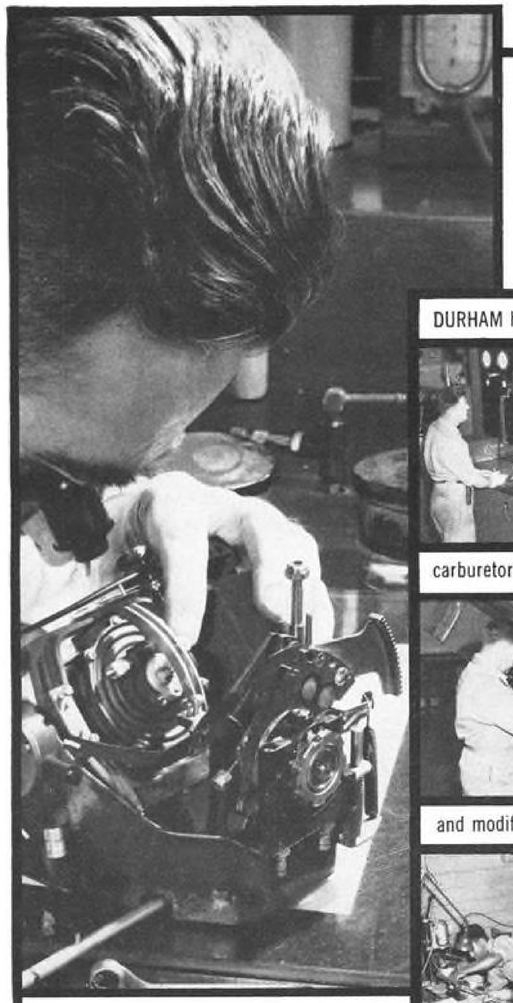

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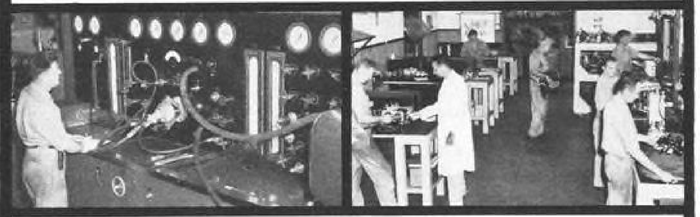

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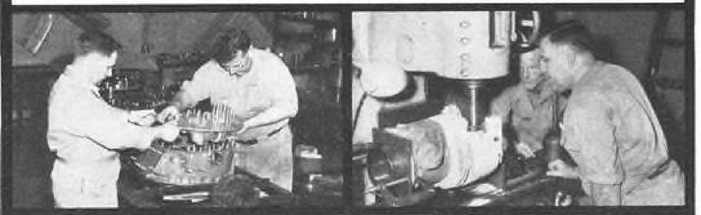

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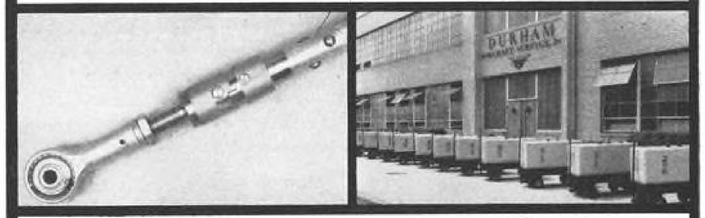

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5	4.25	5.50	11.05	13.05	18.90	24.45	4.65	27.45	29.45
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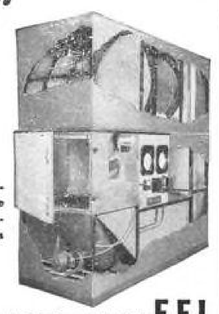

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CO-AXIAL CONNECTORS EXPRESSLY DESIGNED TO SOLVE THE PROBLEMS OF SIZE, WEIGHT, RUGGEDNESS AND NOISE-FREE OPERATION.

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A complete line of small, thread-coupled connectors designed and constructed to assure tight, permanent contact. Available in hermetically-sealed and pressurized as well as in standard weatherproof types. Complimenting the Line are a complete family of adapters to other series such as BNC, N, HN and UHF.

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Small, lightweight, fully-shielded connectors for pulse connection between Modulator and Radar Transmitter Tube and other low-medium power applications. Two sizes with ratings of 3000 Volts and 6000 Volts at 60,000 feet. Weatherproof and pressurized, and can be made for thread or bayonet coupling.

SUB-MINIATURE TYPE

For inter-chassis connections and other applications where extremely small connectors are required. Plugs come in straight and right angle and have a nominal impedance of 93 ohms with adapter-insert for 50 ohm cable. Receptacle and feed-thru adapter are hermetically sealed and are designed for soldered or lock-nut mounting. All can be made with either thread or bayonet coupling.

PRESSURIZED POWER CONNECTORS

These are 2 to 7 pin connectors with wide application in Beacon and Telemetering Equipment as used in Instrumentation Rockets and Missiles. Contact inserts can be modified to take up to 9 circuits. Both plugs and receptacles come with male or female contacts and when mated, the assemblies will withstand a pressure of 60 PSI.

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FTR-3431-L
Transformer-Rectifier
AC Input: 195 to 210 volts, 3-phase, 4-wire, 380 to 420 cycles.
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NEW vs. OLD
View of FTR-3431-L (15" x 7¼" x 7½") compared with a previous 100-amp. type.

Ceilings, speeds, and distances are going *up* . . . boosted by weights that are coming *down!*

A major step in weight reduction is Federal's remarkably rugged and compact FTR-3431-L 100-amp. DC power supply . . . built under a new concept of construction and featuring a smaller, lighter Federal-designed rectifier plate . . . to provide a weight-saving of over *35% per unit!*

Federal's newest contribution to aviation progress is the product of nearly two decades of rectifier pioneering . . . *plus* the vast know-how of IT&T associates around the world.

This unique background—long in the service of America's leading aircraft manufacturers—is ready to supply your ground or airborne DC needs . . . or design to meet them!

For complete data on the FTR-3431-L, write today to Federal, Dept. E3151.

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More and More Leading Air Lines are installing RCA's New Weather Radar

Simplicity, light weight, efficiency and dependability are the reasons for this preference

More and more leading air lines are equipping their ships with RCA's new weather-mapping radar. Their choice has been based upon exhaustive comparisons.

RCA's AVQ-10 is the first airborne radar to use C-Band (5.6 cm) transmission, the wave length most suitable for "looking into" storms, yet having the least amount of scope clutter. It presents the pilot with an easily-interpreted display of storm conditions around him. In addition, it gives the pilot valuable ground-mapping information.

In terms of time saving and increased passenger comfort, the RCA AVQ-10 weather radar is more and more becoming a "must" among air lines. With it, pilots can "see" into storm areas many miles ahead and pick non-turbulent paths between them, often making long and costly detours unnecessary.

RCA is proud that these distinguished air lines have chosen the AVQ-10 to save time and increase passenger comfort. Every effort will be made to meet additional commitments occasioned by the great and growing demand for this equipment. To assure early installation, other air line and private operators are invited to write immediately for further particulars on the RCA AVQ-10. Overseas customers should get in touch with the RCA International Division, 30 Rockefeller Plaza, New York City, or any RCA International Distributor.

Dotted line shows how airplane passed between storm cells in its flight path.

Minutes and miles are saved when a pilot is able to find a smooth path through turbulent areas.

AVQ-10 antenna mounted in nose of airplane scans the forward areas, enabling the pilot to evaluate storm conditions far ahead.

COMMERCIAL AVIATION SALES
RADIO CORPORATION of AMERICA
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You can make it faster and better

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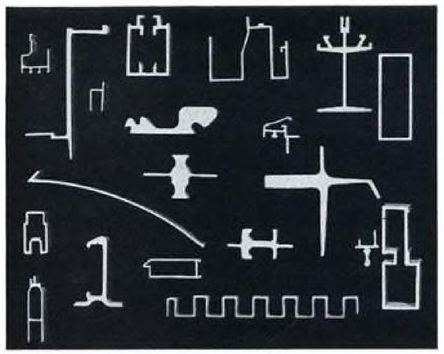
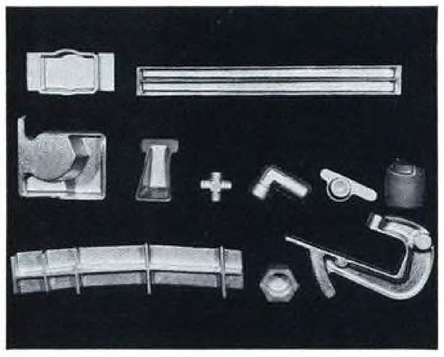
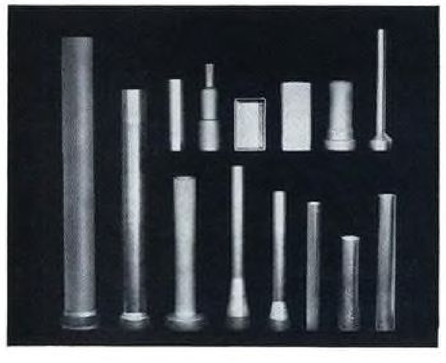


EXTRUSIONS . . . For decorative as well as basic parts, custom-designed aluminum extrusions replace riveted and welded assemblies . . . simultaneously adds strength, simplifies fabrication.



PRESS FORGINGS . . . Where parts must combine maximum strength with savings in weight, cost and manpower, Harvey aluminum forgings often completely solve the problems encountered by the designer.



IMPACT EXTRUSIONS . . . Thin-walled, tubular structures can be produced by this method and held to very close tolerances. Machining is practically eliminated; scrap is greatly reduced.

STRUCTURALS . . . High strength, light weight, workability, corrosion resistance. Aluminum extrusions combine all four . . . are ideal as basic load-bearing members.

MACHINING STOCK . . . Harvey deep-drawn hex and round stock set a new mark in uniform grain structure—consistent from surface to core. This means fast, chatter-free cutting, long tool life, few rejects and true threads.

FORGING STOCK . . . If you make your own forgings in quantity, Harvey extruded forging stock can save many intermediate steps. Custom-designed extrusions whose cross sections approximate the forged blanks may be cut to length.

EXTRUDED PIPE AND TUBE . . . Seamless . . . uniform in structure, size and shape . . . clean and smooth inside and out . . . easily formed. Usable in applications ranging from portable irrigation systems to aircraft heat exchangers.

DRAWN TUBE . . . Combines strength and high finish . . . ideal for TV antennas, furniture, and similar products. Cold drawn for structural uniformity . . . and the temper is specially controlled for good workability.

SCREW MACHINE PRODUCTS . . . The West's largest installation of multiple-spindle screw machines can reduce your manufacturing costs. Harvey carries your job through from engineering to quality control.

Harvey is a leading independent producer of aluminum extrusions in all alloys and all sizes, special extrusions, press forgings, hollow sections, structurals, rod and bar, forging stock, pipe, tube, impact extrusions, aluminum screw machine products and related products. Also similar products in alloy steel and titanium on application.

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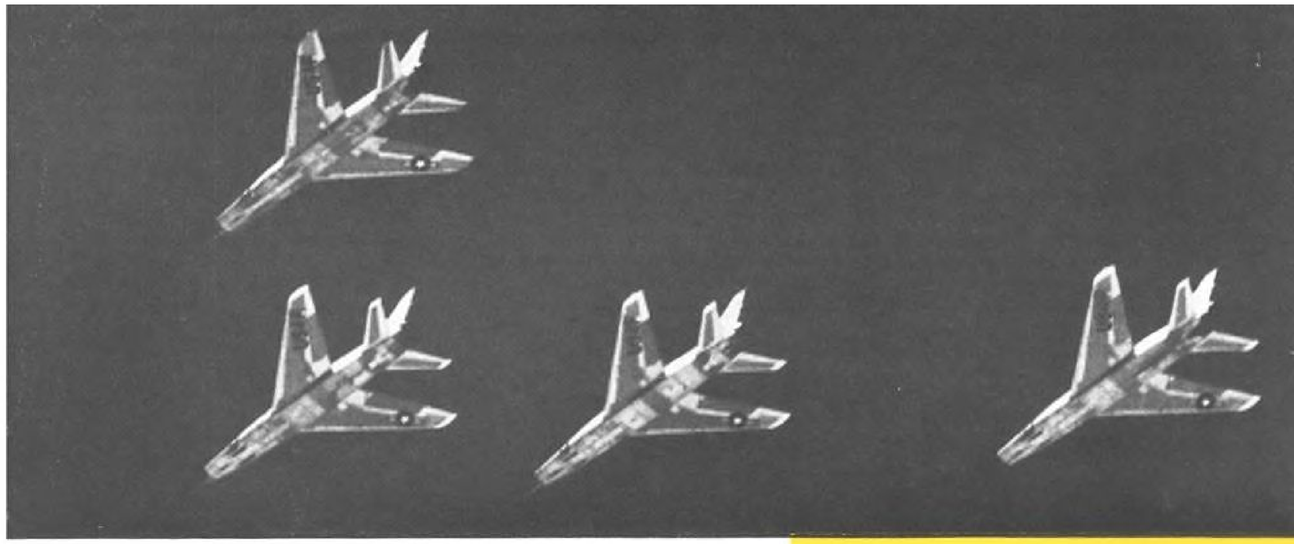
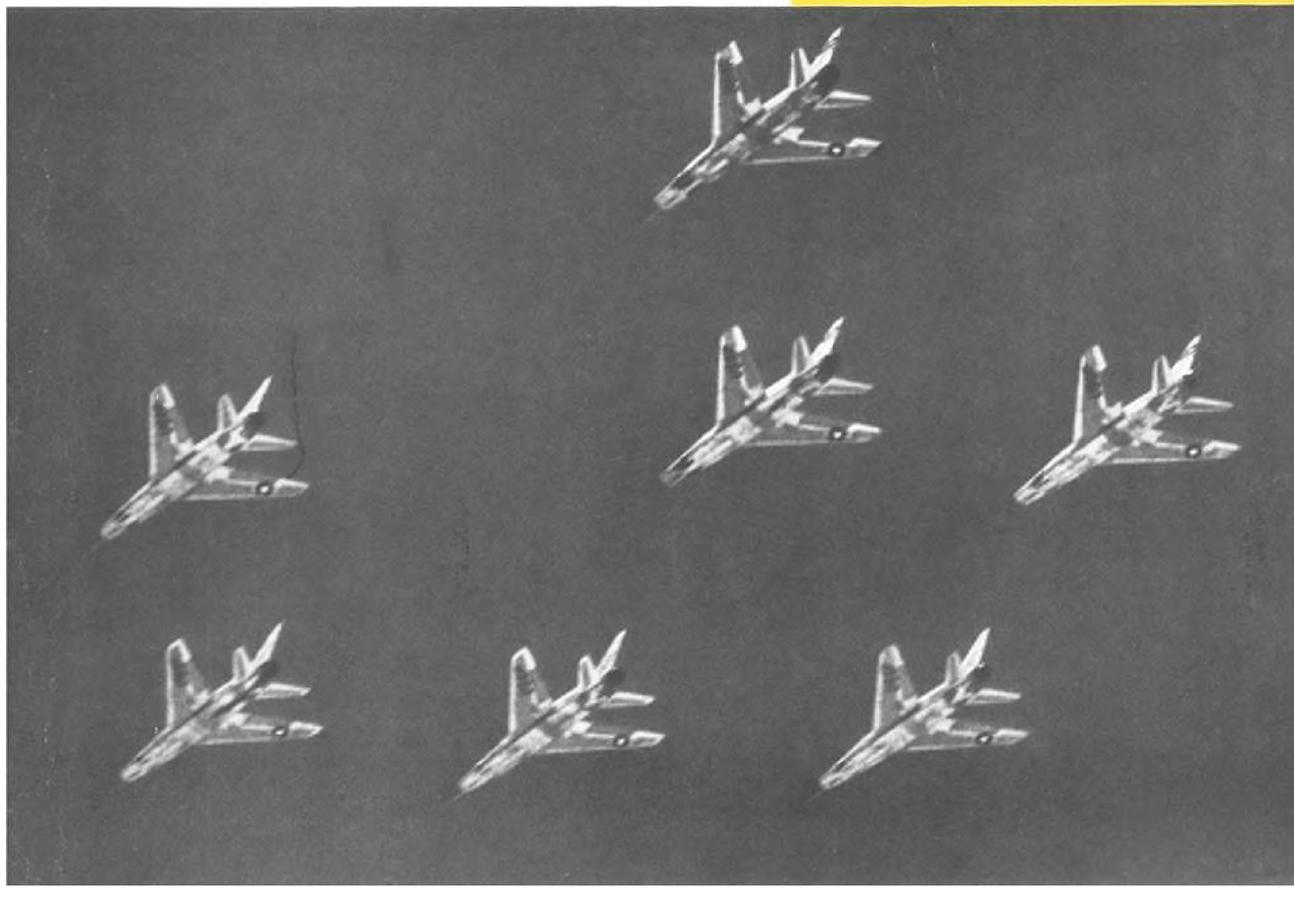


AIRCRAFT

The shapes in the sky are unusual. But within the glistening outlines are the ordinary pieces that have formed airplanes for fifty years: alloys and adhesives, nuts and nameplates, tanks and tubing.



BOEING B-52: Time out for symposiums saved its subcontractors travel and money, paid the cost in payroll time savings.

Symposium Saves Contract Time

Seattle, Wash.—Sub-contractors, real and potential, no longer have to make several trips to the Boeing Airplane Company to find out what they can make and how to do it. At both Seattle and Wichita, Kansas, the company **is holding classes to get the word out in a minimum of time, with a minimum of effort.**

The system, inaugurated more than a year ago for work on the KC-135 Stratotanker and the B-52 Stratofortress, uses a symposium similar to the series recently inaugurated by the Air Research & Development Command (AW, Oct. 17, p. 12). ARDC seeks to stimulate development work by contractors. Boeing's goal is to answer all the questions at one time, make sure everybody knows the right answers.

In the case of the new Air Force tanker, more than 44 pc. of the work is being subcontracted. Under the old system, specifications were sent to interested manufacturers and from there on it was up to them to dig for information.

This involved, in some cases, many trips to a Boeing plant. It tied up Boeing's engineers in individual conferences, most of them repeating a performance already staged for other people.

In addition, it also was inefficient and wasteful from the sub-contractor's viewpoint. Top company officials and engineers spent time and money seeking data, interpretations and improved processes. Not infrequently, it was impossible to get a contract, but this was not known until the item had been fully explored.

Subcontract Symposium

Now a symposium is held for each subcontract for a major assembly or related group of minor assemblies. All interested bidders are invited to attend the two-day session.

Talks are given by top Boeing personnel in purchasing, design engineering, industrial engineering, manufacturing, tool and production planning and traffic. Slides and movies are utilized and the aircraft prototype is studied.

Each guest gets a typed copy of the entire proceedings, including all the questions and answers. Thus they all have the same complete information.

Says Frank Dobbins, material manager of Boeing's Seattle Division:

"We furnished more complete information in one day than we had previously in much longer periods. When we totaled up the cost we found that there was little difference.

"Our savings in payroll time offset the cost of the symposium. Of greatest importance was the fact that we saved ten days or more on each sub-contract."

Boeing Monitors

When bids are in, a team of Boeing men goes to the plant of the lowest bidder or in some cases to the plants of several low bidders. They inspect the facilities, make sure the job will be done.

Next, the company's quality control experts maintain liaison with the subcontractor's plant for duration of the job.

The symposium system is of obvious benefit to small business concerns and they get special attention from Boeing on both the B-52 and KC-135 projects.

In the case of the B-52, there are 4,500 subcontractors and suppliers in 42 states. Of these, 3,500—77 percent —are firms employing fewer than 500 persons.

Boeing figures shows that out of every tax dollar spent for their aircraft, USAF pays 28 cents directly to manufacturers of government-furnished equipment. Of the 72 cents paid to Boeing, 47 is passed along to subcontractors and suppliers. Only 25 cents stays with Boeing for its own operations.

RINGS, BLADE

Dresser Mfg. Co., 41 Fisher Ave., Bradford, Pa.
Federal Mach. Co., Inc., 809 Garfield Ave., Jersey City 5, N. J.
HALL-SCOTT GEAR & ENGINE DIV., 2850 Seventh St., Berkeley, Calif.
Ryan Aeronautical Co., Lindbergh Field, San Diego 12, Calif.
SOLAR AIRCRAFT CO., 2200 Pacific Highway, San Diego 12, Calif.
Thompson Products, Inc., Tapco Plant, 23555 Elucid Ave., Cleveland 17, Ohio

Rings, Clamping (Gas Turbine Engine)

Special Products, Dresser Mfg. Co., 41 Fisher Ave., Bradford, Pa.
Ryan Aeronautical Co., Lindbergh Field, San Diego 12, Calif.
Thompson Products, Inc., Tapco Plant, 23555 Euclid Ave., Cleveland 17, Ohio

Rockets

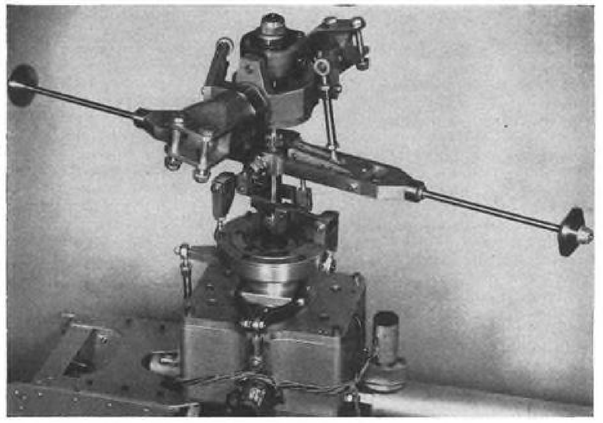
Oerlikon Tool & Arms Corp. of America, Ashville, N. C.

Rotor Assemblies (Gas Turbine Engine)

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

SESCO PRODUCTS
SOLVE ENGINEERING PROBLEMS

RESEARCH MODELS

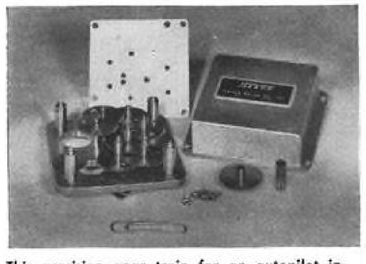


This remote control flying model is one of several helicopter and convertiplane models developed for research projects, training devices and wind tunnel tests.

MINIATURE DAMPER

Used on several aircraft and helicopters for low-friction damping and vibration control. Special modifications or new designs can be engineered to meet your requirements.

PRECISE MECHANISMS



This precision gear train for an autopilot integrating device is typical of prototype development projects engineered and manufactured to meet highly specialized requirements.

Other such projects include: HELICOPTER ROTOR ATTITUDE TRANSDUCER, MULTIPLE ELECTRIC SLIPRING ASSEMBLIES, HYDRAULIC CONTROL BOOST UNITS, HELICOPTER TRAINING DEVICES.
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Kerns Mfg. Corp., 45-18 Court Square, Long Island City 1, N. Y.
SOLAR AIRCRAFT CO., 2200 Pacific Highway, San Diego 12, Calif.
Talley Machine & Manufacturing Corp., 3525 East 16th St., Los Angeles 23, Calif.

Seats, Crew

Aeronca Mfg. Corp., Middletown, Ohio
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Brooks & Perkins, Inc., 1950 West Fort St., Detroit 16, Mich.
Burns Aero Seat Co., Inc., Box 127, 3990 Cohasset St., Burbank, Calif.
Emeco Corp., Hanover, Pa.
Hardman Tool & Engineering Co., 1845 South Bundy Dr., Los Angeles 25, Calif.
Ludwig Honold Mfg. Co., Chester Pike & Folcroft Ave., Folcroft, Pa.
Meteor Aircraft Prods., Inc., P. O. Box 787, Fairmont 1, West Va.
National Parachute Loft, Inc., Washington National Airport, Hangar 8, Washington 1, D. C.
Oro Mfg. Co., 1425 East Michigan St., Adrian, Mich.
Santa Anita Engineering Co., 2451 E. Colorado Blvd., Pasadena, Calif.
Shaw Metal Products Corp., 101 3rd Ave., Garden City Park, N. Y.
STANLEY AVIATION CORP., 2500 Dallas St., Denver 8, Colo.
M. STEINTHAL & CO., 222 Fourth Ave., New York 3, N. Y.
Taylorcraft, Inc., Conway-Pittsburgh Airport, Conway, Pa.
Teco, Inc., 2501 North Ontario St., Burbank, Calif.
The Thermix Corp., Greenwich, Conn.
Thieblot Aircraft Co., Inc., 4924 Hampden Lane, Washington 14, D. C.
Turnbull Enterprises, Inc., 1414 Lovegrove St., Baltimore 2, Md.
WEBER AIRCRAFT CORP., 2820 Ontario St., Burbank, Calif.
Westholt Mfg., Inc., 925 Wheeler, Wichita, Kansas

Seats, Ejector

Aeronca Mfg. Corp., Middletown, Ohio
Aircraft Mechanics Inc., 3200 North Nevada St., Colorado Springs, Colo.
Brooks & Perkins, Inc., 1950 West Fort St., Detroit 16, Mich.
Continental Can Co., 100 East 42 St., New York 17, N. Y.
AERO DIV., GENERAL BRONZE CORP., Stewart Ave., Garden City, N. Y.
Hardman Tool & Engineering Co., 1845 South Bundy Dr., Los Angeles 25, Calif.
Ludwig Honold Mfg. Co., Chester Pike & Folcroft Aves., Folcroft, Pa.
Shaw Metal Products Corp., 101 3rd Ave., Garden City Park, N. Y.
STANLEY AVIATION CORP., 2500 Dallas St., Denver 8, Colo.
M. STEINTHAL & CO., 222 Fourth Ave., New York 3, N. Y.
Teco, Inc., 2501 North Ontario St., Burbank, Calif.
The Thermix Corp., Greenwich, Conn.
Thieblot Aircraft Co., Inc., 4924 Hampden Lane, Washington 14, D. C.
WEBER AIRCRAFT CORP., 2820 Ontario St., Burbank, Calif.
Westholt Mfg., Inc., 925 Wheeler, Wichita, Kansas

SEATS, PILOT

Seats, Passenger

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Brooks & Perkins, Inc., 1950 West Fort St., Detroit 16, Mich.
Burns Aero Seat Co., Inc., Box 127, 3990 Cohasset St., Burbank, Calif.
Emeco Corp., Hanover, Pa.
Executive Aircraft Service, P. O. Box 7307, Dallas 9, Tex.
Flight Equipment & Engrg. Corp., P. O. Box 38, Miami International Airport, Miami 48, Fla.
Hardman Tool & Engineering Co., 1845 South Bundy Dr., Los Angeles 25, Calif.
Lunn Laminates, Inc., Oakwood Rd., Huntington Sta., N. Y.
Meteor Aircraft Prods., Inc., P. O. Box 787, Fairmont 1, West Va.
National Parachute Loft, Inc., Washington National Airport, Hangar 8, Washington 1, D. C.
Santa Anita Engineering Co., 2451 E. Colorado Blvd., Pasadena, Calif.
STANLEY AVIATION CORP., 2500 Dallas St., Denver 8, Colo.
M. STEINTHAL & CO., 222 Fourth Ave., New York 3, N. Y.
Taylorcraft, Inc., Conway-Pittsburgh Airport, Conway, Pa.
Teco, Inc., 2501 North Ontario St., Burbank, Calif.
The Thermix Corp., Greenwich, Conn.
Turnbull Enterprises, Inc., 1414 Lovegrove St., Baltimore 2, Md.
WEBER AIRCRAFT CORP., 2820 Ontario St., Burbank, Calif.

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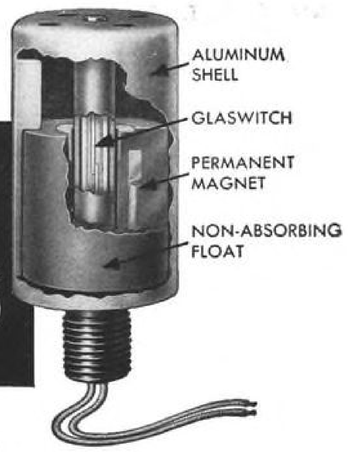
Brooks & Perkins, Inc., 1950 West Fort St., Detroit 16, Mich.
Burns Aero Seat Co., Inc., Box 127, 3990 Cohasset St., Burbank, Calif.
Continental Can Co., 100 East 42 St., New York 17, N. Y.
Emeco Corp., Hanover, Pa.
Executive Aircraft Service, P. O. Box 7307, Dallas 9, Tex.
Hardman Tool & Engineering Co., 1845 South Bundy Dr., Los Angeles 25, Calif.
Ludwig Honold Mfg. Co., Chester Pike & Folcroft Aves., Folcroft, Pa.
National Parachute Loft, Inc., Washington National Airport, Hangar 8, Washington 1, D. C.
Shaw Metal Products Corp., 101 3rd Ave., Garden City Park, N. Y.
STANLEY AVIATION CORP., 2500 Dallas St., Denver 8, Colo.
M. STEINTHAL & CO., 222 Fourth Ave., New York 3, N. Y.
Taylorcraft, Inc., Conway-Pittsburgh Airport, Conway, Pa.
Teco, Inc., 2501 North Ontario St., Burbank, Calif.
The Thermix Corp., Greenwich, Conn.
Thieblot Aircraft Co., Inc., 4924 Hampden Lane, Washington 14, D. C.
Turnbull Enterprises, Inc., 1414 Lovegrove St., Baltimore 2, Md.
WEBER AIRCRAFT CORP., 2820 Ontario St., Burbank, Calif.
Westholt Mfg., Inc., 925 Wheeler, Wichita, Kansas

REVERE FLOAT SWITCHES



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- Current draw is .7 amperes/phase maximum under normal operating conditions
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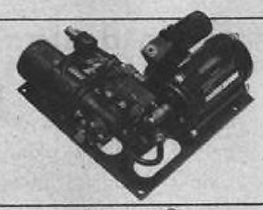
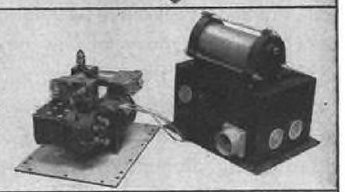
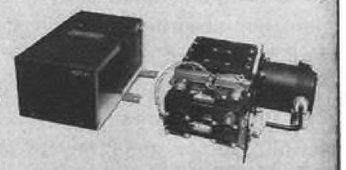


MODEL E/AP-150 TYPE 205
- Operating pressure switch maintains a system pressure of 17 P.S.I.A.
- Motor is 1/25 H.P. 7,500 R.P.M., 27 volts D.C. — T.E.B.B.
- Current draw is 2.0 amperes maximum under normal operating conditions
- Life is 500 operating hours
- Weight is 8 lbs. maximum



MODEL E/AP-1500 TYPE 203
- Operating pressure switch maintains a system pressure of 30 P.S.I.A.
- Motor is 1/15 H.P. nominal 24-28 volts D.C., 5,000 R.P.M., continuous duty, shunt wound
- Current draw is 3.4 amperes maximum under normal operating conditions
- Life is 500 operating hours
- Weight is 12 lbs. maximum



MODEL E/AP-2400 TYPE 201B
- Maintains system pressure of 31 P.S.I.A.
- Motor is 1/10 H.P., 24-28 volts D.C., 5,000 R.P.M. continuous duty
- Current draw is 5.5 amperes maximum
- Life is 500 operating hours
- Weight is 10-3/4 lbs. maximum

MODEL E/AP-3600 TYPE 200
- Maintains system pressure of 31 P.S.I.A.
- Motor is 1/7 H.P., 10,000 R.P.M. { 208 V., 400 cy., 3 ph. / 24-28 V.D.C. } continuous operation
- Current draw is { 1.3 amp./phase / 7.1 on D.C. } amperes maximum under normal operating conditions
- Life is 1,000 operating hours
- Weight is 8-1/2 lb. maximum

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Minnesota Silicone Rubber Co., 5724 West 36 St., Minneapolis 16, Minn.
Parker Appliance Co., 17325 Euclid Ave., Cleveland 12, Ohio
REF MFG. CORP., 393 Jericho Tpke., Mineola, N. Y.
Reid Enterprises, 3715 Santa Fe Ave., Vernon, Calif.
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St. Mary's Carbon Co., State Rd., St. Marys, Pa.
W. S. Shamban & Co., 11617 West Jefferson Blvd., Culver City, Calif.
STEIN SEAL CO., 20th Street & Indiana Ave., Philadelphia 32, Pa.
Stillman Rubber Co., 5805 Marilyn Ave., Culver City, Calif.
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Vibra Seal Corp., 2832 East Grand Blvd., Detroit 11, Mich.
WM. R. WHITTAKER CO., LTD., 915 North Citrus Ave., Los Angeles 38, Calif.

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Aeronca Mfg. Corp., Middletown, Ohio
Airborne Instruments Lab., Inc., 160 Old Country Rd., Mineola, N. Y.
Aircraft Armaments, Inc., Cherry Tree Rd., Cockeysville, Md.
Aircraft Products Co., Church Rd. & Crooked Lane, Bridgeport, Pa.
AMERICAN BOSCH ARMA CORP., Roosevelt Field, Garden City, N. Y.
AMERICAN ELECTRONIC MFG. INC., 9503 West Jefferson Ave., Culver City, Calif.
AMERICAN ELECTRONICS, INC., 4811 East Telegraph Rd., Los Angeles 22, Calif.
United States Gauge Div., American Machine & Metals Inc., Sellersville, Pa.
American Res. & Mfg. Corp., 4914 Del Ray Ave., Bethesda 14, Md.
Aircraft Div., Aro Equipment Corp., Bryan, Ohio
ECLIPSE-PIONEER DIV., BENDIX AVIATION CORP., Teterboro, N. J.
Bowmar Instrument Corp., 2415 Pennsylvania St., Fort Wayne, Ind.
Brandstrom Electric Co., Westport, Conn.
Burroughs Corp., 6071 Second Ave., Detroit 32, Mich.
Burton Mfg. Co., 11201 West Pico Blvd., Los Angeles 64, Calif.
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Control Instrument Co., 67 35th St., Brooklyn 32, N. Y.
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Donner Scientific Co., 2829 7th St., Berkeley 7, Calif.
DUMONT AVIATION ASSOCIATES, 1401 Freeman Ave., P. O. Box 4087, Long Beach 4, Calif.
Dynalysis Devel. Labs., Inc., 11941 Wilshire Blvd., Los Angeles 25, Calif.
EASTERN INDUSTRIES INC., 100 Skiff St., Hamden 14, Conn.
Executive Aircraft Service, P. O. Box 7307, Dallas 9, Tex.

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General Electric Co., Light Military Electronics Equip. Dept., French Road, Utica, N. Y.
General Electronic Lab., Inc., Ames St., Cambridge, Mass.
Electro-Mechanical Div., General Riveters, Inc., 785 Hertel Ave., Buffalo 7, N. Y.
Gillmor's, Inc., 110 Duffy Ave., Hicksville, N. Y.
Gladden Products Corp., 635 West Colorado Blvd., Glendale, Calif.
GLOBE INDUSTRIES, INC., 1784 Stanley Ave., Dayton 4, Ohio
Haliamore Electronics Co., 2001 E. Artesia St., Long Beach 5, Calif.
HOOVER ELECTRIC CO., 2100 South Stoner Ave., Los Angeles 25, Calif.
Houdaille Aviation, 537 E. DeLavan Ave., Buffalo 11, N. Y.
Hydraulic Research & Mfg. Co., 2835 North Naomi St., Burbank, Calif.
Induction Motors Corp., 570 Main St., Westbury, N. Y.
Bill Jack Scientific Instrument Co., P. O. Box C-50, Solana Beach, Calif.
Javelin Aircraft Co., Inc., 1405 South Oliver, Wichita, Kan.
KEARFOTT CO., INC., 1378 Main Ave., Clifton, N. J.
L & M Engrg. Co., 5112 West Jefferson Blvd., Los Angeles 16, Calif.
Lear, Inc., 3171 S. Bundy Drive, Santa Monica, Calif.
Librascope, Inc., 808 Western, Glendale, Calif.
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H. W. LOUD MACHINE WORKS, INC., 969 East Second St. Pomona, Calif.
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Ozone Metal Products Corp., 101-32 101 St., Ozone Park 16, N. Y.
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J. B. Rea Co., 1723 Cloverfield Blvd., Santa Monica, Calif.
Reeves Instrument Corp., 215 East 91 St., New York 28, N. Y.
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Revco, Inc., 2 East Franklin Ave., Minneapolis 4, Minn.
W. C. Robinette Co., 802 Fair Oaks, South Pasadena, Calif.
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Servo Corp. of America, 2020 Jericho Turnpike, New Hyde Park, N. Y.
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Western Div., Servomechanisms, Inc., 12500 Aviation Blvd., Hawthorne, Calif.
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Stairco Industries, 12942 Sherman Way, North Hollywood, Calif.
Standard Coil Products Co., Inc., 1919 Vineburn Ave., Los Angeles 32, Calif.
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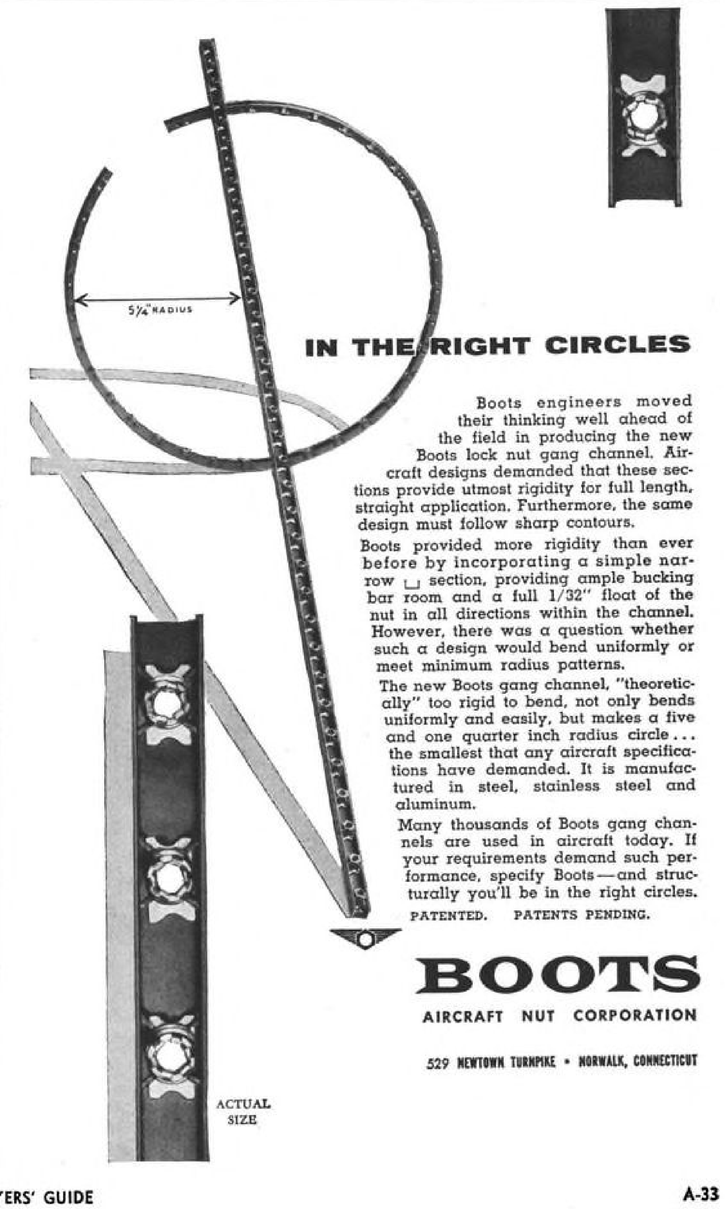
Dalmo Victor Co., Div. Textron American, Inc., 1414 El Camino Real, San Carlos, Calif.
Topp Industries, Inc., 5255 West 102 St., Los Angeles 45, Calif.
TRANSICOIL CORP., 107 Grand St., New York 14, N. Y.
Trio Laboratories, Inc., 3293 Seaford Ave., Wantagh, N. Y.
Ultrasonic Corp., 640 Memorial Dr., Cambridge 39, Mass.
United Supply Co., 3676 S. Broadway Place, Los Angeles 7, Calif.



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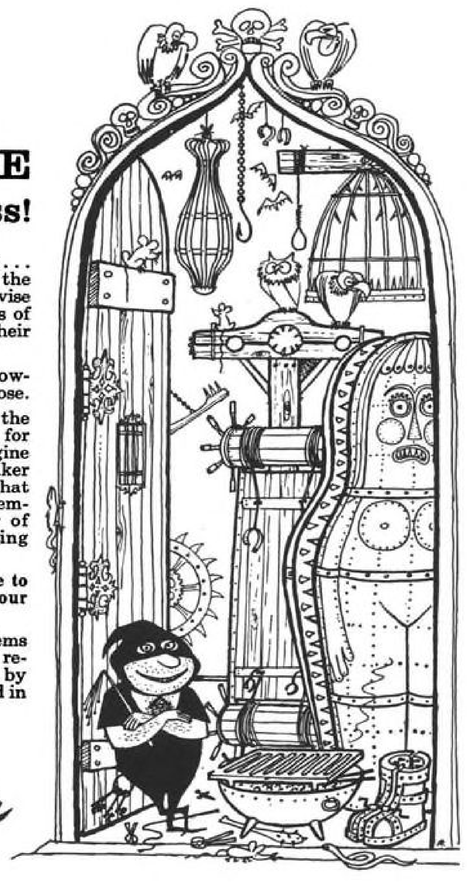

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Exports, Inc., 1406 Leslie Ave., Alexandria, Va.
Kaiser Metal Products Inc., Plant 1, Adm. Bldg., Bristol, Pa.
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Brooks & Perkins, Inc., 1950 West Fort St., Detroit 16, Mich.
Hardman Tool & Engineering Co., 1845 South Bundy Dr., Los Angeles 25, Calif.
Ludwig Honold Mfg. Co., Chester Pike & Folcroft Ave., Folcroft, Pa.
Kaiser Metal Products Inc., Plant 1, Adm. Bldg., Bristol, Pa.
C. D. KAUPP & SONS, 32 Newark Way, Maplewood, N. J.
Kling Metal Spinning Co., 174 Centre St., New York 13, N. Y.
Metalart Corp., 266 Freeman St., Brooklyn 22, New York
Metal Spinning Div., Phoenix Products Co., 4741 North 27th Street, Milwaukee 16, Wisc.
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Vernco, Columbus, Ind.
Westholt Mfg., Inc., 925 Wheeler, Wichita, Kansas
Westinghouse Air Brake Co., 3 Gateway Center, Pittsburgh, Pa.

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F. C. Kent Co., 64 Howard St., Irvington 11, N. J.
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Ryan Aeronautical Co., Lindbergh Field, San Diego 12, Calif.
SMITH-MORRIS CO., 825 Myrtle St., Ferndale 20, Mich.
SOLAR AIRCRAFT CO., 2200 Pacific Highway, San Diego 12, Calif.
Stainless Steel Products, Inc., 2980 San Fernando Rd., Burbank, Calif.
Taylorcraft, Inc., Conway-Pittsburgh Airport, Conway, Pa.
Wesmont Manufacturers Corp., 222-228 West Orange Grove Ave., Burbank, Calif.
Woolf Aircraft Products, Inc., 3441 Filbert St., P. O. Box 270, Wayne, Mich.

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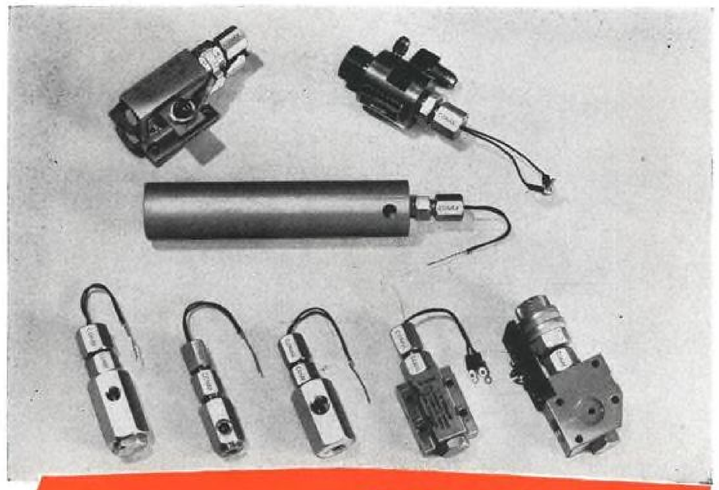

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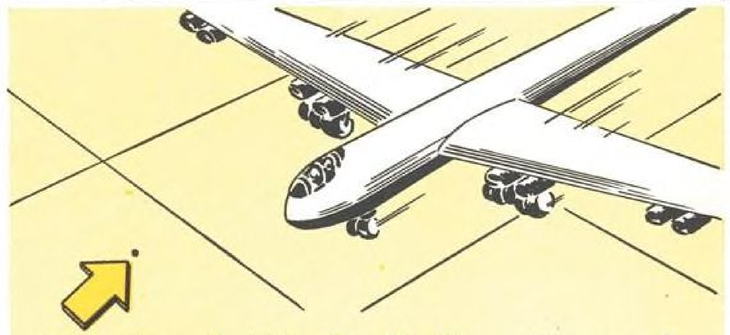

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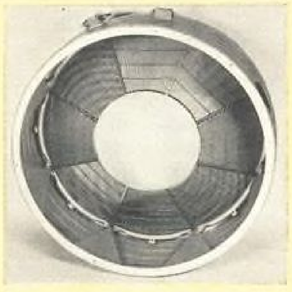

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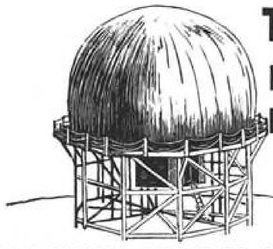

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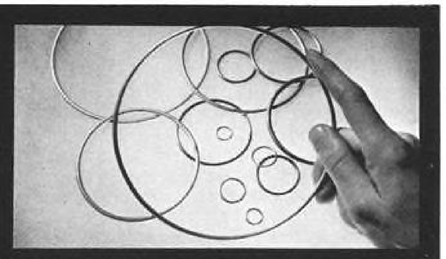

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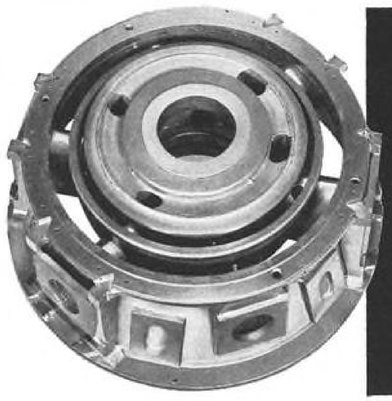

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APPARATUS SALES DIV., GENERAL ELECTRIC CO., 1 River Rd., Schenectady 5, N. Y.
General Electric Co., Light Military Electronics Equip. Dept., French Road, Utica, N. Y.
General Electric International, 570 Lexington Ave., New York 22, N. Y.
The W. L. Maxson Corp., 460 West 34th St., New York 1, N. Y.
Phillips Aviation Co., 1525 Monterey Rd., So. Pasadena, Calif.
FORD INSTRUMENT DIV., SPERRY RAND CORP., 31-10 Thomson Ave., Long Island City 1, N. Y.
Contrs. Div., Stavid Engineering Co., Route U. S. 22, Plainfield, N. J.
Steel Products Engr. Co., 1205 West Columbia St., Springfield, Mass.
Ultrasonic Corp., 640 Memorial Dr., Cambridge 39, Mass.
VICKERS, INC., 1462 Oakman Blvd., Detroit 32, Mich.
WESTINGHOUSE ELECTRIC CORP., P. O. Box 868, Pittsburgh 30, Pa.
Air Arm Div., Westinghouse Electric Corp., Friendship Int'l. Airport, Baltimore 3, Md.
W. C. Twigg Industries, Inc., 1827 East National Rd., Brazil, Ind.
WESTINGHOUSE ELECTRIC CORP., P. O. Box 868, Pittsburgh 30, Pa.

WHEELS, CONTROL

Turrets, Gun

Aeronca Mfg. Corp., Middletown, Ohio
Crosley Div.—Avco Defense & Ind. Prod., Avco Mfg. Corp., 2630 Glendale-Milford Rd., Cincinnati, Evendale 15, Ohio
Brooks & Perkins, Inc., 1950 West Fort St., Detroit 16, Mich.
Control Instrument Co., 67 35th St., Brooklyn 32, N. Y.
AERO DIV., GENERAL BRONZE CORP., Stewart Ave., Garden City, N. Y.
APPARATUS SALES DIV., GENERAL ELECTRIC CO., 1 River Rd., Schenectady 5, N. Y.
Luria-Cournand, Inc., Box 177, Havre de Grace, Md.
The W. L. Maxson Corp., 460 West 34th St., New York 1, N. Y.
Steel Products Engr. Co., 1205 West Columbia St., Springfield, Ohio
WESTINGHOUSE ELECTRIC CORP., P. O. Box 868, Pittsburgh 30, Pa.

Ventilators, Cabin

Airconductors, 1458 W. Compton Blvd., Compton 3, Calif.
HERMAN NELSON DIV., AMERICAN AIR FILTER CO., INC., 1824 Third Ave., Moline, Ill.
Dean & Benson Res., Inc., 16 Richmond St., Clifton, N. J.
Snapvent Co., 1107 West Cumberland Ave., Knoxville 16, Tenn.
Eastern Div., Van Dusen Aircraft Supplies, Teterboro, N. J.
Western Arc Welding, Inc., 749 Kohler St., Los Angeles 21, Calif.

Vents, Air Conditioning

Airconductors, 1458 W. Compton Blvd., Compton 3, Calif.
AIRCRAFT COMPONENTS DIV., Dunbar Kapple, Inc., North Island Ave., Batavia, Ill.
Hussmann Aircraft Div., Hussmann Refrigerator Co., 819 East Taylor St., St. Louis 15, Mo.
Arrowhead Rubber Co. Div., National Motor Bearings, 2350 Curry St., Long Beach 5, Calif.
Pyle National Co., 1334 North Kostner Ave., Chicago 51, Ill.
Stainless Steel Products, Inc., 2980 San Fernando Rd., Burbank, Calif.
Wesmont Manufacturers Corp., 222-228 West Orange Grove Ave., Burbank, Calif.

Warning Systems

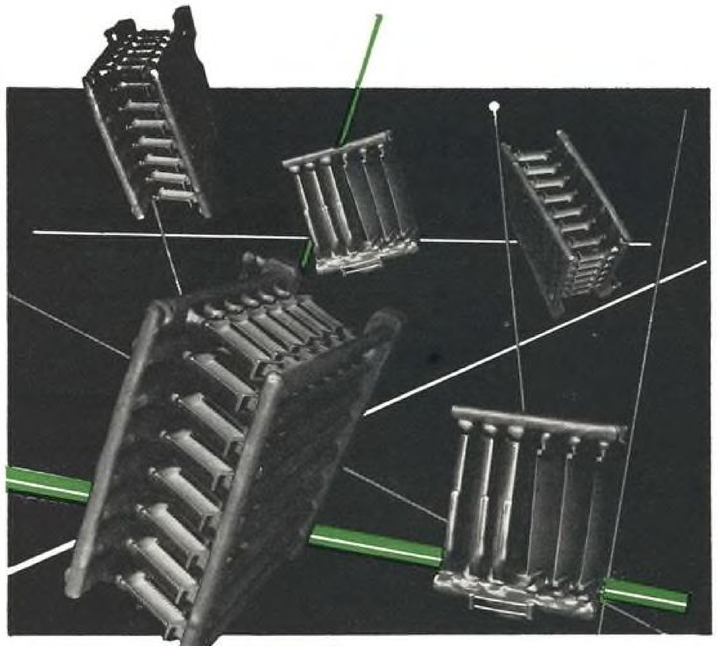
Master Specialties Co., 956 East 108th St., Los Angeles 59, Calif.

Water-Injection Equipment

Hydro-Aire, Inc., 3000 Winona Ave., Burbank, Calif.

Wheels, Control

Aircraft Div., Adams-Rite Mfg. Co., 540 West Chevy Chase Dr., Glendale 4, Calif.
Hansen-Lynn Co., Inc., 800 South Flower, Burbank, Calif.
NATIONAL WATER LIFT CO., 2220 Palmer Ave.,



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For further information about Craig products, systems and services write to
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DANVERS, MASS.
Tel. Danvers 1870

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Scott Aviation Corp., 207 Erie St., Lancaster, N. Y.

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BENDIX PRODUCTS DIV., BENDIX AVIATION CORP., South Bend 22, Ind.
Cleveland Aero Prods. Co., 113 St. Clair Ave., N. E., Cleveland 14, Ohio
The B. F. Goodrich Co., 500 South Main St., Akron 18, Ohio
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AMERICAN BOSCH ARMA CORP., Roosevelt Field, Garden City, N. Y.
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Breeze Corporations, Inc., 700 Liberty Ave., Union, N. J.
BRISTOL ENGINEERING CO., Beaver Dam & Oak Rds., Bristol, Pa.
THE ELECTRIC AUTO-LITE CO., Champlain & Mulberry Sts., Toledo, Ohio
DUMONT AVIATION ASSOCIATES, 1401 Freeman Ave., P. O. Box 4087, Long Beach 4, Calif.
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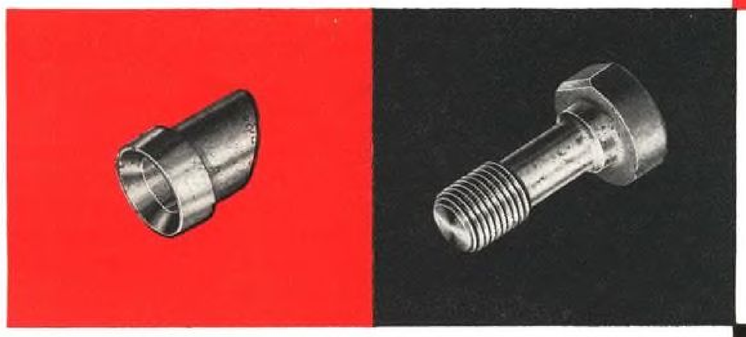

Connector for jet aircraft engine accessory
Overall finish 32 RMS. All diameters concentric with thread within .004", I.D. within .0015 F.I.R. AMS 5645 stainless steel.

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Cone seat finished for pressure sealing. AMS 5648 stainless steel.

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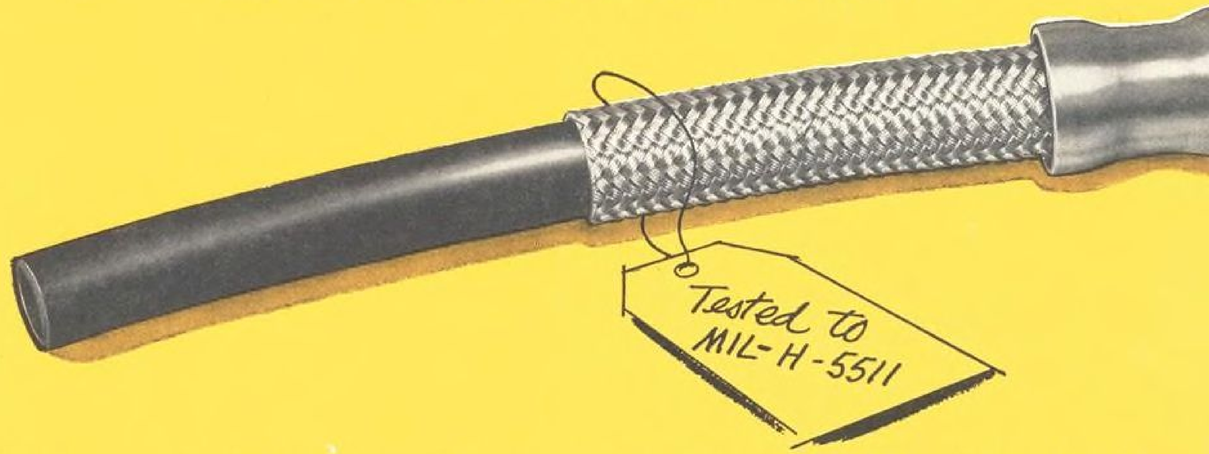
Lightweight Titeflex flexible hose... made from Du Pont Teflon*

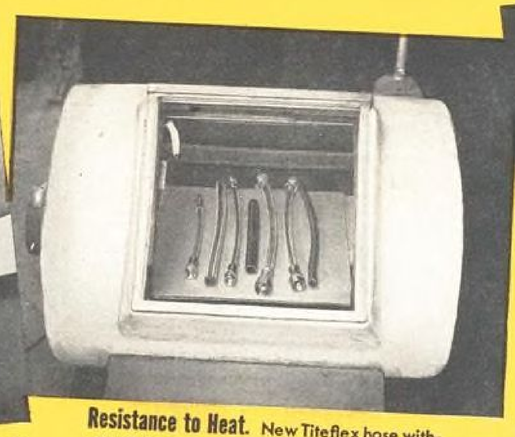


Titeflex knows the aviation hose business . . . has been making flexible aircraft metal hose for over 20 years. And now . . . to keep pace with the requirements of the jet engine industry, Titeflex has developed a *new* type of flexible hose with an inner core made from Du Pont Teflon tetrafluoroethylene resin.

Our Engineering and Research departments with their specialized experience in hose manufacture, working with all types of metals, now adding special resins, have designed, developed and tested a new product to complement our complete line of metal hose. This is not just a Teflon inner core with wire braid covering, but a completely engineered product from fittings to carefully selected braid and materials.

Working with the designers and engineers of leading jet engine manufacturers, we have developed a flexible hose that meets all practical requirements of MIL-H-5511 specifications under independent testing by a leading research laboratory.

Resistance to Chemicals. New Titeflex hose is impervious to the corrosive action of synthetic lubricants, hydraulic fluids, salt spray; is unaffected by fungus.



Resistance to Heat. New Titeflex hose withstands temperatures up to 500°F. Does not soften, deteriorate or change in any way under high heat torture.

Resistance to Cold. New Titeflex hose retains its flexibility even at −100°F. Super-cohesive—will not crack, chip or cause fuel or oil lines to clog.

*Du Pont trademark for its tetrafluoroethylene resin

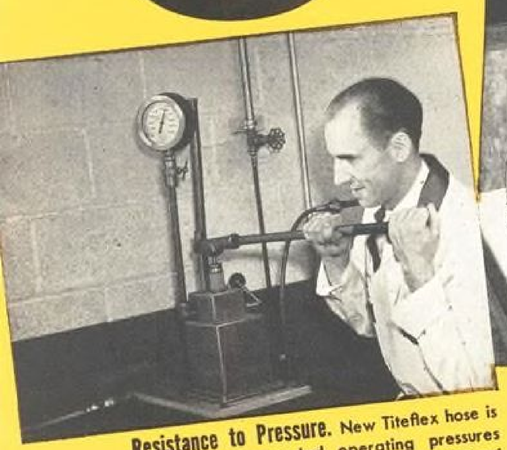
# of Aviation Metal Hose—

Chief Characteristics

- **Has high resistance to synthetic lubricants, hydraulic fluids**
- **Withstands extremely low temperatures**
- **Operates at extremely high temperatures and pressures**
- **Virtually chemically inert**
- **Will not crack, chip; will not cause lines to clog**
- **Has indefinite shelf life**
- **Available in ¼" to 1¼" sizes with standard fittings**

For any conveying application where increasing high pressure and high temperature requirements combine to make most other hose assemblies either uneconomical, too bulky, inefficient or obsolete . . . this latest addition to the Titeflex line of flexible hose offers a practical solution to one of the aviation industry's serious design problems. Use the coupon at right to obtain additional information or request one of our sales engineers to discuss your specific application.

Titeflex



Resistance to Pressure. New Titeflex hose is tough — recommended operating pressures range from 600 psi for 1¼" hose to 3000 psi for ¼" hose. Shows no visible effects from aging, and has unlimited shelf life.

Rigid Testing. Sample Titeflex hose lines set up for impulse-test cycling from 75—2500 lbs. psi. MIL-H-5511 test.

Customer Service. Titeflex sales engineers are competent, trained specialists. They work directly with you to help you find the *right* answers to your aviation hose problems. Call on them, without obligation, at any time.

Quality Control. This is a view of the Titeflex quality control laboratory where raw materials and other components are inspected for uniformity. Nothing is left to chance in maintaining Titeflex standards.

Engineering Service. If you are looking for design ideas, product developments and adaptation of Titeflex aviation hose to your own specifications, call on our highly skilled engineering department. No obligation.

Titeflex

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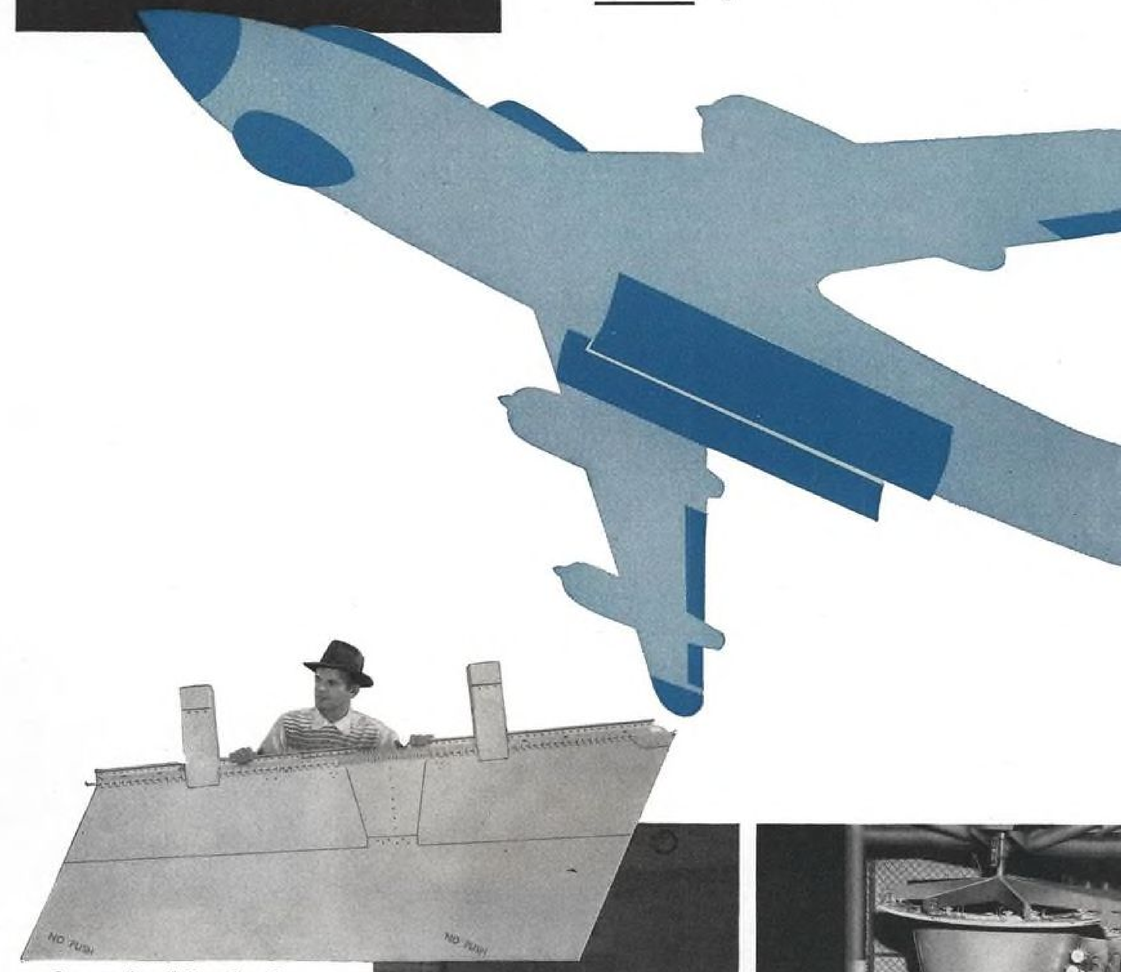
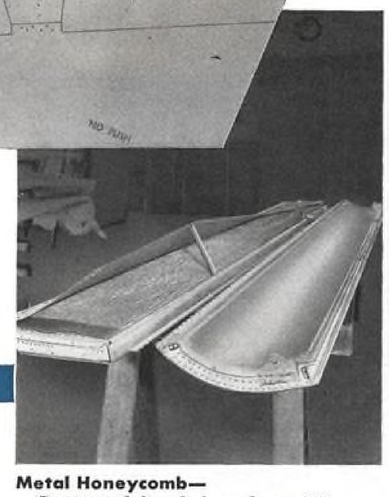
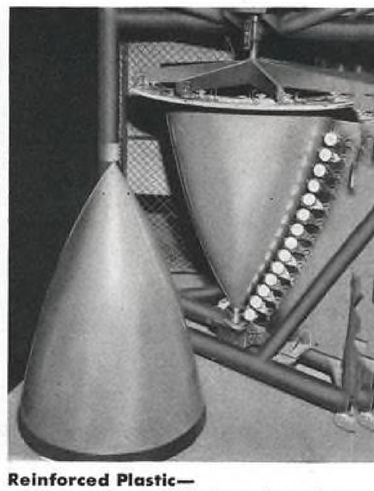


Conventional Metalwork—
Aileron with metal honeycomb trailing edge



Metal Honeycomb—
Contoured bomb bay doors 14' long, raised skin shows core of metal honeycomb

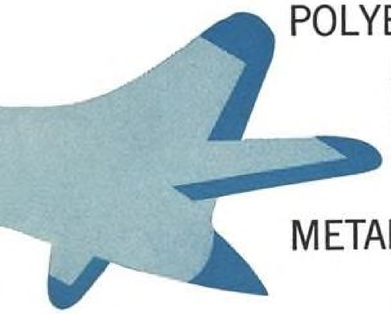


Reinforced Plastic—
Nose radome 5½' long, low drag boresight foamed in place construction

for three basic types of aircraft sub-assemblies

For aircraft components in *any* or *all* of three basic materials you can depend on Brunswick's facilities. Proof? Here are the components that are already in service or in quantity production in Brunswick's manufacturing plants:

POLYESTER REINFORCED PLASTICS



- Radomes (foamed in place)
- Radomes (honeycomb core)
- Radomes (solid laminate)
- Radomes (anti-icing)
- Wing Tips
- Fin and Rudder Tips
- Cowlings
- Nose and Tail Cones
- Ducts
- Housings of all Types

METAL HONEYCOMB FABRICATIONS

- Bomb Bay Doors
- Nose Wheel Doors
- Wing Cover Panels
- Trailing Edges for Flaps, Ailerons, and Other Control Surfaces

CONVENTIONAL AIRCRAFT METALWORK

- Pressurized Windshield and Canopy Assemblies
- Major Radar Assemblies
- Ailerons and Flaps
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- Douglas
- General Electric
- Grumman
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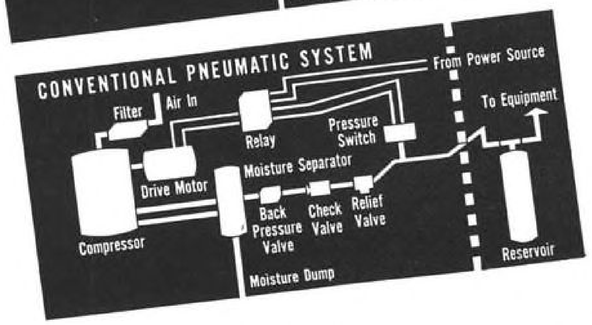
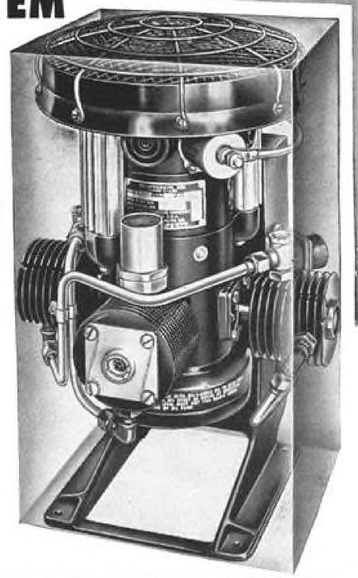
In fighters, bombers, aerial tankers, transports, trainers and helicopters





COMPLETE PNEUMATIC PACKAGE

*The Cornelius Compressor, Model 130, 2CFM, 3000 PSI, is used in the McDonnell F2H-3 and F3H, North American FJ-2 and FJ-3, Chance Vought F7U-3, and Grumman F11F-1. Also on order for the Lockheed P2V, Grumman S2F, Martin P5M, Boeing KC135, Boeing B52, Convair Turboprop Airliner and Canadair Britannia. Thousands of service hours under all operational conditions are proof of outstanding performance.

The Cornelius Model 130 compressor* is the heart of the complete Cornelius "packaged" pneumatic system which includes inlet air filter, starting relay, radio noise filter, moisture separator with automatic condensate dump and heating element, back pressure valve, check valve, relief valve and pressure switch.

Compact Design Saves Space—Entire air supply system occupies only slightly more space than compressor alone in conventional system.

Weight Savings of 5 pounds or more are possible by eliminating separate system components, associated tubing, fittings and flare connections.

System Leakage Is Reduced to a minimum because integration of components removes possible leakage sources such as flare connections and o-ring sealed fittings.

System Reliability Is Assured because each integral component is designed specifically to give optimum performance in combination with the other components.

Time Saved by installation and servicing of *one* unit is another valuable benefit which only Cornelius "packaged" pneumatic systems offer.

The Cornelius "packaged" pneumatic systems are available with either DC, AC or hydraulic motor drives. Please write us in order that a Sales Engineer may discuss with you the application of this "packaged" system as well as the many other pneumatic components which we manufacture.

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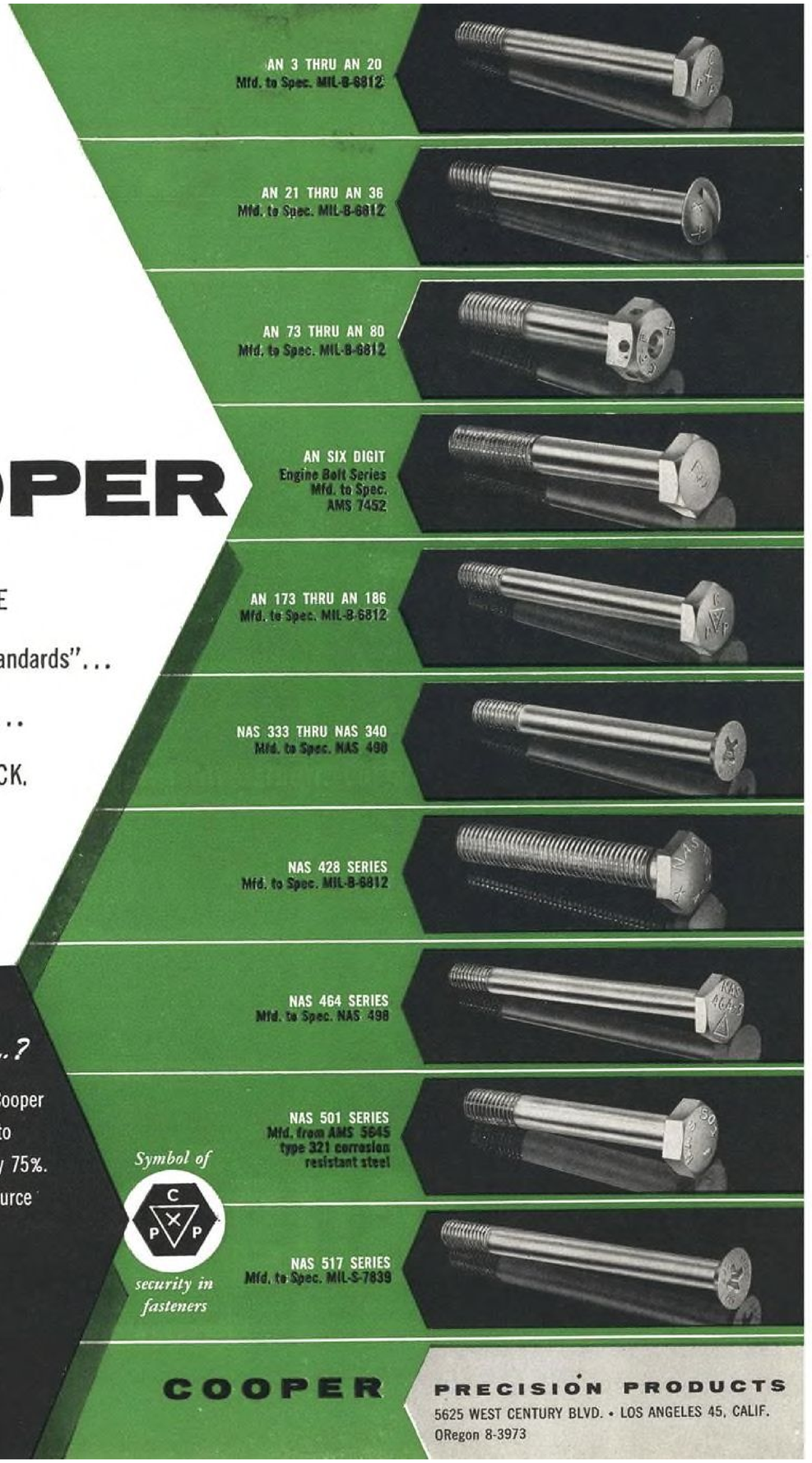

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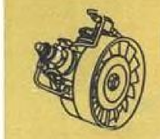

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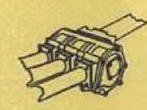
3,000 psi compressors rated to 11.2 cfm free air equivalent

Air Turbine Drives

For Alternators, Hydraulic Pumps and Emergency Power



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Mechanical—Draw Fuel From Tanks in Predetermined Proportions

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With manufacturing facilities on both the east and west coasts, Stratos is integrating many more products into its line of aircraft systems and accessory equipment.

In addition to pressurization and air-conditioning systems for aircraft, Stratos is now supplying high and low pressure compressors, turbo drives, valves and controls—a more complete group of pneumatic accessories and systems for many basic aircraft services.

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Model PCM3 3,000 psi Compressor,
Delivers 11.2 cfm Free Air Equivalent

Model TP25 Turbine Drive
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Model TP15-2 Turbine Drive
for 9 to 12 KVA Alternators

Model TP15-1 Turbine Drive
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Mechanical Fuel Proportioner

Model TP3 Turbine-Generator
Emergency Power Pack

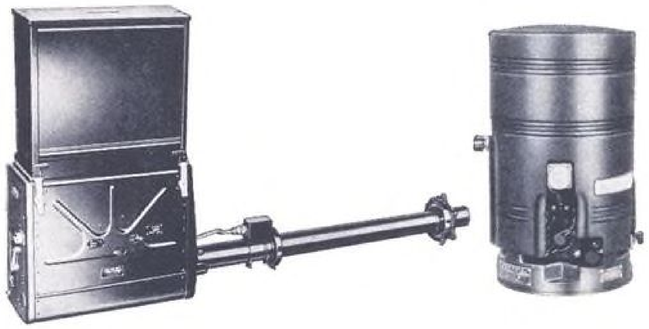
Model 758 Ventilating Fan,
Capacity: 900 cfm

Model 747A Interlock
Valve

Model 807 Retro Drift
Signal Ejector Control

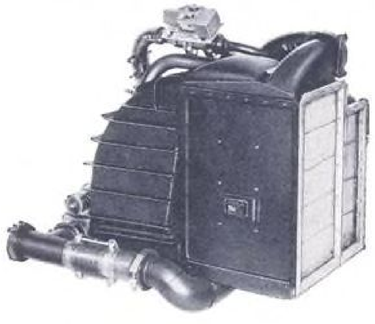
Model 753 Sonobuoy and
Flare Release Control

Model 7008 Pneumatic
Valve. 3,000 psi,
3-way, 2 position



Pneumatic Retro Marine
Marker Ejector

Compressor, 2 cfm, 3,000 psi
self-contained, electrically driven



Model EA75 Refrigeration System—
Nominal Flow Rating: 75 lbs./min.

Model S60-11 Cabin Supercharger

Model S60-5 Cabin Supercharger

Model B60 Bootstrap
Refrigeration Unit

Model N15 Air Cycle Machine

Model MS60 Air Moisture Separator

Ball Valve for
High Temperatures

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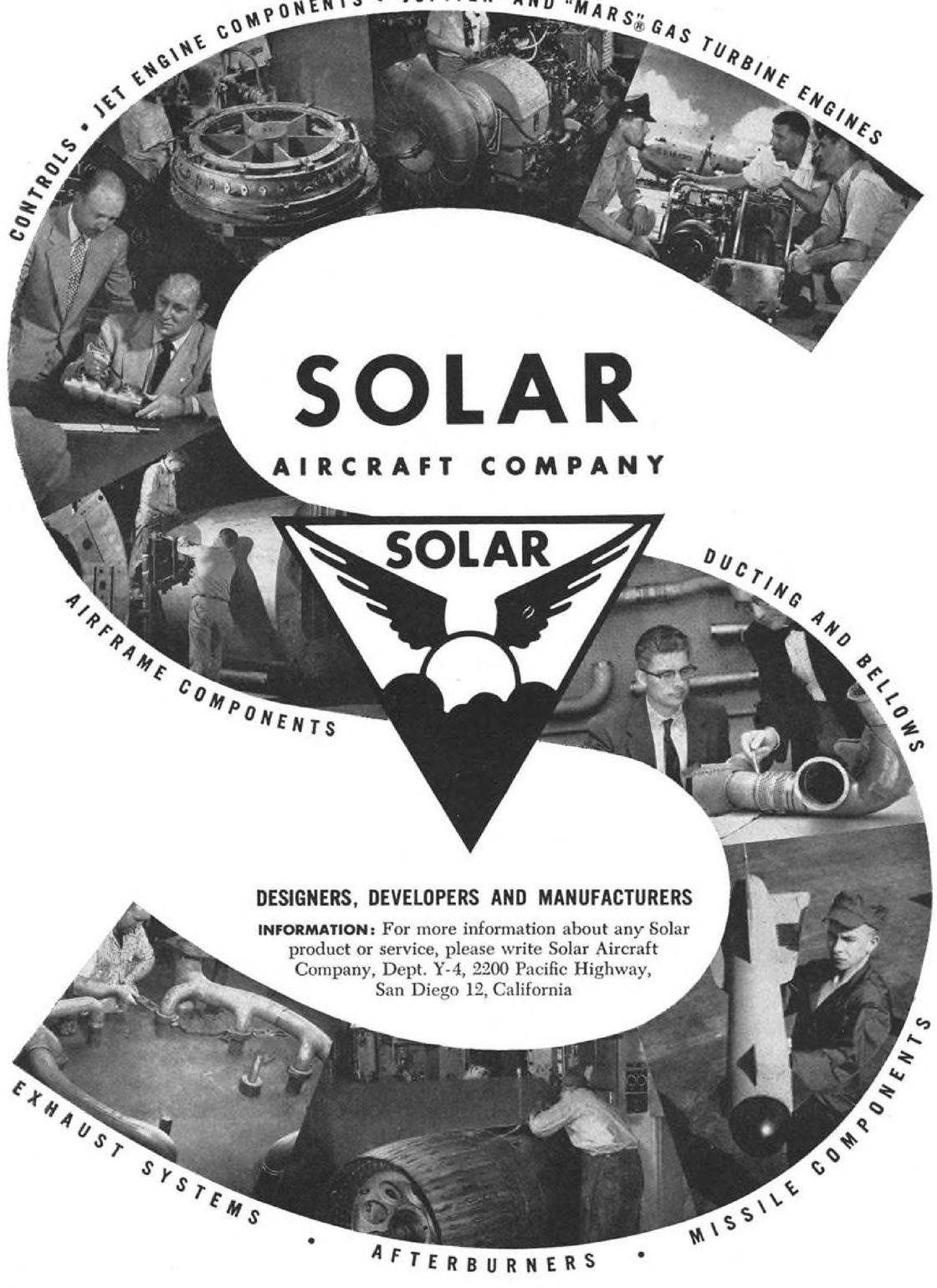

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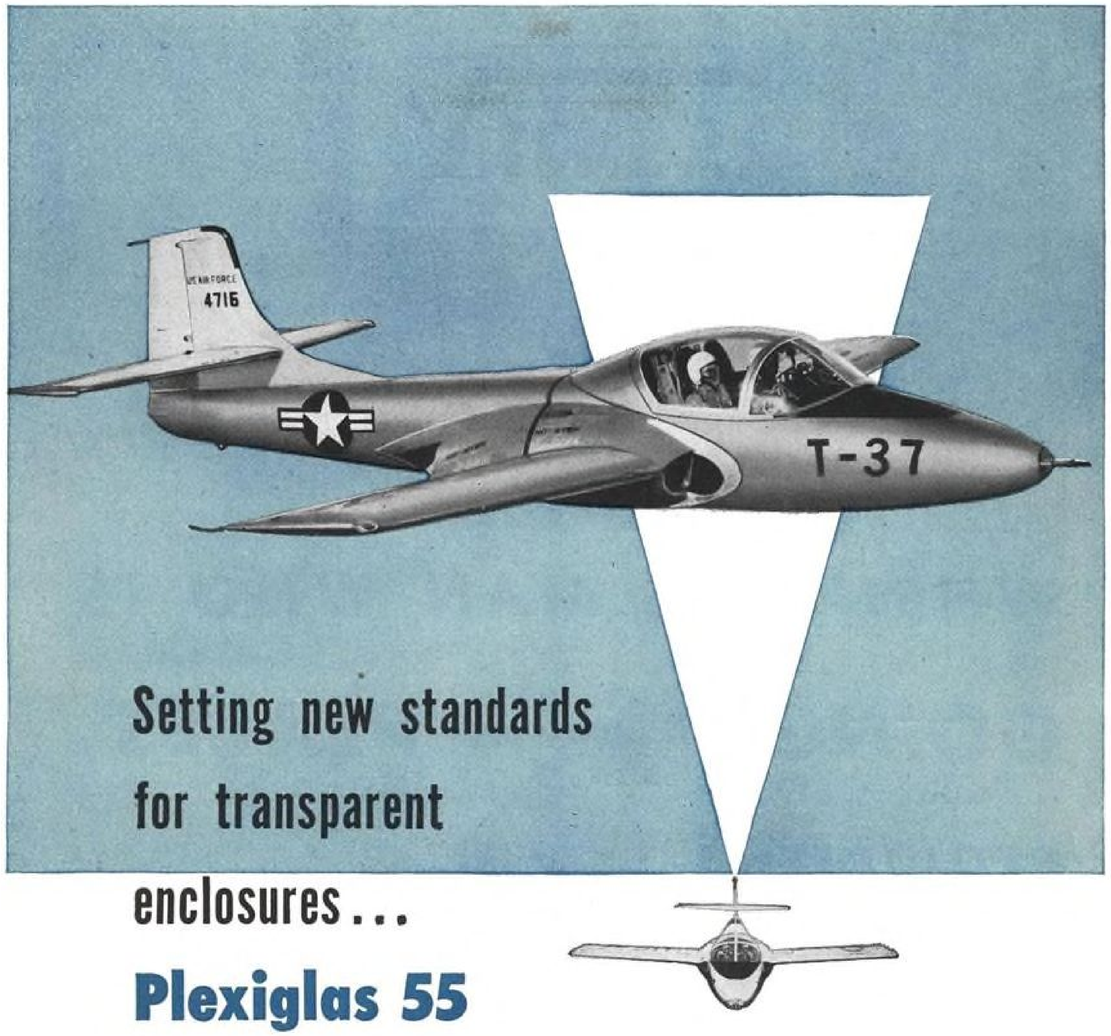

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Convair F-102	Martin XP6M-1, B-57B
North American FJ-4, F-100	

We will be glad to send you detailed information on PLEXIGLAS 55. For the planes of the future, we are working to raise the quality of transparent plastic to an even higher level.

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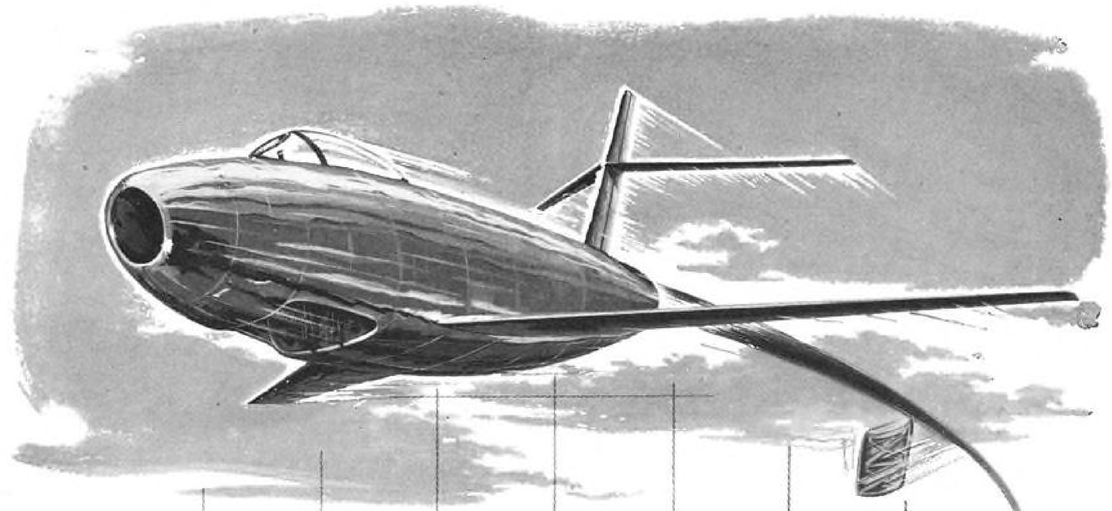

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10,000 FT.

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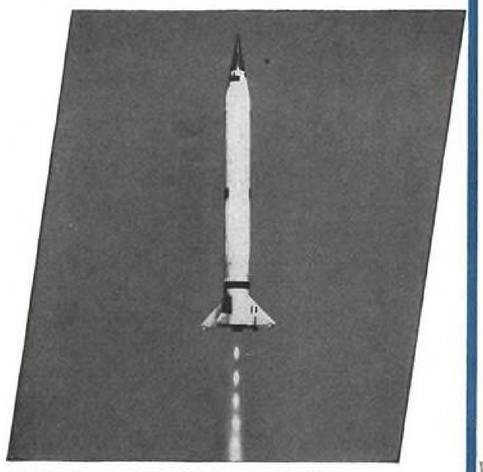
Stanley PROVIDES THE RETURN TRIP TICKET

DESIGNERS AND MANUFACTURERS OF
UPWARD AND DOWNWARD **EJECTION SEATS**

2500 DALLAS STREET — Stanley AVIATION CORP. — DENVER 8, COLORADO

first and foremost in ROCKET POWER



★ *World speed and altitude record holder for single stage rockets . . . RMI rocket powered Martin Viking high altitude research rocket.*

World speed and altitude record holder for piloted aircraft . . . RMI rocket powered Bell XI-A.

Like the high altitude missiles its rocket engines have powered, Reaction Motors, Inc. has covered a great distance in a short time. As America's pioneer rocket engine producer, RMI gave this country its first practical liquid-propellant rocket powerplants and has engineered many barrier-breaking "firsts" in helping to keep our country strong.

- **Missile boosters and sustainers**
- **Aircraft powerplants**
- **Ordnance rocket propulsion**
- **Special propulsion devices**
- **Launching and ejection devices**
- **Auxiliary power units**
- **Boundary layer control**

Another first in rocket engine design and performance . . . Sikorsky HRS-2 helicopter equipped with RMI Rotor Rocket auxiliary power.

Spearheading Progress through Research

RMI

REACTION MOTORS, INC.
Denville, New Jersey

Affiliated with OLIN MATHIESON CHEMICAL CORP.

A-55

NWL — a top aircraft accessory team 100% engaged in design, development, and precision production of aircraft equipment and accessories.

QUALITY CONTROLS . . . *The* Lift LINE

Fluid Servo Mechanisms — Designed to operate airframe controls in highspeed aircraft, these servo actuators may be single or dual system types — mechanically, electrically, or multi-input actuated.

NWL *project teams* . . .

working constantly in the fields of fluid servo mechanisms and controls, hydraulic actuators, electro-mechanical components, and other related aircraft accessories—have built years of experience and "know-how" into the Lift line of products. NWL project teams are immediately available to assist you on your control program . . . from design thru quantity production or any portion to fit your needs.

Contact the NWL resident engineer in your area.

Constant Performance Electro-Servo Valves Direct and pressure operated.

Pumps — Let us prove the advantages of NWL pump "know-how" — spur gear — internal gear — vane — and centrifugal.

OTHER LIFT LINE PRODUCTS

- Screwjacks—Ball and Acme Thread
- Synchronized and Hi-temperature Actuators
- Pneumatic Actuators and Valves
- Mechanical Devices
- Precision Sub-Contract Manufacturing

Electro-Mechanical Actuators, ask for data on the full **Lift** line.

Directional or Pressure Control Valves — Electrical or manual — direct or pilot operated.

NWL **NATIONAL WATER LIFT COMPANY**

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The Lift LINE

A-56

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any amount
any kind
any time

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AIRCRAFT TRANSDUCERS

PRESSURE OPERATED POTENTIOMETERS

Outputs: Linear and nonlinear functions of applied pressure.
Resistances: 100 to 50,000 ohms.
Ranges: 0-5 to 0-5000 psi.
Types: Absolute and differential.
Vibration Ambient: 0 to 55 cps, 0 to 500 cps, and severe vibration 25g to 2000 cps.
Construction: Hermetically sealed.

Write for Pressure Operated Potentiometer Bulletin

ULTRA-SENSITIVE PRESSURE SYSTEM

Output: 50 volts at full scale.
Range: ±¾ psi, differential.
Resolution: 1×10^{-6} psid.
Zero stability: Better than 1×10^{-3} psid.

Write for Bulletin EPMS

RESISTANCE BRIDGE PRESSURE PICKUPS

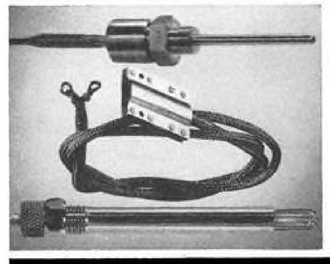
Sensitivity: 5 mv/v at full scale.
Ranges: 0-10 to 0-1500 psi.
Types: Absolute and differential.
Construction: Hermetically sealed.

Write for Bulletin No. 7

RATE OF CLIMB

Outputs: 5 volt signal and/or dial indicator.
Range: ±25,000 ft./min.
Time constant: 0.2 sec. at sea level to 2 sec. at 50,000 ft.

Write for Vertical Speed Transducer Bulletin



RESISTANCE THERMOMETERS

Resistance: 5 to 500 ohms at 32°F.
Materials: Platinum or nickel.
Range: −350 to +2000°F.
Types: Liquid, surface, gas.
Characteristics: Corrosion proof, severe vibration ambient, fast speed of response.

Write for Resistance Thermometers Bulletin

"For Transducers See Trans-Sonics"

Trans-Sonics, Inc.

77 FOREST STREET • BEDFORD, MASSACHUSETTS

75%

of all the helicopters flying today have

Franklin POWER

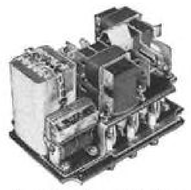
1955 is no exception to the rule that far more Franklin aircraft engines are chosen for helicopter power than any other kind in their power range. Current industry production figures show that this year, as in every year since 1939, 4 out of 5 helicopters under 400 h.p. will have power by Franklin. Why this preference? Because no other engine can match the Franklin engine record for reliability in helicopter installations, combined with low operational and maintenance cost.

Aircooled Motors is also a major subcontractor of precision machining

The same men and plant responsible for the extraordinary success of Franklin helicopter engines can accept additional subcontract work similar to that long produced for major companies in the aircraft field. We are fully equipped for quantity production of precision machining and subassemblies of the highest quality. Your inquiries are invited.

AIRCOOLED MOTORS, INC., SYRACUSE, N.Y.

Contactor - 175 amp., 400 cycle TPST, 28 v. DC operated



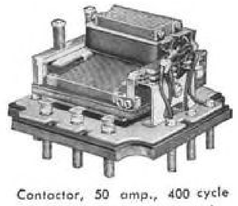
Load transfer contactors with negative sequence sensing

Relay - 400 cycle

Exciter control relay

Grd. Power receptacle contactor with phase sequence sensing

Underfrequency relay 400 cycle



Contactor, 50 amp., 400 cycle TPST, 28 v. DC operated

Phase sequence relay 400 cycle

Overvoltage relay 400 cycle, single or 3-phase

AC operated contactor TPDT, 25 amp. 400 cycle

Electrical nerve centers so vital to modern flying! Exacting specifications to meet ever-widening needs and more difficult environmental conditions.

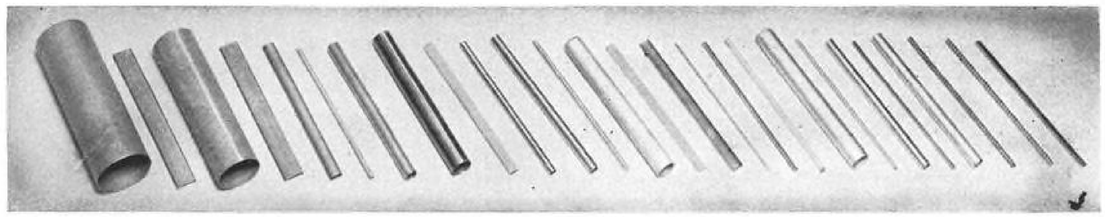
Here at Hartman we take pride in supplying dependable equipment — particularly the specially designed aircraft relays and contactors that can be relied on to keep electrical systems intact.

Call on us for engineering help — A.C. or D.C. — no obligation!

the Hartman Electrical Mfg. co.

"CONTROL HEADQUARTERS"

171 N. DIAMOND ST. MANSFIELD, OHIO



Superior Tube Offers the Finest in Small Diameter Precision Tubing for Aircraft Uses

Choice of over 63 analyses, wide variety of shapes and sizes, all made to close tolerances

Large OD lightwall tubing in seamless and Weldrawn* (welded and drawn). For applications of aircraft instruments, aircraft flexible metal hoses, low-pressure heat exchangers, aircraft ducting, bellows. The seamless tubing is offered in AISI Types 304, 321 and 347, and Monel.† Produced in pickled or cold drawn finish and in fully annealed, half-hard, full-hard drawn, or intermediate tempers. Length 5 to 22 ft. in random, multiple or cut lengths.

AVAILABLE SIZES IN SEAMLESS TUBING

OD	Minimum wall	Maximum wall
To 7/8" inc.	.006"	.035"
1"	.007"	.035"
1 1/8"	.008"	.035"
1 1/4" to 1 3/8"	.010"	.035"
1 1/2" to 2 1/2"	.010"	.025"

Weldrawn tubing is offered in Types 304 and 321 with max. length of 28 ft. Available sizes up to 2 1/16" OD. Wall thickness tolerance is ±10% on all sizes.

High-quality aircraft stainless hydraulic tubing—For tubing applications to withstand pressures as high as 15,000 psi. Featuring qualities for bending without flattening and fracturing, Superior hydraulic tubing is 100% hydrostatically tested as well as flare tested under 10X magnification.

Every length (1/8" OD and larger) of aircraft hydraulic tubing is continuously marked—analysis, heat number, size, specification. Tubing is thoroughly cleaned in standard pickling solutions for stainless steel to insure freedom from oxide film and metallic or nonmetallic particles. Offered in analyses AISI Types 304, 321, 347 and 410. Sizes range: 1/8" to 3/8" OD with maximum walls of 1/8" and 3/8" to 2 1/16" OD — maximum wall .025".

Titanium tubing—For structural applications, refrigeration and air conditioning lines, hydraulic and pneumatic lines. This alloy has a low linear coefficient of expansion, good ductility and formability and high resistance to erosion and cavitation. Featuring high strength to weight ratio, it is available in seamless, Weldrawn, and AS TUBE REDUCED.

Sizes range from .012" to 1.50" OD, wall thickness .002" to .187". Max. length 24 ft.

High temperature alloy tubing—For gas turbines, guided missiles, jet engines, other aircraft tubing exposed to high temperatures. Superior offers this tubing in stainless steels, nickel, and a variety of super alloys. Available in round or shaped tubing with commercial tolerances meeting 90% of all requirements. Stainless analyses Types 321 and 347 are used for welding where parts cannot be subsequently annealed—aircraft hydraulic and engine fuel lines.

AISI 4130, a low-alloy steel, is used for aircraft structure and engine parts. In annealed condition, it has good workability and can be hardened by heat treatment.

Low carbon steel tubing is produced to AMS 5050E—used for engine fuel and oil lines.

Superior presents quality as well as wide choice in tubing. Close control and application of modern testing facilities throughout the manufacturing process assure the aircraft manufacturers of tubing to meet the most exacting requirements.

Providing direct and prompt service to manufacturers on the West Coast, Pacific Tube Company, Los Angeles, offers the complete line of Superior tubing.

For detailed information about Superior tubing, including analyses for the aircraft industry, write for Bulletin 40. Address Superior Tube Co., 2038 Germantown Ave., Norristown, Pa., or Pacific Tube Co., 5710 Smithway St., Los Angeles 22.

Round and shaped tubing available in Carbon, Alloy and Stainless Steels; Nickel and Nickel Alloys; Beryllium Copper; Titanium; Zirconium.

*T.M. Superior Tube Co., Reg. U.S. Pat. Off.
†T.M. Internat. Nickel Co., Reg. U.S. Pat. Off.

Superior Tube

the big name in small tubing

West Coast: Pacific Tube Company **5710 Smithway St., Los Angeles 22, Calif. • RAymond 3-1331**

All analyses .010" to 5/8" OD. Certain analyses in light walls up to 2 1/2" OD.

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   (1) Automatic Pressure Compensated
   (2) Cylinder Controlled
   (3) Electrically Depressurized
   (4) Flow Reversing
   (5) Servo Controlled

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a. Electric Motor Driven Fixed Pumps
b. Electric Motor Driven Variable Pumps

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b. Pressure Regulators
c. Sequence Valves
d. Pump Control Valves
e. Pressure Reducing Valves
f. Reducing Relief Valves
g. Brake Valves
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c. Servo Valves
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   (3) Constant Speed
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b. Winch Systems
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   (2) Lighter Than Air
   (3) Helicopters
c. Electro-Hydraulic Servo Systems
d. Special Hydraulic Devices

Various special devices not listed above are also manufactured. Phone, wire or write us for a proposal describing the aircraft hydraulic accessory required for your particular project. Details of the above products are available on request. Ask for the new General Bulletin A-5200-B which will introduce you to our complete Aircraft Products line.

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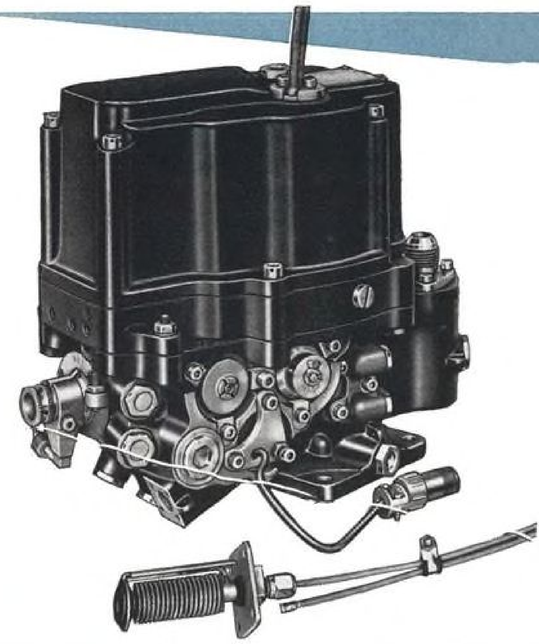
ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

THE COMPLETE, UNITIZED SYSTEM



Proved by past performance, CECO Fuel Control Systems have helped make possible many of the barrier-shattering achievements in aviation history. CECO design — maintained in advance of the field by an endless program of intensive research — plus CECO precision manufacture will make Chandler-Evans *always* the logical source for the latest and the finest.

Remember, *only* Chandler-Evans produces complete, unitized fuel control systems which include multi-element pumps, main controls and manual controls, with all components engineered and manufactured to function together as a perfectly integrated team. Here *today* to provide the equipment to meet tomorrow's needs is *one* source, *one* responsibility, *one* unbeatably high standard of product quality and performance.

CECO

FUEL CONTROL SYSTEMS

THESE COMPONENTS IN ONE SYSTEM

GEAR TYPE FUEL PUMPS

Pump fuel at pressures up to 1500 psi. Provide efficient operation at ambient temperatures from −65°F to +650°F. Produced in both single and multi-element units with integral boost . . . available with pressure regulating valves. Super-precision manufacturing techniques give high volumetric efficiency over a wide range of discharge pressures.

AFTERBURNER FUEL CONTROLS

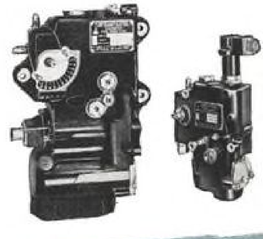
The first afterburner fuel controls in the aviation industry were developed and produced by Chandler-Evans. The basic CECO Afterburner Control is a by-pass type regulator operating on a constant metering head across a variable orifice. Size of the orifice is regulated by the airflow parameter. Throttle modulation is available by providing for manual variations in either metering head or orifice size.

MAIN FUEL CONTROLS

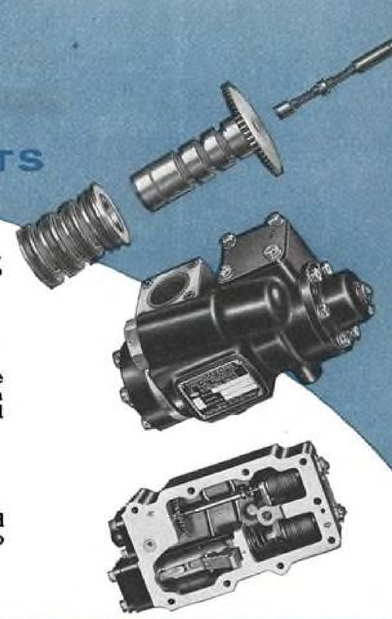
Provide automatic metering of fuel for all conditions of rpm, altitude and airplane speed. Manually selected engine thrust is automatically controlled so that the desired thrust is attained in the shortest possible time consistent with conditions for proper engine operation.

EMERGENCY FUEL CONTROLS

Cut in manually or automatically, this element takes over the essential functions of the main fuel control in the event of battle damage or other emergency. Like many main fuel controls, this is a pressure regulating by-pass system.



AIRCRAFT ACCESSORIES . . .
PRECISION COMPONENTS



SERVOMECHANISMS

High precision essential to modern performance standards. Tolerances between critical mating parts are often held to .00008".

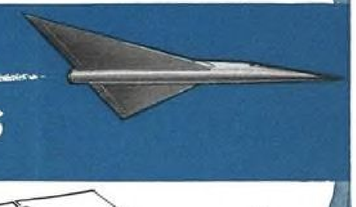
CONTROL VALVES

Piston-type variable by-pass valves operated by pressure differential. For such applications as location between fuel filter and main fuel pump to provide a scheduled fuel pressure to the engine.

SENSING MECHANISM

Variations in speeds, temperatures, pressures, altitude and other factors are automatically sensed and translated into mechanical motion to either engine or aircraft controls.

READY TODAY . . .
FOR TOMORROW'S PROGRESS



the CECO Service Story

FROM DRAWING BOARD TO FLIGHT LINE

Complete CECO Service starts at the drawing board stage with CECO Development Engineers working in the closest possible cooperation with aircraft engine designers to develop and produce CECO Fuel Control Systems integrated into the engine design requirements. Accepting a continuing responsibility to maintain CECO-equipped aircraft always at optimum performance levels, CECO follows through in the field . . . sending CECO Service Engineers onto the flight lines to incorporate all improvements and new developments.

ALSO MANUFACTURERS OF: CARBURETORS, VANE TYPE FUEL AND WATER PUMPS AND PROTEK-PLUGS

Chandler CECO Evans

Charter Oak Boulevard, West Hartford, Connecticut

. . . STEEL NERVES
for sensitive aircraft

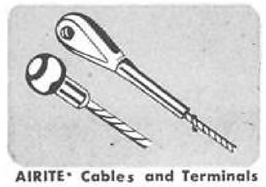
Precise flight control of fast jets or large airliners depends upon the split-second transmission of sensitive impulses to the control surfaces.

The wire cables transmitting these vital impulses are the steel nerves of the aircraft's control system. Constantly higher air speeds, larger overall size and greater temperature variation add serious new problems to those formerly confronting engineers specifying wire rope for control cable.

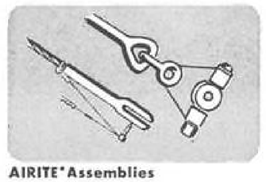
Because of this BERGEN WIRE ROPE COMPANY developed AIRITE* —a control cable specifically designed for modern aircraft. Proven in service by leading aircraft manufacturers, dependable AIRITE combines increased safety with proper bending qualities necessary for complex airborne installations. Multi-strand construction and precision pre-forming reduce friction, improving sensitivity for superior all around performance

AIRITE terminals are swaged by newly designed equipment . . . rotary pressure reduces internal stresses and fatigue cracks for longer, more reliable service with lower maintenance. The perfect alignment of AIRITE cables and terminals assures equal load distribution.

When you need quality aircraft cables, slings, tie-downs or assemblies specify AIRITE for maximum strength and safety — Bergen gives you quick deliveries of unique types too!



AIRITE* Cables and Terminals



AIRITE* Assemblies

*Trademark

Write today, for your free copy of Bergen's Brochure on AIRITE Cable — it's the easy way to solve control cable and assembly problems!

AIRCRAFT DIVISION
BERGEN
WIRE ROPE COMPANY
6 GREGG STREET, LODI.

SERVING THE LEADERS OF INDUSTRY

A-64

Assemblies-Fabrication Selection check list

Sound, Experienced Engineering

Kawneer engineers have broad experience coupled with initiative and desire to efficiently translate your requirements into a finished product. The department is functionally organized in groups to give you the best possible service: Project Engineering, Processing, Tool Control, Tool Inspection and Layout, and Development.

Proven Quality Control Methods

Kawneer Quality Control is constant—machines and instruments are periodically checked more often than required by specification to achieve *plus* quality. Kawneer's processing, fabrication, welding, anodizing and heat treating are all certified to Air Force Quality Control Standards. All procedures conform to MIL SPEC 5923B.

Efficient Production Line

Kawneer aircraft production is under one roof. The economy of well-planned production lines to integrate all functions is a cost-saving factor to you. The special plant has 110,000 square feet of floor area with a 16′ clear ceiling. The modern equipment includes routers, mechanical presses, milling machines, spray painting, etc.

Extensive Research and Development

Kawneer research is backed by over 50 years of experience in metal working; years that have seen Kawneer discover new processes that have revolutionized metal shaping methods. Kawneer maintains complete equipment necessary for chemical and physical research. Possibly this development work can be used to your advantage.

Adequate Supply of Skilled Labor

Kawneer's skilled labor force is thoroughly trained in the latest application techniques of the modern machine. These men come from an abundant pool of skilled labor located in the Niles, Mich., and South Bend, Indiana area 90 miles from Chicago!

• Cockpit Enclosures • Major Airframe Assemblies • Metal Bonded and Honeycomb Assemblies • Acrylic Forming and Fabrication • Jet Engine Sheet Metal Parts and Assemblies • Heliarc Die Welding

Write for the new Aircraft Division 24-page book for complete facility details

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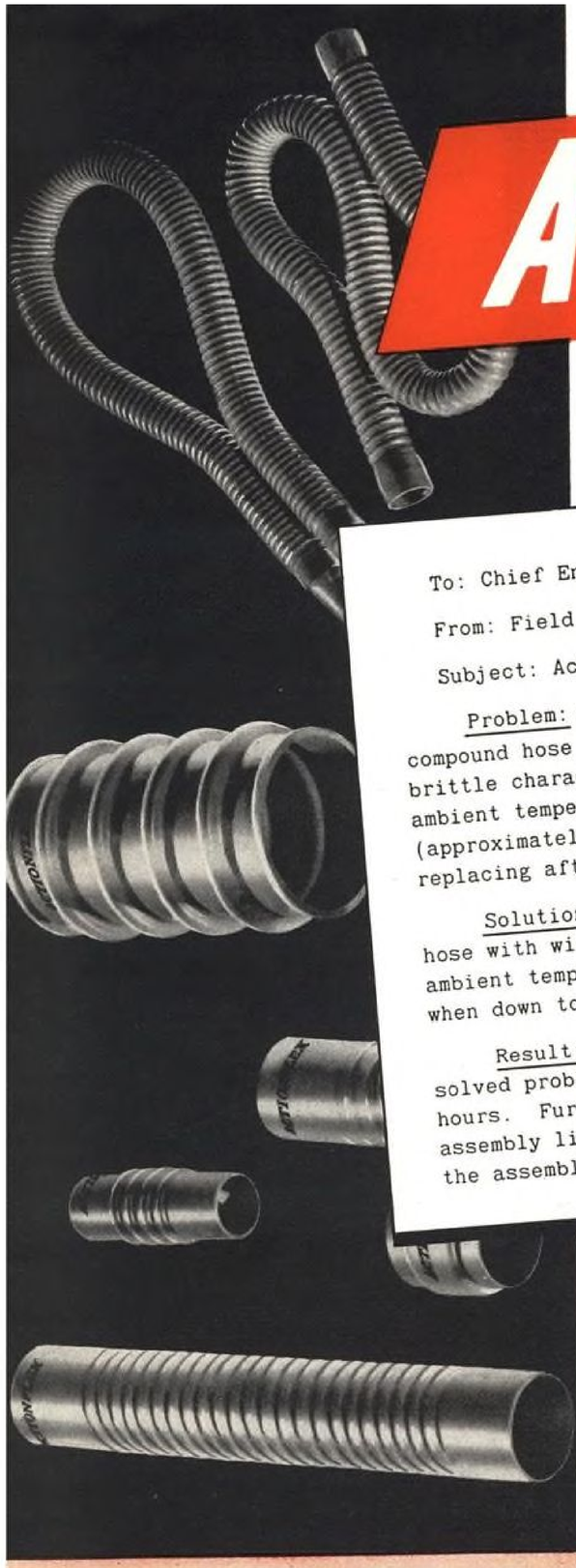
Berkeley, Calif. · Lexington Ky. · Toronto, Can
AIRCRAFT PRODUCTS DIVISION

A-65



Actionflex

Fiberglass-Silicone

Memo

To: Chief Engineer, Plant No. 4

From: Field Engineering Office

Subject: Actionflex Field Report #55-137

Problem: Develop Actionflex hose to replace rubber-compound hose carrying hot air which showed extremely brittle characteristics after extended use due to high ambient temperatures, and cracks and leakage due to tight (approximately 4") bend radii. Assembly required replacing after 50 engine hours.

Solution: Actionflex engineered a fiberglass-silicone hose with wire support that would not delaminate under ambient temperatures induced, and that would not collapse when down to 4" bend radii.

Result: Initial Actionflex assembly immediately solved problem, assembly life lengthened to 500 engine hours. Further Actionflex engineering design lengthened assembly life to 1000 engine hours, and reduced cost of the assembly by 1/3.

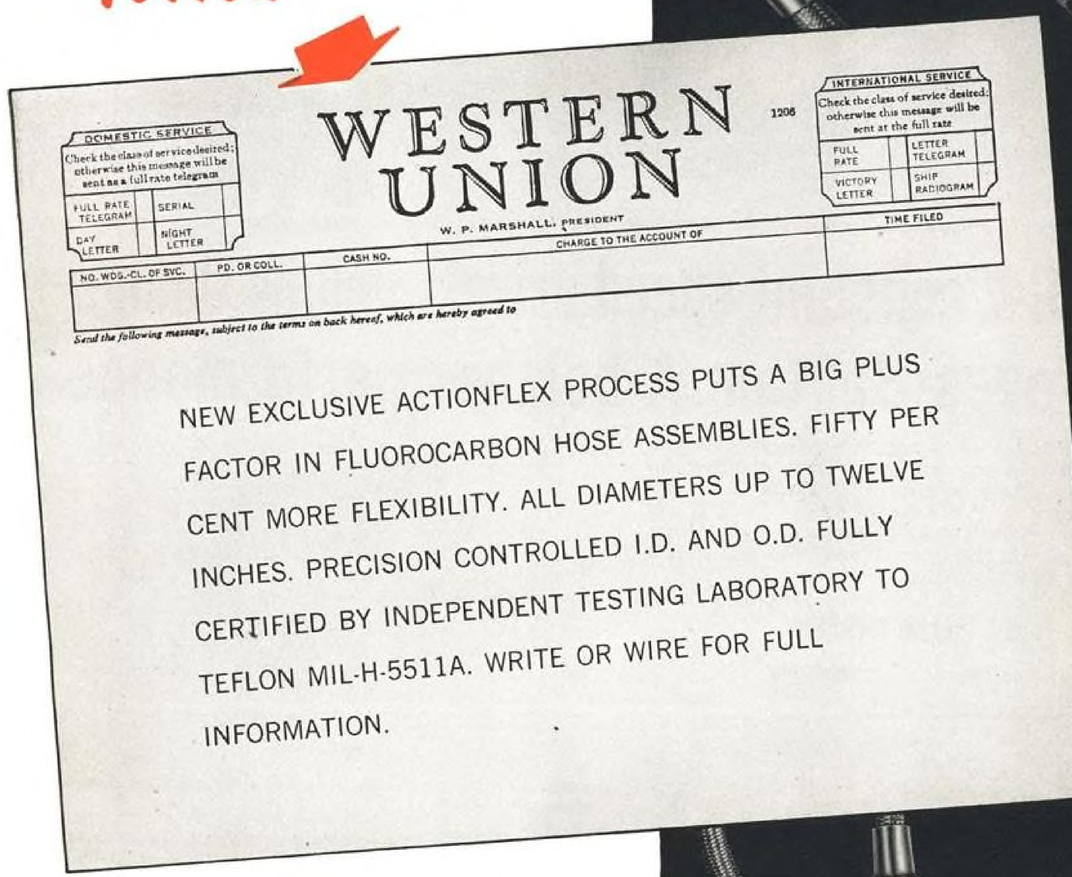
Actionflex field engineers are helping airframe and engine manufacturers solve equally difficult problems in tube, duct, hose and sleeve assemblies with tough and durable Actionflex fiberglass-silicone laminations. Call on your nearest Actionflex representative for complete information.

Actionflex Fiberglass-Silicone

TUBES • DUCTS • LINES • COUPLINGS

in Action

Teflon*



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Check the class of service desired; otherwise this message will be sent at the full rate
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Send the following message, subject to the terms on back hereof, which are hereby agreed to

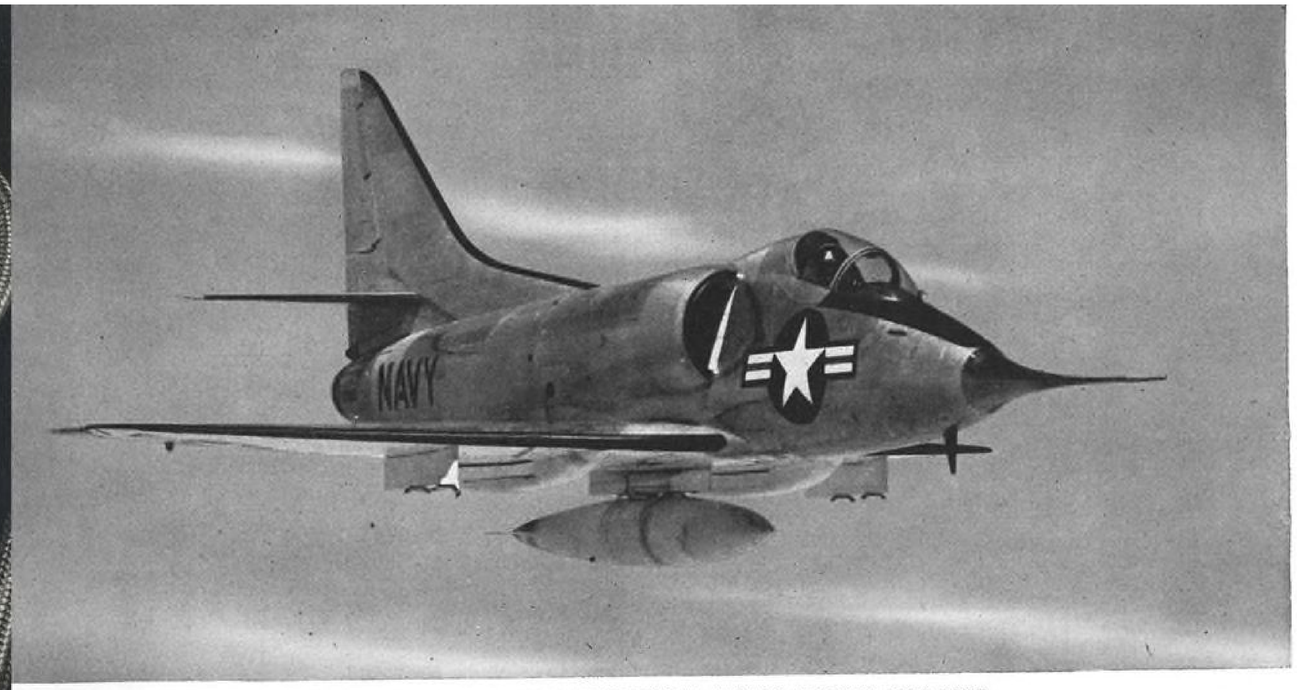
NEW EXCLUSIVE ACTIONFLEX PROCESS PUTS A BIG PLUS FACTOR IN FLUOROCARBON HOSE ASSEMBLIES. FIFTY PER CENT MORE FLEXIBILITY. ALL DIAMETERS UP TO TWELVE INCHES. PRECISION CONTROLLED I.D. AND O.D. FULLY CERTIFIED BY INDEPENDENT TESTING LABORATORY TO TEFLON MIL-H-5511A. WRITE OR WIRE FOR FULL INFORMATION.

*Teflon is the registered trade mark of DuPont tetrafluoroethylene.

ACTIONFLEX Division, ORCHARD INDUSTRIES, INC.
Hastings, Michigan

Actionflex Teflon

TUBES • HOSE • LINES • DUCTS • BELLOWS

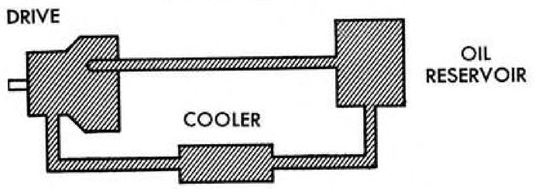


DOUGLAS A4D SKYHAWK USES LIGHTWEIGHT GENERAL ELECTRIC CONSTANT SPEED DRIVE.

How G-E constant speed drive's unique design improves Bantam A-bomber performance

The unique ball piston design of the General Electric 9 KVA hydraulic constant speed drive improves the performance of the Douglas A4D Skyhawk by providing a more reliable drive of reduced weight and size. The simplicity and symmetry of the few moving parts also permit the drive to run "full of oil" in a completely oil-filled system.

OIL-FILLED SYSTEM



ADVANTAGES OF G-E OIL-FILLED DESIGN

LESS WEIGHT no scavenge pump or vent line required

SMALL OIL RESERVOIR no space needed for deaeration

ALL-ATTITUDE OPERATION not affected by aircraft maneuvers

SIMPLIFIED COOLING circulating oil cools all drive components

POSITIVE LUBRICATION all moving parts operate in oil bath

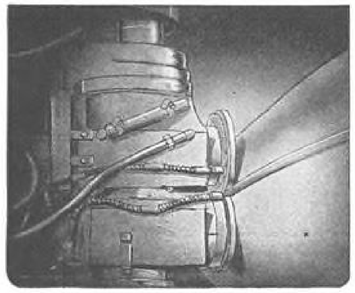
VERSATILE 9 KVA DRIVE allowed addition of starting gears on A4D application

The General Electric hydraulic constant speed drive is currently being built in 9 and 20 KVA sizes. Drives can be built up to 60 KVA covering a wide range of speeds and many design variations.

FOR SPECIFIC INFORMATION on how a G-E constant speed drive can be designed to suit your particular application, contact your General Electric Apparatus Sales Office. For further technical information on these G-E drives, write for bulletins GEA-5979 and GET-2480. Address request to: General Electric Co., Section 221-5, Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC



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PRECISION SHEET METAL & MACHINE PARTS
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AT LAST!

An all-new 5-place executive amphibian—

THE ROYAL GULL

America's outstanding high-performance utility amphibian for business flying and charter service operation. Check this partial list of advantages —
★ Twin 270-hp engines ★ Weight loaded 6000 lbs . . . empty 4400 lbs ★ Top speed 182 mph ★ Cruising speed 164 mph ★ All metal monocoque construction ★ Spray-free visibility and new, easy water handling ★ Sleek, modern exterior and richly appointed interior

WRITE FOR FREE BULLETIN RG-20A

Royal AIRCRAFT CORPORATION
MILWAUKEE 1, WISCONSIN
A subsidiary of KEARNEY & TRECKER CORP.

PSP SOLENOIDS COVER THE FIELD!

What do you want in DC SOLENOID performance...

HIGH PRESSURE TYPES?
PSP has developed DC solenoids that withstand internal fluid burst pressures to 7,500 psi and operate at pressures to 1,500 psi in the plunger cavity – while withstanding ambient temperatures to 500°F! Other features: dynamically balanced plungers, precision adjustable plunger stroke, continuous duty operation on 30 Volts DC. Engineered also as a *pull* type to meet all requirements of precision aircraft valve operation.

HIGH TEMPERATURE TYPES?
PSP "hot" solenoids incorporate special wiring, special insulation and high temperature switches to operate without fail in ambient temperatures to 600°F and beyond. These solenoids are engineered throughout to provide a positive, reliable actuating force for a whole range of valve control operations in aircraft and guided missiles where heat is a problem.

HIGH VOLTAGE TYPES?
PSP now provides direct current solenoids in the 60-125 Volt range for the engineering of new electronic control systems on computers, missiles and aircraft. These high voltage units provide several important advantages: the same power can be obtained with less current . . . savings in weight can be realized . . . switching from mechanical to electronic control can be accomplished without intermediate equipment. Made in both single and double coil and push or pull types for all requirements.

MINIATURES?
These little PSP solenoids can do *big* jobs in computers, memory units and other electronic control units! They are made in a range of types for all applications requiring short strokes. Models are available with strokes adjustable to an accuracy of plus or minus 0.002", insuring the exact control required for precise instruments, for accurately opening and closing valves, etc.

CO-AXIAL VALVES?
This miniature co-axial solenoid-operated valve uses the plunger of the solenoid as a means of admitting and shutting off flow of air. Model shown has 1/16" flow orifice, operates on continuous duty and under opening and closing pressures to 200 psi with 14-30 Volts DC applied. Made in both normally open and normally closed types, operating at ambient temperatures to 500°F. Threaded adapters are furnished to meet all requirements, and the valve can be supplied with or without electrical receptacle.

PSP engineers will be glad to recommend one or more of 350 standard solenoids to fit your needs – or work with you toward solution of your problem.

Largest manufacturer on the Pacific Coast producing aircraft quality solenoids exclusively

Send for the informative PSP catalog!

PSP SOLENOIDS

ENGINEERING COMPANY

8420 OTIS STREET, SOUTH GATE, CALIFORNIA

In New York, New Jersey & Connecticut, contact Michael W. Stollmack, 227 Broadway, New York 7, N. Y. Phone COrtlandt 7-4330.
In Texas, Oklahoma, Kansas & Missouri, contact J. S. Neely, P. O. Box 9822, Forth Worth, Texas.
Northwestern Representative: Seatronics, Inc., 911 Western Ave., Seattle, Washington. Phone Main 5-046.

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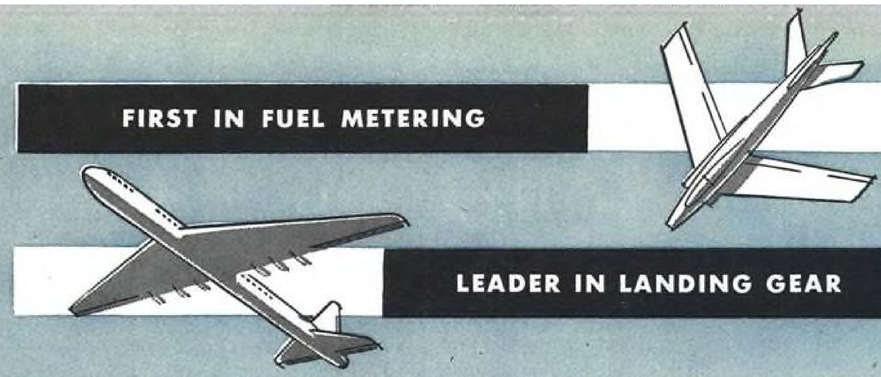
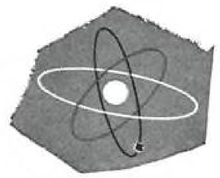
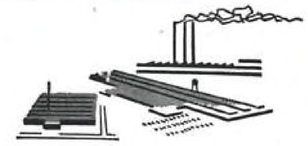


BENDIX BUILDS BEST!



RESEARCH

ENGINEERING



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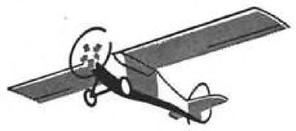
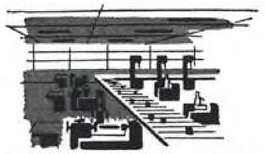


PREVIOUS ACCOMPLISHMENTS



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LOWER COST

The fact that Bendix Products Division of the Bendix Aviation Corporation has specialized for more than thirty years in two highly technical phases of aviation—fuel metering and landing gears—makes this organization unique in the industry.

During this unparalleled record of service in engineering and manufacturing of vital aircraft components, every resource and facility of Bendix Products has been constantly expanded to meet the challenges of new plane and engine design. Bendix Products has done far more than just keep pace with the industry. It is no exaggeration to state that in instance after instance in the fields of fuel metering, landing gears, wheels and brakes, Bendix sets the pace by developments making possible greater speeds, heavier loads and increased safety.

Thus, today, Bendix Products accumulative knowledge of research, engineering and manufacturing offers to air frame builders and engine manufacturers the best solution to better products, quicker deliveries and lower costs in fuel metering, landing gear, wheels, brakes, and components.

Bendix Products Division

Past performance is the best assurance of future achievements.

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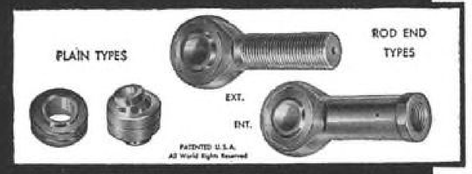
"MONOBALL"®
Self-Aligning Bearings



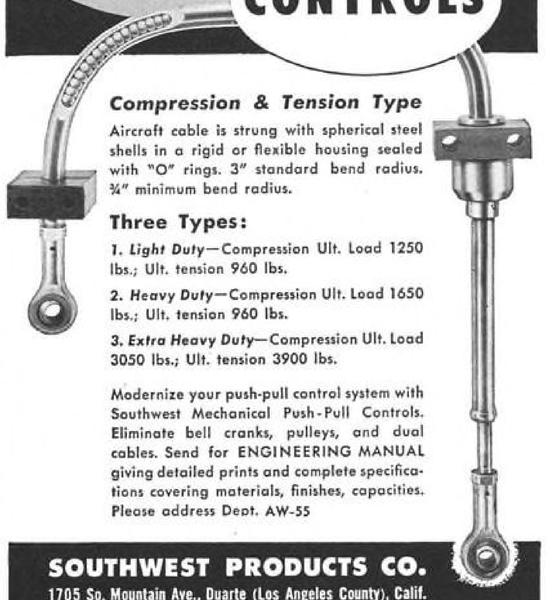
CHARACTERISTICS

	ANALYSIS	RECOMMENDED USE
1	Stainless Steel Ball and Race	For types operating under high temperature (800-1200 degrees F.).
2	Chrome Moly Steel Ball and Race	For types operating under high radial ultimate loads (3000-893,000 lbs.).
3	Bronze Race and Chrome Moly Steel Ball	For types operating under normal loads with minimum friction requirements.

Thousands in use. Backed by years of service life. Wide variety of Plain Types in bore sizes 3/16" to 6" Dia. Rod end types in similar size range with externally or internally threaded shanks. Our Engineers welcome an opportunity of studying individual requirements and prescribing a type or types which will serve under your demanding conditions. Southwest can design special types to fit individual specifications. As a result of thorough study of different operating conditions, various steel alloys have been used to meet specific needs. Write for revised Engineering Manual describing complete line. Address Dept. AW-55

SOUTHWEST PRODUCTS CO.
1705 So. Mountain Ave. • Duarte, California
(LOS ANGELES COUNTY)

push-pull CONTROLS



Compression & Tension Type

Aircraft cable is strung with spherical steel shells in a rigid or flexible housing sealed with "O" rings. 3" standard bend radius. ¾" minimum bend radius.

Three Types:

1. *Light Duty*—Compression Ult. Load 1250 lbs.; Ult. tension 960 lbs.
2. *Heavy Duty*—Compression Ult. Load 1650 lbs.; Ult. tension 960 lbs.
3. *Extra Heavy Duty*—Compression Ult. Load 3050 lbs.; Ult. tension 3900 lbs.

Modernize your push-pull control system with Southwest Mechanical Push-Pull Controls. Eliminate bell cranks, pulleys, and dual cables. Send for ENGINEERING MANUAL giving detailed prints and complete specifications covering materials, finishes, capacities. Please address Dept. AW-55

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Do you use blades, vanes or turbine and compressor wheels?

We specialize in the production of *investment castings* of airfoil shapes produced with specialized equipment, under strict dimensional and quality control.

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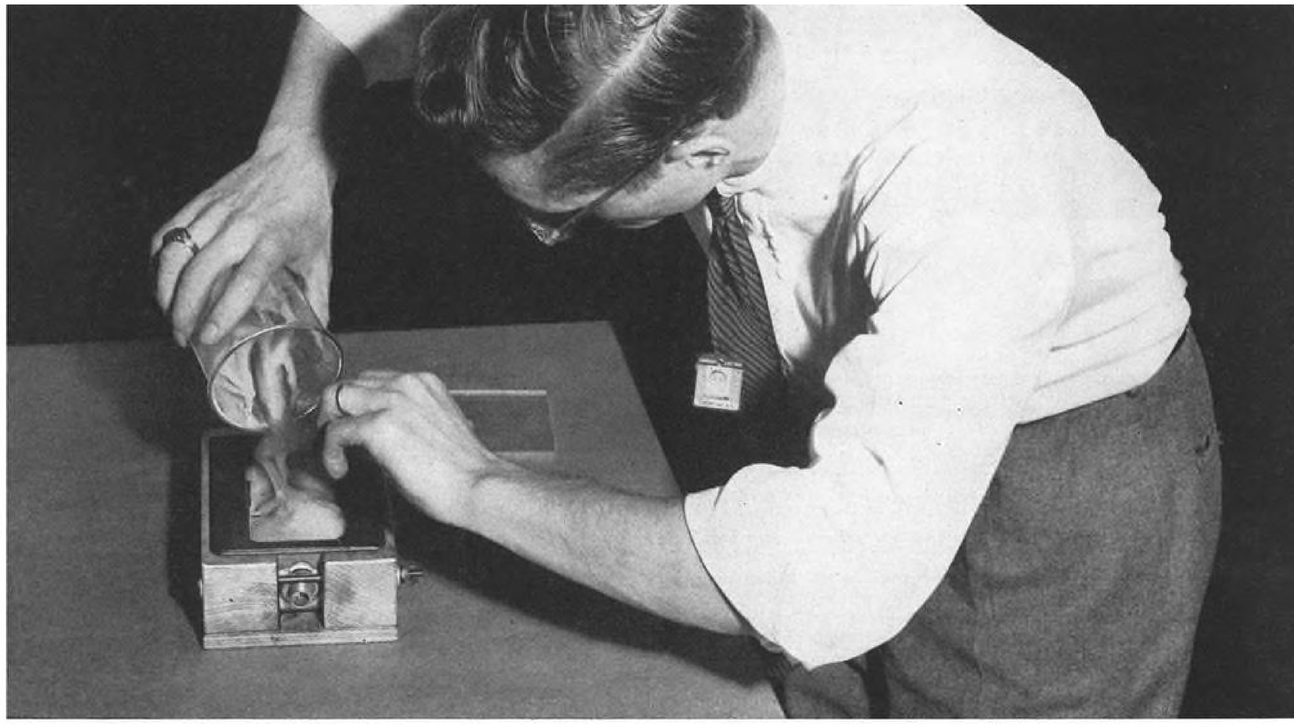
A-71



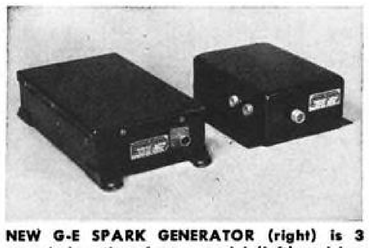
NEW SEALING FOAM is poured over electrically connected components. Foam expands, sealing parts firmly in place.

New process helps save up to 5 pounds on G-E jet ignition systems

A new manufacturing process that uses a hard setting foam to seal capacitor discharge jet ignition components is being used at General Electric. Weight of the system is greatly reduced, as lightweight foam replaces heavy component supports. The sealing foam also provides better vibration and shock resistance.

As a result of experience gained in producing thousands of jet ignition systems, G.E. has made many other design improvements. For instance, miniaturized components are used to reduce size and weight, recessed electrode and semiconducting insulator increase efficiency of spark plugs, and improved capacitors provide increased spark energy.

FOR DETAILED INFORMATION on General Electric capacitor discharge jet ignition systems, contact your G-E Apparatus Sales Office, or write to: Section 221-11, General Electric Co., Schenectady 5, New York.



NEW G-E SPARK GENERATOR (right) is 3 pounds less than former model (left) and has increased spark energy.

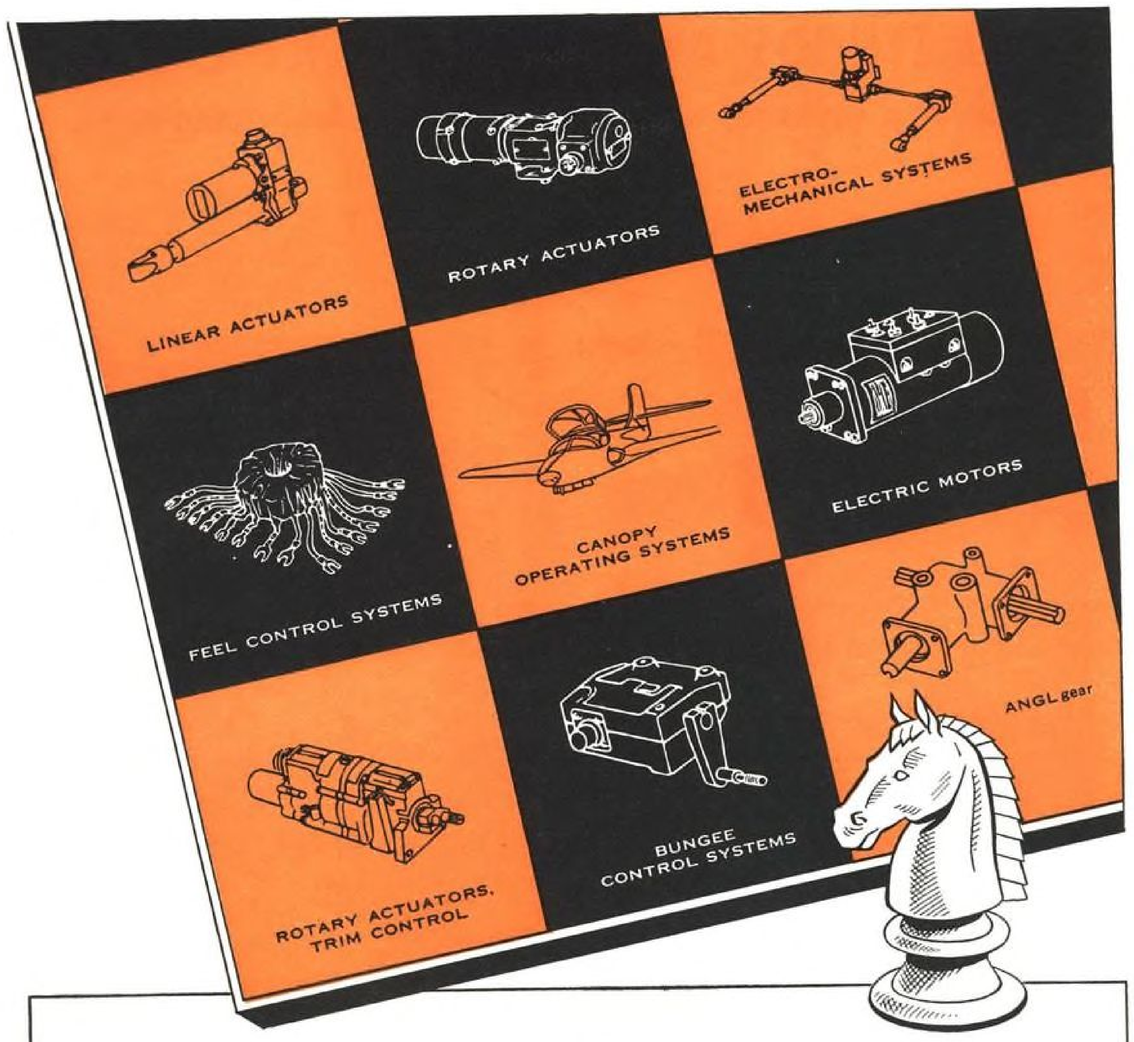
IMPROVED LEAD AND PLUG (center) greatly increases useable spark energy and reduces system weight 2 pounds.

THESE LIGHTWEIGHT JET IGNITION SYSTEMS AVAILABLE FROM G.E.

SYSTEM TYPE	POWER INPUT	VOLTAGE OUTPUT	STORED ENERGY PER PLUG (joules)	NUMBER OF PLUGS FIRED	COMPLETE SYSTEM WEIGHT (POUNDS)
SLG-2A	a-c	low v	1.6	1	3.4
SLG-7C	d-c	low v	2.4	1	5.6
SHG-2A	a-c	high v	2.4	1	5.9
PLG-2B	a-c	low v	1.1	2	4.9
PMG-2B	a-c	med v	1.1	4	9.1
DLG-1D	d-c	low v	2.0	2	7.0

Progress Is Our Most Important Product

GENERAL ELECTRIC



Your move

If you play chess, you know how specialized and versatile the 16 pieces can be. Each has its prescribed function, yet can be employed in endless strategies to effect a checkmate.

The Airborne products shown above are similarly specialized, equally versatile. Each was designed to solve a particular problem in aircraft technology, and has proved adaptable to many other engineering needs.

Airborne service to aircraft manufacturers is completely integrated, from design engineering to production and follow-up in the field. We even make the many basic components of our products, such as motors, magnetic amplifiers, R.F. filters, and starting capacitors.

When you're ready for your next move, call on us. We're anxious to serve you.

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Contains full information on the Airborne line of electromechanical actuators and feel systems. Write for your copy today.

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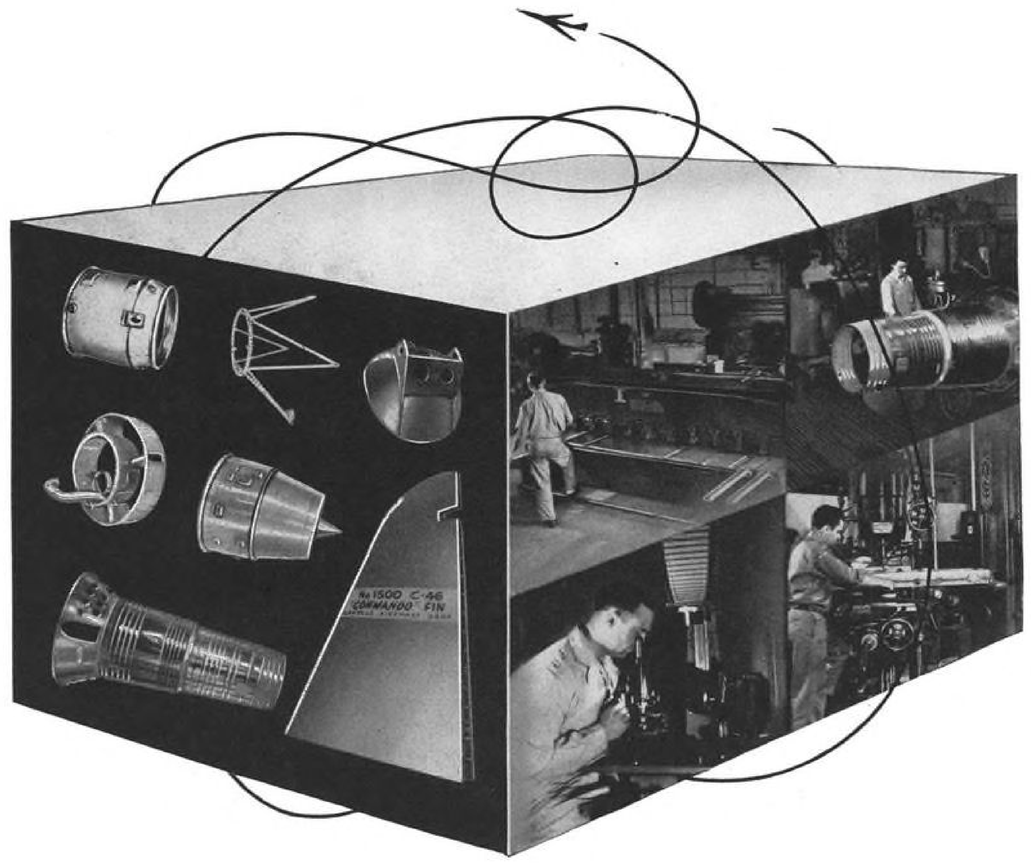
MEN, METHODS AND MACHINES AT LAVELLE

. . . deliver a packaged service to meet *your* fabricating needs



Lavelle's packaged service includes engineering, production planning, tool making, machine shop and sheet metal facilities . . . resistance, inert gas, and metallic arc welding, painting, anodizing, testing and quality control.

TYPICAL ENGINE, AIRFRAME AND RADAR COMPONENTS PRODUCED BY LAVELLE

- Engine Cowlings, Mounts, Exhaust Nozzles and Baffles
- Engine Tailpipes, Shrouds and Burner Supports
- Engine Combustion Chambers, Liners and Casings
- Radar Reflectors, Nacelles, Consoles and Shelters
- Tail Surfaces, Ladders, Tanks, Flaps and Fire Walls
- Heat Exchangers, Flameholders, Manifolds and Fairings

A new illustrated brochure describes in detail the men, methods and machines ready to serve your fabricating needs at Lavelle. Write for a copy without obligation.

Lavelle

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STAINLESS STEEL • ALUMINUM • TITANIUM • ALUMINUM COATED STEEL

A-74

SERVICE

DESIGN

You can reduce your engineering costs on hydraulic, pneumatic and fuel control problems by using COM-AIR specialists. COM-AIR engineers specialize in this highly complex field. Illustrated are some examples of problem solutions which COM-AIR engineers have worked out for airframe and engine manufacturers. These *particular* solutions may not help you, but the experience of our engineers *can* help solve your specific hydraulic, pneumatic and fuel control problems. Contact our representatives today.

PRODUCTION

Production problems always arise between the signed contract and delivery date. COM-AIR sub-contract service can help meet *your deadline*. COM-AIR's well equipped plant, efficient production methods and quality control system insure prompt delivery on quantity production orders. Ask our representatives about COM-AIR's sub-contract service today.

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FUEL VALVES

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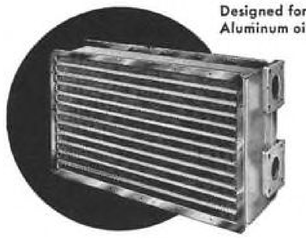
ACCUMULATORS

SERVO VALVES

DESIGNERS AND MANUFACTURERS OF HYDRAULIC, PNEUMATIC AND FUEL CONTROLS



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Aluminum oil cooler

developed...
for the world's hottest
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heat exchangers

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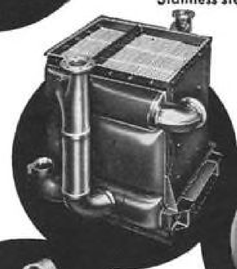
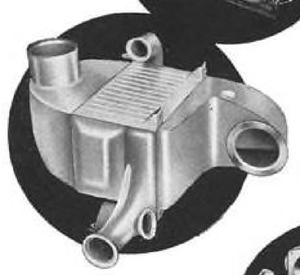
LIQUID-TO-LIQUID
AIR-TO-EVAPORATING-LIQUID
stainless steel or aluminum to meet your specific needs!

Designed for North American—
Stainless steel tube bundle



Designed for Stratos—
Stainless steel tube bundle

Designed for
Hamilton Standard—
Stainless steel tube bundle



Designed for Stratos—
Stainless steel tube bundle

Designed for
Hamilton Standard—
Stainless steel tube bundle

Leading aircraft engineers choose South Wind heat exchangers to meet the challenge of higher jet engine temperatures under all conditions. These heat exchangers fully comply with the rigid specifications set up by airframe and engine manufacturers, as well as the makers of air cycle refrigeration systems.

South Wind pioneered the development of heat transfer equipment for heating modern aircraft. Now this experience has been combined with advanced engineering and vast production facilities to make South Wind a leader in the production of heat exchangers for cooling. Lightweight thinwall units in both stainless steel and aluminum are being designed and fabricated for a wide range of uses.

South Wind heat exchangers are available with either the tube bundle, or plate and fin type design to meet your specific requirements. Whatever your need in heat transfer equipment—whether it's air-to-air, liquid-to-liquid, air-to-liquid, or air-to-evaporating-liquid—you can depend on South Wind's engineering team for expert counsel. For information, write Stewart-Warner Corporation, South Wind Division, 1514 Drover Street, Indianapolis 7, Ind.

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South Wind

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HEAT EXCHANGE EQUIPMENT
INERT GAS GENERATORS

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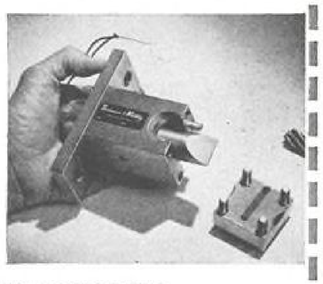
explosive-actuated devices



CABLE CHOPPER

Severs cable up to 1⅛ inches diameter, initiated over a simple electrical circuit requiring a minimum of 5000 ergs. One of several types used in missiles and aircraft for separating structural and electrical cables, oil lines, etc.

DISCONNECT

Combined into the body of an AN standard electrical plug and receptacle, this unit gives instantaneous opening of as many as 100 circuits on a non-shorting basis. Controlled time delay can be included.

Used in nearly all major missiles, Beckman & Whitley Explosive-Actuated Devices include standard items for many applications. A well-rounded organization of personnel and facilities provides for rapid modifications and adaptations to cover the needs of your special applications.
Completely integrated, pre-loaded packages are supplied ready for immediate use. Besides the Cable Chopper and Explosive Disconnect shown, the Beckman & Whitley line includes Explosive Bolts and Safety and Security Destructors.
Your special inquiries are invited for actuation problems involving large punch in a small package.

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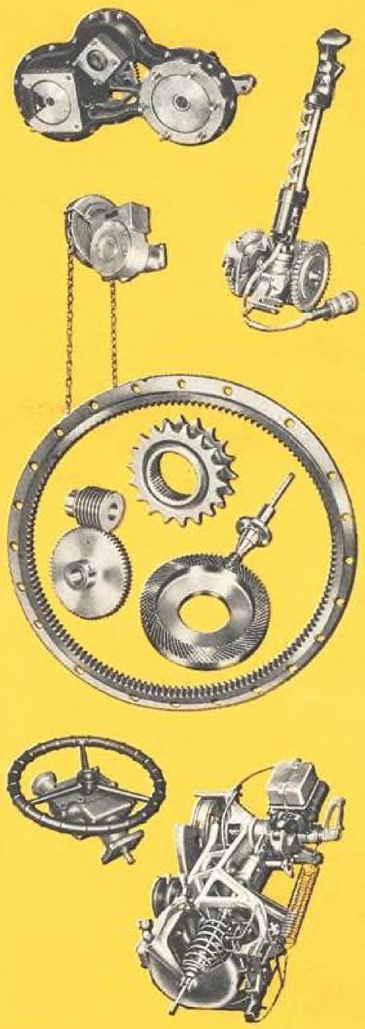
GEARS AND GEAR ASSEMBLIES *for aircraft that fly today and tomorrow!*



Advanced aviation is looking to gear manufacturers for greater engineering developments that result in finer precision, closer tolerances, lighter weight and compactness that meet the requirements of today's missiles, transports and fighter planes.

ADVANCE GEAR is meeting this challenge with gears and gear assemblies that are used for everything from ground handling equipment to the pilot's compartment.

Twenty years of experience in meeting rigid specifications qualify us to handle your toughest gearing problems. Complex precision gears or intricate assemblies both receive infinite care of veteran craftsmen at ADVANCE GEAR, where you'll find real cooperation on any gear requirement that you may have.

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2
MAJOR IMPROVEMENTS-

Patented

give you an automatic safetying PIP pin with added versatility, wider design applications and uses!

Like other PIP pins, the Model "B" double-acting pin is solving countless equipment and machine quick-disconnect problems. The continuous ring and extended spindle are changes enabling the "B" series PIP pin to work easily where stress loading or hole misalignment problems cause ordinary pins to bind and resist removal. The new continuous pull ring is designed for heavy duty use for forcible removal of "bound" pins. An intentional blow on the protruding head or tip shifts an inner spindle—locking balls recede into body of pin and pin moves with the blow for easy installation or removal.

Actually, the pin may be driven in or out! Both of these PIP design advantages, combined with higher material strength, are available in the "B" series pins which include "T", "L" and "Button" type head styles (optional) in sizes to most bolt standards.

Because PIP self-safetying is automatic, no bolt, nuts, cotter pins, etc are needed. PIP pins are ideal for bracket, clevis, tube joining or similar uses in all commercial, industrial or critical military and aviation applications.

Complete drawings and specifications can be had by writing for brochure 5500.

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IMPROVED FROM FIELD EXPERIENCE TO GIVE YOU THE SAFEST, SELF-LOCKING, QUICK-RELEASE PINS AVAILABLE ANYWHERE!

*Shape of things that come— from TWIN COACH

Piston or jet . . single or multi-engine . . . trainer . . . interceptor, triphibian or tanker transport —Twin Coach Aircraft Division is probably unique among America's great subcontractors in its ability to produce major assemblies for many different aircraft types.

That's because we're *aircraft* specialists. Twin Coach Aircraft Division's five plants are devoted *exclusively* to production of airframe major assemblies. We build no other products . . . do no other work.

This is important because it means your airframe assemblies are built by experienced aircraft specialists . . . *men whose one aim is to produce to specification, on schedule, at the lowest possible cost.*

Onsrud Invomill, a combination power-router and skin-milling machine that can remove up to 150 cu. in. aluminum per minute, is just one of many hundreds of modern, high-speed machines. AA-1639

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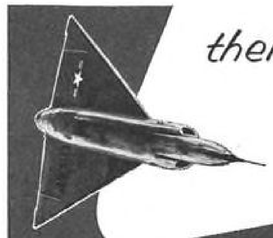

there is no substitute for proven performance!

that's why AIRFRAME and ELECTRONICS MANUFACTURERS PREFER CAMLOC FASTENING DEVICES

CAMLOC PRODUCTS ARE USED—

BY . . .

A GLANCE at this list of companies and the aircraft products they make tells an important story . . . a story of manufacturer acceptance of Camloc fasteners and latches.

America's airframe and electronics manufacturers know—through years of actual service—that Camloc products meet the most rigid requirements for tension and shear strengths . . . for long fatigue life under loads.

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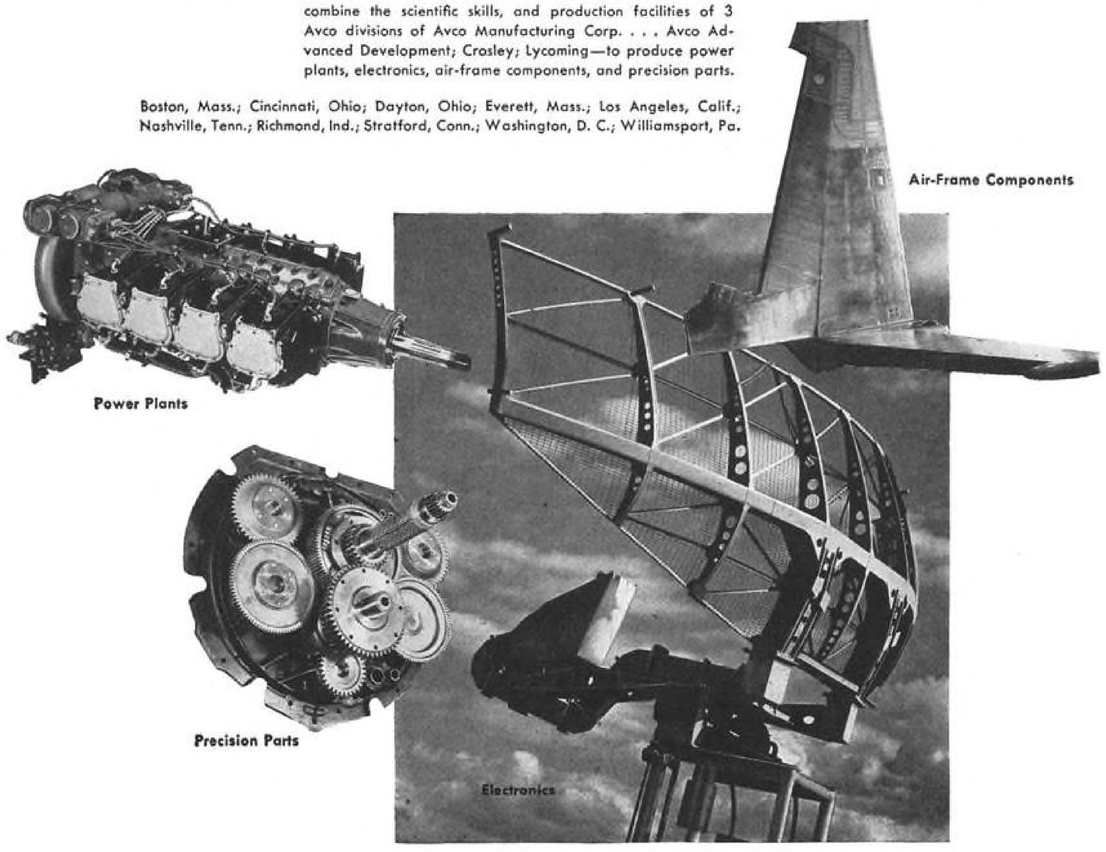

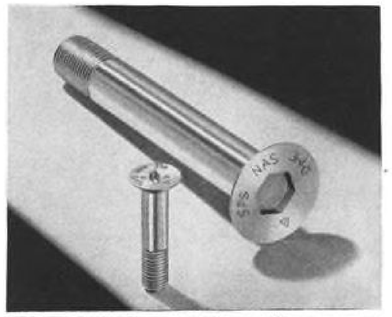

SPS NAS 100° FLUSH HEAD SHEAR BOLTS

Phillips Cross Recess or Internal Hexagon Head
10-32 through ⅝-18
Procurement Specification NAS 498
Made of aircraft alloy steel, cadmium plated. Supplied undrilled or with drilled shank.

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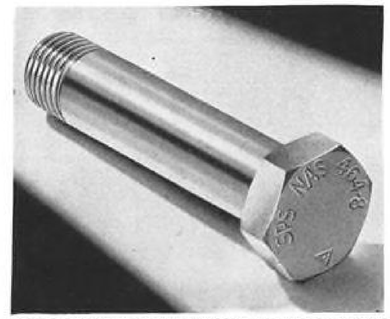


SPS NAS HEX HEAD EXTERNAL WRENCHING SHEAR BOLTS

10-32 through 1-14
Procurement Specification NAS 498
Made of aircraft alloy steel, cadmium plated. Heat treated to 160,000-180,000 psi. Supplied undrilled or with drilled shank.

SPS PRECISION FASTENERS

SPS MS 20004 SERIES INTERNAL WRENCHING BOLTS

¼-28 through 1½-12
Procurement Specification MIL-B-7838
Made of aircraft alloy steel, heat treated to 160,000-180,000 psi tensile. Head to shank fillets are cold worked for greatly increased fatigue life. Threads are fully formed by rolling after heat treatment. Supplied undrilled or with drilled head.

SPS HI-TI TITANIUM BOLTS

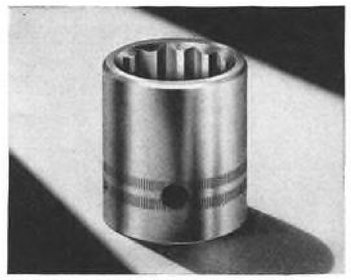
SPS HI-TI titanium bolts are manufactured in both tension and shear types. Tension-tension fatigue test data and other pertinent technical information on these high-strength, lightweight fasteners is now available from SPS. This material, the result of more than 30 months' intensive research and development within the SPS organization, is obtainable on request. Write today to Aircraft Products Division, STANDARD PRESSED STEEL CO., Jenkintown 3, Pa.

SPS NAS 144 SERIES INTERNAL WRENCHING BOLTS

¼-28 through 1½-12
Procurement Specification NAS 159
Made of aircraft alloy steel. Heat treated to 160,000-180,000 psi. Threads are fully formed by rolling after heat treatment.

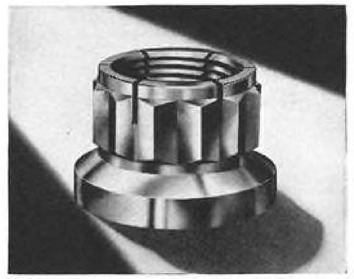
SPS AN STANDARD 6-DIGIT ENGINE BOLTS

All sizes
External hexagon head type or internal hexagon socket head type. Made of aircraft alloy steel or corrosion-resistant steel. Supplied with drilled head or drilled shank.



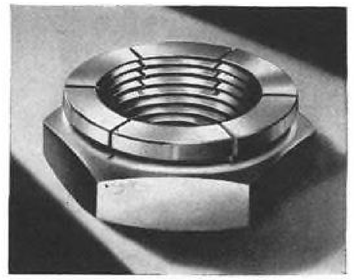
SPS NAS INTERNAL WRENCHING LOCKNUTS

¼-28 through 1¼-12
Procurement Specification AN-N-5 except as noted on NAS 443
Made of aircraft alloy steel, cadmium plated. They are self-locking units with positive locking provided by two nonmetallic plugs inserted through the body of the nut and contacting the threads of the bolt.



FLEXLOC EXTERNAL WRENCHING LOCKNUTS

¼-28 through 1½-12
Procurement Specification AN-N-10a and NAS 353 or any other specification that may apply.
Made of aircraft alloy steel. One-piece, all-metal lock and stop nuts. Locking is accomplished by the slotted section locking on the bolt threads. Approved to 550°F.



FLEXLOC SELF-LOCKING NUTS, THIN, AN 364

6-32 through 1¼-12
Procurement Specification AN-N-5b
Made of steel, cadmium plated. They are one-piece, all-metal lock and stop nuts. Positive locking is accomplished by the slotted locking section which locks on the threads of the bolt. Designed for temperatures to 550°F.

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Procurement Specification MIL-F-5509
Made of heat treated alloy steel, aluminum alloy or magnesium. Threads are fully formed to provide positive sealing without compound. Alloy steel plugs are cadmium plated in accordance with QQ-P-416 or zinc plated in accordance with AN-P-32. Aluminum plugs are anodized. Magnesium plugs are unplated.

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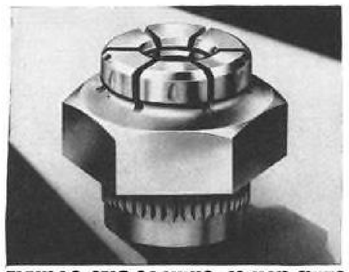
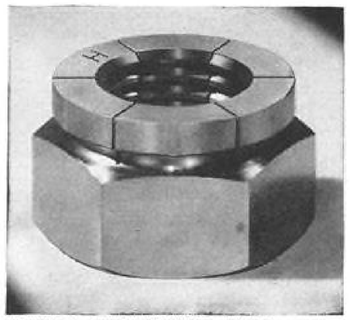
MS 171401 through MS 171900
Nominal Diameter—.062 through .500
Procurement Specification AMS7207
Made of AMS5506 corrosion-resistant steel. Hardness, Rockwell "C" 43-52. Also made of heat treated carbon steel—zinc or cadmium plated, or phosphate coated.



FLEXLOC SELF-LOCKING CLINCH NUTS

4-40 through ¼-28
Made of steel, cadmium plated. They are self-contained units, incorporating the positive self-locking of regular FLEXLOC locknuts. Have knurled hollow shanks for fastening to material in which nut is to be used. For use on aircraft equipment and component parts such as instrument mountings and electrical equipment.



FLEXLOC SELF-LOCKING NUTS

AN-363 6-32 through ¾-16
AN-363C 6-32 through ¾-16
AN-365 4-40 through 1¼-12
Procurement Specification AN-N-10a and AN-N-5b
AN-363 and AN-365 nuts are made of steel, cadmium plated. They are designed for temperatures to 550°F. AN-363C nuts are made of corrosion-resistant steel, silver plated. They are designed for temperatures to 800°F. All are one-piece, all-metal lock and stop nuts of regular AN height. Positive locking is accomplished by the slotted locking section which locks on the threads of the bolt.

For complete information about SPS Fasteners for the aircraft industry, write Aircraft Products Division, STANDARD PRESSED STEEL CO., Jenkintown 3, Pa.

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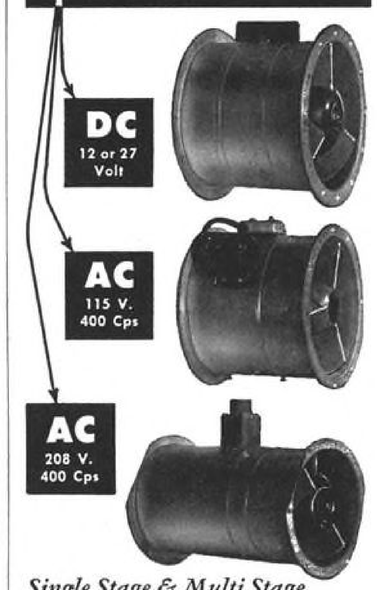

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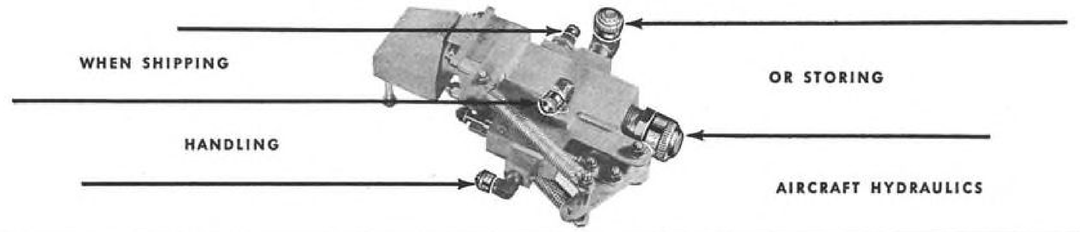

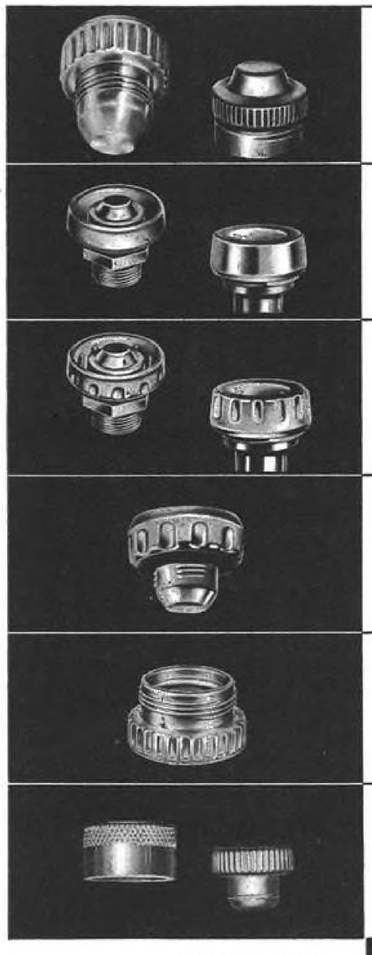

AN-Type Steel or Aluminum Shipper Plugs and Caps
Designed to conform to all applicable specifications. Gaskets for plugs are ordered separately. These closures will seal hand tight on fittings of 37° nose taper.

AN-Type Cadmium Plated Steel Caps and Plugs
Caps are designed for units with external threads and plugs are for internal threaded service connections. Both conform to all applicable specifications and will seal hand tight on fittings of 37° nose taper.

AAF-Type Cadmium Plated Steel Seal Caps and Plugs
These caps and plugs conform to AAF specifications and are reusable many times.

AN-Type Cadmium Plated Steel Boss Plugs
Gaskets are included but not installed. They are designed for gasket sealed bosses and are manufactured to AN and AAF thread specifications.

Aluminum Shipper Plugs for ERMETO Fittings
These are new plugs designed specifically for the increasingly popular Ermeto type fittings for aircraft.

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RUDDER TRIM TAB ACTUATOR
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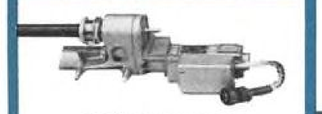

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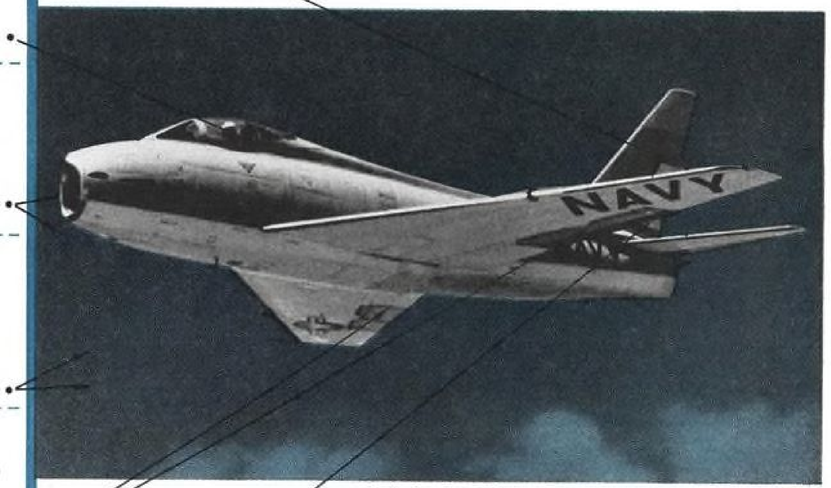
STABILIZER BUNGEE TRIM ACTUATOR
model D-1850



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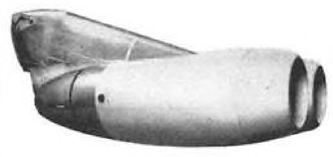

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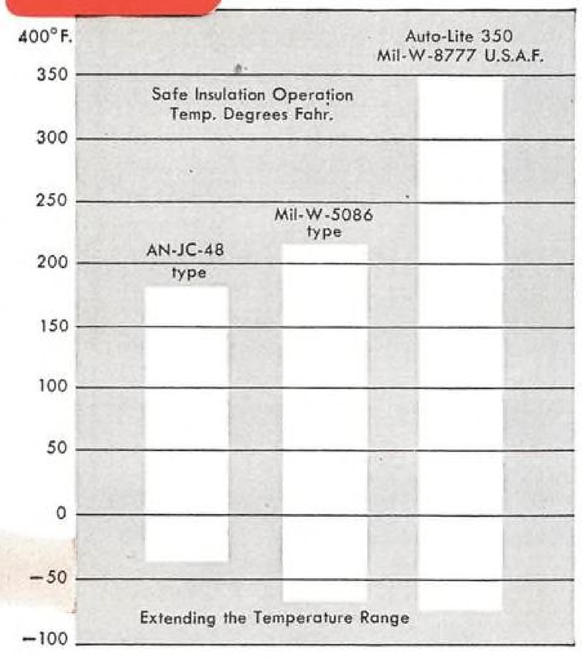

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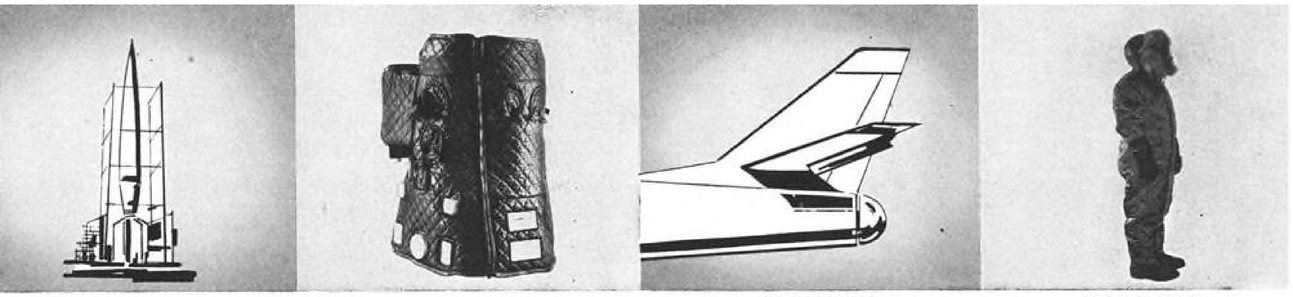

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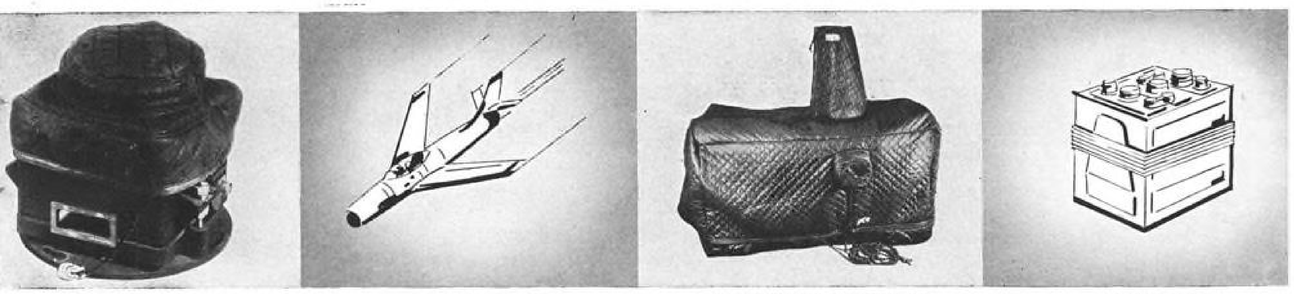

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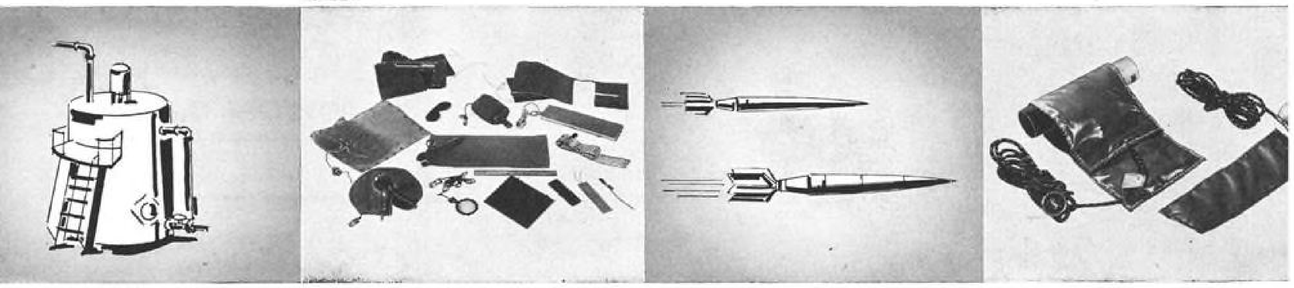

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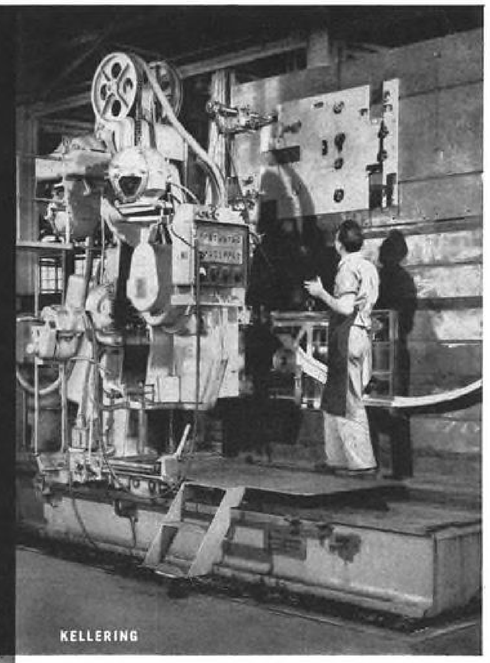

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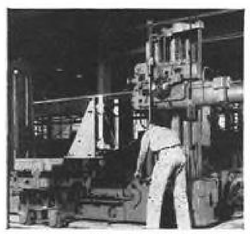

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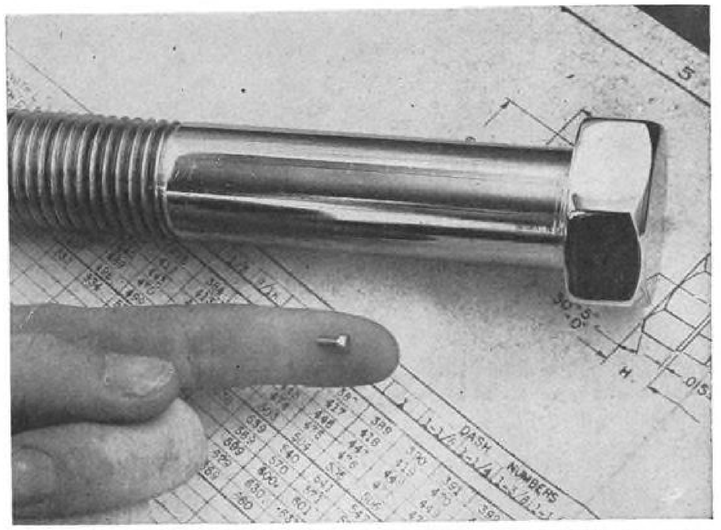

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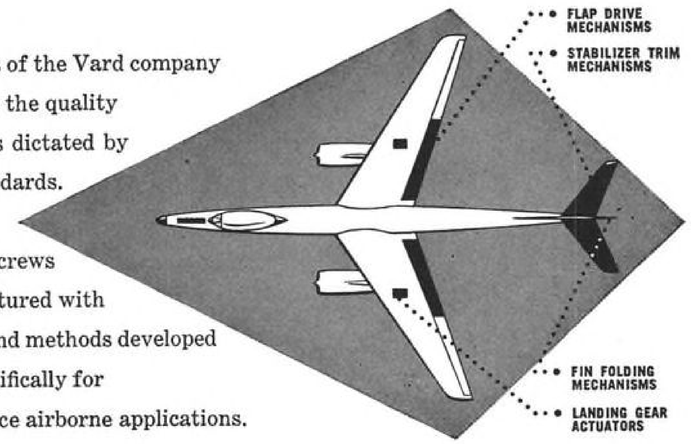

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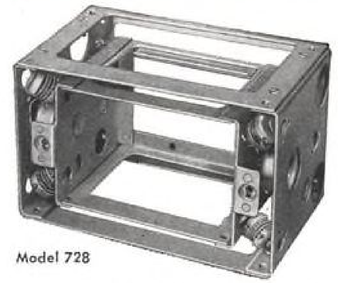
Robinson Mounting for Lear Altitude Control. Simple strap type attachment for cylindrical instruments with electrical and vacuum connectors integrated in system.



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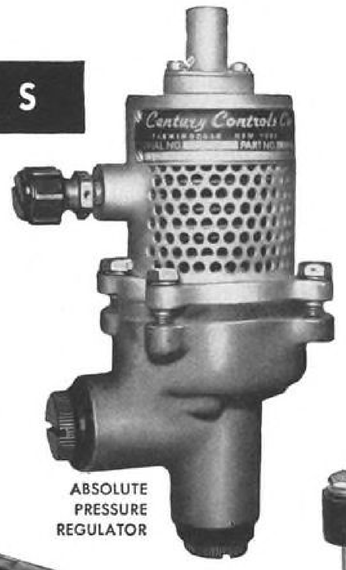
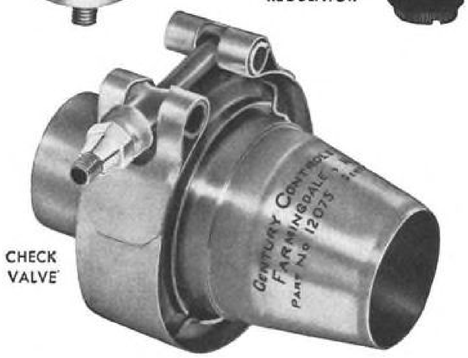
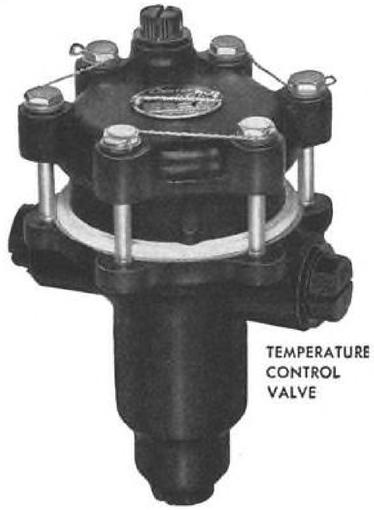


ABSOLUTE PRESSURE REGULATOR

GAGE PRESSURE REGULATOR



CHECK VALVE



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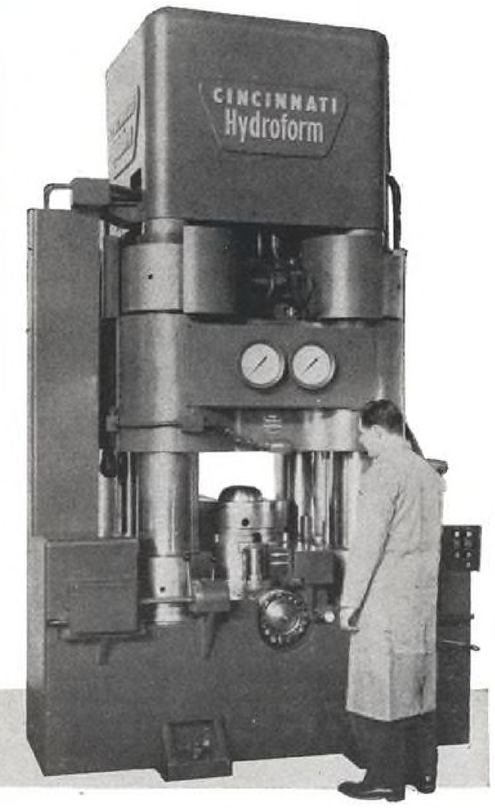

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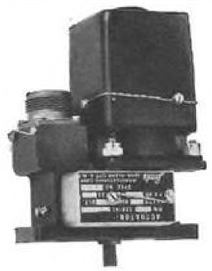

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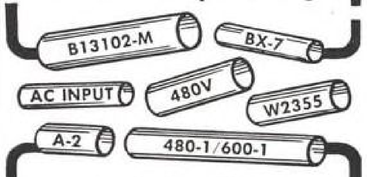

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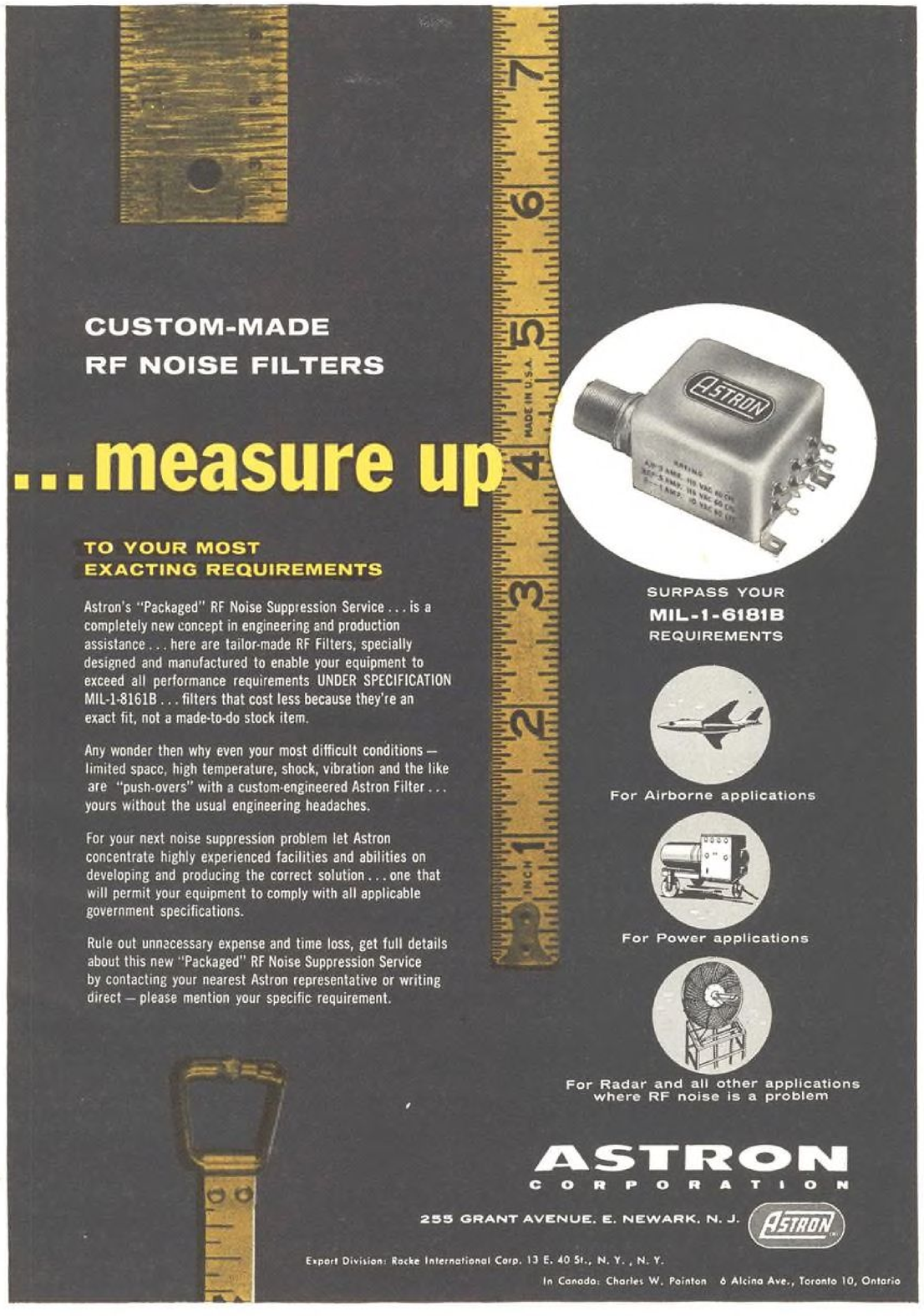

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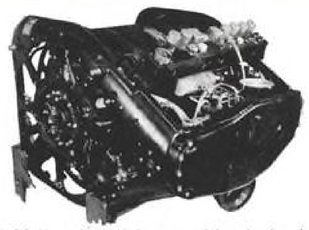

A-12 Hose Reel Unit—several hundred gallons per minute rate. Qualification test reports have been submitted to WADC. Standard U. S. Navy equipment, modification available for wing-tip mounting.

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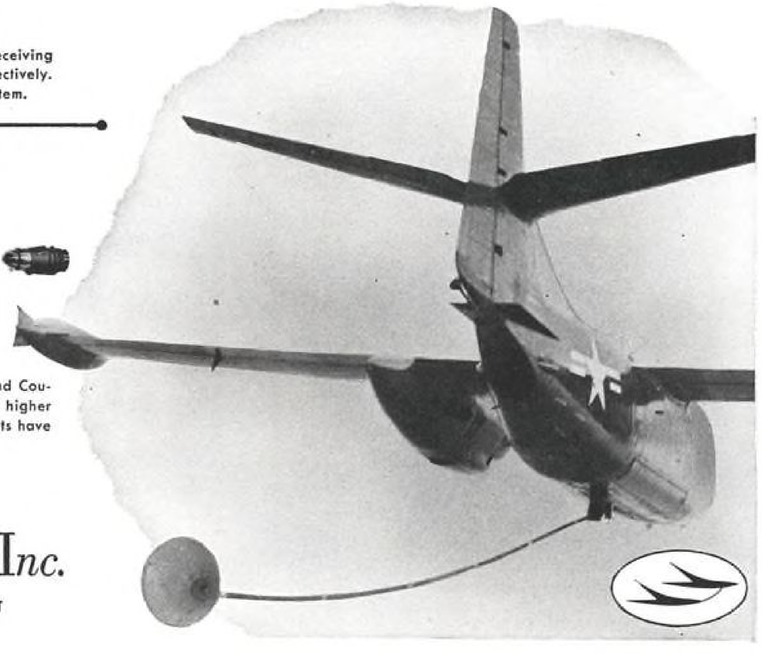

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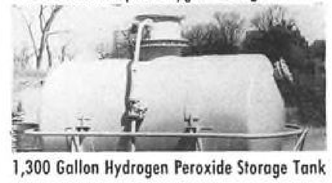

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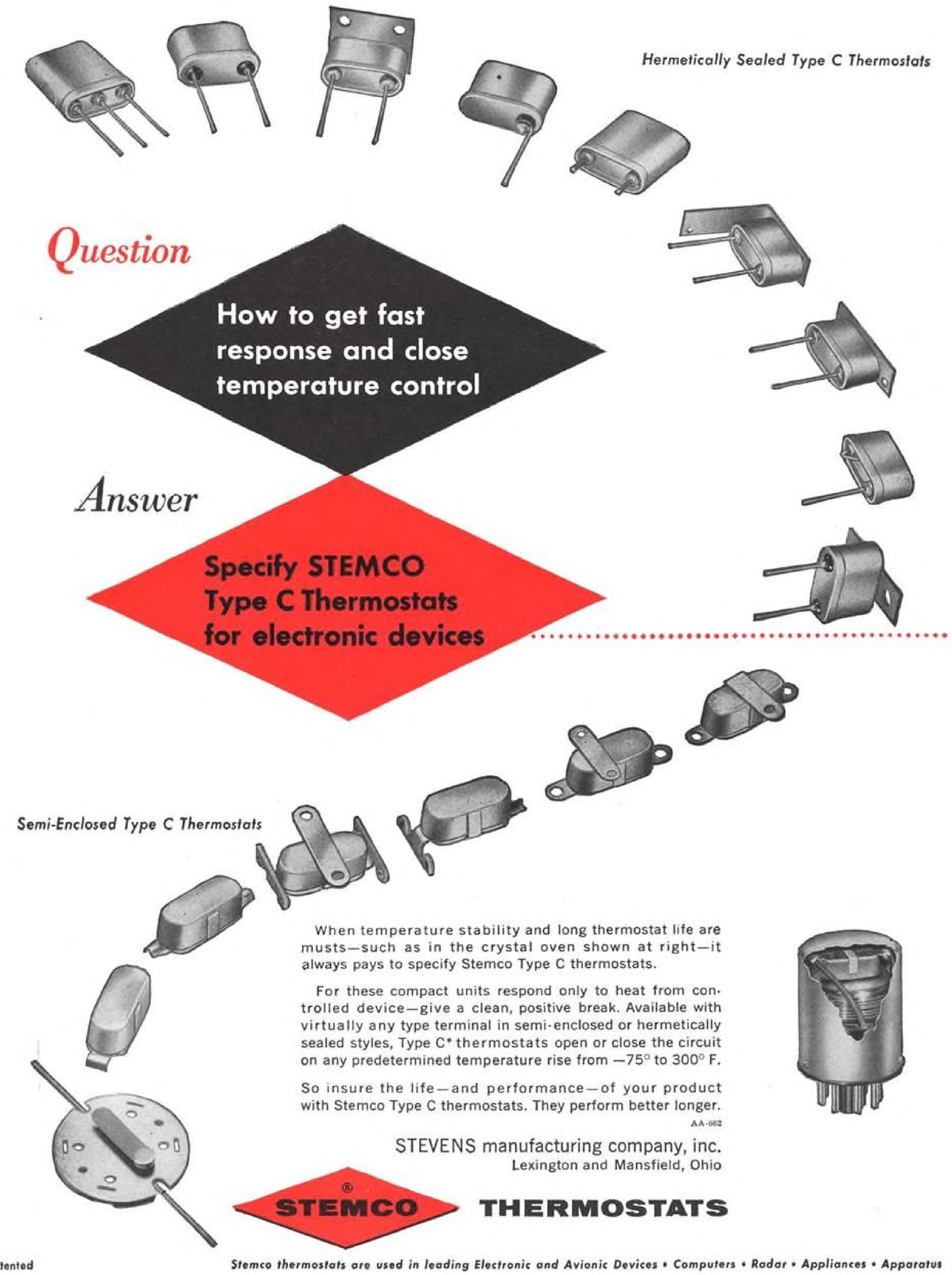

Hermetically Sealed Type C Thermostats

Question

How to get fast response and close temperature control

Answer

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Semi-Enclosed Type C Thermostats

When temperature stability and long thermostat life are musts—such as in the crystal oven shown at right—it always pays to specify Stemco Type C thermostats.

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Crystal oven courtesy James Knights Co.

Stemco thermostats are used in leading Electronic and Avionic Devices • Computers • Radar • Appliances • Apparatus

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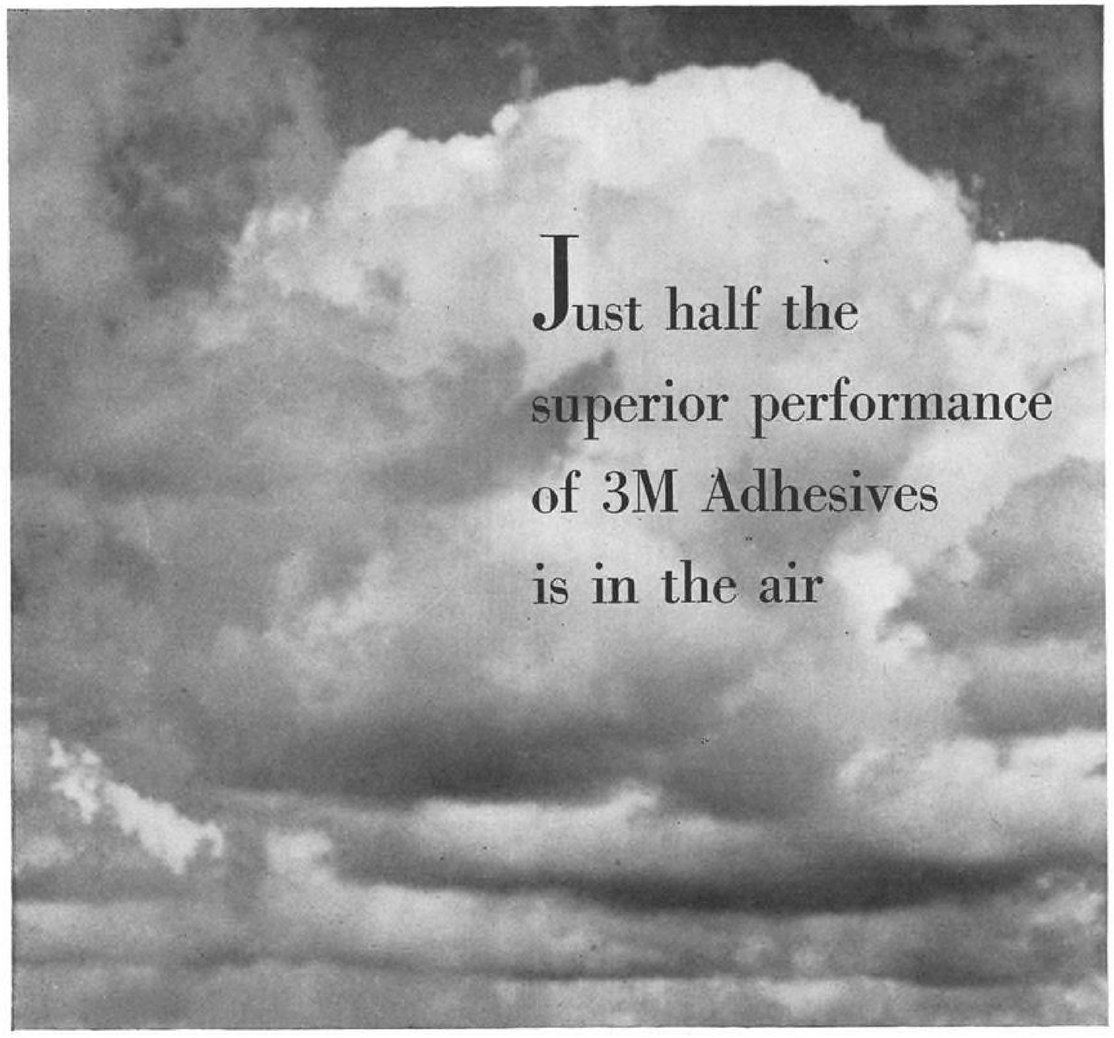

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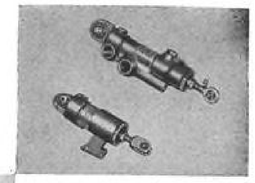
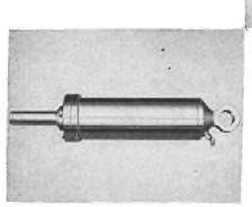


Gun Purge Door Cylinder—3000 psi, 3/4" bore x 2-1/2" stroke

Door Latch Cylinder—3000 psi, 1-1/16" bore x 1" stroke

Armament Displacing Cylinder 1500 psi air cylinder 2" bore x 8-1/4" stroke



M.L.G. Actuating Cylinder—3000 psi, 6" bore x 17-1/2" stroke

When a manufacturer gains the reputation of being a primary source for any product, it is usually indicative that they have the "know how" and facilities to produce at competitive prices.

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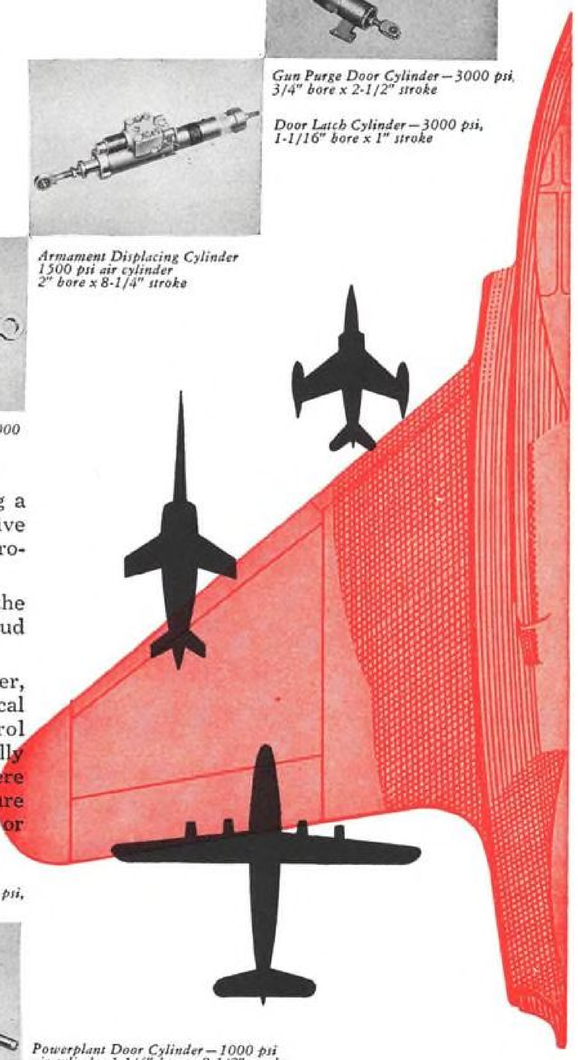
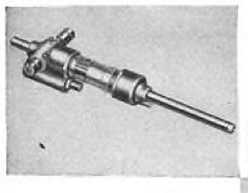


Aileron Booster Cylinder—1500 psi, 1-9/16" bore x 6-1/8" stroke



Powerplant Door Cylinder—1000 psi air cylinder 1-1/4" bore x 8-1/2" stroke w/mech. locks at both ends of stroke

Nose Gear Door Cylinder—3000 psi, 1-3/16" bore x 7" stroke

Nose Wheel Steering Cylinder—3000 psi, 1-1/4" bore x 6-3/4" stroke

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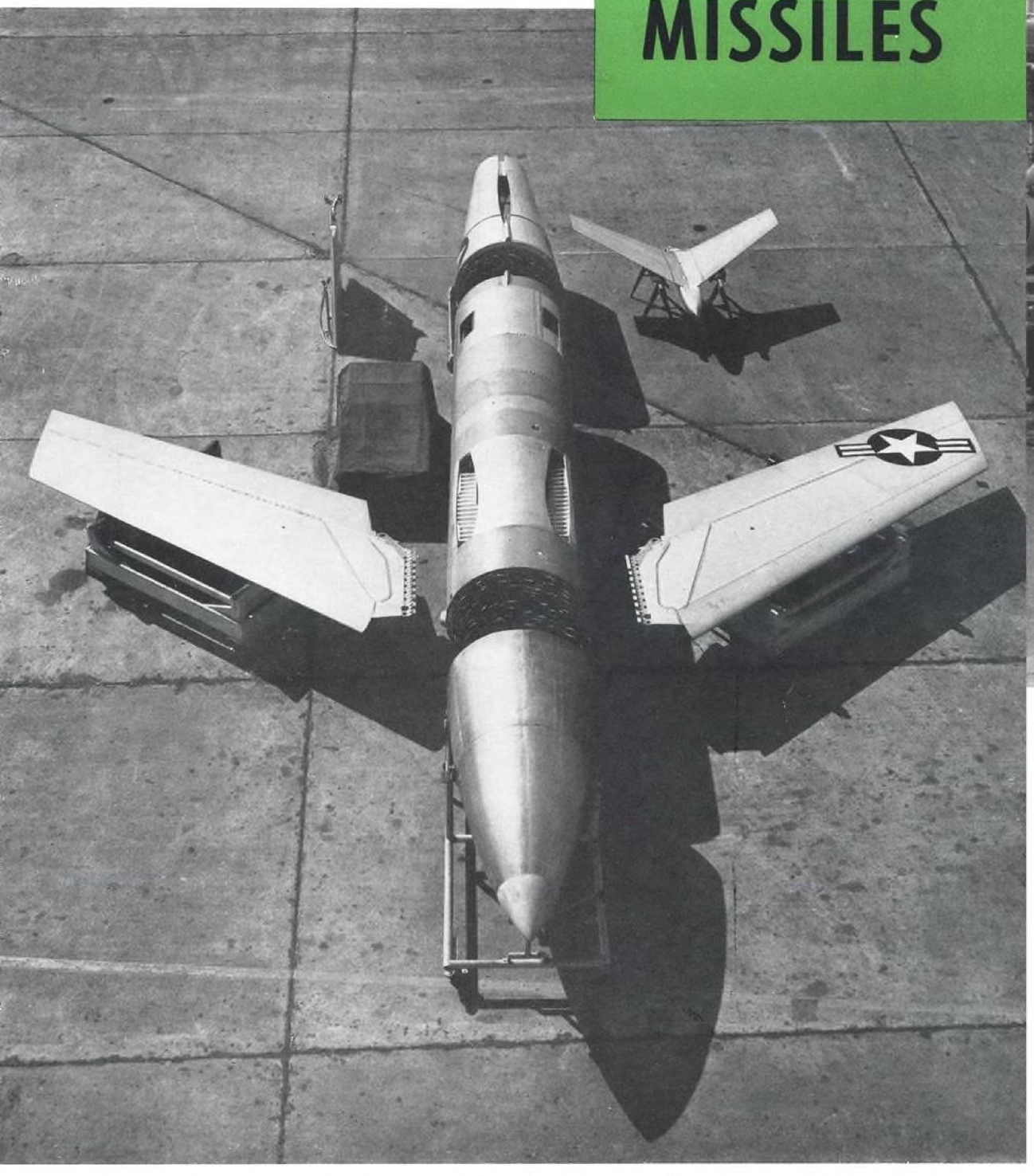
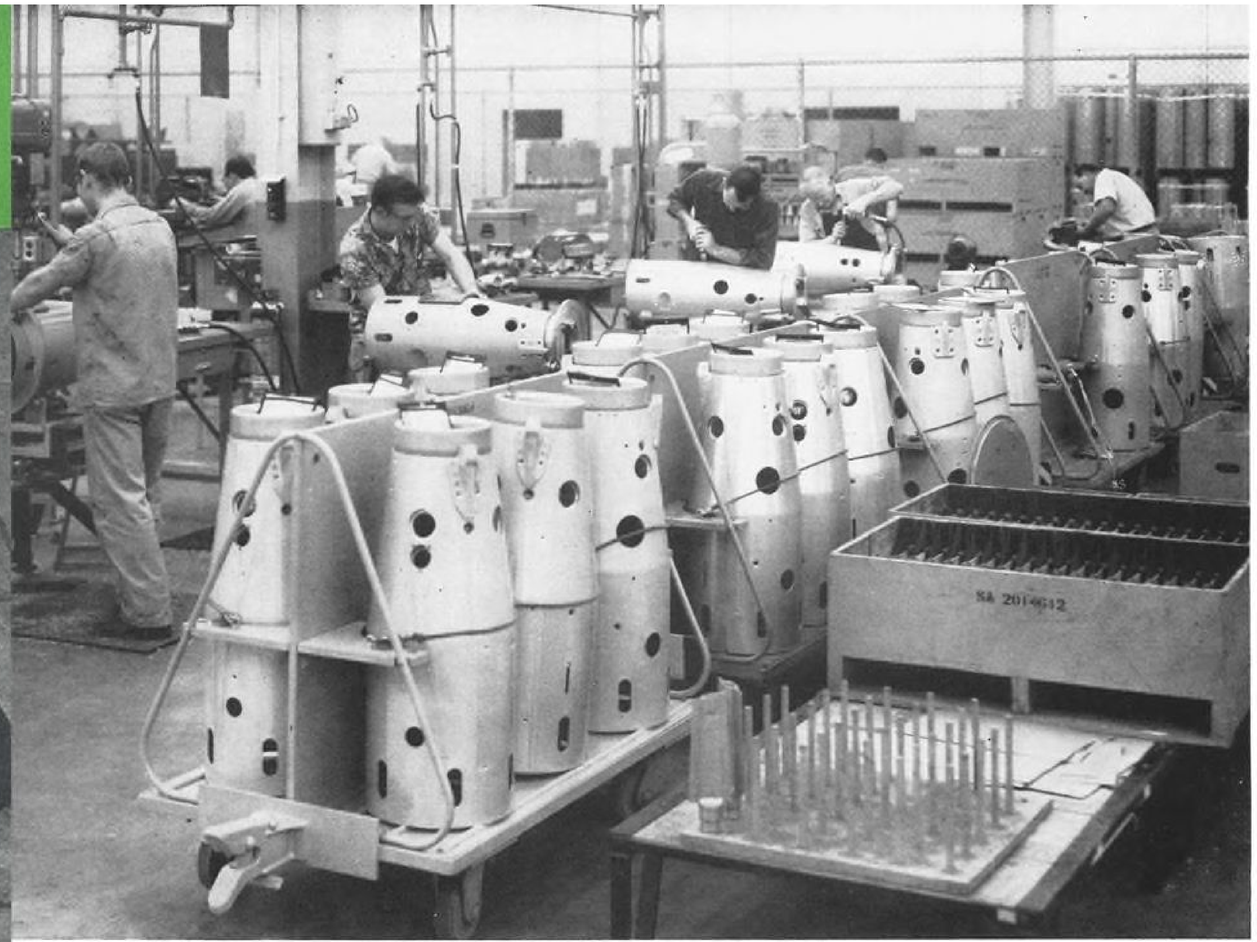
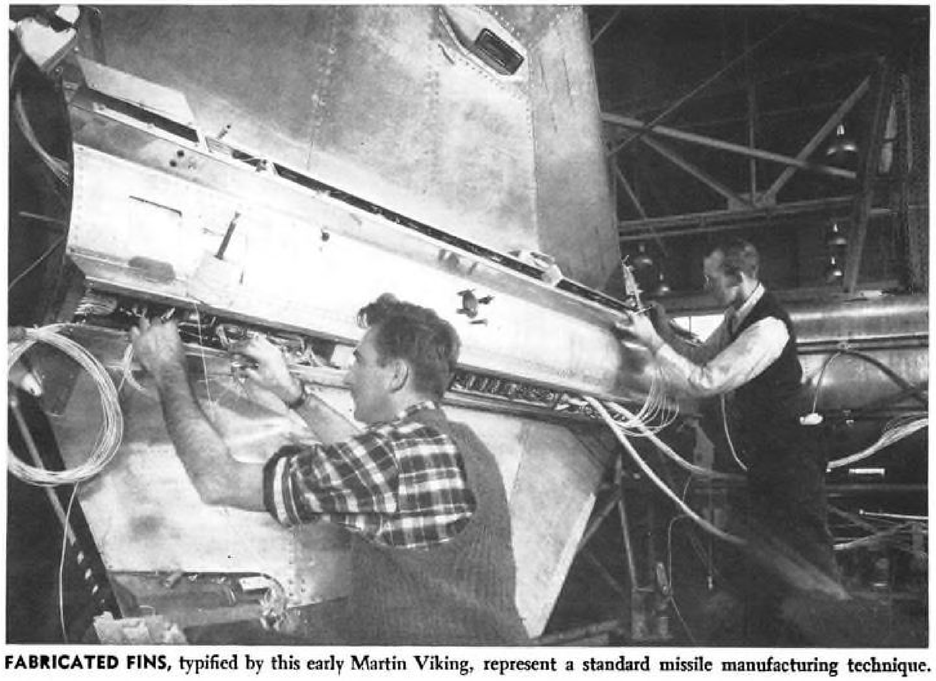
MISSILES



There is no cockpit, no pilot. Instead there is built-in intelligence crammed into black boxes. There are new metals to take heat and load, chemical fuels for supersonic propulsion. Underneath are the familiar elements of an airframe.



MACHINED PARTS, such as these aft guidance sections for the Convair-built Terrier, comprise major sections of today's missiles.



FABRICATED FINS, typified by this early Martin Viking, represent a standard missile manufacturing technique.

Technical Progress Boosts Missile Buying

By David A. Anderton

Guided missiles and supporting services will be bought at a rate approximating one billion dollars per year for the next few years.

During the past decade, and starting from almost nothing, the money allotted annually for missile procurement has been rising rapidly until today it has touched the $700-million mark. A total expenditure near six billion dollars has been estimated for the missile program to date; the future growth is limited only by the rate of technological expansion possible in missile development.

Actually, the division of missile funds allocated to procurement or research and development is difficult to make. Each of the military services supports a large research and development program whose results may be applicable to both the piloted and pilotless varieties of aircraft. There is no obvious way of pro-rating the cost of a new wind tunnel at a government facility to missiles or aircraft.

Procurement practices vary also. The Army, for example, lumps its missile procurement money together with its funds for ammunition for all sizes of rifles, artillery and rocket launchers.

Thus the billion dollar annual figure is an estimate, but in the light of current trends in procurement, a realistic one.

The lion's share of that money is used now for actual purchase of missiles for training and standby use or for experimental firings. This is a reversal of the situation at the beginning of the decade, when almost all of the money was rightly channeled into development.

Six in Service

The weapons arsenal of the U. S. military services now stocks about half dozen operational missiles, with several more about to leave developmental status for production. Three of these have advanced to the point where they are supplied as regular armament to American units stationed in NATO countries.

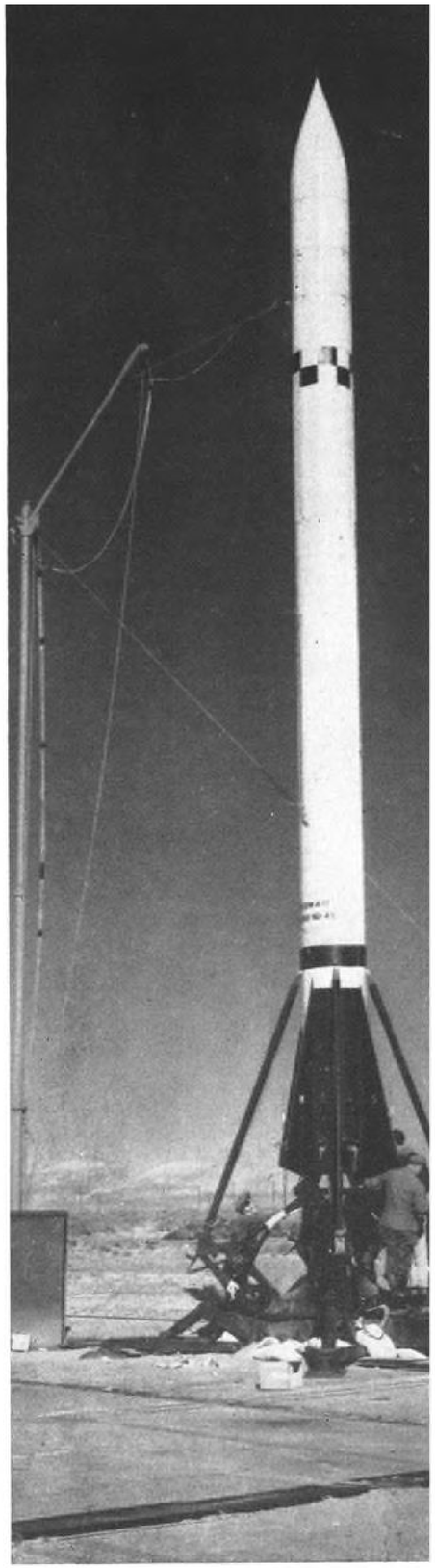
Total number of active missile projects is about 24; this embraces an extremely wide range of missions, sizes and complexities.

There are four fundamental missions established as guides for missiles design in this country:

• **Air-to-air, for fighter and bomber weapons.** These are small missiles, generally of a size and weight that can be man-handled on the ground. The powerplant is generally a solid-propellant rocket motor. Intelligence may be contained within the missile, or it may be contained in the mother plane and transmitted to the missile. Typical examples of this category are the Hughes Falcon, for USAF, and the Sperry Sparrow, for the Navy.

• **Surface-to-air, for anti-aircraft defense.** Next step up the size scale, these missiles are typified by the Army's Nike, now stationed around the United States in city defense, and soon to be sent to Europe. Missiles like this generally are powered by a liquid-propellant rocket motor, although some later models to come will have ramjet engines and be capable of longer range. Intelligence may be self-contained, or it may be transmitted to the missile along a radar beam which the missile rides like a leaf rides the center of a runing brook. A typical size (Nike) is 20 ft. long by one foot in diameter.

FALCON exemplifies small missiles.



CORPORAL is one of the biggest.

• **Air-to-surface, for bombing missions.** These missiles are primarily a bomb to which wings, powerplant and intelligence have been added. In use, they are carried internally or externally on a piloted bomber to a point perhaps 100 miles from the ultimate target. The bomber then releases the missile, which flies on its own power to destruction at the target. In the interval, the mother airplane has had time to get out of the target area. The small size and high speed of the missile make it a difficult target. Powerplant would almost invariably be a rocket engine using liquid propellants. The intelligence would be self-contained. Size might be about 20 ft. long, with a 10 or 15-ft. wingspan and a body diameter of three or four feet. Outstanding current example of this class is the Bell Rascal, for USAF.

• **Surface-to-surface, for artillery support or bombing missions.** There are two sub-classes within this group: short-range missiles, primarily intended to supplement or replace artillery, and used by the Army; long-range missiles, primarily intended to supplement or replace bombers, and used by the Air Force. The Army missiles are rocket-propelled, and follow a ballistic trajectory like an artillery shell's flight path. They have built-in intelligence for accuracy at the target. The Air Force missiles resemble conventional airplanes; current weapons are powered by turbojet engines, although ramjet plus rocket powerplants are a future engine. Topping the list is the intercontinental ballistics missile, a giant with a 5,000-mi. range. Typical sizes could be about 50-ft. height for the Army missiles, and about 50-ft. wingspan for the Air Force pilotless bombers. Atlas, the intercontinental missile, could stand as high as 100 ft., although its ultimate size depends on H-bomb technology.

More than Airplanes

The two basic differences between airplanes and missiles give rise to a large number of detailed differences:

• **A missile does not have a pilot;** therefore the intelligence must be built in. This leads to an enormous amount of internal avionics and other controls, governed by intelligence designed into other black boxes, either in the missile or on the ground. The complications of this equipment lead to new design and production techniques, new testing and maintenance tricks, and transport and housing for the ground equipment, to cite three examples.

• **A missile does not have to come back from a mission.** This means that some compromises can be made with cost of components; this generally shows up in production techniques, developed for high-volume, low-cost output. But it may also show up in a new engineering concept for an expendable engine or airframe. By the same token, reliability must be increased, because a one-way mission has to be an accurate one with a very high chance of making the kill. In a defensive weapon, such as the Nike, this kill probability has to be high to justify use of the missile in the first place.

Under the Skin

Missiles have much in common; under their metallic hides they all share the same basic components. Whether the job is to strike an enemy bomber five miles away or the enemy industrial heart 5,000 mi. away, these are the dependent pieces that combine to do the job:

• **Warhead, which is the payload of the missile to be delivered on target.** This may be a 50-lb. explosive charge, a baby atomic bomb or an H-bomb. It may be a small cone, or a large sphere or a shaped charge. It may need protection from heat, or it may require to be heated. Its mounting may be a sensitive one, or as crude as high explosive poured into an artillery shell.

• **Guidance, which tells the missile where to go.** There are three basic categories of guidance equipment: active, semi-active and passive. The words describe the types quite well. Generally, the earlier missiles (chronologically speaking) and the shorter range missiles use a passive or at best, a semi-active system. They are told what to do, and they do it. The later missiles and those with longer ranges generally have the inherent capacity to figure out what to do and then to execute the command.

• **Powerplant, which makes the missile go.** Today's missiles are powered by conventional turbojets, the same basic engines that propel airplanes; by ramjets, the aerodynamic and thermodynamic powerplant that depends on its own forward speed to keep going; and rockets, which carry along their own fuel and oxidizer in liquid or solid form and, alone among the three types of engines, can operate outside the earth's atmosphere.

• **Airframe, which holds all the other components.** This outside shell is a difficult design problem because of the extreme variety of loads imposed by flight, altitude, temperature, powerplant and in some cases, warheads. It may resemble a sophisticated skyrocket or a sweptwing interceptor; it may be built of stainless steel, plastics, or aluminum alloy. It may be machined with great precision, or pressed out with less.

On the Ground

Supporting these missiles are the items of ground equipment used to transport, assemble, check out, fuel and fire the weapon. These include an extreme variety of wheeled vehicles: mobile trainers, field fuelers and tanker transports, portable power supplies, gantry cranes, radar trailers, tool carts.

One missile system now entering service testing has no less than 65 different units, mostly on wheels, used to support field operations.

The missile has grown from the original concept of a cheap, expendable, simple one-shot item to a complex weapons system that requires as much supporting effort as does any manned airplane. Its cost has mounted until some missile airframes ready to fight cost as much as some airplanes at the ready.

At the same time, it has grown from a scientific toy to an operational weapon, and from a capricious test vehicle to a reliable machine.

Its future prospects look brighter now than at any time before.

HONEST JOHN battery in field service with U. S. Army.

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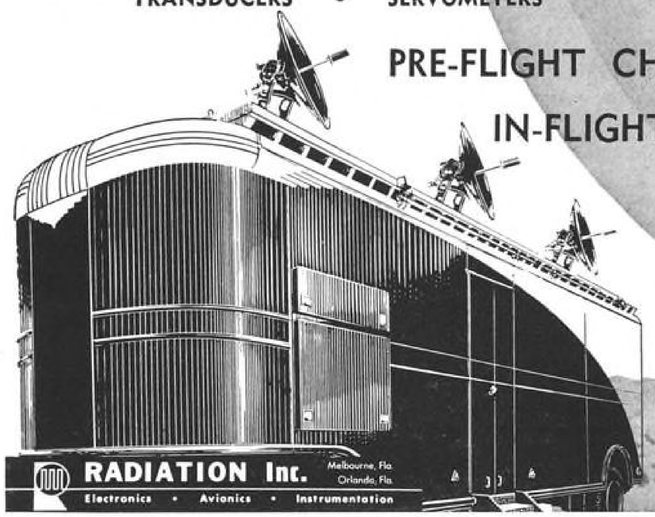

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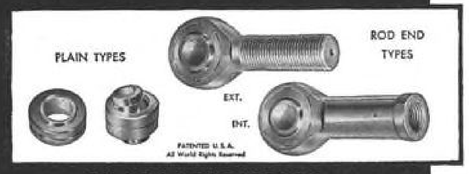

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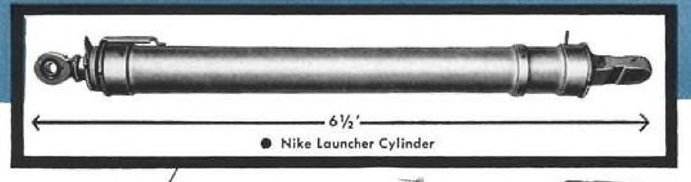

● Nike Launcher Cylinder

● AD-6 Navy Dive Bomber Fuselage

● Hydraulic Door-catch Cylinder

● Ram Air Pressure Regulator

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● Pneumatic Anti-G Blackout Valve

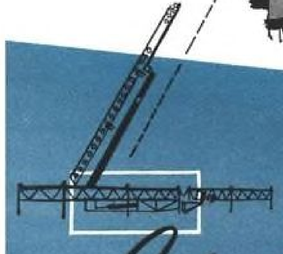
● Pneumatic Selector Valve

● Pneumatic Air Valve (rotating)

● Hydraulic Actuating Cylinder

● Hydraulic Fuel-selector Valve

● Hydraulic By-pass Valve



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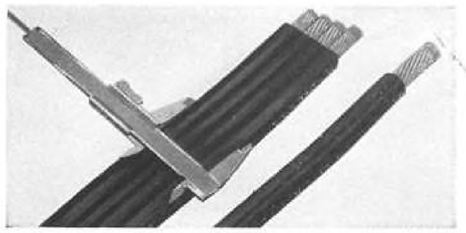
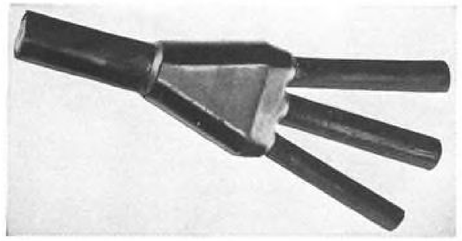
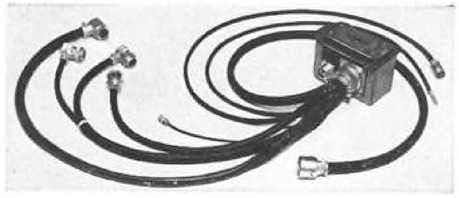


moulded cable transitions

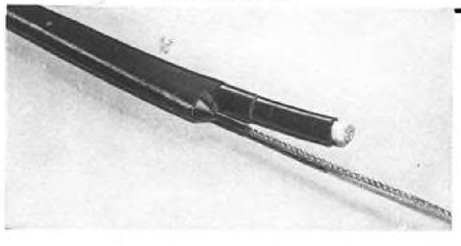


special cable assemblies



combined electrical and pneumatic and hydraulic components

electronic cable comprising steel strain member



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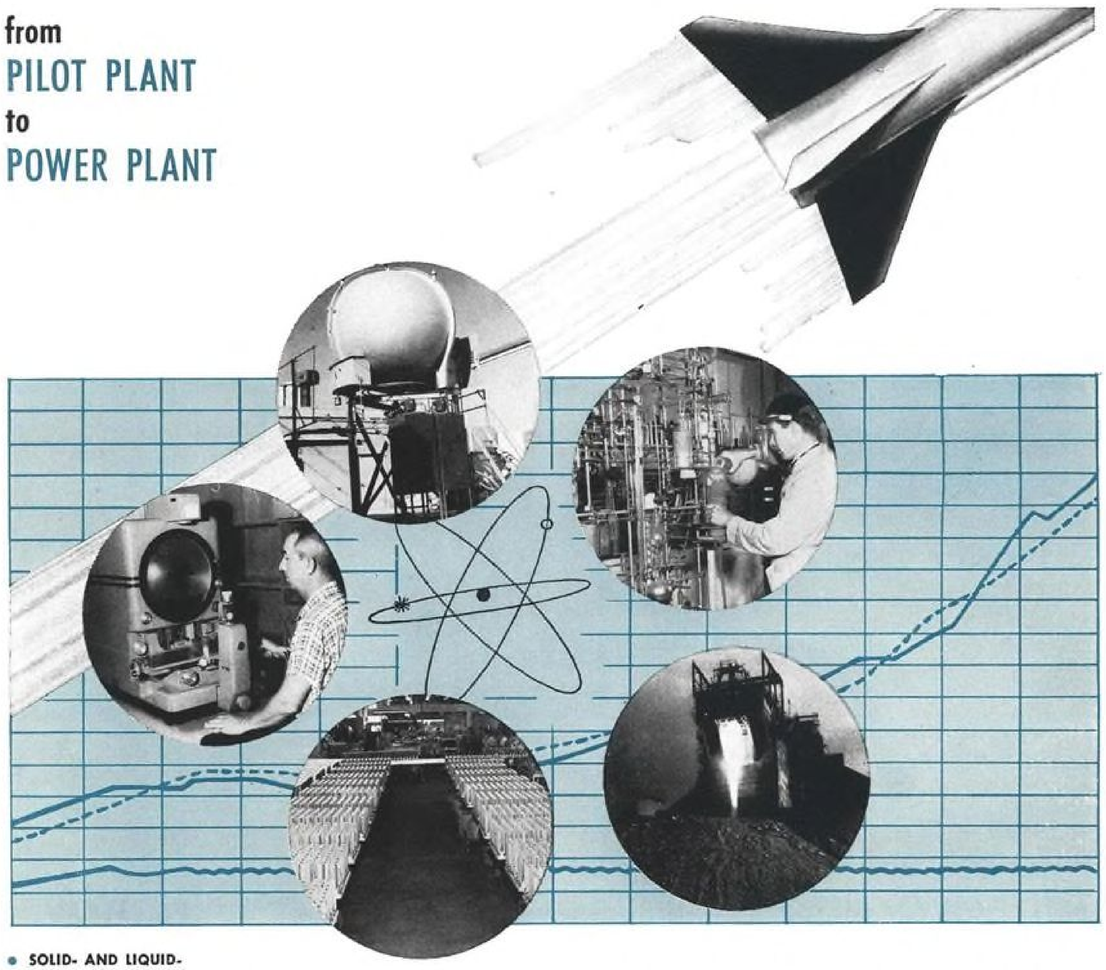

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AVIATION WEEK BUYERS' GUIDE
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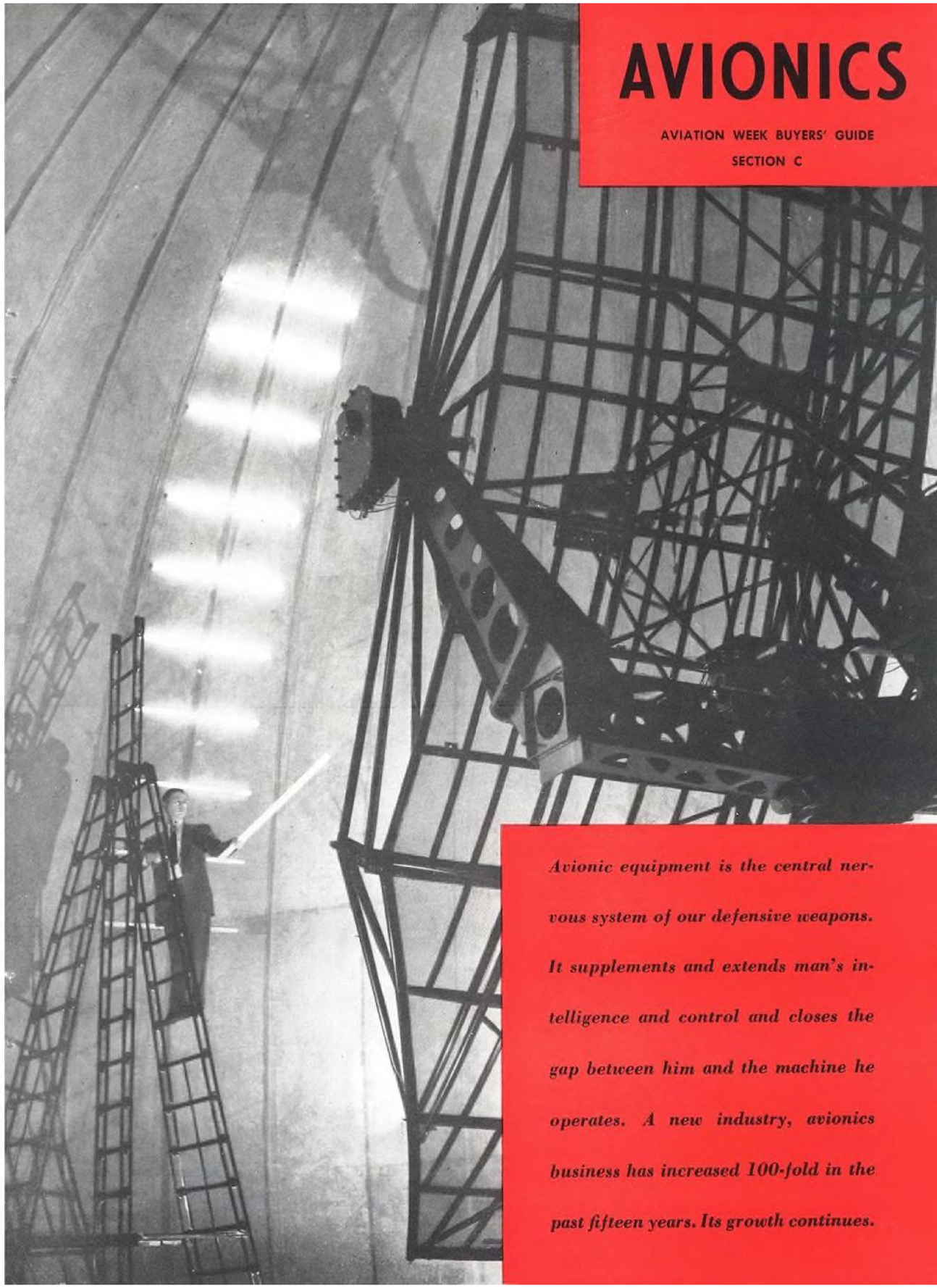
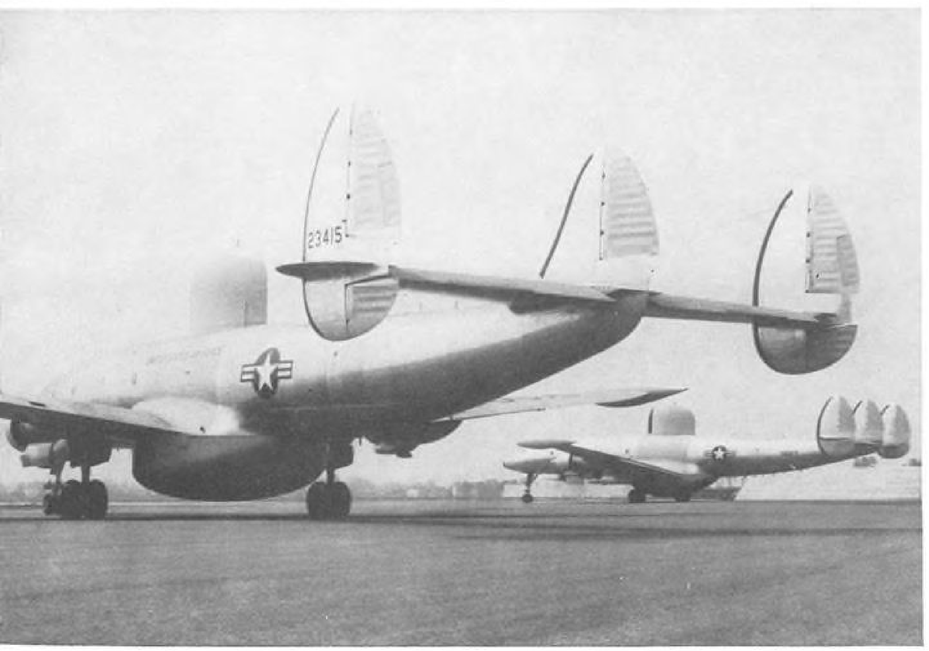
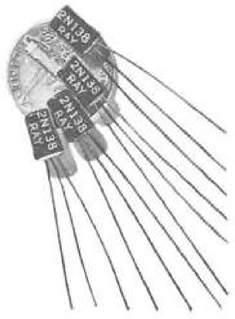


Avionic equipment is the central nervous system of our defensive weapons. It supplements and extends man's intelligence and control and closes the gap between him and the machine he operates. A new industry, avionics business has increased 100-fold in the past fifteen years. Its growth continues.



SHARP PRICE cutting now prevails on avionic equipment, ranging from large airborne surveillance and height finding radars used on the Lockheed RC-121 early warning aircraft (left) to tiny transistors (below) and other components. Cost thus joins size, weight, performance and reliability in determining which companies win military procurement contracts.



Price Now Figures in Avionics Buying

By Philip J. Klass

For the first time in more than 15 years, the dollar sign has become a significant factor in military avionics procurement. This has forced the avionics industry to sharpen its costing pencil and resort to the same sort of penny-watching practices long employed in the radio-TV manufacturing industry.

For many newcomers in the avionics field, this is a novel, and sometimes painful, experience. However, it has also shaken some of the older and large avionics producers, causing them to scramble for business.

This does not mean that equipment size, weight, performance, and reliability are less important. It is just that price has moved up into the big leagues. And this keen competition, following the post-Korean stretch-out, has been felt even more by component suppliers to the avionics equipment industry.

Military procurement practices normally provide that the first production procurement of a new item should go to the firm which developed the device. However, after this initial procurement, it is anybody's ballgame.

A company which develops a new equipment, and manufactures the first procurement, should have a slight advantage in subsequent procurements. Its production tooling is paid for, and it has considerable experience and know-how. Despite this, there are growing numbers of firms who are losing follow-up procurements. For example:

- **APS-20B** airborne surveillance radar, was originally developed and produced by General Electric, but Hazeltine won the follow-up procurement.
- **APS-45** airborne heightfinder radar, developed and first produced by Philco, is now in production at Texas Instruments Inc.
- **APA-56** airborne radar indicators, developed by General Electric, have been given to Texas Instruments to produce.

Sharp Pencil Or Ignorance?

Recently the Government held a competition for follow-up procurement of equipments for which it had initially paid $1,400 each. The original producer bid $1,100, a 20% reduction from his initial figure. However, the competition was won by a small newcomer who bid only $800. This figure was less than the original producer's estimated manufacturing cost.

This sort of situation always prompts the loser to suspect that the winner has badly underestimated the magnitude of the job, because of lack of experience with the initial procurement. In at least some instances, this is the correct explanation for the low bid.

When an equipment manufacturer discovers that he has mistakenly underbid the job, or knowingly underbids it to fill up his factory load (and thus lower distributed overhead on other products), it calls upon component suppliers to sharpen up their costing pencils.

Pressures On Suppliers

For example, instead of buying mica capacitors from one manufacturer, paper capacitors from another, and electrolytics from a third, more and more equipment manufacturers are asking manufacturers for a "package quote" on all the capacitors required for the production of the new equipment.

By holding out as bait the prospect of a single order for $50-100,000, the equipment manufacturer expects, and frequently gets, a sizeable reduction from normal net price.

The representative of one capacitor manufacturer, who lost such a packaged bid, told AVIATION WEEK that the price quoted by his competitor was less than his company's direct manufacturing costs.

These highly competitive buying practices, while not yet as rugged as those employed in the radio-TV industry, are surely making avionics components suppliers, including some of the larger firms, price conscious. They also create pressures on component suppliers to expand their lines so they can give package-type quotes for all types of capacitors, resistors, or tubes required by an equipment maker.

Not all of the pressures are being generated by the equipment manufacturers. In at least one case, a component manufacturer has voluntarily shifted to "hard-sell" techniques. One transistor manufacturer, in order to stimulate the use of transistors in general, and his in particular, has offered to give an equipment manufacturer a sizeable cut off regular price if he will agree to use a given number of the semiconductor devices. One medium-size avionics firm made such an agreement, and promptly set about redesigning its new equipment to use transistors. As a result, most of its new avionics equipment will be completely or largely transistorized.

Salutary Effect

No one questions the salutary effect that this general shake-down is having on the avionics industry, despite his own occasional discomfort. For example, one equipment maker which has been underbid on several jobs, is bringing in more component suppliers. As a result of passing the competition down the line, the firm expects to be able to lower its quotes in the future. For example, on a radar mixer which it previously bought from one source, the company now has two alternate suppliers. The result is that the cost of the radar mixer has been cut in half, a spokesman says.

Perhaps the most significant difference between military and civil avionics equipment is the difference in their procurement procedures and the resulting effect on the equipments themselves.

Some observers suspect that at least a portion of the unreliability problems now encountered on military avionics equipment are attributable to the military practice of "procurement by specification," instead of making more use of the competitive forces which govern commercial buying.

Considering the fact that the military spend an average of twice the initial equipment cost every year in maintenance, and the fact that it is difficult to put equipment reliability into specification form, these observers believe that present procurement practices may be "penny wise and pound foolish."

No Clear-Cut Difference

Although there are some recent indications that military buying practices are moving in the direction of commercial procedures, the safeguards which Congress insists upon for military procurement make it appear doubtful that the pendulum can ever swing all the way.

From a technical standpoint, there is no clean-cut cleavage between civil and military avionics equipment. In

fact, avionics equipment for one branch of the military often bears a closer kinship to the avionics of one segment of civil aviation, than to another branch of the military. For example:

- **Airline avionics** equipment closely resembles, and is often identical to, that used in aircraft of the Military Air Transport Service, but differs greatly from equipment used in civil lightplanes.
- **Army Aviation's** lightplanes and helicopters use communication and navigation gear which closely resembles or is identical to that used by civil lightplane operators. Cost, as well as size and weight, are important factors to both, because of Army Aviation's small budget.

Difference Of Degree

Where technological requirements differ, the difference is usually one of degree or emphasis. This was brought out during a recent symposium in Baltimore on the subject: "Comparison of Design Features Required for Military and Civil Airborne Equipments." The eight-man panel represented the three military services, the airlines, lightplane operators, and three manufacturers of military and civil avionics equipment.

All users emphasized the importance of equipment reliability. While the price of avionic equipment failure to an airline may run into thousands of dollars, "the penalty of failure in a military aircraft can run much higher," Ludlow Hallman pointed out. Hallman is technical director of the Communications and Navigation Lab at Wright Air Development Center.

The lightplane operator, whose plane and pocketbook can not take dual installations, also needs a high order of reliability, A. R. Applegarth, chief engineer of Narco pointed out.

Size, weight, and power consumption are important factors for all aircraft operators, but weight is "critical" in many Army helicopters now in use, Lt. Col. John L. Wilson, Jr., chief of the Aviation Branch, Army Signal Corps, said.

To meet the operational requirements of carrier-based aircraft, the Navy must cram more avionics into cramped airframes. As a result, it is calling for avionic equipment designers to go to more sub-miniaturization. This greater "density", raises serious cooling problems, according to Al Winick, head of BuAer's Navigation Aids Branch. Winick also pointed out that carrier catapult launching subjects avionics equipment to a high-G shock which may last 2½ seconds.

Despite these specialized requirements, J. C. McElroy, assistant head of research and development for Collins Radio, sees "little fundamental difference in design requirements between airline and military" avionics equipments. Bendix Radio's George Church noted that the design of avionics equipment "is a series of compromises."

Difference In Buying

When a new military device or equipment has been developed, the initial procurement normally goes to the firm which made the development. Subsequent procurements are then made on a competitive bid basis, with the lowest qualified bidder getting the job. Although a firm's past performance on a number of contracts for a variety of avionic equipment is weighed in determining whether the company is "qualified," only the original developer has had any production experience with the specific item under procurement.

If the second procurement goes to a new contractor, more often than not this company goes through the same "learning pains" as the original producer. Sometimes, but not always, the same troubles which plagued the original equipment, or entirely new ones, crop up in the second procurement equipment. The reason is that there is a lot of production know-how that can not be put on blueprints or into specifications.

If there is a third procurement, and it goes to a new supplier, the whole cycle may be repeated. The dollars which the Government saves in initial equipment costs may be more than dissipated in increased field maintenance costs.

However, such is not always the case. Sometimes a new supplier makes significant improvements and refinements over the original equipment. (Texas Instruments Inc. is a notable example of a consistent low-bidder who does a good job, a Navy spokesman tells AVIATION WEEK. However, he quickly adds that not all of BuAer's low-bidders can be held up to support present procurement practices.)

Different With Airlines

Competition and commercial buying practices are an important factor behind the greater reliability of airline avionics equipment, according to William T. Carnes of Aeronautical Radio, Inc. For example, if Company "X" gets an airline order for a new type navigation receiver, it knows that repeat orders from that airline for new aircraft, and orders from other airlines, depend in large measure upon the reputation (both performance and reliability) which the equipment racks up.

If the set proves extremely dependable, Company "X" can be pretty certain of getting subsequent business, without fear that an "unknown" in the field might come with a slightly lower price and snag the business.

This does not mean that the airlines are not interested in cost. However, they recognize that maintenance costs quickly exceed the original equipment cost. While it is difficult quantitatively to measure or define these intangibles, an airline operation is small and closeknit enough to enable its engineering department and purchasing agent to factor such important considerations into their buying decisions.

Step In Right Direction

The recently announced policy of the USAF's Air Materiel Command to penalize contractors for poor performance and late delivery (AW Sept. 19, p. 12) was called "a foundation stone in any sound business transaction and one which the airlines consider in buying equipment," by Collins Radio's McElroy. Collins is a major supplier of both civil and military avionics.

"We believe," McElroy said, "that industry can and should do more in the role of supplying the military with equipment based on the same rules and procedures that control normal business transactions. Industry should be given the opportunity, and actively encouraged to develop equipment to satisfy military requirements, using its own financial resources, and to specs determined largely by industry."

In announcing the new AMC policy, Maj. Gen. David H. Baker, Director of Procurement and Production, said: "In negotiations we will look carefully for indications that contractors are willing to accept normal business risk and fuller responsibility for products developed and produced."

Give Industry Free Hand

Where evidence exists that industry is willing to develop equipment on its own to meet military needs, McElroy called on the military to "refrain from initiating competitive programs." McElroy also called for "a just means of providing industry with compensation for proprietary items," If such a plan is established, and adhered to, there would be no sole-source procurement problems, McElroy said.

The military "must find ways of informing industry's thinkers and doers of their future planning," McElroy said. Security barriers should not deprive the military of industry's technical brain power. Recent moves in this direction by the Air Research & Development Command (AW Oct. 17, p. 12) were called "a very encouraging step," by McElroy.

"The powerful uncompromising hand of economic necessity can be made to orient the majority of divergent views to . . . where little difference exists in tomorrow's avionics equipment, be it for Army, Navy, Air Force, or airlines," McElroy concluded.

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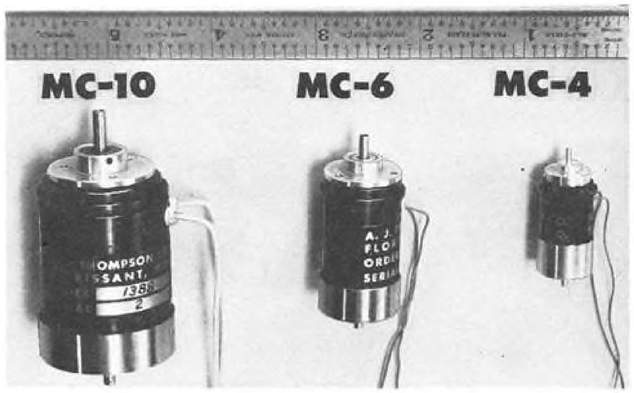

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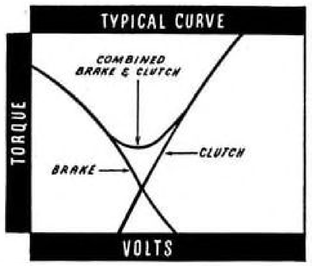

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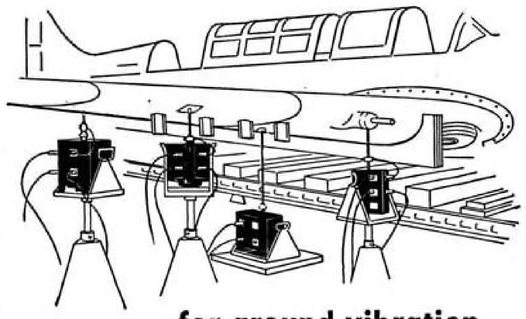

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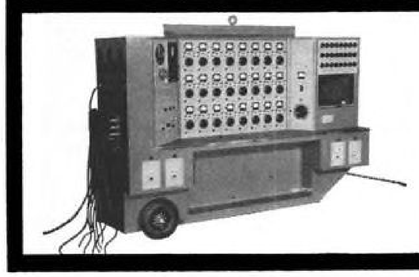

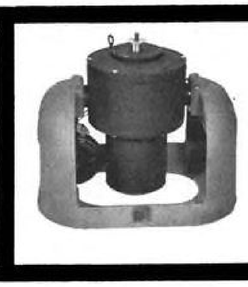

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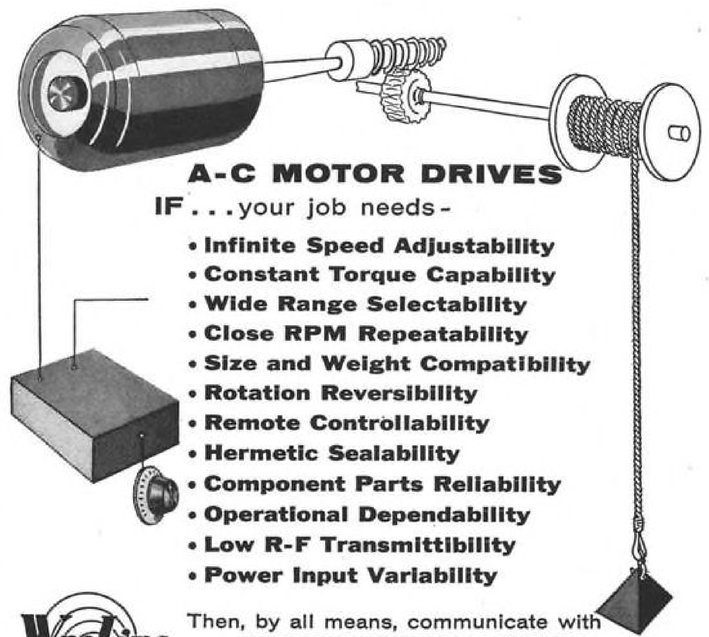

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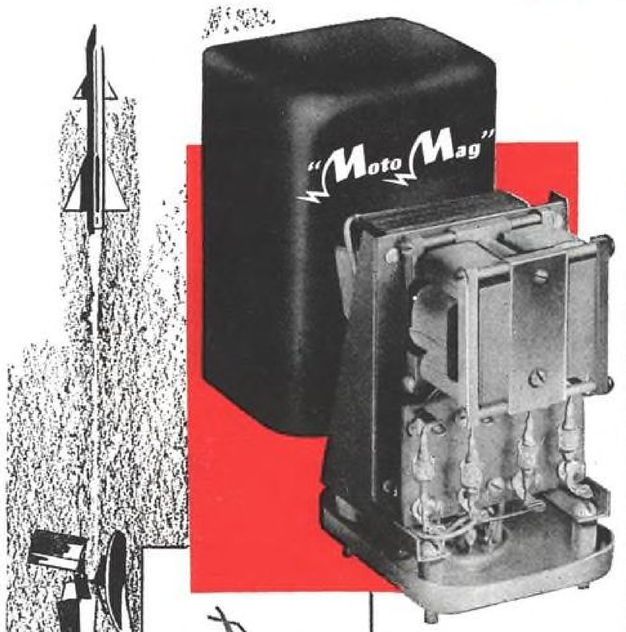

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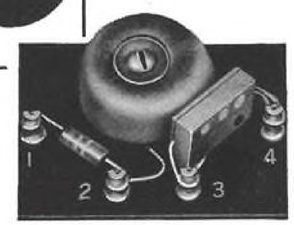

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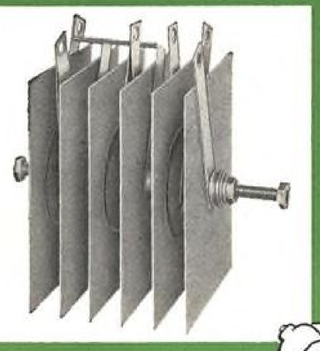

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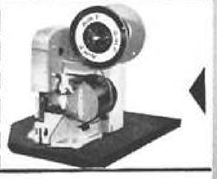

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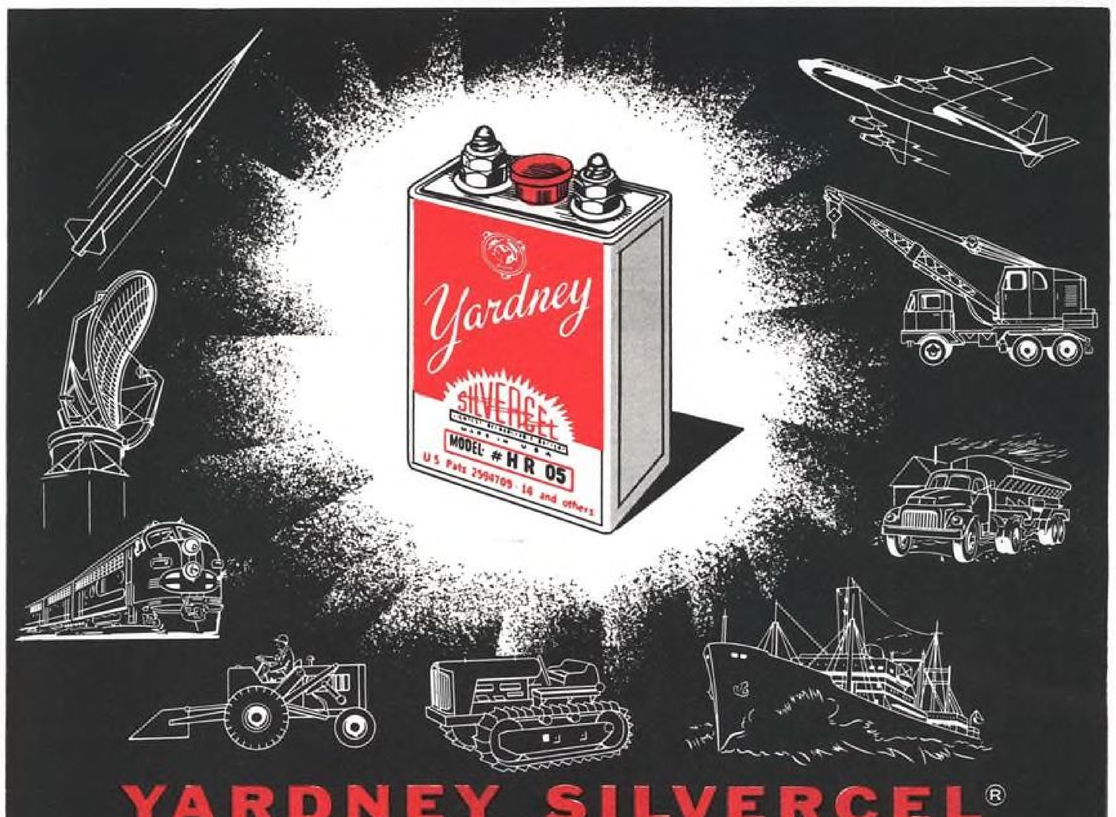

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HR 05	0.5 AH	30 amps	0.70	1.52	1.10	0.55	Telemetering
HR 1	1.0 AH	45 amps	0.79	1.98	1.08	0.54	Motor-Driven Recorders
HR 3	3.0 AH	75 amps	2.98	2.86	1.72	0.59	Tow-Target Drones
HR 5	5.0 AH	75 amps	4.24	2.95	2.08	0.80	Photo-Flash, Camera Drives,
HR 10	10 AH	220 amps	7.88	4.78	2.32	0.74	Portable Lights, Missile Guidance
HR 20	20 AH	500 amps	13.82	4.28	2.05	1.73	Missile Power Sources and
HR 21	20 AH	500 amps	15.02	7.56	2.31	0.81	Servo Controls
HR 40	40 AH	600 amps	23.20	7.0	3.25	0.99	Torpedo Propulsion
HR 60	60 AH	1000 amps	31.85	4.50	2.75	2.38	Portable TV
*HR 85	100 AH	1900 amps	52.30	9.44	2.81	1.81	Aircraft Power Sources
HR 90	100 AH	1800 amps	51.40	7.0	3.25	2.16	Tow-Target Drones
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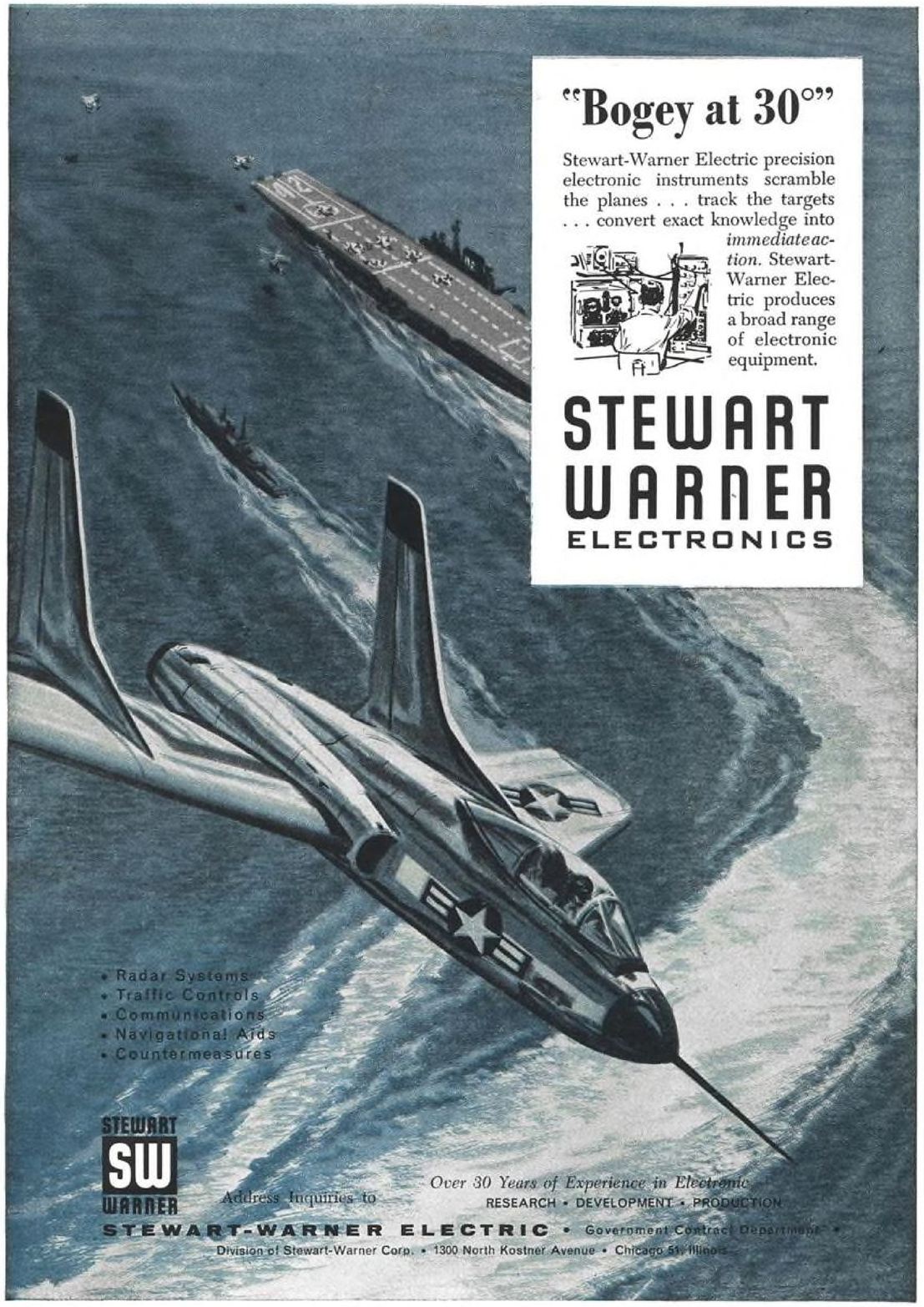

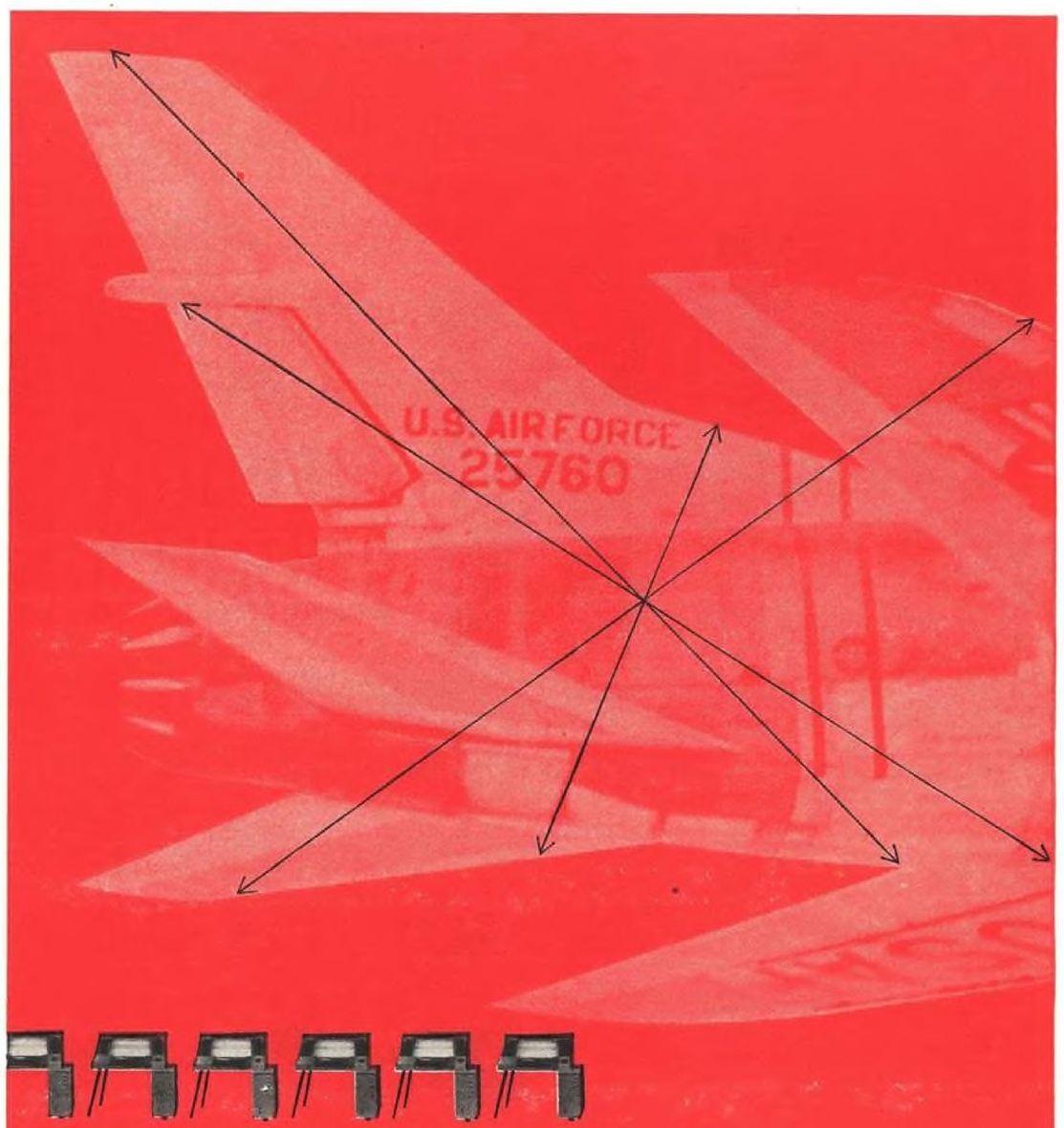

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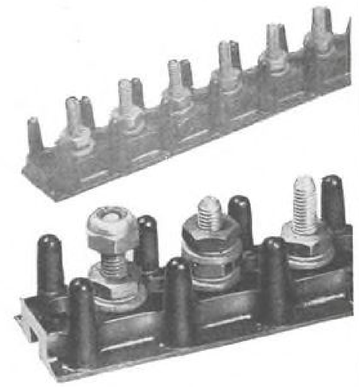

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"One-Piece" Terminal Blocks

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ELECTRICAL PRODUCTS CORPORATION
HILLSIDE, NEW JERSEY
IN CANADA GASACCUMULATOR CO. (CANADA) LTD.
12 GOWER ST. TORONTO 16, ONTARIO

NEW!

41%
lighter...shorter, same capacity, a.c. or d.c.

actual size

AXIAL BLOWER

only 2" long...weighs only 5 ounces!

Globe . . . pioneer precision motor manufacturers and leaders in miniaturization . . . now offers the latest in axial blower design! A *further miniaturization* of existing equipment *for high air delivery in smaller space!* Units consist of a Globe sub-miniature a.c. or d.c. motor, a dynamically balanced 2-blade aluminum fan, mounted in a rigid one-piece aluminum housing.

A.C. blowers are for 400 and 60 cps operation. Other frequencies available. D.C. blowers are available up to 90 volt operation. Air flow in a.c. up to 50 cfm free air. Back pressure up to 0.8" H_2O. Both types a.c. or d.c. provide air flow in either direction, and meet military specifications. Write today for bulletin 520.

GLOBE INDUSTRIES, *inc., dayton 4, ohio*

manufacturers of precision miniature motors and motorized devices

TWENTIETH CENTURY Relay Torture

The Potter & Brumfield Way

Relays operating in special constructed ovens are subject to temperatures exceeding 400° Fahrenheit. Recording instruments indicate any malfunction.

Frost covered sealed relays are taken from especially designed sub-zero chamber which has subjected them to continuous operation at — 100° Fahrenheit.

Shaker and rotary power supply located in soundproof room has frequency range of 0 to 2000 C.P.S. Complete with automatic servo control of acceleration and frequency cycler.

Control of metal finishes are a must for accurate relay operation. Parts are periodically subjected to a minimum 20% salt spray to check their resistance to corrosion.

One of the reasons that keeps Potter & Brumfield Relays out in front.

The best Engineering design is not enough. Prototypes must pass all torture qualification tests.

More important the manufactured product must meet engineering expectations. Not just now and then, but for as long as the relay is made.

That is why Potter & Brumfield relays are tortured regularly throughout production runs.

Different relay designs are subjected to torture tests in varying degrees.

Potter & Brumfield builds relays to all quality levels and at the best possible price to you.

Samples available for immediate delivery.
Send your specification for recommendation and quotations.

POTTER & BRUMFIELD
PRINCETON, INDIANA

Tester built to JAN specifications provides shock of over 100 G's. Contact reactions are indicated on oscilliscopes—thyratrons or other special equipment depending on speed.

Typical rugged life test using a series of 1000 watt lamps causing the relay to operate under a load 10 times more severe than normal.

For quick delivery over 350 different standard relays stocked by 500 Franchised Electronic Parts Distributors throughout the United States and Canada.

ALL TYPES—ALL SIZES—FOR ALL APPLICATIONS

C-88

SOME RESEARCH AND DEVELOPMENT ACCOMPLISHMENTS

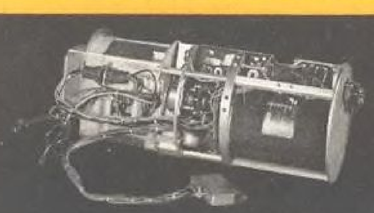
AN/DKT–4 AIRBORNE TELEMETER

SPECIAL PURPOSE COMMUTATING SWITCH

B 2A BOMB RELEASE INTERVALOMETER

TERRIER MISSILE DATA RECEIVING AND RECORDING STATION

SPECIAL PURPOSE ANTENNA MULTI-COUPLER



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For the answers to your electronic research, development and production problems--

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Our engineers are ready to work with you on the design, development and production of precision electronic and electro-mechanical systems and equipment *to your specification*. 1955 marks 53 years of quality manufacture — with a permanent segment of our facilities and personnel permanently allocated to the development of specialized avionic and Military equipment. Our production facilities match our engineering skills. We have an outstanding record of "*on time*" delivery.

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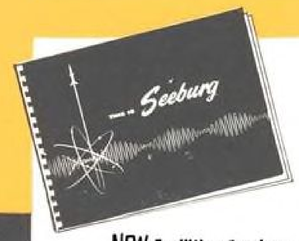
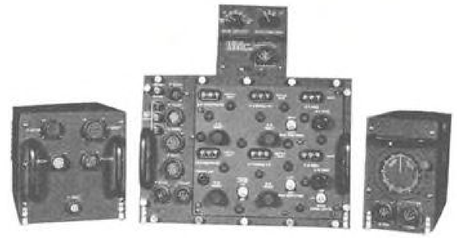
SOME PRODUCTION ACCOMPLISHMENTS





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- Aircraft Controls
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Established 1902
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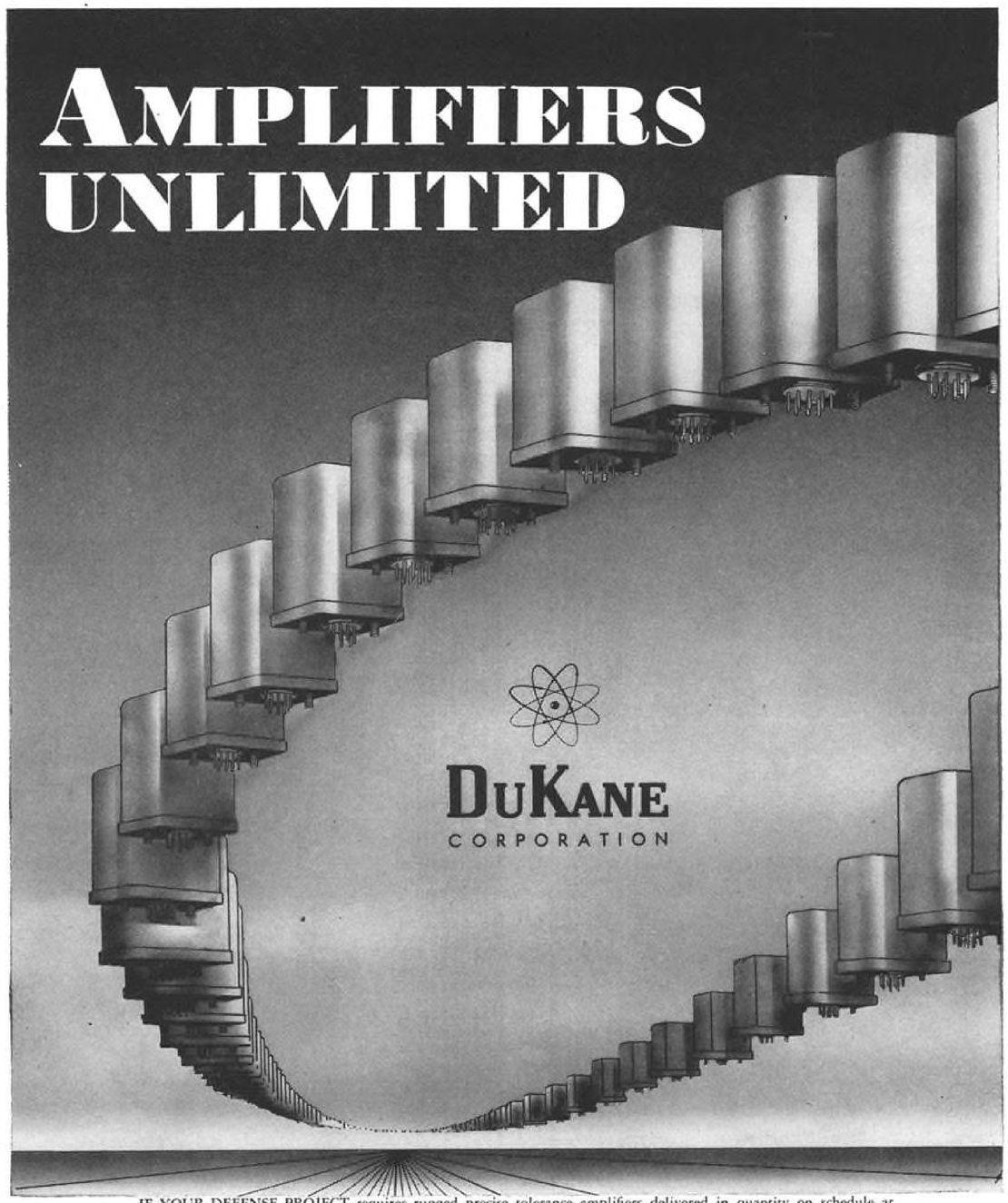
WORLD'S LEADING MANUFACTURERS OF AUTOMATIC MUSIC SYSTEMS

AMPLIFIERS UNLIMITED



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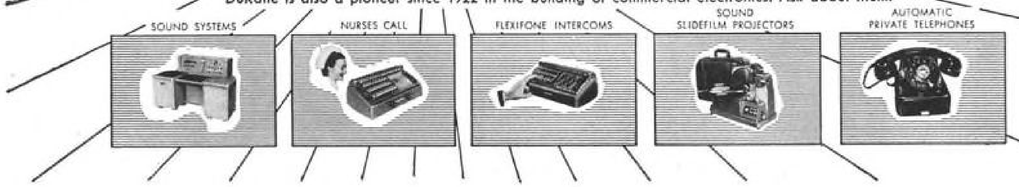

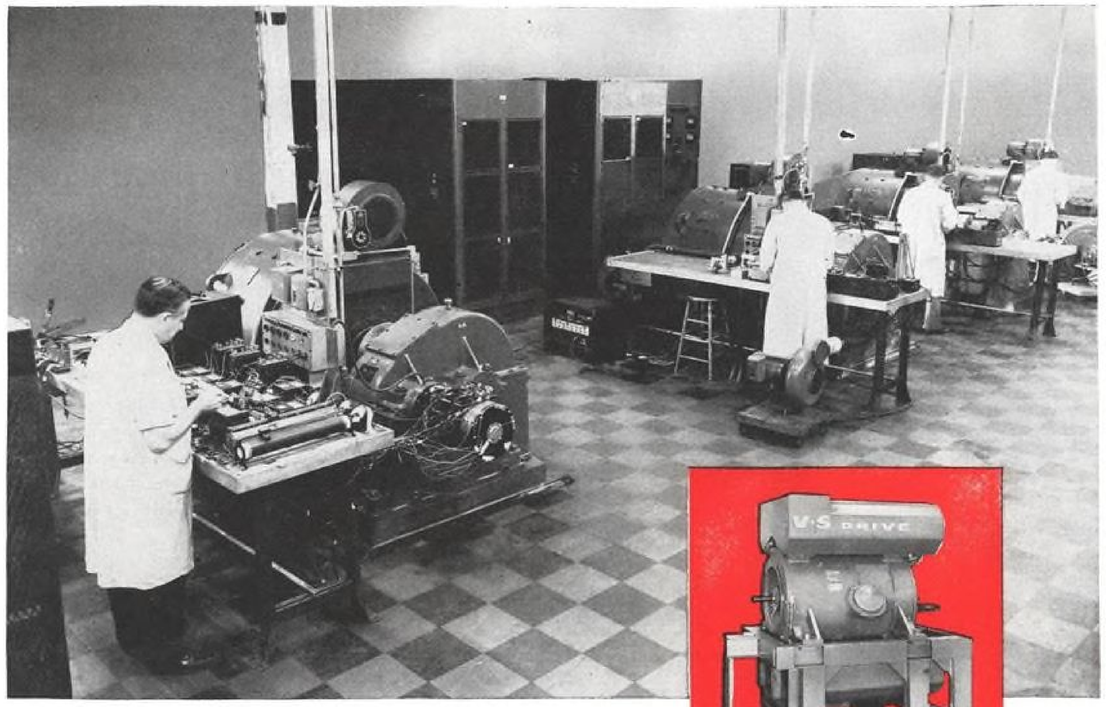

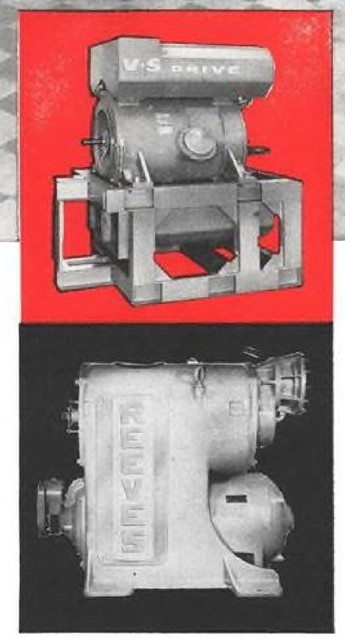

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. . . yet they are able to examine and evaluate functioning engine components and auxiliary parts with scientific precision.

Extremely accurate Reliance test stand drives and dynamometers play an important part in this action diagnosis, providing new highs in accuracy and flexibility.

Check the figures and you'll see what we mean:

Speed variations as great as 200:1.

Drive speeds as high as 50,000 rpm.

Controlled acceleration rates as high as 3000 rpm. per second.

Automatic speed regulation as close as $\frac{1}{10}$ of 1%.

Explosion proof drives as large as 250 hp. for class I, group D service.

If you are thinking of buying or modernizing any test stand equipment, it will pay you to talk with your Reliance Sales Engineer first. D-1507

Drives available 1/8 through 1000 hp.—regulated or unregulated—a-c. or d-c.—mobile or fixed—constant torque, constant horsepower, or variations of both.

For full information, write for Bulletin L-2001.

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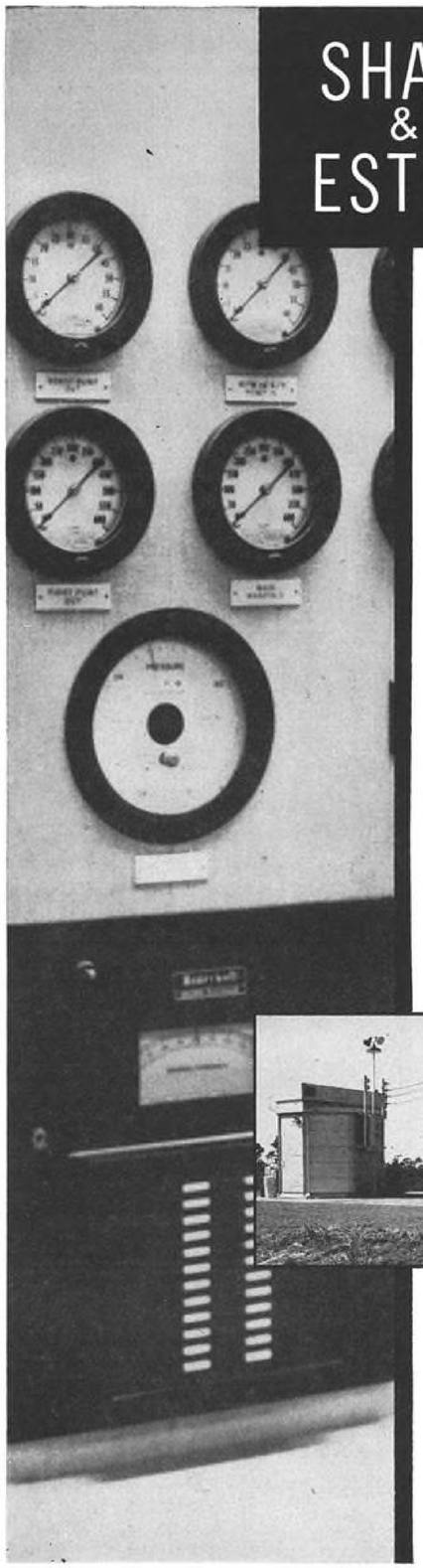

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TEST SYSTEMS ENGINEERING at Shaw & Estes is based on experience . . . the experience necessary to integrate and coordinate all the skills, techniques and materials required to provide a simple, yet complete, and reliable solution to a test problem.

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- Spin testing facilities with controlled speeds up to 24,000 r.p.m.
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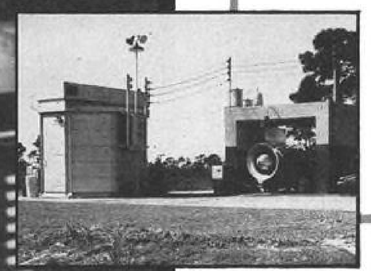
More than 250 S & E Test Cells are in use throughout the Free World.



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CUSTOM - SUBMINATURE
toroids

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UNCASED TOROIDS
Basic inductor component. Plain, wax, or plastic dip with flex-leads. Hi Q values up to 10 mc. Complete range of sizes: subminiature, wedding ring, etc.

PLASTIC CASED TOROIDS
CAC compression molded toroids have become the standard of the industry. Incorporated in most advanced military and domestic applications. Stocked units for immediate shipment.

STEEL CASED TOROIDS
Hermetically sealed to MIL-T-27 specifications—mounting area minimized — lo-hum pickup — hi-perm cases — standard inductances in stock.

TUNED CIRCUITS
For Printed Circuit Applications
- Multiple Tuned Transformers
- Delay Lines
- Tuned Circuits

W — 1"
L — 4¼"
H — 7/16"

SUB-MINIATURE FILTERS
All types of filters—toroidal inductors and special capacitors for maximum stability, sharpness, and attenuation—advanced design and printed circuit techniques make possible high degree of miniaturization—hermetically sealed construction.

PULSE TRANSFORMERS
Customized toroidal units. Blocking oscillator and pulse coupling transformers for specific applications. Nth degree subminiaturization.

C-A-C®

DELAY LINES
Designed to your specifications —of lumped constant type. Ideal for sonar applications.

MAGNETIC AMPLIFIERS
Toroidal construction and quality materials provide: high gain per stage—fast, stable response. Multiple, electrically isolated input and output windings—line frequencies 60 cycles, 400 cycles and higher-operating temperatures —55° to +100° C—hermetic sealing to MIL specs.

SATURABLE REACTORS
Transformers: Up to 12" OD x ⅝" ID x 4½" high—handling 16 to 38 wire on largest units—miniature transformers to 48 AWG.

TUNED REACTORS
Applications:
- Servo Systems
- Data Telemetering
- Remote Frequency Control

Illustrated—High Frequency Reactor Tuned by Varying D.C. Current.
W — 1"
L — 1¼"
H — 15/32"

HI-CYCLE TRANSFORMERS
- Range—400-6000 cps
- Efficiency—up to 95%
- Wattage—6 mw—200 watts
- Temperature —55° to +155° C
- Depicted—6 KC 100 Watt Unit Less than 1.65 cubic inches

DISCRIMINATORS
Linear frequency sensitivity and temp. compensated. May be packaged with MAG AMPS to produce control functions from small signals.

Why is it? . . .

In 7 short years, CAC has reached a dominant position as an exclusive toroidal coil winding and component producer.

Why?
We believe it is due to meticulous care, advanced research—and to the specialized skill of our people.
Thankful for the trust important customers have placed in us, we are ever mindful of a growing responsibility—YOU CAN DEPEND ON CAC!

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Precision Delivery Quality

CONTROL SYSTEMS, STABLE PLATFORMS, MINIATURE AND SUB-MINIATURE RATE GYROS, VERTICAL GYROS, FREE AND DIRECTIONAL GYROS, ACCELEROMETERS, INTEGRATION, INTERVALOMETERS, POTENTIOMETERS, SYNCHROS, RESOLVERS, SENSING AND ACTUATING COMPONENTS.

Precise CONTROL takes TEAMWORK!

More than ever before, new missile and aircraft control and indicating systems are the result of close teamwork between the Military, their prime contractors, and a multitude of sub-contractors.

Daystrom Pacific Corporation and its American Gyro and Potentiometer divisions are proud of being a first string member of this championship team, a position won and continually maintained through production of quality control components and systems, and advanced research and development leading to the production units of tomorrow.

CONTROL SYSTEMS, STABLE PLATFORMS, MINIATURE AND SUB-MINIATURE RATE GYROS, VERTICAL GYROS, FREE AND DIRECTIONAL GYROS, ACCELEROMETERS, INTEGRATION, INTERVALOMETERS, POTENTIOMETERS, SYNCHROS, RESOLVERS, SENSING AND ACTUATING COMPONENTS.

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Write for complete information on products and facilities!

Openings exist for highly qualified engineers.

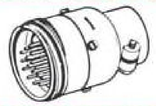
connect with CANNON PLUGS for better aircraft and electronic equipment

For Aircraft, Electronics, Instruments
AN

AN Series . . . conforming to Specification MIL-C-5015B. 15 diameters and 260 insert layouts. 6 shell styles, AN3100 to AN3108.

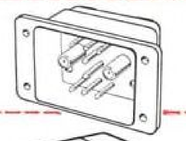
For Aircraft Vibration Resisting—Moisture Proof
AN-E

AN-E Series . . . environment resisting. Meets Specification MIL-C-5015B. Completely sealed from cable to cable. Integral cable clamp. New grounding lugs. Improved sealing grommet and new grommet follower. Resilient inserts.



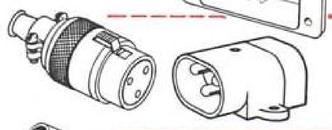
For General Circuitry in More Rugged Applications
K, RK

K, RK Series . . . *Special Acme thread.* Rugged. 8 basic shell shapes, 8 diameters, and 204 catalogued insert layouts. The all-purpose line.



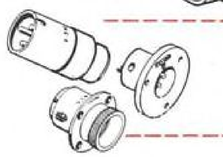
For Rack-and-Panel Applications
DP

DP, DPB, DPD, DPD2, DPD2R, DPR, DPA (miniature), and DPM Series . . . rectangular in shape with many insert layouts in DPB and DPD.



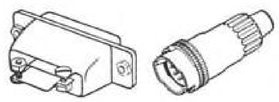
For Audio
P,O

P and O Series, the original microphone series . . . 22 shell styles and 7 insert layouts.



For Low Level Circuits
X, XK, XL

X, XK and XL Series . . . 23 basic shell styles and 8 insert layouts for cord-end or wall mounting.



For Portable Radio and Other Audio Circuitry
D, U

Sub-Miniature Connectors . . . The D and U Series for cord-end, rack-and-panel, or wall-mounted applications. The D Series has 3 basic shapes, up to 50 contacts. The hermetically-sealed U Series, cylindrical with 4 basic shell sizes, accommodates up to 12 contacts in 12 insert layouts. DH Types used for hermetically-sealed miniature components.

For High Pressure Applications
GS

Hermetically-Sealed Connectors . . . with steel shells and contacts to withstand high pressures. Available in the GS, KH, DH, and U Series. Insulation is a vitreous material, fused under high temperature to shell and contacts, thus forming a true hermetic seal.

For Open Flame Protection
STEEL SHELL FIREWALL

AN-K and Cannon K Firewall or High Temperature Connectors . . . offer you the greatest variety of this type of connector. Cannon made the first firewall connector and is still the leader in the field. Wall- or box-mounting receptacle. Straight or angle 90° plugs. Crimp-on contacts . . . no solder to melt. Inserts of asbestos-filled or glass-filled material.

Refer to Dept. 110A

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40th YEAR 1915 - 1955

Send for a copy of the Cannon Plug Guide. Be sure to see Cannon's informative 16mm technical film "Contact."

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SOURCE for Avionic Components

Only AMPHENOL can offer a *single source advantage* for electronic connectors, cable and miscellaneous electronic components. With over 11,000 separately cataloged items, AMPHENOL provides 'one stop' service for the avionics industry.

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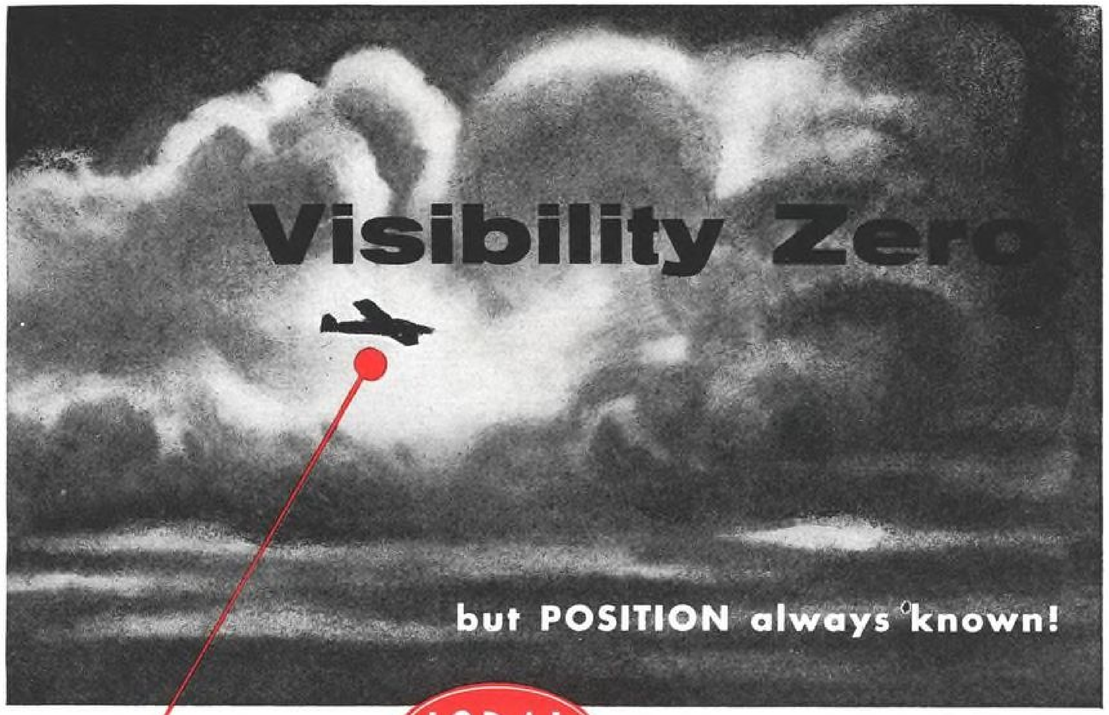

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GROUND POSITION INDICATOR

ACCURATE!
INSTANTANEOUS!

Developed Specifically for LIGHT AIRCRAFT and HELICOPTERS.

A new dead reckoning navigational computer — AUTOMATICALLY indicating ground position — derived from airspeed, heading and wind.
TOTAL SYSTEM WEIGHT — 18 LBS.

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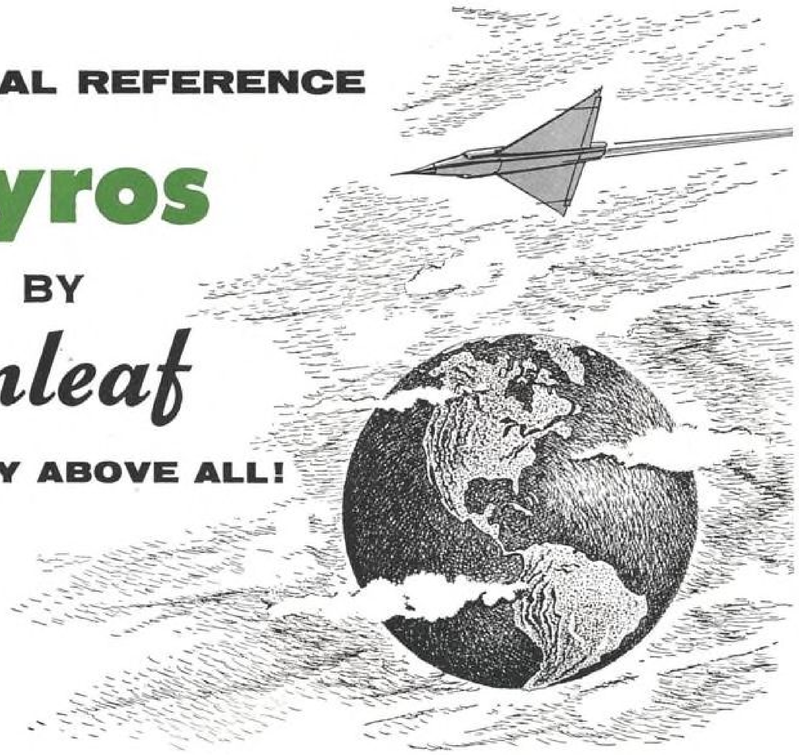
Gyros

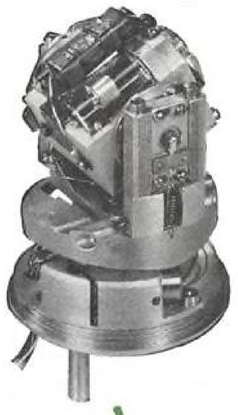
BY

Greenleaf

QUALITY ABOVE ALL!



Two Degree of Freedom Gyro Unit



1. GYRO MOTOR DATA

*a. 115 VAC 400 CPS 1 and 3 Phase

b. Angular Momemtum .6 In. Lbs./Sec. at 24,000 R.P.M.

c. Warm-up Time 1 Minute at 78° F.

d. Temperature—From -65°F. to +180°F.

2. GYRO OPERATIONAL DATA

*a. Accuracy—Roll Position indicated to a Minimum of ±3° over Full Range of 360°.

b. Drift Rate—1.0° per Minute Maximum.

c. Gyro Freedom—Inner Gimble ±70°. Outer Gimble 360°.

3. PICK OFF DATA

*a. Type—Potentiometer

*b. Linearity—0.3%

*c. Resolution—.25°

*d. Resistance—5000 ohms

e. Excitation—5 Volts D.C.

f. Dead Space—2° Maximum

4. CAGING MECHANISM

*a. Electrical Uncaging 28 Volts D.C.

*b. Mechanical Caging

*Can be modified to conform to customer's requirements.

The Greenleaf Line of Gyros and associated devices is being steadily expanded. It now includes a wide selection of Free and Rate Gyros, and the HIG-3 and HIG-4 Gyros.

THE Greenleaf MANUFACTURING COMPANY

ENGINEERING · DEVELOPMENT · PRODUCTION

Write, wire or phone for further information.

7814 Maplewood Industrial Court • Saint Louis 17, Missouri

Producers of the HIG-3 and HIG-4 Gyros, Rate and Free Gyros, Differential Pressure Mach Meters, Air Speed Indicators, Computers, Switches and many other precision-built components.

At Greenleaf Plant No. 2 facilities are available for precision castings

AE

for control of **SHOCK and VIBRATION**

BARRY B MOUNT

NEW ALL-ANGL VIBRATION ISOLATORS — in ALL MIL SIZES

The practical solution to mounting problems in jets and missiles; work at any angle, in maneuvers through every position; have high damping in all directions, low transmissibility at resonance. Built to handle the new jobs that are too tough for MIL-standard mounts. Available in all MIL sizes.

Type	MIL size	Load rating
B22-BB	0	0 to 3 lbs.
B44-BA	1	1 to 10 lbs.
B64-BA*	2	2¼ to 40 lbs.

*Available Feb. 1, 1956. Free data sheets give dimensions, performance curves, and application information.

AIR-DAMPED VIBRATION ISOLATORS

Types 780 (MIL #2), 770 (MIL #1), and 6475 (Miniaturized) . . . to protect airborne equipment; meet latest Gov't specifications; give maximum protection under normal service conditions.

ASK FOR CATALOG 523-A

ALL-METL VIBRATION ISOLATORS

Types M24, M44, and M64 . . . have non-packing, wire-mesh damper; meet latest Government specifications for airborne electronic equipment; ruggedized; light weight, operate over wide temperature range.

ASK FOR BULLETINS 534, 536

RACKS and MOUNTING BASES

To meet dimensional and material requirements of MIL-C-172B; also special sizes to fit customer's needs; built with ALL-METL, AIR-DAMPED, or ALL-ANGL unit Barry mounts.

ASK FOR CATALOG 523-A

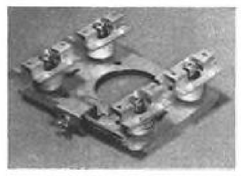
ISOLATORS for VERY LIGHT LOADS

Small, rubber, vibration isolators for light-duty, low-cost service; load ratings from 2 ounces to 9 pounds.

ASK FOR CATALOG 504-B

WHEN YOU NEED SPECIAL BASES:

Barry prototype service can help you by designing and constructing special mountings for your equipment, either adapting standard BARRYMOUNT® isolators or developing a completely new isolation system.



This service provides all necessary design and development to determine the proper mounting arrangement. Barry testing equipment proves the effectiveness of the new mounting, and our manufacturing facilities produce the mounting-rig efficiently and economically.

These two examples of special bases developed by the Barry prototype service utilize standard BARRYMOUNT isolators and meet all the requirement of each special installation as determined by the limitations of space, load-weight, temperature, and frequency or magnitude of shock and vibration.

BARRY PRODUCT DIGEST

Lists all Barry bulletins, technical articles, reprints. Files your own copies for ready reference. Gives the names, addresses, and telephone numbers of all Barry sales representatives.

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- **Application engineering** — Our Field Engineering service gives you the full benefit of the widest practical experience, backed by complete testing and development laboratory facilities.
- **Development engineering** — When a totally new design is needed, our engineers can analyze your problem and develop an isolating system to solve it.
- **Consulting engineering** — Barry engineers can set up and carry out scientifically designed tests to learn how shock and vibration affect your products, can tell you how to protect your equipment, and can help you solve a variety of problems in shock and vibration.

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TIGHTEST COUPLING size for size

Size 8
.750" diameter
ACTUAL SIZE

Size 10
.937" diameter
ACTUAL SIZE

Size 11
1.062" diameter
ACTUAL SIZE

SIZE 8
Weight 32 grams

Function	Type Number	Excitation Voltage & Frequency	Output Voltage	Guaranteed Accuracy Spread	Remarks
Transmitter	CG-8-AS-1	26 Volts 400 c.p.s.	11.8 Volts	15°	Transmitter for control circuits; not recommended for torque transmission
Control Transformer	CT-8-AS-1	11.8 Volts 400 c.p.s.	23 Volts	15′	3 or 4 will operate satisfactorily from CG-8-AS-1 transmitter
Resolver	CS-8-AS-1	11.8 Volts 400 c.p.s.	21 Volts	15′	
Control Differential	CD-8-AS-1	11.8 Volts 400 c.p.s.	10.2 Volts	15′ Stator 15′ Rotor	

SIZE 10
Weight 50 grams

Transmitter	CG-10-AS-1	26 Volts 400 c.p.s.	11.8 Volts	12′	High Power Transmitter; MIL-T-5350A; Multiple C.T and Receiver Applications
Transmitter	CG-10-AS-7	26 Volts 400 c.p.s.	11.8 Volts	12′	For C.T. Operation
Receiver	CR-10-AS-1	26 Volts 400 c.p.s.	11.8 Volts	30′	Torque 2,400 mg-mm/degree with CG-10-AS-1 Transmitter; MIL-I-7057
Control Transformer	CT-10-AS-1	11.8 Volts 400 c.p.s.	23.0 Volts	15′	
Control Transformer	CT-10-AS-4	11.8 Volts 400 c.p.s.	23.0 Volts	15′	High Impedance
Control Transformer	CT-10-AS-7	11.8 Volts 400 c.p.s.	46.0 Volts	15′	High Sensitivity (Double Rotor Output)
Control Differential	CD-10-AS-1	11.8 Volts 400 c.p.s.	10.8 Volts	15′ Stator 10′ Rotor	
Resolver	CS-10-AS-1	11.8 Volts 400 c.p.s.	21 Volts	15′	2 Phase Rotor, 2 Phase Stator
Resolver	CW-10-AS-1	11.8 Volts 400 c.p.s.	21 Volts	15′	1 Phase Rotor, 2 Phase Stator
Sine-Cosine Generator	CV-10-AS-1	26 Volts 400 c.p.s.	11.8 Volts	15′	1 Phase Rotor, 2 Phase Stator
Linear Voltage Generator	LT-10-AS-1	26 Volts 400 c.p.s.	10 Volts @ 60°	15′	Linearity to 65° better than 1%

The units on these pages are standard with us and deliverable in *3 weeks or less.*
Synchros wound for other voltages and frequencies and with special shaft lengths and configurations are available on special order in production lots.
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T. W. Shoop, Sales Manager, Phone (Phila.) MAdison 6-2101.
West Coast Rep., Wm. J. Enright, 988 Kensington Rd., Los Angeles. MUtual 6573.
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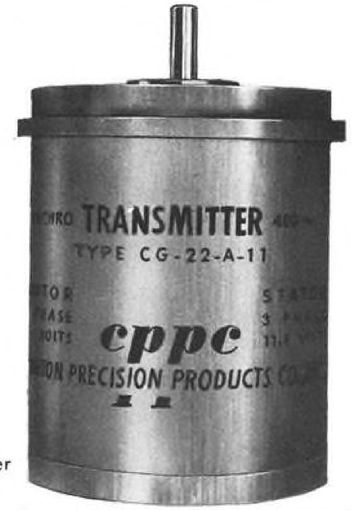
1.437" diameter
ACTUAL SIZE

BuOrd Size 15
1.437" diameter
ACTUAL SIZE



Size 22
2.161" diameter
ACTUAL SIZE

SIZE 11
Weight 82 grams

Function	Type Number	Excitation Voltage & Frequency	Output Voltage	Guaranteed Accuracy Spread	Remarks
Transmitter	CG-11-B-2	26 Volts 400 c.p.s.	11.8 Volts	12′	High Power Transmitter; MIL-T-5350A; Multiple C.T. and Receiver Applications
Transmitter	CG-11-B-7	26 Volts 400 c.p.s.	11.8 Volts	12′	For C.T. Operation
Transmitter	CG-11-B-6	115 Volts 400 c.p.s.	11.8 Volts	12′	High Level Excitation (Saves Transformers!)
Receiver	CR-11-B-2	26 Volts 400 c.p.s.	11.8 Volts	30′	Torque 3,300 mg-mm/degree with CG-11-B-2 Transmitter; MIL-I-7057
Control Transformer	CT-11-B-2	11.8 Volts 400 c.p.s.	23 Volts	12′	
Control Transformer	CT-11-E-7	11.8 Volts 400 c.p.s.	23 Volts	12′	High Impedance
Control Transformer	CT-11-D-6	11.8 Volts 400 c.p.s.	57 Volts	12′	High Sensitivity (1 volt/degree)
Control Transformer	CT-11-B-8	11.8 Volts 400 c.p.s.	22 Volts	12′	
Control Differential	CD-11-B-2	11.8 Volts 400 c.p.s.	10.9 Volts	10′ Rotor 12′ Stator	
Resolver	CS-11-B-2	12.6 Volts 400 c.p.s.	22.6 Volts	12′	
Resolver	CS-11-B-5	22 Volts 400 c.p.s.	22 Volts	12′	High Impedance
Resolver	CS-11-B-7	30 c.p.s.	180 Mv.	20′	
Compensated Resolver	CY-11-B-2	22 Volts 400 c.p.s.	25 Volts	12′	Includes two additional stator windings for feed-back compensation

SIZE 15
Weight 126 grams

Function	Type Number	Excitation Voltage & Frequency	Output Voltage	Guaranteed Accuracy Spread	Remarks
Transmitter	CG-15-A-1	26 Volts 400 c.p.s.	11.8 Volts	10′	High Power Transmitter; MIL-T-5350A; Multiple C.T. and Receiver Applications
Transmitter	CG-15-A-4	26 Volts 400 c.p.s.	11.8 Volts	10′	For C.T. Operation
Receiver	CR-15-A-1	26 Volts 400 c.p.s.	11.8 Volts	30′	Torque 3,300 mg-mm/degree with CG-15-A-4 Transmitter; MIL-I-7057
Control Transformer	CT-15-A-1	11.8 Volts 400 c.p.s.	22 Volts	10′	
Control Transformer	CT-15-A-4	11.8 Volts 400 c.p.s.	22 Volts	10′	High Impedance
Control Transformer	CT-15-A-7	11.8 Volts 400 c.p.s.	57 Volts	10′	High Sensitivity (1 volt/degree)
Control Differential	CD-15-A-1	11.8 Volts 400 c.p.s.	10.8 Volts	10′ Rotor 10′ Stator	
Resolver	CS-15-A-1	11.8 Volts 400 c.p.s.	22 Volts	10′	
Resolver	CS-15-A-4	11.8 Volts 400 c.p.s.	22 Volts	10′	High Impedance
Resolver	CW-15-A-1	15 Volts 400 c.p.s.	28 Volts	10′	Very High Impedance
Transmitter	CG-15-MS-1	115 Volts 400 c.p.s.	90 Volts	10′	MIL-S-16892; Gov't. Designation 15CX4a Weight 174 grams

SIZE 22
Weight 528 grams

Transmitter	CG-22-A-1	26.0 Volts 400 c.p.s.	11.8 Volts	10′	Available for 60 c.p.s. use on Special Order.

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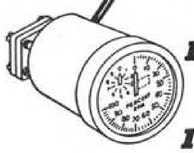
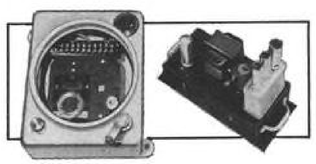


Reads Jet Engine Speed to Guaranteed Accuracy of 10 RPM in 10,000 RPM (±0.1%)

The new B&H TACKAL incorporates a refinement of the frequency meter principle. It operates in the low (0 to 1000 cps) range, reading the frequency of the tachometer generator on a scale calibrated in percent RPM corresponding to the engine's RPM. In addition the TAKCAL checks the tach system. The TAKCAL circuit and tachometer are parallel so that readings can be made simultaneously to determine the accuracy (or inaccuracy) of the aircraft's tach system. The TAKCAL operates during the engine run to properly set up engine controls for maximum economy and safety.

Originally developed as a component part of the J-Model JETCAL ANALYZER, the TAKCAL is now available as a separate unit for use with all earlier models of the JETCAL TESTER.

The TAKCAL operates accurately in all ambient temperatures from –40°F. to 140°F. Low in cost for an instrument of such extreme accuracy, it is adaptable to application in many other fields.



Explosion-proof TAKCAL for special applications. Measures 200 to 7500 RPM, direct reading, with ±0.1% accuracy.

For full information write or wire . . .

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Roosevelt Field, Garden City, NY

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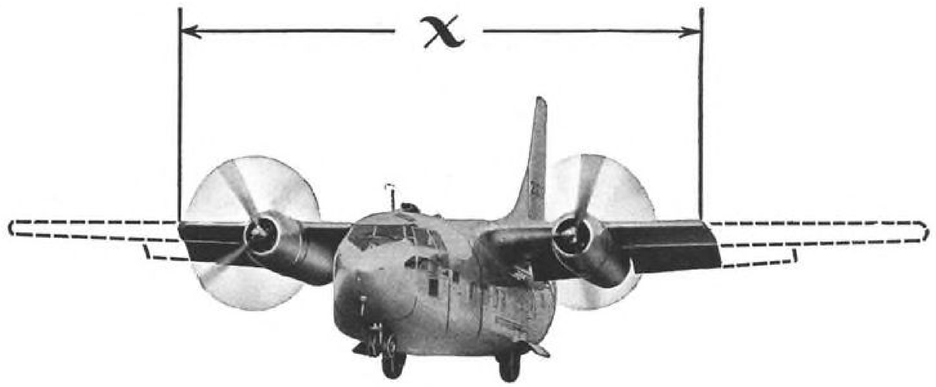

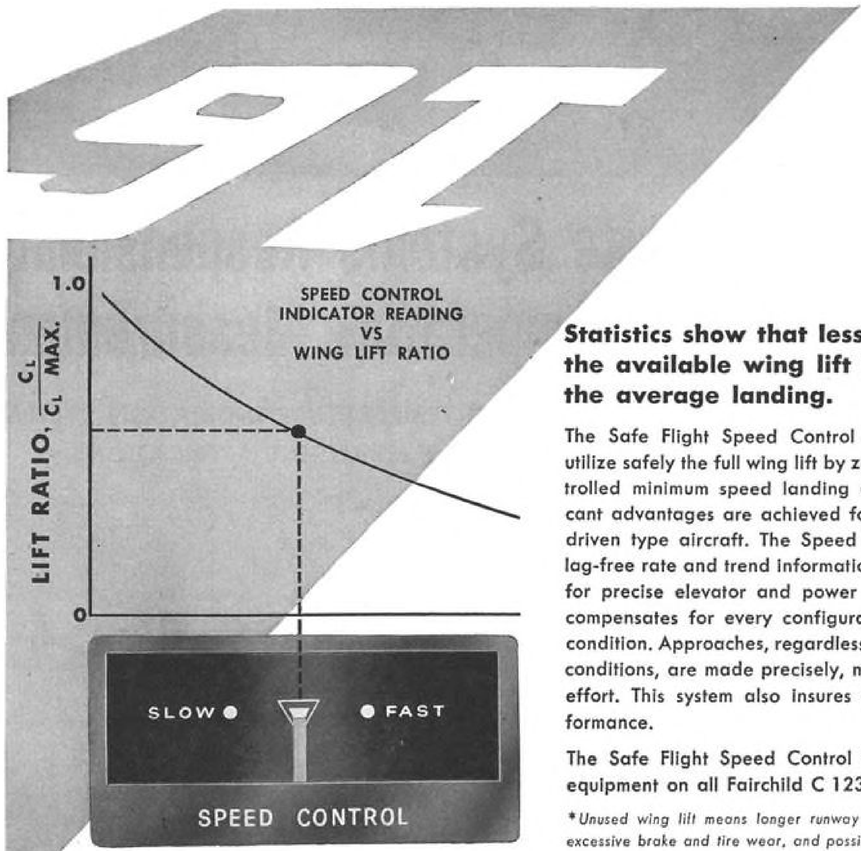

Statistics show that less than one half of the available wing lift is being used for the average landing.

The Safe Flight Speed Control System enables you to utilize safely the full wing lift by zeroing-in a perfectly controlled minimum speed landing every time. Very significant advantages are achieved for both jet and propeller driven type aircraft. The Speed Control System presents lag-free rate and trend information which is easy to follow for precise elevator and power control. It automatically compensates for every configuration, weight, and power condition. Approaches, regardless of turbulence or weather conditions, are made precisely, more safely, and with less effort. This system also insures best take-off climb performance.

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**Unused wing lift means longer runway requirements, lower payloads, excessive brake and tire wear, and possibility of overshoots.*

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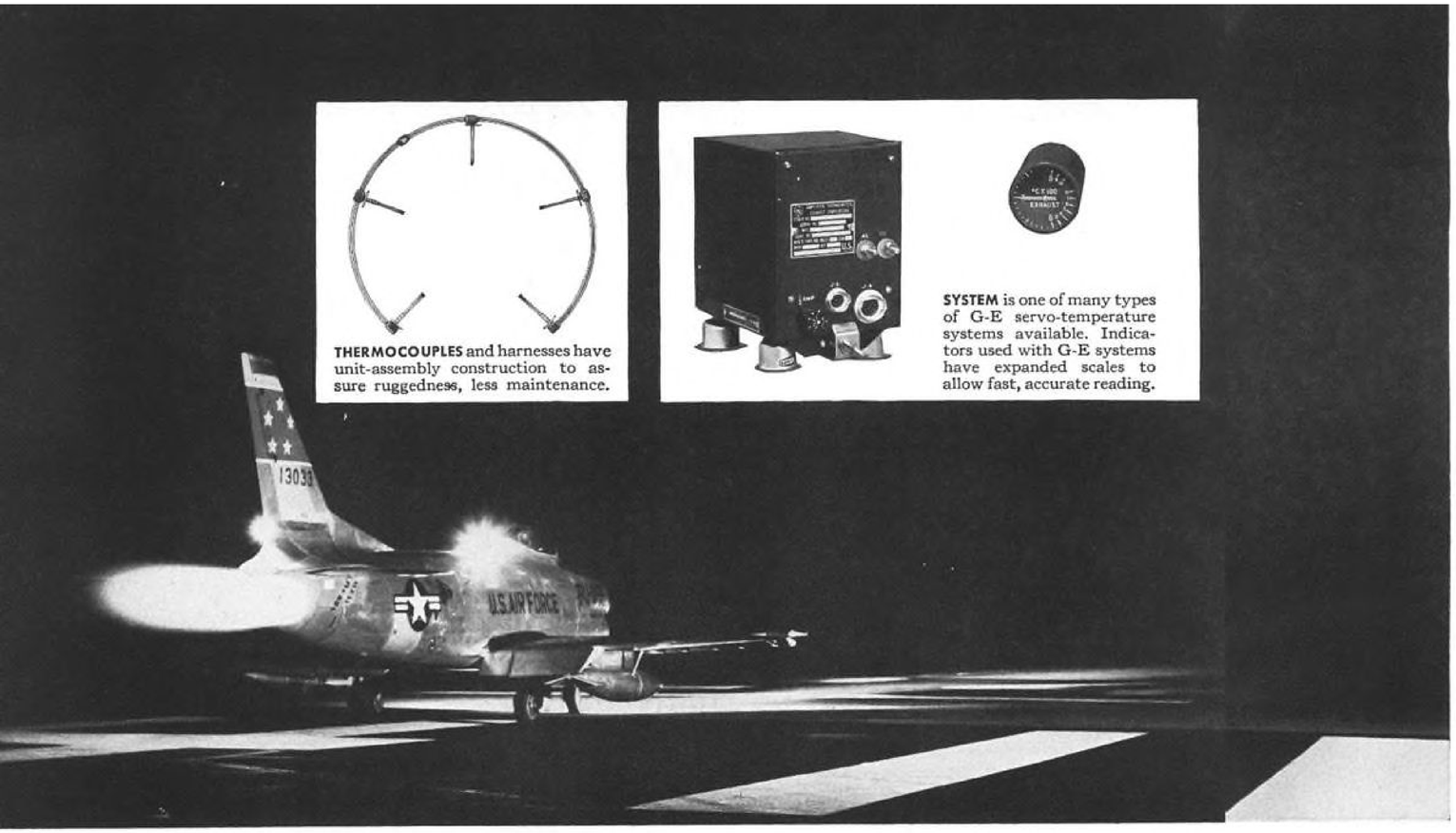


THERMOCOUPLES and harnesses have unit-assembly construction to assure ruggedness, less maintenance.

SYSTEM is one of many types of G-E servo-temperature systems available. Indicators used with G-E systems have expanded scales to allow fast, accurate reading.

G.E. Offers Complete Systems Responsibility with a "Team" for Temperature Measurement

HIGH-ACCURACY THERMOCOUPLES AND SERVO-TEMPERATURE INDICATION SYSTEMS OFFER "SINGLE-SOURCE" ADVANTAGES FOR JET ENGINE APPLICATIONS

G-E THERMOCOUPLES, using stainless-steel harnesses and unit-assembly construction, assure long-lived reliability in jet exhaust-gas temperature measurement. Completely swaged magnesia thermocouple harness-and-lead assemblies can operate efficiently under extreme temperature and vibration conditions found in aircraft gas turbine applications. Life of typical G-E exhaust-gas temperature systems is 750 hours.

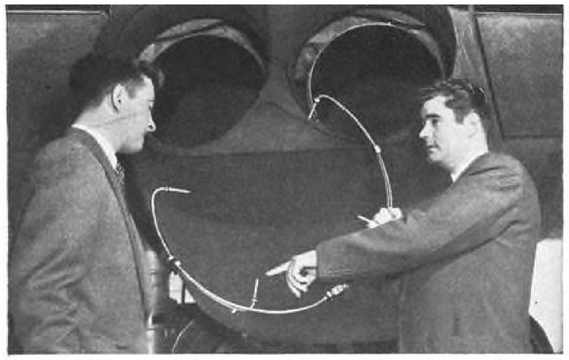
UNIT-ASSEMBLY CONSTRUCTION allows self-supporting harnesses to be installed easily. You simply tighten locknuts to bosses. Because separate connectors are eliminated, less maintenance is required. These outstanding features in low-cost G-E thermocouples can provide accurate, reliable temperature measurement for every jet engine application.

SEE FOR YOURSELF how General Electric exhaust-gas thermocouples will provide improved temperature measurement for your jet engine by ordering prototypes. G.E. is prepared to design and provide prototypes of any exhaust-gas thermocouple—without charge.

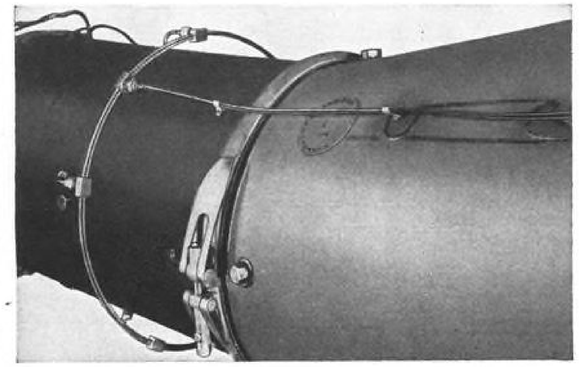
G-E SERVO-TEMPERATURE INDICATION SYSTEMS allow the use of easy-to-read repeater indicators. Expanded-scale type indicators have only one pointer instead of the usual two for more accurate reading. G-E repeater indicators are especially adaptable to the requirements of X-model aircraft where simultaneous readings on both pilot's panel and photo panel are desired. Systems can provide a signal for control initiation proportional to temperature, time over temperature indication, or for dual indicators. More accurate than millivoltmeter systems, G-E servo-temperature indication systems offer a high-accuracy way to temperature indication.

FOR FURTHER INFORMATION on the G-E thermocouple and servo-temperature indication system "team-mates" and how they can meet your temperature measurement problems, contact your nearest G-E Apparatus Sales Office or write Section 586-2, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC



UNIT-ASSEMBLY thermocouples and harnesses weigh as little as 25 ounces, offer longer operating life. Swaged magnesia thermocouples and stainless-steel harnesses withstand high temperatures.



EASY TO INSTALL, G-E exhaust-gas thermocouples are self-supporting and require fewer connections, less maintenance than most other systems. To install each thermocouple, you tighten a simple locknut.

MORE THAN 8,000,000 HOURS flying time has been logged by Air Force Boeing B-47s using G-E jet engines equipped with G-E thermocouples. Over ten years' experience in production assures G-E exhaust-gas thermocouple accuracy, dependability, and long life.

IN ALL TYPES of aircraft, including fighters like the U.S. Marine Corps' North American FJ2, G-E thermocouples meet the demands of reliable performance in high ambient temperatures. Harnesses and leads can withstand acceleration hundreds of times that of gravity.

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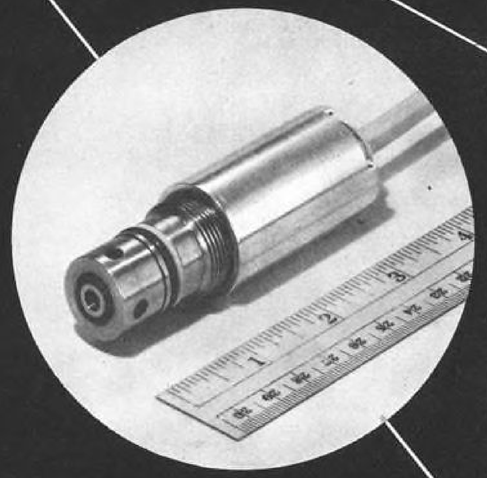

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about aerial navigation

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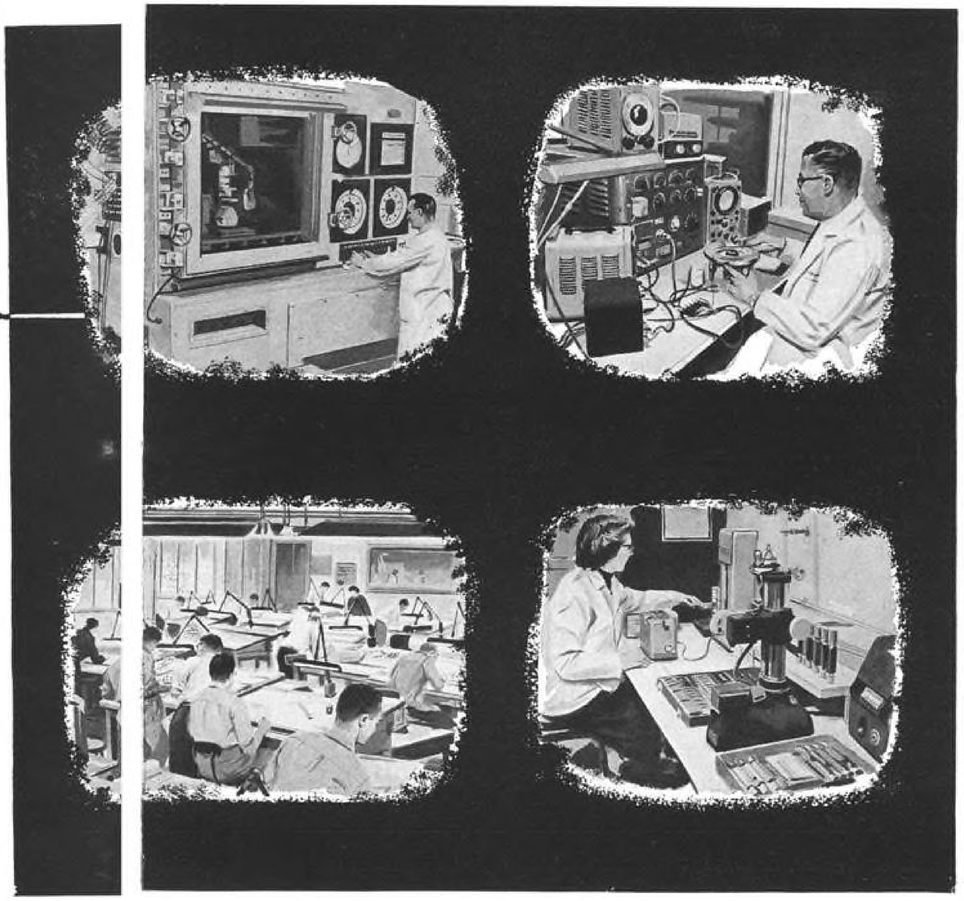

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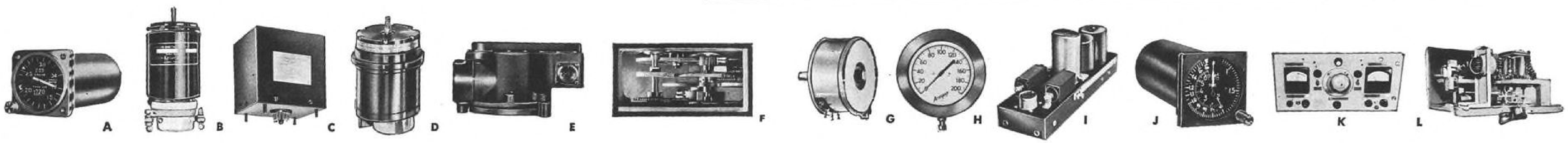

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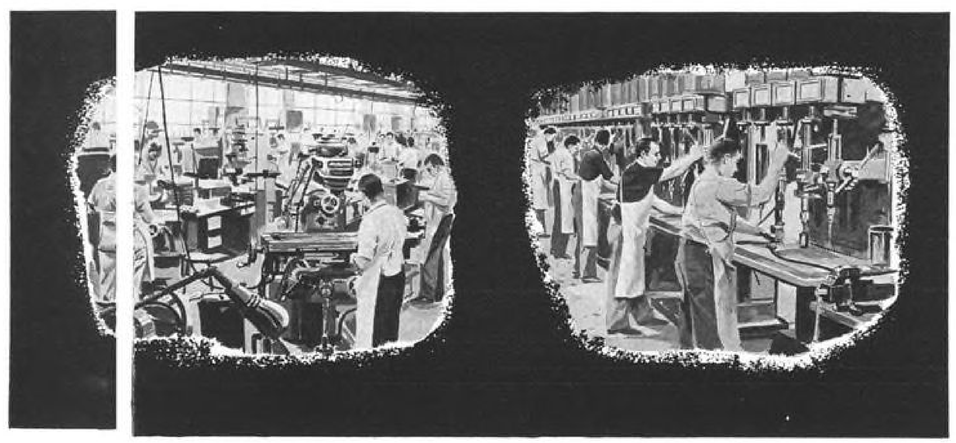

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J...Air Data Instrumentation. Engineers are available to show how our experience in this field can help you in the solution of your problems.

K...Marine Equipment. Interior communication equipment, salinity indicators, engine order telegraphs, compass repeaters, and marine equipment. Write for specific data.

L...Electro-Mechanical Assemblies. Complete enginering and manufacturing facilities are available for sub-contracts of complete equipments.

For Technical Skill and Diversified Experience in

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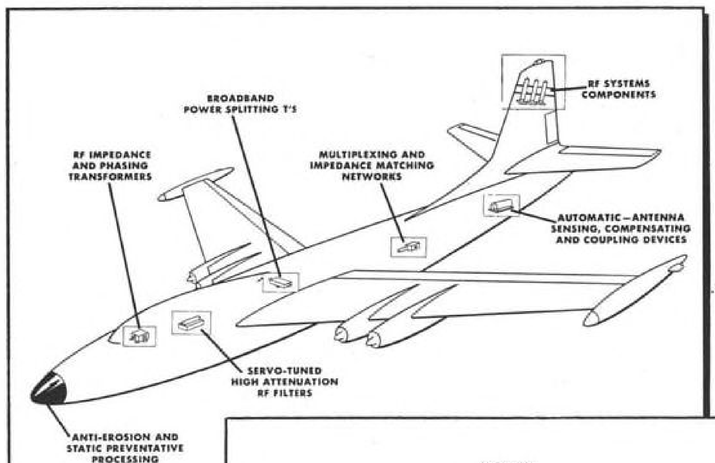
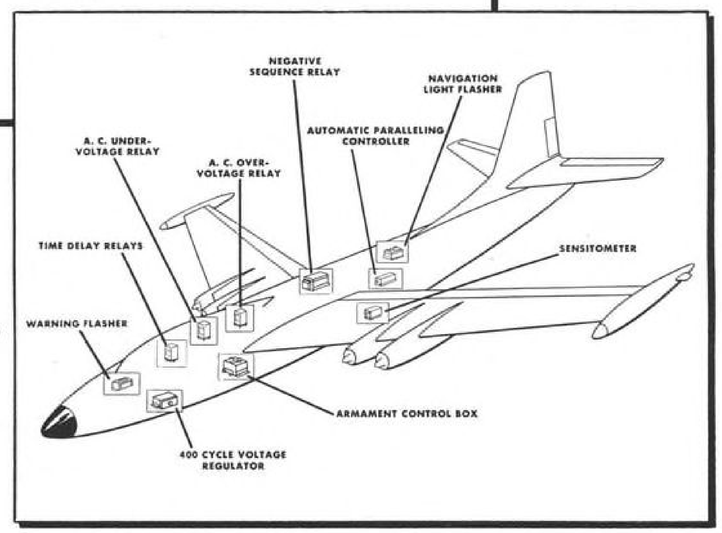


RF COMPONENTS



MINIATURE ELECTRONIC COMPONENTS

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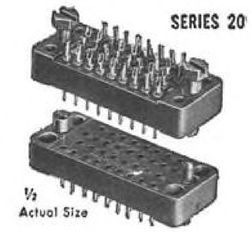
precision Continental Connectors

MINIATURE

SERIES 20



½ Actual Size

Contacts: 7, 8, 9, 11, 14, 18, 20, 21, 26, 34, 50, 75, 104. For #20 AWG wire. Current rating: 5 amps. Voltage: 2100V. RMS.

SUB-MINIATURE

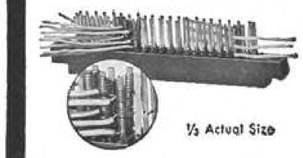
SERIES SM-20

Actual Size

Contacts: 7, 11, 14, 20, 26, 34. For #20 AWG wire. Current rating: 5 amps. Voltage: 1900V. RMS.

PRINTED CIRCUIT

SERIES PC



½ Actual Size

Solderless wire wrap (double rows of 22 contacts) or standard type printed circuit receptacle (6, 10, 15, 18, 22 contacts). Current rating: 10 Amps. Voltage: 2500V. RMS.

HIGH VOLTAGE AN-TYPE

SERIES 800

For AN-36 shell. 15 contacts. 3 high voltage contacts in center are removable. Current ratings: 10 and 20 Amps.

¾ Actual Size

EASY RELEASE

SERIES E-Z

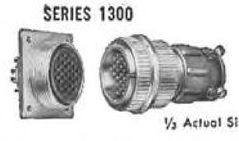
½ Actual Size

Solder cup contacts, taper pin cups for solderless wiring or turret terminals. Current rating: 10 Amps. Voltage: 4500V. RMS.

MINIATURE AN

SERIES 1300

One-piece molded inserts. Current rating: 7.5 Amps. Voltage: 3000V. RMS.



⅓ Actual Size

POWER

SERIES 14 & 16

⅓ Actual Size

Contacts: 12, 18, 24, 34. Spring loaded contacts for easy release. Coaxial contacts and bayonet locks also available. Current rating: 10 and 25 Amps. Voltage: 4700V. RMS.

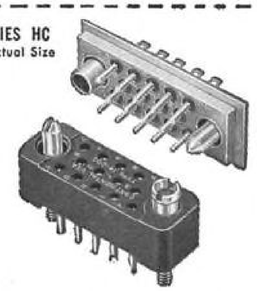
SPECIAL DESIGNS

Our engineering department will be glad to design types to your exact specifications. Send us your requirements for analysis.

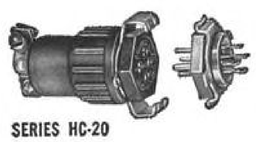
HERMETIC SEAL

SERIES HC

¾ Actual Size



For high altitude applications. Plug contacts individually compression sealed in glass. Guide pin and guide socket, or polarizing screwlock available. Fits series 20 receptacles.



SERIES HC-20

¾ Actual Size

Hexagonal hermetic plug has solid glass insert. For pressurized electronic equipment. 4, 5, 7, 9 and 10 contacts.

High precision, dependable Continental Connectors have achieved a reputation for excellence throughout the aircraft and electronics industries. The widest range of applications can be made from our standard line. For special requirements and technical data sheets on these Connectors write Electronic Sales Division, DeJUR-Amsco Corporation, 45-01 Northern Blvd., Long Island City 1, N. Y.

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Applications:

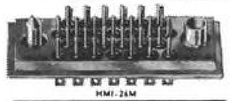
- PORTABLE EQUIPMENT
- INSTRUMENTATION
- TEST APPARATUS
- COMMUNICATION
- GUIDED MISSILES
- AIRCRAFT

MI-24F MI-24M

MI SERIES
Plugs: MI-7M, 8-4M, 14M, 18M, 20M, 21M, 26M, 34M, 43M, 50M, 75M
Receptacles: MI-7F, 8-4F, 14F, 18F, 20F, 21F, 26F, 34F, 43F, 50F, 75F

MI-14HR

MI-H (Alum. Hoods)
Available all MI Series
Typical: MI-14HR (Rear cable entrance)
MI-14HS (Side cable entrance)



MI-50M2

MI-50HSSL MI-50F2SL

SC-22F

SC-21M

HMI-26M

HMI SERIES (Hermetic Seal Miniature Plug)
Available all MI-M types

980-34HRSL 980-34F2 980-34M2SL

980-SL SERIES (Double Lead Screw Lock)
Available all 980 types
Typical Cat.
980-34HSSL - Side cable entrance hood
980-34HRSL - Rear cable entrance hood
980-34M2 - Receptacle used with hood
980-34F2SL - Plug used on chassis
980-34F2 - Plug used with hood
980-34M2SL - Receptacle used on chassis

980-34F 980-34M

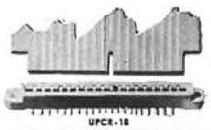
980 SERIES (Spring Ejection)
Plugs: 980-12F, 18FS, 24F, 34F
Receptacles: 980-12M, 18MS, 24M, 34M

589A

CABLE CLAMPS
Withstanding 100 P.S.I. in cable sizes 3/16" to 21/32"

990-18F 990-18M

990 SERIES
Plug (Long contacts) 990-7M, 10M, 15M, 18M
Receptacle (Long contacts) 990-7F, 10F, 15F, 18F
Plug (Short contacts) 990-7MS, 10MS, 15MS, 18MS
Receptacle (Short contacts) 990-7FS, 10FS, 15FS, 18FS



UPCR-18

UPCR SERIES
Single Row UPCR 6, 10, 15, 18, 22
Double Row UPCR D6, D10, D15, D18, D22

902MG 902FG

902 SERIES
902MG-1S Contact plugs (Gold Pl.)
902MS-1S Contact plugs (Sil. Pl.)
902FG Mating Recep. (Gold Pl.)
902FS Mating recep. (Sil. Pl.)

MI-SL SERIES (Double Lead Screw Lock)
Available all MI SERIES types
Typical Cat. No.
MI-50HSSL - Side cable entrance hood
MI-50HRSL - Rear cable entrance hood
MI-50M2 - Plug used with hood
MI-50F2SL - Receptacle used on chassis
MI-50F2 - Receptacle used with hood
MI-50M2SL - Plug used on chassis

SC (Scapa Connectors)
SC-21M 21 Contact, male
SC-21F 21 Contact, female
Other designs to specification

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Associated with U. S. Tool and Mfg. Co., Inc.
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Duration .7–1.2 uS

Model 510A

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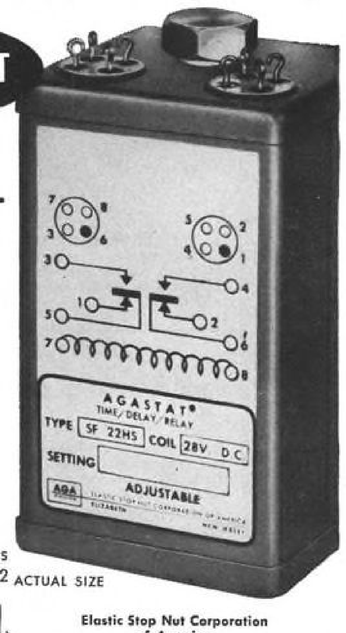
aircraft time delay relay

AGASTAT

light... compact... hermetically-sealed

- 2⅛" x 2⅛" x 4"
- weight 1.2 lbs.
- adj. range 30 miliseconds to more than one minute
- mass spectrometer tested to 80,000 feet

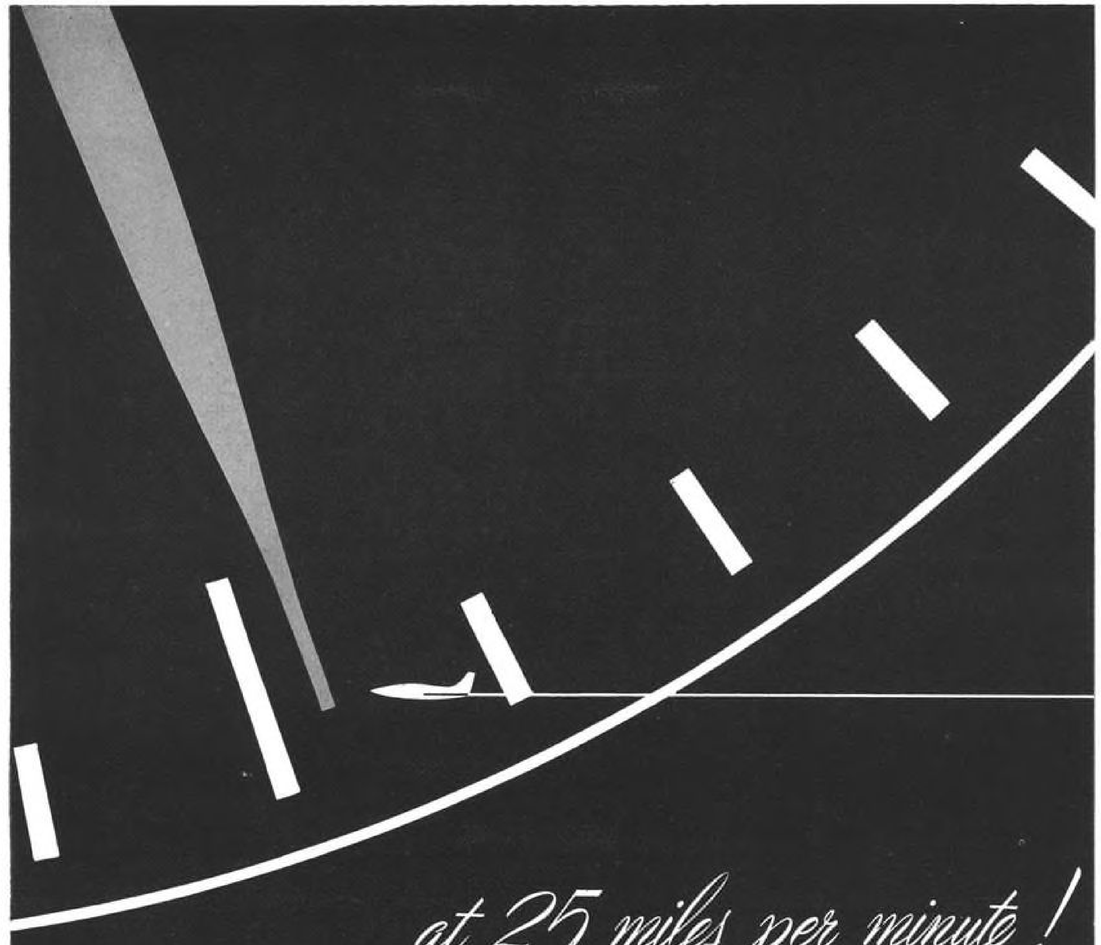
write for specifications
address Dept. A27-5522



ACTUAL SIZE

AGA DIVISION

Elastic Stop Nut Corporation of America
1027 Newark Avenue, Elizabeth, New Jersey
Pioneers in pneumatic timing.



at 25 miles per minute!

IT TAKES TIME . . . time to see . . . time to recognize . . . time to react. Control systems at MACH 2 and higher require man's intelligence, but infinitely faster reactions.

Kearfott has the ability, products and facilities to give you these controls. Stable Elements, Inertial Systems, Directional Gyro Compass Systems and related components produced by Kearfott have been proven the best available. Kearfott's leadership is made possible by the most modern facilities containing 438,000 square feet and employing over 3000 highly trained specialists.

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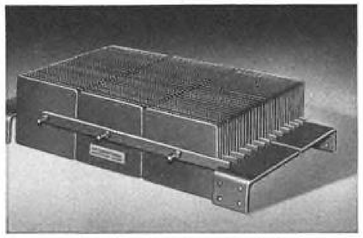
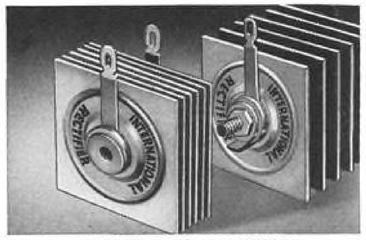


INDUSTRIAL POWER RECTIFIERS

For all DC power needs from microwatts to kilowatts. Features: long life; compact, light weight and low initial cost. Ratings: to 250 KW, 50 ma to 2,300 amperes and up. 6 volts to 30,000 volts and up. Efficiency to 87%. Power factor to 95%. **Bulletin C-349**

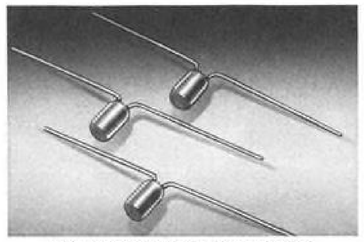


TV AND RADIO RECTIFIERS

The widest range in the industry! Designed for Radio, Television, TV booster, UHF converter and experimental applications. Input ratings from 25 to 195 volts AC and up. DC output current 10 to 1,200 MA. Write for application information. **Bulletin ER-178-A**

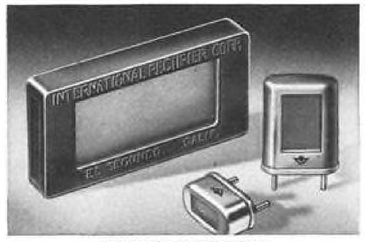
HIGH VOLTAGE CARTRIDGE RECTIFIERS

Designed for long life and reliability in Half-Wave, Voltage Doubler, Bridge, Center-Tap Circuits, and 3-Phase Circuit Types. Phenolic Cartridge and Hermetically Sealed types available. Operating temperature range: −65°C to +100°C. Specify **Bulletin H-2**



SUB-MINIATURE SELENIUM DIODES

Developed for use in limited space at ambient temperatures ranging from −50°C to +100°C. Encapsulated to resist adverse environmental conditions. Output voltages from 20 to 160 volts; output currents of 100 microamperes to 11 MA. **Bulletin SD-1B**



PHOTOELECTRIC CELLS

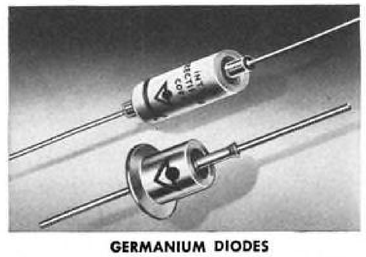
Self-generating photocells available in standard or custom sizes, mounted or unmounted. Optimum load resistance range: 10 to 10,000 ohms. Output from .2 MA to 60 MA in ave. sunlight. Ambient temperature range: −65°C to +100°C. **Bulletin PC 649**

International Germanium Products

High quality units of improved design are the results of years of experience in the production of exceptionally fine germanium crystals plus extensive research, development and field performance testing!

GERMANIUM POWER RECTIFIERS

This new line features: High efficiency—up to 97%, Lowest forward drop, High reverse to forward current ratio, unlimited life expectancy. No reforming required after storage. Ratings: 26 to 66 AC input v. per junction: 150 to 100,000 amps DC output. Operating temperature range: −55°C to +75°C. In three styles. **Bulletin GPR-1**



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POINT CONTACT. High quality crystals—long reliable life—superior resistance to humidity, shock, temp.-cycling. **Bulletin GD-2**
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Resolution to less than 1/100 of 1 degree

Write for Bulletin KG11B

TYPE K RATE GYROS measure absolute angular rates about any one axis for flight test evaluation or control of aircraft. They are also proven components for use in control and homing systems in guided missiles.

Accurate to ¼ of 1% of full scale

Write for Bulletin S11B

SYNCHROS size 11 (1.062" O.D.) 115 volt, 400 cps Control Transmitters and Transformers are approved standard military components (MIL-S-16892). Other sizes and types are also available.

Average electrical error — 5 minutes of arc

Write for Bulletin CFG11B

CAGEABLE FREE GYROS are designed expressly for guided missile applications. They are available with either Synchro or Potentiometer type pickoffs.

Drift is less than ¼ degree/minute

Write for Bulletin SM11B

SERVO MOTORS two-phase, 115 volt, 400 cps fulfill the requirements of MIL-S-17087 (BuOrd). Available in sizes from 1.062 inches O.D. to 1.750 inches O.D.

Acceleration 33,800 radians/second²

Write for Bulletin VF11B

VFDD POWER SUPPLY – DEMODULATOR serves as a link between sensing instruments and recording equipment. With the DOELCAM Type K Rate Gyros it comprises a complete system for flight evaluation of military aircraft.

Voltage-regulated to 1%
Frequency stabilized to 0.2%
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Master-precision

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HAYDON AT TORRINGTON

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Precision Timing

INJECTS IMPROVED PERFORMANCE INTO *Your Product*

HAYDON* TIMING MOTORS

1600

BASIC, STANDARD DUTY

The 1600 Series is the basic motor of the HAYDON line. This motor offers dependable performance, small size, total enclosure, operation in any position, controlled lubrication, simple assembly and a wide range of standard speeds from 60 to 1/60 rpm. Can be supplied to military specifications.

LIGHT DUTY, SLOW SPEED

The 4400 Series offers very slow output shaft speeds from 6 hours to 1 week for all normal duties. This motor is unique in providing the speed range available in such small space, with totally enclosed gearing, at comparatively low cost. Affords many possibilities for economical design without resort to the bulk and expense of external reduction gearing.

4400

3100

HEAVY DUTY, SLOW SPEED

The 3100 Series motor consists of the basic HAYDON motor and a heavy-duty gear train in a round housing. Designed for applications requiring higher torque at slow shaft speeds, this unit is particularly suitable for chart drive use in recording and control instruments. Standard speeds from 1 hour to 14 days per revolution.

D-C, REVERSIBLE

The HAYDON 9200 Series D.C. motor for timing applications is designed for operation from 6 to 30 volts. It can be supplied uncalibrated for use with external resistance or calibrated with resistance type leads.

D-C, R F FILTER

The 9250F Series D.C. motor provides the more uniform torque and speed characteristics of a unit wound for 28 volts, and has an R F Interference filter. The current and power drain is lower and no calibration is required.

9200
9250F

6700

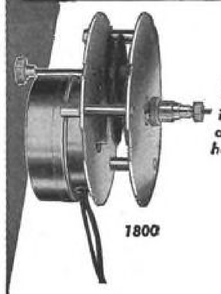
400 CYCLE HYSTERESIS-TYPE

The 6700 Series 400 cycle timing motor is an hysteresis type synchronous timing motor, essentially two phase. It is furnished with capacitor for self starting operation on single phase. Variations in temperature, voltage and heat do not affect timing, which is as accurate as the frequency control.

ALL HAYDON TIMING MOTORS

are totally enclosed and can be operated in any position. Write for free "Haydon Electric Timing Motors" catalog.

HAYDON CLOCK MOVEMENTS



1800

ROUND MOVEMENT

Compact round movement only 3" in diameter for use where space is at a premium, as in certain novelty, household and advertising clocks.

RECTANGULAR MOVEMENT

Features completely enclosed construction and easy installation. Back or bottom set, earlug or center mounting, choice of various arbor groups and sizes.

1802

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-- Your product's performance depends on the performance of all its component parts.

When product specifications call for TIMING MOTORS — TIMING DEVICES — or CLOCK MOVEMENTS build in extra dependability by specifying HAYDON precision timing instruments.

Both HAYDON standard and custom-designed units are properly engineered and buyer-approved for ***accuracy and dependability of operation . . . long-life coupled with minimum maintenance . . . adaptability to any operating position . . . correctness of design vital to reducing installation costs . . . plus, meticulous mass-production methods, when volume is required, offering even greater savings.***

The Haydon Manufacturing Company specializes in the design and mass production of custom-engineered timers for volume application. HAYDON Timers for clothes driers, milk pasteurizers, dishwashers, and defrosters illustrate a few examples of HAYDON custom-engineered and mass-produced units.

HAYDON* TIMING DEVICES

7008

400 CYCLE ELAPSED TIME INDICATOR

The 7008 Series Elapsed Time Indicator is designed specifically for 400 cycle operation in airborne equipment. Barrel diameter is 1.525", length 2-45/64", weight 6 oz. Power consumption is less than 3 watts and it indicates in units of tens of hours up to 10,000 and repeats.

60 CYCLE ELAPSED TIME INDICATORS

The 5700 Series Elapsed Time Indicators provide simple, compact and accurate metering of elapsed time for 60 cycle operation. They are designed for use as inexpensive components for equipment requiring register of total operating or job time, or with existing machinery and devices.

5700

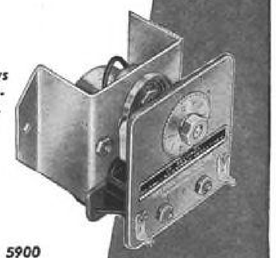
5103

HERMETICALLY-SEALED TIME DELAY RELAYS

The 5103 Series Time Delay Relay is an hermetically sealed timer for military applications. It can be supplied for 60 or 400 cycle A.C., or D.C. The use of a relay coil for switching operation imposes a minimum load on the motor which is assigned to its true function as a time standard.

RESETTABLE TIME DELAY RELAYS

The 5900 Series Time Delay Relays provide time delay or interval timing in various ranges up to 10 minutes for such applications as the protection of power tubes, or timing portions of a complete cycle of operation.



5900

5800

FIXED INTERVAL REPEAT CYCLE TIMERS

The 5800 Series Timers offer extreme flexibility and adaptability for timing problems requiring continuous repeat cycling, or single cycle operation to be initiated by an external circuit. These HAYDON timers are built up by various combinations of motors with adjustable, blank or specially designed cams operating a series of precision snap switches.

HEAVY-DUTY INTERVAL TIMER

The 8006 Series is a rugged, heavy-duty interval timer for general commercial, industrial and appliance applications. Construction is the simplest possible, for low cost and long life, consisting basically of a standard HAYDON synchronous motor driving through external reduction gearing a notched cam to operate a heavy switch, with a friction to permit setting.

8006

Write for Free "Haydon Electric Timing Devices" Catalog

There is a factory-trained HAYDON Field Engineer in your area — a timing specialist with the answers to your timing questions. Write us today for his name and location.

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HAYDON Manufacturing Co., Inc.

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600 ELM STREET, TORRINGTON, CONN.

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FLIGHT GYROS • GYRO FLUX GATE* COMPASSES • POLAR PATH* COMPASSES • STABLE PLATFORMS

*TRADEMARKS BENDIX AVIATION CORPORATION

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GYROS • LOW INERTIA SERVO MOTORS • PACKAGED SERVO MECHANISMS • PYGMY SERVO MOTOR GENERATORS • RATE GENERATORS (TACHOMETER GENERATORS) • RADAR ANTENNA DEVICES • SYNCHROS

BY Bendix

You can do no better than to specify Eclipse-Pioneer Division, Bendix Aviation Corporation, Teterboro, New Jersey—foremost developer and manufacturer of these systems and products. Let "by Bendix" be your guide to *buy Bendix*.

West Coast Office: 117 E. Providencia Ave., Burbank, Calif.
Export Sales and Service: Bendix International Division, 205 E. 42nd Street, New York 17, N. Y.

Eclipse-Pioneer DIVISION

Bendix AVIATION CORPORATION

An incremental synchro positioner before wiring to header and hermetic sealing. The synchro rotor is stepped in one or fifteen degree increments clockwise or counterclockwise depending upon which of four coils is momentarily energized by a d-c pulse. The synchro can be rotated any number of degrees or revolutions. Cylindrical member next to the synchro resets it to electrical zero if a pulse is applied to "reset" circuit.

Type 9 motor-driven induction generator driving two Type 11CT synchros through gear train having ratio of 1500:1. Slip clutch permits one control transformer to operate when second control transformer has shaft restrained by stops. Cams close two switches during specified degrees of synchro rotation.

Equipment to indicate phase angle difference between two like frequency signals received over radio links. One chassis is a 400-cycle oscillator supply for two indicators, other chassis combines impedance matching and a servo amplifier for one indicator. Complete system includes an oscillator, two indicators, and two amplifiers.

control problems like yours

...with but one solution

Typical of all Transicoil solutions are the three illustrated here. They "do the job right" because each is designed for a single application . . . by a company whose major function is to provide complete servo assemblies precisely engineered and manufactured to solve individual servo control problems.

Of course, if you want servo *components*, you'll find Transicoil's control motors, motor-gear train combinations, motor-gear train-generator combinations, and servo amplifiers built to the highest order of precision and accuracy. But it is in the "package" engineering of unique assemblies that Transicoil's experience and creative imagination offer the greatest value. And in most cases, these assemblies cost no more than the individual components would purchased separately. *That's why it pays to check your servo control problems out with Transicoil first.* For further information, call your nearest Transicoil representative.

thinking of automation?

If you have a problem in the field sometimes referred to as automation, and have not worked on it before because you just haven't had the time, and outside organizations would only handle it on a "research and development" boondoggling basis, Transicoil may solve it for you. You will be under no obligation and you'll pay only for results—on a fixed fee basis for equipment delivered and performing properly. Transicoil is a manufacturer—not a research and development organization!

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3 REASONS WHY IT'S for Aircraft and

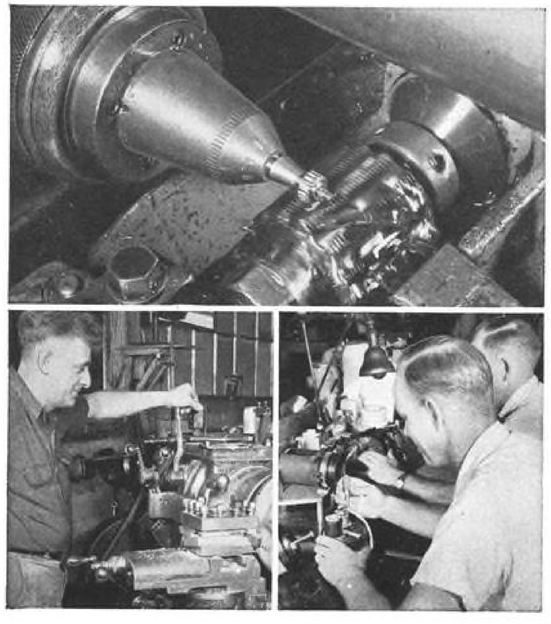
IN CHARGE OF SYSTEMS DEVELOPMENT at General Mills are Dr. Carl L. Kober (left) who was a top man on German radar and V2 teleguidance and also spent five years at Wright Air Development Center; and Dr. Howard H. Baller (right) who came to General Mills via Cal Tech, Inyokern, Fairchild Guided Missile division and W. L. Maxon Corp. Looking on is Dr. Cledo Brunetti, director of Engineering Research and Development, a national figure in electronics because of his work for the National Bureau of Standards, Stanford Research, General Mills, and the Department of Defense.

1. THE RIGHT PEOPLE

It takes a highly specialized kind of creative engineer to develop top-notch aircraft systems—guidance, navigation, bombing and fire control. At General Mills you get a complete staff of such specialists—men who have met and mastered problems just like those you are facing. In addition, our staff includes personnel trained in laboratory studies, prototype manufacturing and exacting performance testing. Top people in electronics, in mechanical research and in physics and chemistry research are also available for specific phases of any problem.

2. THE RIGHT EQUIPMENT

Our modern plants, with 400,000 sq. ft. of area, are completely equipped for exhaustive research, engineering and development work in addition to precision manufacturing. All types of operations in the manufacturing process, from raw materials to finished systems, can be carried out within our plants. The unusually high level of precision maintained often requires reworking of standard machine tools in our shops to maintain microscopic tolerances. All inspection and calibration work is done in dust-free, temperature-controlled rooms. Quality control is rigidly maintained through detailed inspection of all materials, manufactured parts and sub-assemblies.



AMONG THE SPECIALIZED EQUIPMENT in our plants are ultra-precise gear hobbing machines; big engine lathes (shown turning head end castings for the Y-4 bombsight); modern equipment for precision assembly and inspection.

General Mills Missile Systems...

HERE ARE SOME EXAMPLES of the precision electro-mechanical engineering and close-tolerance production services available to you at General Mills. The *Y-4 Bombsight* permits pinpoint bombing from fantastic heights; the *Coordinate Converter* links the Y-4 Bombsight with other elements of an aircraft's bombing system; the *Flight Recorder* maintains a complete flight record of velocity, acceleration and altitude; the *Autofab* Machine assembles electronic circuits automatically at high speed.

3. THE RIGHT EXPERIENCE

Besides manufacturing precision ordnance instruments since 1940, we have had broad experience in the development of aeronautical and industrial control systems. Our engineers have a first-hand understanding of the theoretical as well as the practical requirements of effective systems; we have developed several unique new weapons for the armed forces as well as feedback instrument systems for precision control of industrial processes and military operations. Other projects include highly complicated electronic and electro-mechanical airborne computing and control systems.

READY TO SERVE YOU . . . are complete facilities for electronic and electro-mechanical research, design, development, production engineering and precision manufacturing in connection with . . . ☐ automation ☐ aircraft systems ☐ industrial instrumentation and control ☐ specialized precision instrumentation ☐ navigation and missile control systems ☐ electro-mechanical computers ☐ remotely-controlled manipulators ☐ telemetering (radio and wire) ☐ fine-particle technology ☐ meteorological and high-altitude research. WRITE TODAY to Dept. AW-8, Mechanical Division of General Mills, 1620 Central Avenue, Minneapolis 13, Minn.

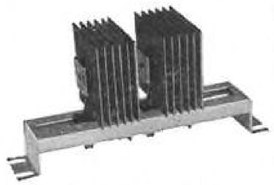
Job opportunities available for creative engineers. Work closely with outstanding men on interesting projects.

MECHANICAL DIVISION OF General Mills, Inc.

Sarkes Tarzian "Centre-Kooled" SELENIUM RECTIFIERS

POWER RECTIFIERS Sarkes Tarzian Power type rectifiers provide extreme versatility and flexibility of design. Seventeen basic cell sizes provide the widest range in the industry, from milliamperes to thousands of amperes.

RADIO-TV TYPES A wide range of ratings is available to cover applications in radio and television receivers as well as a variety of electronic equipment. The special "Plug-In"* feature, available at no extra cost, provides a wide range of mounting methods.



* PATENT APPLIED FOR

Also available is Conversion Chassis, CC-1, that converts present television receivers to use plug-in rectifiers.

EMBEDMENTS Sarkes Tarzian embedments provide the low-cost, light-weight, small-size answer on applications where hermetic sealing is either required or desirable. Special fillers extend the embedment resins practical temperature range from —55° to 100° C.

HIGH VOLTAGE Sarkes Tarzian high voltage rectifiers utilize four cell sizes and current ratings range from 0.5 milliamperes dc, to 75 milliamperes dc. All types from simple half wave to complex three phase configurations are available.

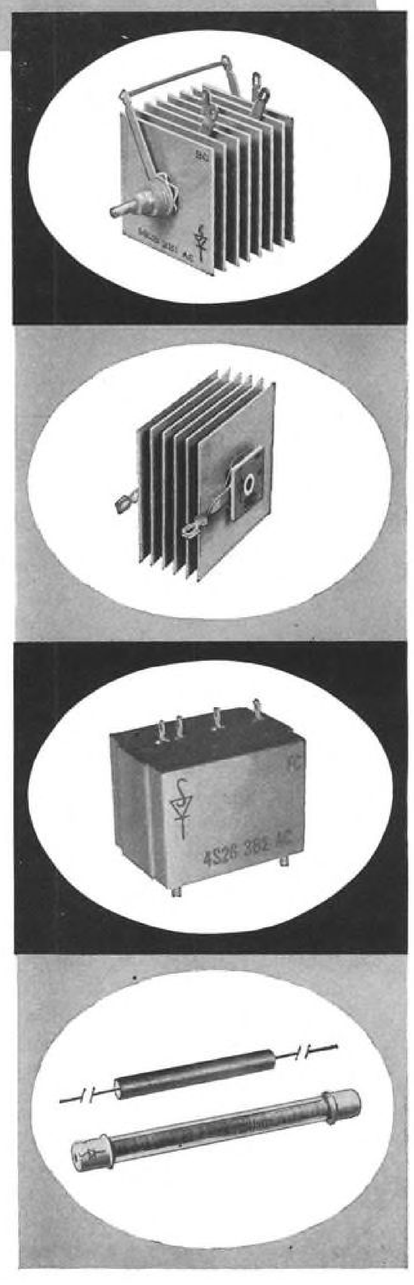
High Temperature Selenium Rectifier

Developed in Sarkes Tarzian Research Labs, these types provide cell temperature ratings to 150° **without derating.** Production quantities available for prompt delivery. Write for complete information and ratings.

Get the latest Selenium Rectifier Handbook and up-to-date Replacement Guide

Sarkes Tarzian, Inc., Rectifier Division

DEPT. AW, 415 NORTH COLLEGE AVENUE, BLOOMINGTON, IND.



C-124

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Guided Missile Plant
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LOCKHEED
Analog Ground Station
Van Nuys, California

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ASCOP
M Series Ground Stations
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UNEQUALED PERFORMANCE
in telemetering, guided-missile monitoring and radiosonde reception.

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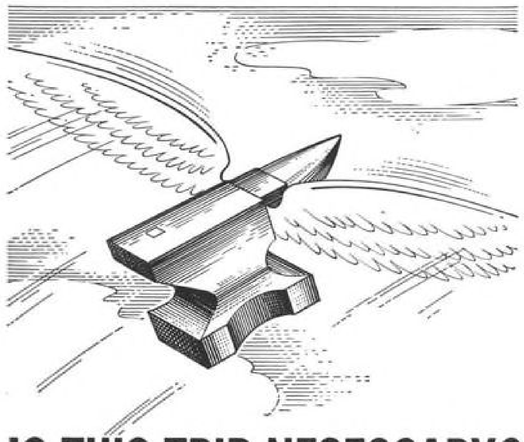
For Further Details Write Dept. A

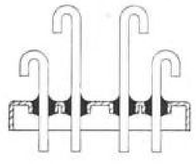


IS THIS TRIP NECESSARY?

Put enough horse power to it and you could probably make an anvil fly. But what purpose would it serve?

When Fusite pioneered a glass-to-steel hermetic terminal one very important reason we worked for an interfusion between the glass and metal is that only with this type of construction is it possible to use a light formed stamping for the base.

In this age of flight, more and more hermetically sealed electrical components are called upon to fly. Every ounce of unnecessary weight becomes a liability. Despite the light weight of Fusite Terminals they are rugged enough for mass production handling and for service as a structural part as well as a conducting seal.



Send for your FREE copy of our catalog giving complete information of our extensive line to

Dep't. M-3

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THE FUSITE CORPORATION
6000 FERNVIEW AVENUE
CINCINNATI 13, OHIO

C-125

Pulse Width Data Systems

THOMAS S. MEDEROS, JR., Sales Manager

Applied Science Corporation of Princeton

Princeton, New Jersey

A PW data system is a grouping of equipment which uses the techniques of time division multiplexing and Pulse Width coding to put a number of voltages representing physical quantities, into a form which permits transmission over a single circuit or link, or recording on a single channel or track. The system also provides for the separation and identification of the previously multiplexed data channels and decoding back into voltages, which are used to provide visual display, graphic records, input to data processing equipment or control functions.

M SERIES PW GROUND STATION

Separates and reduces all data channels in real time. Operates on signals from standard airborne set, FM/FM subcarrier, or magnetic tape recorder.

In a PW system, the intelligence is conveyed by the pulse duration rather than amplitude, and therefore the transmission medium is not required to have amplitude linearity but only the ability to discriminate between two states which may be called "on" and "off" or "mark" and "space."

Operation

The basic functional units required in any PW system are transducers, a commutator with suitable driving device, a keyer, an RF transmitter, and data reduction equipment for converting the PW data signals into usable form.

Since the PW data system requires that input signals should be in the form of voltages, suitable transducers capable of converting physical quantities into voltages are used. Present ASCOP PW multicoders operate from signals in the range of 0 to +5 volts, but low-level equipment will be available in early 1956 with sufficient sensitivity to accommodate inputs in the low millivolt range.

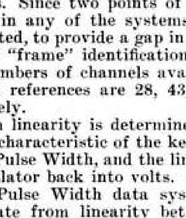
The time division multiplexing is accomplished by a motor-driven rotary sampling switch or commutator. Standard sampling rate is 900 samples per sec, and commutators are now available for operation at 30 RPS over 30 points, 20 RPS over 45 points, and 10 RPS over 90 points. Since two points of the commutator in any of the systems are left unconnected, to provide a gap in the pulse train for "frame" identification, the existing numbers of channels available for data and references are 28, 43, and 88, respectively.

System linearity is determined by the transfer characteristic of the keyer, from volts to Pulse Width, and the linearity of the translator back into volts. A typical ASCOP Pulse Width data system does not deviate from linearity between the scale end points, by more than 0.5 per cent. The total system drift, from any cause, is less than ±0.5 per cent of full scale. Since system levels are maintained by an automatic electronic servo, this degree of stability is maintained over periods of days or weeks, and is accomplished without any warm-up time.

With the stairstep type of electrical output provided by the M Series ground station, it is generally conceded that 6 samples per cycle of the highest data frequency component present allow visual interpolation of output records to better than 1% accuracy. This means that any channel of a 30 × 30 system can reproduce 5 cps data. The frequency response of one or more data channels in the system can be increased by a factor of 2, 3, 4, or more by increasing the effective sampling rate. This can be accomplished by applying the same transducer output to a corresponding number of commutator contacts, and making similar provision during decommutation.

F SERIES MISSILE SETS

Samples up to 43 data sources. This rugged equipment is sealed and pressurized to withstand high altitudes, operation and temperature extremes.



SPECIAL MISSILE SET

ASCOP-designed for a customer.

D SERIES PW MULTICODER

For aircraft, mobile or other applications where recovery or continued use is practical and where space and weight are not critical. Samples up to 43 data sources.

Uses

At present, most PW data systems are used for recording experimental test data from missiles and aircraft, where hazard, space limitation, and volume of data to be gathered make the use of a human observer impossible. Measurements of such quantities as the temperature, pressure, strain, altitude, acceleration, flow rate and position are made at rates thousands of times faster and much more accurate than could be done by visual observation and manual recording.

Additional application is also found in experimental test work where hazard and space are not limitations, but where the total volume of data require both high speed automatic measurement and recording. Engine test stands, reactors, and complex electronic equipment are typical devices whose testing requires the automatic measurement and recording of large numbers of physical properties.

PW data systems have been used where many measurements must be transmitted and displayed in easily interpreted form, as in the case where a pilot on the ground must rely on display instruments while he controls a drone aircraft, or in the case where the flight test engineers on the ground must observe conditions in a piloted aircraft in order to insure the safety of the pilot.

ASCOP

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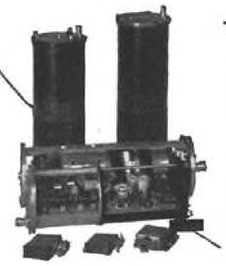
PW DATA SYSTEMS

MULTICHANNEL DATA TRANSMISSION OR RECORDING, USING RF CARRIER, FM SUBCARRIER, OR SINGLE MAGNETIC TAPE TRACK

Pulse width coding and time division multiplexing techniques result in systems of large numbers of data channels, excellent accuracy, and exceptional simplicity of operation.

TYPICAL SYSTEM PERFORMANCE

NUMBER OF DATA CHANNELS...	26	41	86
SAMPLES/CHANNEL/SECOND.....	30	20	10
FREQUENCY RESPONSE, CPS.....	5	3.3	1.6
Linearity	Better than 0.5% of full scale		
Stability	Long term drift less than 1% of full scale		

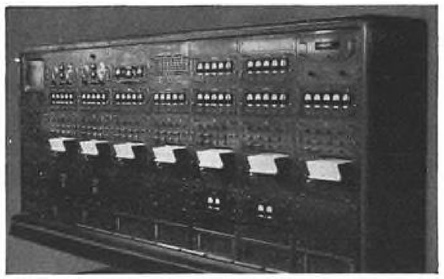


← **F SERIES MISSILE TELEMETERING SETS**

For short life applications, where the ultimate in compactness, ruggedness, and performance are required. Standard packages as shown are available for 30x30 and 45x20 operation. Special configurations, using standard functional components may be ordered. Some components are sold separately.

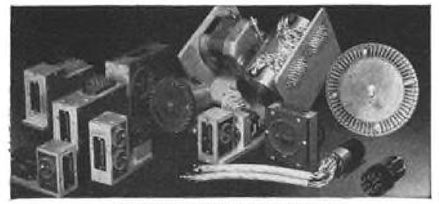
D SERIES MULTICODERS AND TELEMETERING SETS →

For applications where repeated use is required. Available for 30x30, 45x20, and 90x10 operation, 0 to 5 volt or 0 to 30 millivolt sensitivity, 28 volt DC or 115 volt 400 cycle primary power, for RF carrier, FM subcarrier, or magnetic tape recording. 45 watt RF power amplifier available.



← **M SERIES PW GROUND STATIONS**

Operate on pulse width signals from RF receiver, Subcarrier discriminator, or magnetic tape playback unit to produce visual monitoring of all data channels and reduced graphic output records of selected channels, in real time.



ROTARY SAMPLING SWITCHES

Over 40 models, single and multi-pole, with up to 180 contacts per pole and speeds up to 100 RPS. For all applications requiring high quality switching of low level signals. Bulletin 521-R.

A SERIES ACCESSORY EQUIPMENT

RF Preamplifier units, for greatly increased receiving range, and RF Multicoupler, for operation of up to 4 receivers from a single Preamplifier or antenna. Broad band operation 215 to 235 megacycles.

G SERIES FIXED INSTALLATION MULTICODERS (Not shown)

PW Multicoders for multichannel tape recording or transmission from fixed installations. Operate from standard 60 cycle power lines ... Designed for long life ... easy accessibility.

Our experienced field engineers will be pleased to discuss your application. Please direct your inquiries to either office.

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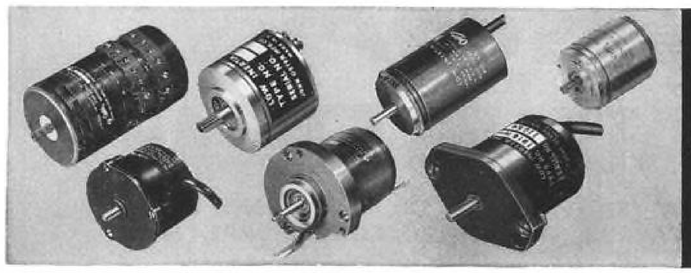

Oster®

These high performance 400 cycle servos conform dimensionally with Bu Ord specs in many models. Greater efficiency, minimum air gaps and extremely high torque-to-inertia ratio is attained by precision manufacturing. 60 cycle units can be made available.

Type Number	Size	Length	Mounting	Minimum Stall Torque in Oz.	No Load Speed Minimum	Power Input at Stall Total Watts	Rated Voltage		Special Features
							Fixed Phase	Control Phase	
1916	10	1 3/16"	Flange	.15	9,000	3.	28	28	
2409	10	1 3/16"	Flange	.13	9,000	2.3	18	18	Hi Temp application
2155	10	31/32"	Synchro	.24	4,800	4.5	52	52	
2162	10	31/32"	Synchro	.24	4,800	5.5	26	26	
2201	10	31/32"	Synchro	.24	5,000	5.2	26	52	
2442	10	1.156"	Synchro	.13	10,000	3.2	18	18	
3009	10	1.156"	Synchro	.13	10,000	2.5	18	54	1400 OHM cont. ph. Z
3040	10	.975"	Synchro	.149	10,000	2.6	18	54	1400 OHM cont. ph. Z
3053	10	.975"	Synchro	.15	10,000	2.8	18	18	
3185	10	.968"	Synchro	.3	6,000	6.2	26	26	avail. up to 125°C
2156	.980" OD	.965"	Synchro	.15	6,000	5.	27.5	14	125°C
2307	1" OD	1.5"	Synchro	.25	10,000	10.	115	115	
3188	1" OD	1.611"	Flat	.35	10,000	12.6	115	115	
3199	11	1.703"	Synchro	.63	6,200	7.	115	115	Mark 14 Mod O
3161	15	1.312"	Flange	.45	5,000	5.8	26	50	
3148	15	1.640"	Synchro	1.45	4,800	12.2	115	115	Mark 7 Mod O
2287	15	1.640"	Synchro	1.45	4,800	12.2	115	115	avail. up to 150°C
3159	15	1.640"	Synchro	1.45	4,800	12.2	115	230	
3271	15	1.640"	Synchro	1.0	10,000		115	115	
3272	15	1.640"	Synchro	1.0	10,000		115	230	
3273	18	2."	Synchro	2.35	4,800	18.4	115	115	
3217	18	2."	Synchro	2.35	4,800	18.5	115	282	
3270	18	2."	Synchro	1.4	9,800	18.0	115	115	
2094	2" OD	2.718"	Flange	3.5	7,200	40.	115	115	Damping Generator
2237	2 7/8" OD	4.750"	Synchro	23.	10,000	130.	115	115	

Many of the above units can be supplied with gear train to your specifications.
Other servos to your requirements.

Write for further details, giving type number.

Other products include Actuators, AC Drive Motors, DC Motors, Motor-Gear-Trains, Fast Response Resolvers, Servo Torque Units, Synchros, Reference Generators, Tachometer Generators, and Motor Driven Blower and Fan Assemblies.

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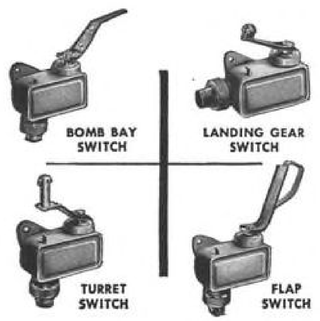
new ELECTRO SNAP ROCKET SAFETY SWITCH

Sketch shows typical switch and rocket tube application. Rocket switch controls various indicator, sequence and other electrical circuits. Several models now in production. Send us your design requirements.

...from the makers of the leading line

of HERMETICALLY SEALED LIMIT SWITCHES



Electro-Snap has developed a complete line of hermetically sealed limit switches to bring the ultimate in environment-free switching to aircraft control circuits. With a record of dependability totaling millions of hours, Electro-Snap Hermetically-Sealed Switches have been used as original equipment by major aircraft producers—on standard and experimental aircraft for both commercial and military use. They are also being widely used for retro-fitting, to modernize existing control circuits for the more exacting demands imposed on today's aircraft. If aircraft switching is your responsibility, you should know about this modern line of switches for modern aircraft. Write for specifications.

To meet modern aircraft requirements, Electro-Snap has developed and perfected this, the first truly hermetically sealed rocket switch. Because both the basic switch and the operating mechanism are sealed in an inert gas, the switch is unaffected by extreme heat, or cold, humidity, water, oil or temperature cycling. Tipping action of the actuator prevents jamming by ice. Completely environment-free, the dependability of the switch and its operating action have been thoroughly proved on today's newest fighter aircraft.

IMPORTANT CHARACTERISTICS

Contact Arrangement ..... SPDT, 1 circuit

Capacity.....4 amps. resistive, 2.5 amps. inductive at 30v DC.

Electrical and Mechanical Life.....150,000 operations min.

Vibration and shock resistance.....Excellent

Full information is available on request. Write for Data Sheet RSM-11.

ELECTRO-SNAP SWITCH & MFG. CO.
4218 West Lake Street, Chicago 24, Illinois

We will meet your design requirements—send us your prints

a

WESTINGHOUSE

BALTIMORE DIVISIONS

opportunity

for experienced electronic engineers seeking long-range positions of responsibility and opportunity.

Current opportunity at the Westinghouse Baltimore Divisions combines most of the ordinary advantages—such as good income and employe benefits—with a foremost program of professional recognition, advanced education at company expense, and long-range development work that is creative and interesting. Work in modern facilities that are ideally located. Apply today!

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Many products... One Standard

*Instrument Quality

There is one characteristic common to all Giannini instruments—built to rigid, instrument-quality standards, they are instruments with an earned reputation of offering the utmost in mechanical and electrical design. High performance results from outstanding craftsmanship and rigorous calibration, testing and inspection procedures. Your job requirements can be met or exceeded by Giannini IQ instruments.

ACCELEROMETERS
Linear Motion

PRESSURE TRANSDUCERS
Capsule and Bourdon Tube Types

VANE TRANSDUCERS
Pitch and/or Yaw • Pitot-static Tip

TEMPERATURE PROBES
For Stagnation Temperature Measurement

PRECISION POTENTIOMETERS
Rectilinear, Infinite Resolution and Rotary Wire Wound Types

DIGITAL DATA RECORDING SYSTEMS
Digital Commutators

GYROS
Free-Directional-Vertical and Rate

AIR DATA COMPUTING SYSTEMS
Mach-TAS Pressure Ratio

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INSTRUMENTS
CONTROLS

Giannini

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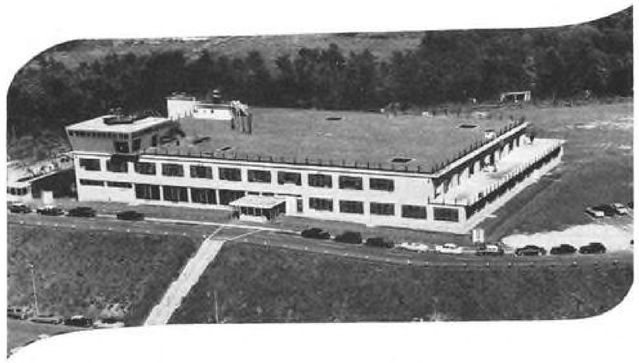


Long Range Opportunities for ENGINEERS

A continued expansion of Raytheon's Missile Systems Division has created long range opportunities for experienced engineers. The Missile Systems Division is housed in a modern laboratory 20 miles from Boston in a country setting and offers a choice of urban or country living, excellent recreational facilities and proximity to the educational, cultural, and entertainment advantages of Boston.

Raytheon has eighteen prime contracts in the guided missile field including contracts involving overall responsibility for system design including air frame guidance, motor, and auxiliary equipment. This Division is engaged in all phases of missile development from study programs through design, flight testing and production. Our aircraft systems department is engaged in the fulfillment of contracts for complete aircraft electronic systems including navigation systems, weapons control systems, and automatic flight and landing control systems. These programs involve development of interesting new techniques such as FM/CW and pulse doppler radar.

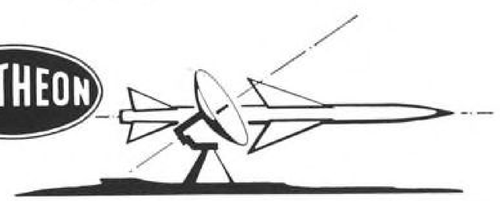
Salary and advancement commensurate with ability. Liberal vacation, sick leave, group life and health insurance and a worthwhile pension system. Tuition support plan for engineering courses. Relocation expenses paid.

Engineering Positions are available at all levels in the following fields.

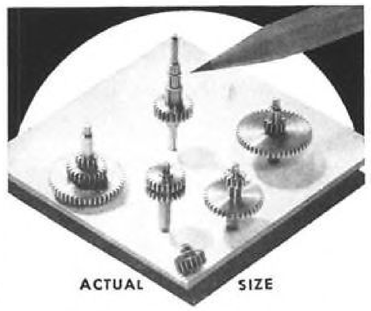
Electronics Systems
Systems Analysis
Inertial Systems
Circuit Design
Specifications
Electronic Packaging
Microwave Development
Heat Transfer
Mechanical Design
Aeromechanics
Operations Analysis
Tube Development and Applications

If you are interested please send us a few details concerning your experience. A mutually convenient time and place for interview of qualified applicants will be arranged. Address G. P. O'Neil

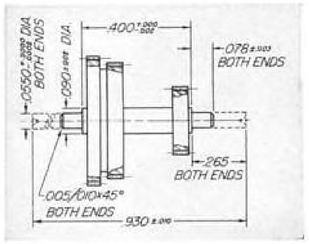
RAYTHEON



MISSILE SYSTEMS DIVISION — BEDFORD, MASS.



miniaturized GEARS and GEAR TRAINS



*Extreme Precision**

GEARS
- Tooth to tooth composite tolerance, 0.0003''
- Total composite tolerance, 0.0005''
- Journal diameter tolerance, ±0.0001''
- 20 degree pressure angle, 80, 96 or 120 diametral pitch
- Hardened stainless steel, brass, aluminum, and others
- Burnished gear teeth and burnished bearing diameters
- AGMA standards used throughout

*Standard production runs

PLATES
- Bearing centers held to ±0.0001''
- Hole diameters held to ±0.0001''

TRAINS
- High-quality, performance, long life
- Near-zero backlash

Early Delivery

Gears and plates: 30 days or less
Gear trains: 45 to 60 days

Low Cost

Unique manufacturing techniques plus skilled personnel means low prices. For quotations on your requirements, write or phone us.

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The 6 separate divisions of AMERICAN ELECTRONICS INC. and how they serve the Aviation and Electronics Industries

American Electronics, Inc., is the result of an unprecedented industrial growth... a combination of 6 separate divisions under individual names, devoted to supplying aircraft and related electronic items. Each division operates independently, yet each draws upon the experience of the other. Briefly, here are the component parts of this new electrical-electronic enterprise:

1 **AMERICAN ELECTRIC MOTORS, INC.,** Miniature Components Division. Plant location: 4811 Telegraph Road, Los Angeles 22, California. Products: Complete line of miniature ac high cycle drive motors and actuators; miniature fans and blowers.

2 **AMERICAN ELECTRIC MOTORS, INC.,** Electric Machinery & Equipment Division. Plant location: 2112 N. Chico Avenue, El Monte, California. Products: High cycle and variable frequency power supplies, motor induction couplings, pneumatic power supplies, refrigerating units for ground test and check-out, marine blowers.

3 **AMERICAN ELECTRONIC MFG., INC.,** Instrument Division, Plant location: 9503 W. Jefferson Blvd., Culver City, California. Products: Servo motors, synchros, resolvers, brushless induction potentiometers and motor tachometers for various systems requirements.

4 **BERLANT INSTRUMENTS,** Audio & Recordata Division. Plant location: 4917 W. Jefferson Blvd., Los Angeles 16, California. Products: Magnetic tape recorders, magnetic pickup heads, memory devices, tape-transport mechanisms, Recordata Systems.

5 **PIERSON ELECTRICAL & ENGINEERING CO.,** DC & Research Division. Plant location: 1017 E. Washington Blvd., Los Angeles 21, California. Products: dc motors, 400~ alternators, governed and geared motors, rotary actuators, generators (wind-driven and engine-driven types).

6 **REED-CURTIS NUCLEAR INDUSTRIES** Plant location: 307 Culver Blvd., Playa Del Rey, California. Products: alpha, beta, gamma and X-ray nuclear count rate meters; gamma ray spectrometers; super-sensitive nuclear leak testers; scintillation counting survey meters; personnel radiation dosage services; radio chemical, radio isotope services.

AMERICAN ELECTRONICS INC.
Sales Engineering Offices:
2112 N. Chico Avenue, El Monte, Calif.
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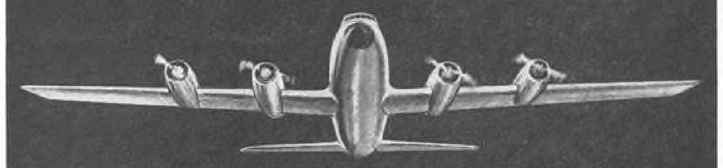
AIR-MARINE MOTORS



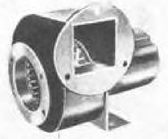
first choice for high specification AIRBORNE BLOWERS

The blowers illustrated are part of a magnificent family of Air-Marine Motors specialized rotating equipment, including motors, fans and blowers.

Design and construction features such as stainless steel thru-bolts, rigid die-cast aluminum housings, positive bearing alignment, omni-position mounting, and dependable operation in extreme temperatures are common to all Air-Marine Motors equipment. Many other features add their contribution to in-flight safety.

WRITE FOR DETAILED SPECIFICATIONS AND PERFORMANCE DATA . . . and use the Air-Marine Motors advisory services without obligation.

A15ABF-1 115 Volt — 400 cycle. Blower delivering 50 CFM at 8500 RPM. Propeller fan delivering approximately 300 CFM at 8500 RPM.



B20B-3 115 Volt 400 cycle single phase centrifugal blower. Delivering 140 CFM of air against 2" of water operating at 6500 RPM minimum.

A15BD 115 Volt 400 cycle single phase double blower delivering 26 CFM total at 0 static. Has special mounting brackets.

A11A-1 115 Volt 400 cycle single phase propeller type blower using 4" four blade fan.

A11A-2 115 Volt 400 cycle single phase axial vane blower delivering 70 CFM at 1" static pressure at 11,000 RPM.

VARIABLE FREQUENCY BLOWER — 115 VOLT SINGLE PHASE, AXIAL FAN OR CENTRIFUGAL BLOWER
A15BF-15 50 to 800 cycles, single winding.
A15AB-2 50-60 cycle and 400 cycle single winding.
A15CF-10 50-60 cycle and 320-1000 cycle dual winding.

air-marine motors Inc.

Constantly developing to meet your exacting needs . . .

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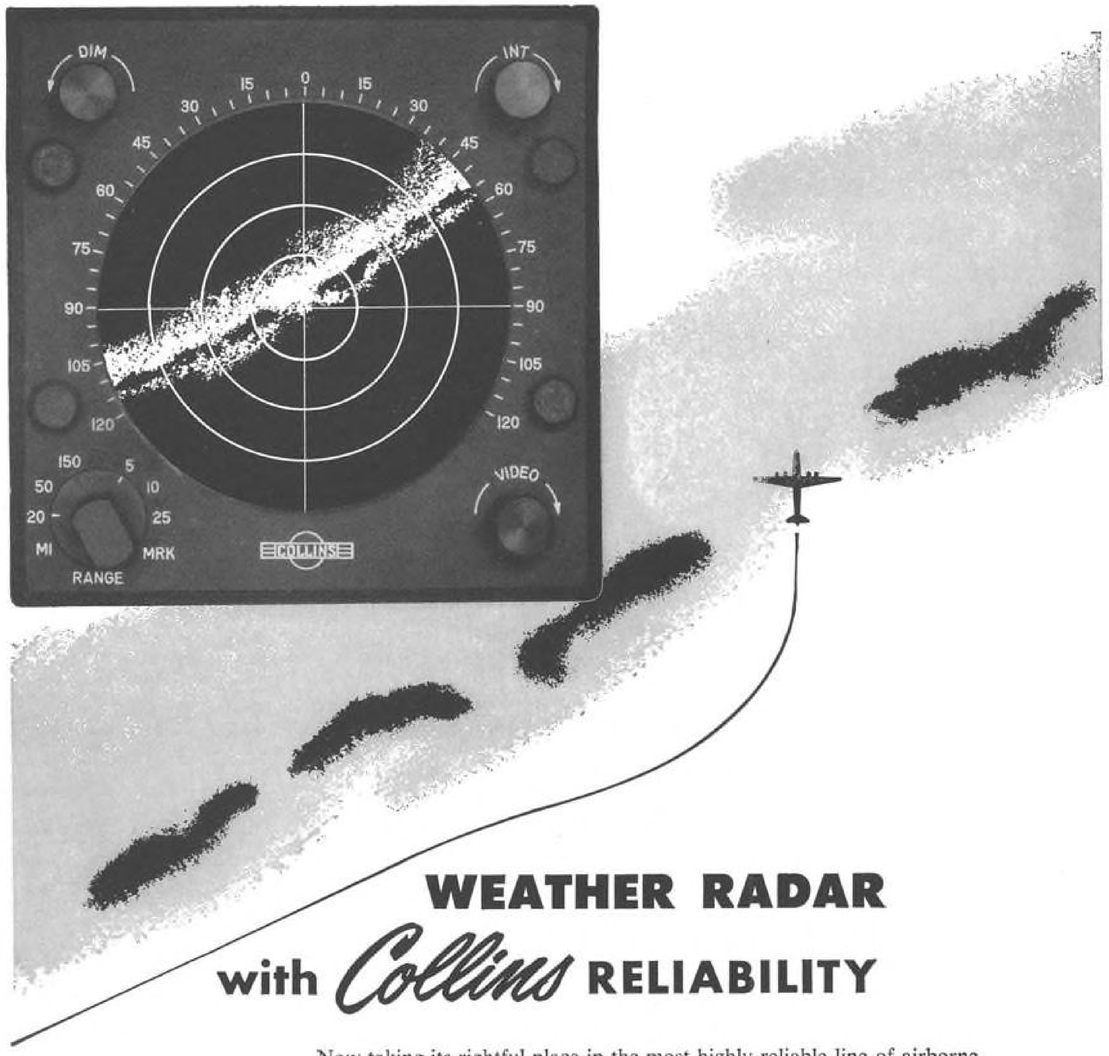
West Coast Factory: 2055 Pontius Avenue, Los Angeles 25, Calif.



WEATHER RADAR
with *Collins* RELIABILITY

Now taking its rightful place in the most highly-reliable line of airborne electronic equipment is Collins Weather Penetrating Radar System, the WP-101. Lightweight and compact, the new System is designed to Arinc specifications and includes in its features: (1) Printed wiring to cut weight and space, to provide uniformity and easier maintenance and to improve reliability (2) A load isolator to minimize the effects of high VSWR with long wave guide runs, thus assuring long life for the magnetron (3) Magnetic amplifier-regulated power supplies to reduce tube requirements, and (4) Modular plug-in type design with readily-accessible test points for simplified maintenance.

Write for Collins WP-101 brochure.

Collins CREATIVE LEADER IN AVIATION ELECTRONICS

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COLLINS RADIO COMPANY OF CANADA, LTD.
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C-134

SPERRY IN AVIATION

Instruments . . . controls . . . systems . . . Wherever airplanes fly you will find Sperry. Whether it be helping the pilot, navigator, flight engineer, radar operator, bombardier, gunner or drone operator, Sperry instrumentation plays an important role in assuring on-schedule flights in all kinds of weather and in assuring the successful completion of military missions.

Sperry has been a pioneer in aviation since 1912. In that year Lawrence Sperry made the first automatic flight, turning his hydroaeroplane over to the first Sperry Stabilizer. *This was the beginning of automatic flight controls.* In 1915, working with the U.S. Navy, Lawrence Sperry again pioneered in developing the first aerial torpedo whose course could be pre-set and held during prolonged flight with Sperry instruments. *This was in actuality the first guided missile.* In 1929, Lieutenant "Jimmy" Doolittle flew under a hooded cockpit, guided by the Sperry Gyro-Horizon and Directional Gyro. *This was the first complete "blind" flight.* In 1937, an Air Corps crew landed their Fokker aircraft using the Sperry Automatic Pilot and radio as guidance. *This was the first complete automatic landing.*

When the above events took place, these developments were advanced for their time. They were solutions to future problems. Other outstanding "Sperry firsts" are represented by such famous names as Zero Reader* Flight Director, Gyrosyn* Compass, Engine Analyzer and the Electronic Gyropilot.* This pioneering in advanced instruments and controls has been a continuing program for Sperry . . . a program of anticipating the needs of tomorrow's aircraft . . . of anticipating the needs of the military in helping to discourage possible aggressors.

Today Sperry pioneering continues in the design, development and production of aviation instruments, controls and systems. To maintain its traditional leadership in aviation, a new Aeronautical Equipment Division has been recently organized to assure optimum efficiency in meeting future aviation requirements. Additionally, the needs of the Army, Navy and Air Force for special military systems are met through our headquarters' organization. And a new Special Missile Systems Division coordinates major Sperry activities in this expanding field. How extensively Sperry is engaged in aviation is indicated by the many specific fields of endeavor described briefly in the following pages . . .

* T.M. REG. U.S. PAT. OFF.

FLIGHT CONTROL SYSTEMS

The latest in gyroscopic, servo and signal system techniques have been incorporated in Flight Control Systems to give precise, automatic control of aircraft. Various commercial models of Sperry automatic pilots are in constant use on the world's leading airlines and on hundreds of business aircraft. Used in conjunction with the Sperry Radio Beam Coupler, the automatic pilot keeps the plane on the radio ranges unerringly. In landing, the Radio Beam Coupler automatically responds to the localizer and landing beams for complete automatic approaches.

Military models of Flight Control Systems include automatic pilots for bombers, fighters, transports, helicopters, drones and missiles. Tied in with the latest bombing-navigation system, the automatic pilot flies the bomber during the last crucial moments of the bombing run. For helicopters a flight control system gives precise automatic stabilization and control even under the most exacting condition of hovering.

New systems today incorporate the Sperry Integrated Instrument System to give the pilot display information from common gyros and power supplies. Other new developments in Flight Control Systems are hydraulic power controls, yaw and pitch dampers and G-limitor systems.

FLIGHT INSTRUMENTS

More flight data, in clearer visual form, in less space, is the modern cockpit need answered by the Sperry Integrated Instrument System. This System consists of a more accurate and reliable primary direction instrument, a combined Zero Reader flight director and gyro-horizon, and a pictorial deviation indicator. These three new instruments are incorporated into the basic six panel instruments now in common use, giving the pilot more of the data he needs without increasing the number of instruments on his panel. This System also is integrated with Flight Control Systems so that the same gyros and power supplies can be used for automatic as well as manual flying. Other Integrated Instrument Systems are in development which combine engine instruments and fire control systems with flight instruments and control systems.

In direction instruments, Sperry has many models of Gyrosyn Compasses, Directional Gyros and Heading Indicators to provide accurate heading information. In attitude instruments, Sperry has a variety of Gyro-Horizons, Roll and Pitch Indicators, Stable Platforms and Compensated Vertical References to provide accurate attitude information. Specific instrumentation for helicopters include a Flight Director for ease of manual control and an engine rpm control.

In navigation systems, Sperry developments include a true-North Gyro-Compass, Stable Platform for pitch, roll and heading, an Inertial Navigation System and a Doppler Inertial Navigation System.

ENGINE ANALYZERS

On the world's leading airlines and many US military aircraft, Sperry Engine Analyzers keep a constant check on every part of a plane's ignition system . . . *looks* inside each cylinder and shows the exact performance of every spark plug. Before take-off, the system enables quick "tune-up" to assure smooth, maximum power. In the air, the flight engineer, watching the images on his analyzer scope, can detect malfunctions in the engine's performance which can be quickly corrected by adjustments or replacements immediately upon landing. Another important function of the Engine Analyzer is providing vibration analysis. Valve clearance trouble with its resulting fuel and power waste is easily detected. Portable Engine Analyzers are widely used in ground maintenance and engine test cells.

ENGINE ANALYZER IS MANUFACTURED UNDER JOHN E. LINDBERG PAT. NO. 2518427

Engine Analyzers, including vibration analysis, have now been developed for turbojet and turboprop engines. In addition to fixed-wing aircraft, Engine Analyzers are applicable to helicopters.

TURBINE CONTROLS

With the increasing speed of aircraft, it has become more and more important to integrate power plant controls with the airplane and its mission. Sperry is actively engaged in developing control instruments and systems for turboprop, turbojet and ramjet engines. New developments, in addition to an Engine Analyzer which includes vibration analysis, are a Thrust Indicator, Temperature Indicator and Fire Detector.

BOMBING NAVIGATION SYSTEMS

The K Bombing System developed for the Air Force by Sperry combines automatic navigation with all-weather identification and bombing of any target. Once in the target area the Navigator-Bombardier-Observer locates the target optically, or if hidden, by radar. With the Observer keeping cross-hairs directly over the target, the K System takes over and automatically navigates, flies the bomber, compensates for speed, altitude and wind, and releases the bomb at the instant required to assure a direct hit. Advanced types of bombing-navigation systems to meet critical mission requirements of future aircraft are currently under development.

AIRCRAFT FIRE CONTROL SYSTEMS

In this field, advanced projects of a classified nature include the design and development of systems to meet the tactical and strategic requirements of new bomber, fighter-bomber, and interceptor aircraft. New techniques in integrating flight control, computer and radar functions of fire control systems are rendering obsolete the computing gunsights of today.

DRONE SYSTEMS

Unmanned jet drones are currently being flown remotely with precision by USAF specialists from ground-based

control stations or airborne director aircraft. Equipped with Sperry Remote Flight Control Systems, the drones respond to "beep" box commands on special missions such as weapon systems' evaluation. Under radio command the drones are fully maneuverable and recoverable and in atomic tests have penetrated a blast area with split-second accuracy. Advanced drone systems are currently under development.

GUIDED MISSILES

Navy's Sparrow I is the first air-to-air guided missile produced in volume for operational use. Designed by Sperry for the Bureau of Aeronautics, Sparrow I is rocket-powered, radar-guided and light and compact enough so that multiple units can be carried by fighter-type jets. It is deadly accurate and capable of outmaneuvering the swiftest combat aircraft.

In addition to the Sparrow I, Sperry also supplies the stabilization system for Navy's Regulus, Chance Vought's surface-to-surface missile. Keeping Regulus on its course with a vise-like grip, the Sperry system is sensitive to the slightest signal change in flight path, makes instant corrections and flies Regulus unfailingly through intricate maneuvers at all speeds and altitudes.

Sperry is also engaged in five other classified missile programs in supplying guidance, stabilization and control systems.

RADARS

Working in both pulse and continuous wave, Sperry has radars in all important frequencies for a wide range of applications. Among radar functions provided in recent developments are fire control tracking, airborne beacon, navigational-search, air-to-air rendezvous, airborne range for measurement of distance to target, and long-range navigation by ground-based radar.

In addition to an extensive radar program, Sperry is also engaged in the development and production of Electronic Counter Measures.

KLYSTRONS AND TRAVELING WAVE TUBES

A wide range of tubes is available for important microwave uses. Covering frequencies from 200 mc. to 40,000 mc. and with power from a few milliwatts to many millions of watts, these tubes are noted for their dependability and long life. Megawatt Klystrons are the power source behind radar defenses, making it possible to detect approaching planes at greater distances than ever before. These tubes, with Moving Target Indication, permit radars to show indications of moving objects only, even at great distances, thus giving our defenses more time to be alerted.

The Klystron tube, a Sperry development, is the heart of microwave radar. Airborne radars employ Klystrons for mapping, fire control, storm warning, and for navigation and bombing. In guided missiles the Klystron makes possible more accurate control, permits guidance over longer paths. In air navigation and traffic control systems, Klystrons amplify stable radio signals to the power required for the range of the system.

MICROWAVE TEST EQUIPMENT

A complete line of test equipment includes every type of device essential to precision measurement in the entire microwave field. These include laboratory instruments used in design and in quality control in manufacture, field test equipment for use in maintaining and servicing, and components for systems' requirements. Instruments available are Barretter and Thermistor Mounts, Barretter and Thermistor Elements, Impedance Meters and Transformers, Frequency Meters, Directional Couplers, Attenuators, Terminations, Detectors and Mixers, Adapters and Shorts. Field test equipment includes Combination Radar Test Sets, Direct-reading VSWR Meters and Peak Power Meters.

FLIGHT RESEARCH

A specialized fleet of company-owned aircraft including a helicopter is based at the company's flight research center. Each of these planes is a "flying laboratory" for testing and evaluating Sperry instrumentation. A wide variety of military aircraft ranging from jet fighters to heavy bombers is assigned to the flight research center to aid in carrying out various development contracts.

RESEARCH AND ADVANCED DEVELOPMENTS

In an ever-continuing search to anticipate the needs of the future in aviation, Sperry is constantly at work on components and systems to solve the problems of tomorrow. Meanwhile, a long-range research program is underway to explore new scientific horizons to speed aviation's progress.

SPERRY SERVICE

More than 300 field engineers especially trained for customer service are stationed on every continent where Sperry equipment is in use – at military test centers, remote proving grounds and at air bases and terminals –to check out equipment efficiently and promptly.

Specific information on any phase of SPERRY IN AVIATION can be obtained by writing to our Aeronautical Equipment Division, or our headquarters' organization, Great Neck, New York. If it is more convenient, get in touch with our nearest District Office.

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3807 West 150th Street
Cleveland 11, Ohio
Winton 1-7741

LOS ANGELES
2200 East Imperial Highway
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Oregon 8-6226

NEW ORLEANS
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Seattle 99, Washington
Alder 7551

WICHITA
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Wichita 16, Kansas
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IN CANADA
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P.O. Box #710
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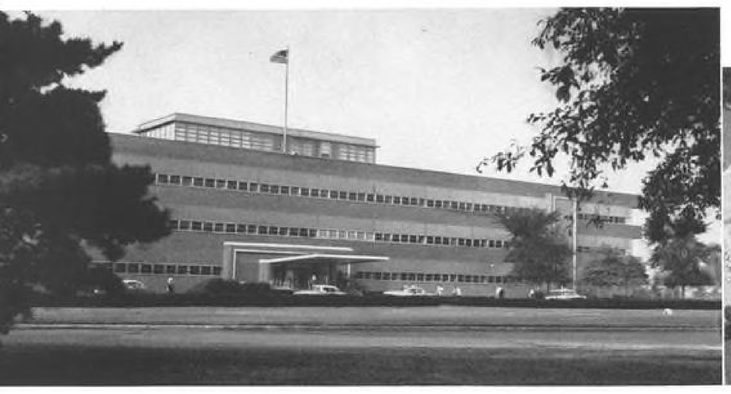
Montreal, Quebec, Canada
Bywater 5561

SPERRY GYROSCOPE COMPANY
GREAT NECK, N. Y.

DIVISION OF SPERRY RAND CORPORATION



[ABOVE] Sperry Gyroscope Company's main plant and headquarters at Great Neck, New York.

[BELOW] Sperry Flight Research Center, MacArthur Field, Long Island, New York.

[ABOVE] Sperry Farragut Company, Bristol, Tennessee, is devoted to the production of Sparrow I missile.

[BELOW] Sperry Electronic Tube Division, Gainesville, Florida, is producing Klystrons in large quantities.

CONTROLLED POWER FOR RESEARCH AND INDUSTRY

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Sorensen

1956

CONDENSED STANDARD SPECIFICATIONS

SORENSEN & COMPANY, INC., • STAMFORD • CONNECTICUT

Model E-6-15A

NOBATRONS (Reg. U.S. Pat. Off.)

(low-voltage, high-current, regulated DC sources).

Provide stability comparable to batteries and eliminate recharging interruptions, fume and acid hazards, installation difficulties.

Models available (numbers indicate voltage & current) E-6-5A, E-6-15A, E-6-40A, E-6-100A, E-12-5, E-12-15, E-12-50A, E-28-5, E-28-10, E-28-30, E-28-70, E-28-150, E-48-15, E-125-10, E-200-5.

ELECTRICAL CHARACTERISTICS

Input	95-130 VAC, 1ϕ, 50-60 cycles. 190-260 VAC, 1ϕ, for E-28-70, 120/208, 3ϕ, 4-wire wye for E-28-150.
Reg. accuracy	$\pm$0.2% against line (105-125 volts or 200-240 volts). $\pm$0.2% against load (1/10 to full).
Ripple	1% max. at 60 cycles.
Output voltage adjustment range	6 volt units, 5.4 to 7.7 volts in two ranges. E-12-50A, 9.0 to 17.6 volts in two ranges. E-200-5, $\pm$50%, all others +10%, –20%
Recovery time	0.2 seconds on all models but E-28-70 (0.35 sec.) and E-28-150 (0.3 sec.)

Model SR2

NOBATRON-RANGERS

(wide-range-variable regulated DC sources).

These versatile and popular instruments have electrical characteristics similar to the standard Nobatrons, except that output voltage is continuously adjustable.

ELECTRICAL CHARACTERISTICS

Input	95-130 VAC, 1ϕ, 50-60 cycles for SR30 and SR100. 190-260 VAC, 1ϕ, 50-60 cycles for the SR2.		
Reg. accuracy	$\pm$0.25% at any voltage setting		
Ripple	1% RMS max.		
Output: Model	SR100	SR30	SR2
VDC	5-135	5-30	100-300
Amps	1-10	3-30	1-10

Model 600B

B-NOBATRONS

(high-voltage, low-current, regulated DC supplies).

Designed to meet the broadest technical and economical requirements. The internal impedance figures given are from measurements in accordance with IRE specifications for measurement of power supply internal impedance.

ELECTRICAL CHARACTERISTICS

Model	325BB	560BB	500BB	600B	100BB
Output voltage (VDC)	0-325	0-500	0-500	0-600	200-1000
Output current (Ma)	0-125	0-200	0-300	0-500	0-500
Reg. accuracy	$\pm$0.5%	$\pm$0.5%	$\pm$0.5%	$\pm$0.25%	$\pm$0.5%
Ripple (MV-RMS)	5 max.	5 max.	5 max.	3 max.	20 max.
Bias supply (VDC at 0-5 Ma)	0-150	0-150	0-150	0-150	none
Internal impedance (max.)	2.0 ohms	2.0 ohms	2.0 ohms	2.0 ohms	2.0 ohms
AC input range (50-60 ~, 1ϕ)	105-125	105-125	105-125	105-125	105-125
AC voltage (C.T., unreg.)	6.3 at 10 amp.	6.3 at 10 amp.	6.3 at 10 amp.	6.3 at 15 amp.	— — —
Max. bias circuit impedance	25000 ohms	25000 ohms	25000 ohms	50000 ohms	

Model VRS-AC750

AC VOLTAGE REFERENCE SOURCES

These instruments provide highly stable AC voltage for many laboratory uses such as the direct calibration of voltmeters and oscilloscopes.

ELECTRICAL CHARACTERISTICS

	Model VRS-AC 10	Model VRS-AC 750
Input voltage	105-125 VAC, 1ϕ	
Input frequency	50-60 cycles; also to 400 cycles with minor loss of accuracy	60 cycles $\pm$.5
Output voltage	10 mv to 10 v in 3 ranges	1-799 v in 1 v steps
Calibration accuracy	$\pm$0.1%	
Reg. accuracy	$\pm$0.25% with line; $\pm$0.25% with load of .5 megohm or higher	overall accuracy * $\pm$0.25%
Distortion (generated by instrument)	negligible	1% maximum

*Much greater accuracy possible through correction curves.

Model 1001

PRECISION AC REGULATORS

(electronic).

Giving ultra-precise, $\pm$0.01% regulation, these instruments are rugged and serviceable, as proved by hundreds of applications in the field. Models available with capacities of 1000VA and 2500VA.

ELECTRICAL CHARACTERISTICS

Input	95-130 VAC, 1ϕ, 50 and 60 cycles.
Output	115 VAC, 1ϕ, adj. 110-120.
Reg. accuracy	$\pm$0.01% against line, $\pm$0.01% against load.
Distortion	3% maximum.
P.F. range	Unity to 0.7 lagging.
Load range	0 to full load.

Model 1000S

AC REGULATORS *(electronic).*

Utilizing the original Sorensen circuit and incorporating the *Safety Diode*, these regulators are noted for accuracy, economy of operation, easy maintenance. Models available with capacities from 150VA to 15KVA, single phase.

Models available (Numbers denote VA capacities) 150S, 250S, 500S, 1000S (-2S also), 2000S, 3000S (-2S also), 5000S (-2S also), 10000S (-2S also), 15000S (-2S also).

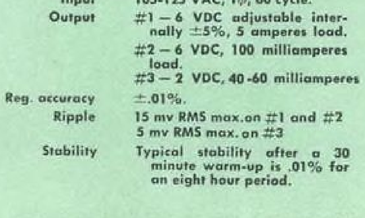
ELECTRICAL CHARACTERISTICS

Input	95-130 VAC, 1ϕ, 50 or 60 cycles $\pm$10%. 190-260 VAC in "-2S" models.
Output	115 VAC adj. 110-120; 230 VAC with "-2S" models.
Reg. accuracy	$\pm$0.1% against line, $\pm$0.1% against load.
P.F. range	Unity to 0.7 lagging.
Distortion	Varies to 3% max. under worst conditions.
Load range	0 to full load.

Model FL5015

FILTER SECTIONS FOR NOBATRONS

The ripple voltage of all Nobatrons is 1% of the nominal output voltage setting, under worst conditions. This is adequate for most applications. If, however, less ripple is required, Filter Sections are available for use with units rated up to 50 amperes, which will reduce the ripple to 0.1%.



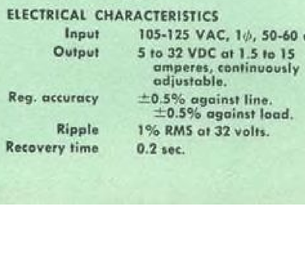
Model DE-28-10

400-CYCLE INPUT NOBATRONS

These instruments are not normal production items but are available on an extended delivery schedule.

ELECTRICAL CHARACTERISTICS

Output voltage and load range	Model DE-6-40 — 6 VDC at 4 to 40 amperes. Model DE-12-10 — 12 VDC at 1 to 10 amperes. Model DE-28-10 — 28 VDC at 1 to 10 amperes.
Input voltage	105-125 VAC, 1ϕ, 360-440 cycles.
Reg. accuracy	$\pm$0.25%.
Ripple	1% RMS maximum.
Recovery time	0.2 seconds.



HERMETICALLY SEALED & MILITARIZED REGULATORS

The wound components of many Sorensen instruments can be hermetically sealed by the Fosterite process or by standard potting. Sorensen also builds equipment to meet MIL-T-27 and JAN specifications on resistance to shock, vibration, humidity, etc., as well as to the new class H type high temperature design.

Sorensen

THE WORLD'S AUTHORITY ON REGULATED POWER

Whatever your power control requirements, for industry, military applications or research, Sorensen can furnish a unit which meets your specifications *exactly*. A wide variety of instruments available in a broad range of capacities. Sorensen offers unusual experience in the engineering and production of special equipment for unique regulation problems.

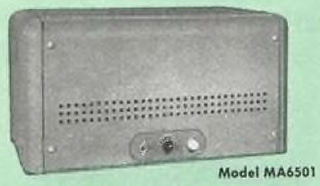
Model MA65

TUBELESS REGULATED DC SOURCES

Designed for heavy-duty industrial applications, these instruments utilize magnetic amplifier principles and offer the utmost in reliability.

ELECTRICAL CHARACTERISTICS

Model	MA65	MA640	MA2850
Input (VAC, 60~)	105-135, 1ϕ	105-125, 1ϕ	190-250, or 210-250, 3ϕ, 4-wire, wye.
Output (VDC)	5.4-6.6, adj.	4.5-7.7 adj.	23-32 adj.
Load range	0-5 amp.	0-40 amp.	0-50 amp.
Ripple	1% max.	1% max.	2% max.
Reg. accuracy	$\pm$0.2% against line or load	$\pm$ 1.0% for any combination of line and load.	
Recovery time	0.15 sec.	0.20 sec.	0.5 sec.



Model MA6501

PRECISION REGULATED TUBELESS DC SOURCE

A transistorized precision regulated DC source utilizing magnetic amplifier principles. This highly-stable, temperature-compensated unit is Sorensen's new design for use with the Beckman Model DU Spectrophotometer.

ELECTRICAL CHARACTERISTICS

Input	105-125 VAC, 1ϕ, 60 cycle.
Output	#1 — 6 VDC adjustable internally $\pm$5%, 5 amperes load. #2 — 6 VDC, 100 milliamperes load. #3 — 2 VDC, 40-60 milliamperes
Reg. accuracy	$\pm$.01%.
Ripple	15 mv RMS max.on #1 and #2 5 mv RMS max. on #3
Stability	Typical stability after a 30 minute warm-up is .01% for an eight hour period.

Model MR3215

MAGNETIC RANGER

(tubeless wide-range variable regulated DC source)

A rugged, tubeless DC source requiring negligible maintenance, the MR3215 is a highly versatile unit providing continuously adjustable output voltage.

ELECTRICAL CHARACTERISTICS

Input	105-125 VAC, 1ϕ, 50-60 cycles.
Output	5 to 32 VDC at 1.5 to 15 amperes, continuously adjustable.
Reg. accuracy	$\pm$0.5% against line. $\pm$0.5% against load.
Ripple	1% RMS at 32 volts.
Recovery time	0.2 sec.

Model D2500SAN

400-CYCLE AC REGULATORS

These instruments are available in models D250SAN, D500SAN, D1200SAN, D2500SAN (numbers 250, etc. denote VA capacities)

ELECTRICAL CHARACTERISTICS

Input	95-130 VAC, 1ϕ, 400 cycles $\pm$10%.
Output	115 VAC, 1ϕ, adj. 110-120.
Reg. accuracy	$\pm$0.25% against line, $\pm$0.25% against load
Distortion	5% maximum.
P.F. range	Unity to 0.7 lagging.
Load range	0 to full load.

Model MVR500

MVR's (magnetic voltage regulators).

These magnetic voltage regulators are tubeless, give utmost reliability with good regulation. Very compact, they are ideally suited for incorporation as components. Available in capacities of 15, 30, 60, 120, 250, and 500 VA. A 1000 VA model is in design. MVR's with 6.3, 12.5 and 230 volt outputs are also planned.

ELECTRICAL CHARACTERISTICS

Input	95-130 VAC, 1ϕ, 60 cycles.
Output	115 VAC nominal, 1ϕ.
Reg. accuracy	$\pm$0.5% against line.
Load range	0 to full load.

Model MA1000S

TUBELESS AC REGULATOR

For unattended installations requiring extremely dependable automatic line regulation, the tubeless MA1000S offers stable long-life performance with an absolute minimum of maintenance.

ELECTRICAL CHARACTERISTICS

Input	95-130 VAC, 1ϕ, 50 or 60 cycles.
Output	115 VAC, adj. 110-120 v.
Reg. accuracy	$\pm$0.5% against line. $\pm$0.5% against load.
P.F. range	Unity to 0.7 lagging.
Distortion	3% max. at 60 cycles.
Load range	0 to 1000 VA.

CONTROLLED POWER FOR RESEARCH AND INDUSTRY

400-CYCLE FREQUENCY CHANGERS

ELECTRICAL CHARACTERISTICS

Input	105-125 VAC, 1φ, 50-60 cycles for FCD250; 208 or 230 VAC ±10%, 1φ, 50-60 cycles for FCD1000.
Output voltage	115 VAC, adjustable 105-125 v.
Output freq.	320-1000 cps in two ranges for FCD250. 360-440 cps for FCD1000.
Regulation	Voltage — ±1%. Frequency — ±1% in standard models, ±0.01% with auxiliary frequency standard (fixed at 400 cycles).
Load range	0-250 VA for FCD250. 0-1000 VA for FCD1000.

Model FCD1000

FREQUENCY CONTROL

Sorensen electronic frequency changers convert 50 or 60 cycle line to 400 cycles regulated or 60 cycles regulated. These instruments have found manifold uses in laboratories, production lines and inspection sections.

60-CYCLE FREQUENCY CHANGER

(Model FC1000)

ELECTRICAL CHARACTERISTICS

Input	208 or 230 VAC, ±10%, 1φ, 50-60 cycles.
Output voltage	115 VAC, adjustable ±10%.
Output frequency	60 cycles, adjustable 45-65 cycles.
Reg. accuracy	Voltage — ±1.0%. Frequency — ±1.0% in standard model, ±0.01% with auxiliary frequency standard fixed at 50 or 60 cycles.
Capacity	0-1000 VA.

AIRBORNE ELECTRONIC FREQUENCY CHANGERS AND INVERTERS

Sorensen has designed and built a wide variety of frequency changers and inverters for incorporation in military aircraft. These instruments meet a great many different specifications and are not considered standard instruments. Each customer requirement is quoted on individually.

For the most part, the changers convert variable (320-1000~) input power to precision (±0.05%) output frequency. Most models are also voltage regulated (±1%) with minimum distortion (5-10%).

Sorensen airborne inverters are built to convert 28 VDC input to 400-cycle, 3-phase output, with output frequency accurate to 0.05% over wide ambients.

Sorensen's wide experience with commercial and military frequency changers may well supply the answer to your precision frequency problems. Your inquiries are earnestly solicited.

COAST-TO-COAST

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446 Broadway
Phone Sherman 2501

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Yewell Associates (Peter Lahana)
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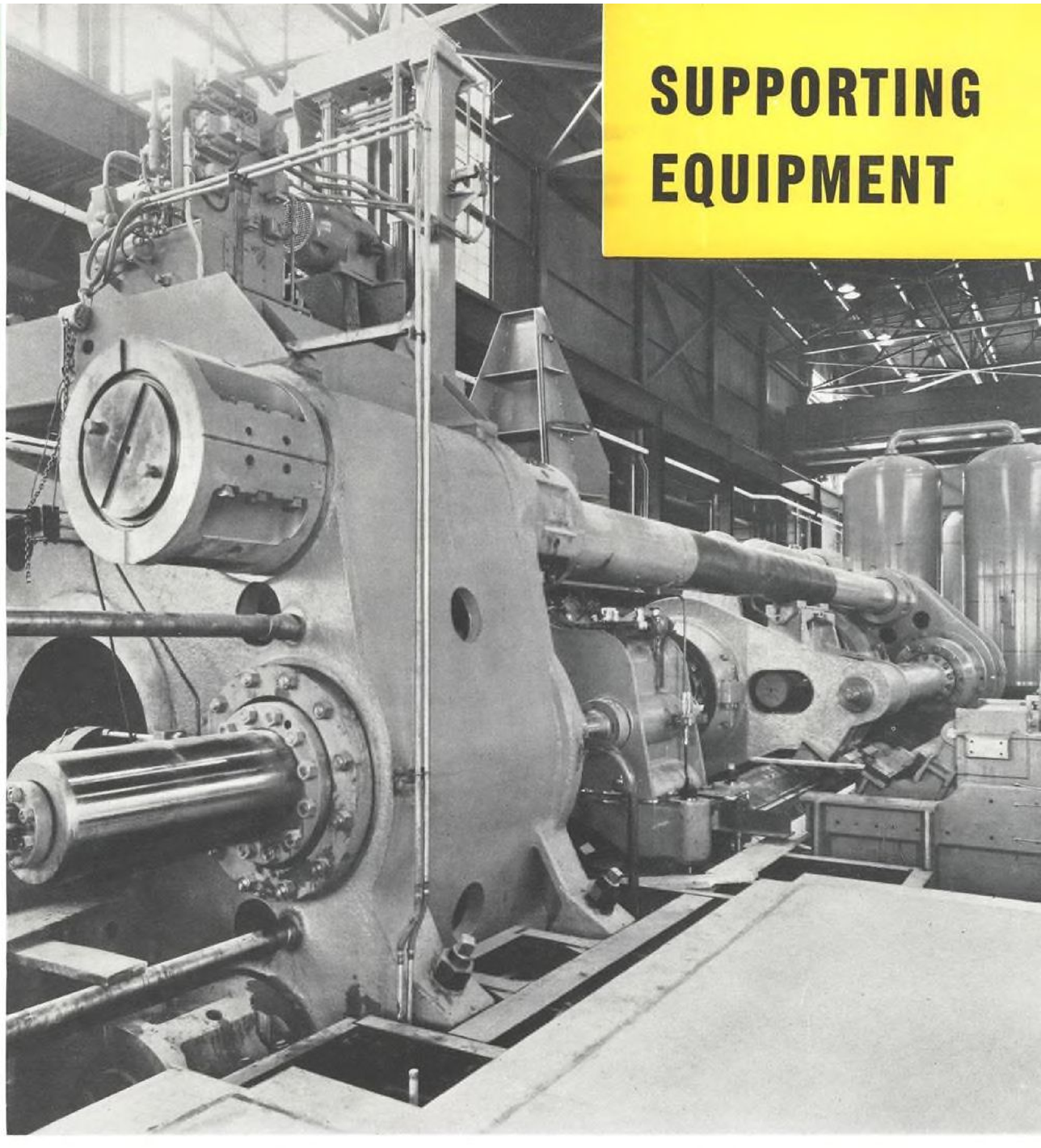

SUPPORTING EQUIPMENT

AVIATION WEEK

BUYERS' GUIDE

SECTION D

Weapons of the air are forged on the ground; they have their genesis on drawing boards, in billets of alloys and a myriad of hardware. The drinking fountain and the lift truck are important parts of weapon support.

Support Items Determine Weapon Value

The airframe is no longer the dominant component in the development and production of an aerial weapons system.

This is a complete reversal of the traditional concept where the actual airplane was the major end item of any manufacturer's program. Now in one typical missile system, 63 items of support equipment go into squadron service with the missile.

Design and production responsibility for those 63 items has been placed squarely in the lap of the prime contractor on the weapons system.

This subordination of the airframe to the supporting equipment has created a host of new problems. Greatest impact on the aircraft industry has been the awarding of missile prime contracts to non-aviation firms, who have added insult to injury by subcontracting the airframe to aircraft manufacturers. Thus several of the country's top plane builders have found themselves working for an electronics firm, an automobile manufacturer or a university.

Another major impact has been the realization of the aircraft manufacturer that when he took on a weapons system, he took on the production of trainers, technical manuals and transportation. "We started to build missiles, and wound up in the trailer business," was the complaint of one aircraft executive.

He made the comment while looking over an assembly floor along which stretched two parallel production lines. Down one moved a series of fixtures holding the brightly-painted missile airframes. Down the other stood an assortment of two- and four-wheeled vehicles: hooded wagons for field tool kits, mobile maintenance vans, ground-control and firing centers, and special transport trailers.

Each one of these items was a specific part of an overall weapon, and each was necessary to the successful operation of the system.

Missiles Are Typical

Follow a typical missile from the time it is delivered to an operational unit until it is launched toward the target.

It is off-loaded from train, plane or boat and transported by road to an assembly and inspection area. After assembly, it is checked out for operational functions.

The next stop is the storage area, where the missile is placed on a ready alert basis. Specific missions may require specific adjustments of the equipment.

Final fueling and attachment of the warhead are done in separated areas. The launching vehicle or transport then takes over and carries the missile to its takeoff point.

That operational sequence has required about 50 different pieces of equipment, divided into six general categories:

- **Handling,** for transporting the missile and moving it around storage, inspection and maintenance areas. There might be a separate handling vehicle or dolly for each of the major missile components, for a total of about six.
- **Checkout and test,** for the necessary functional proofs of missile systems operation. These might vary in number from one major all-purpose unit to a number of smaller pieces of equipment.
- **Training,** for the technical support of the firing crews. Missiles obviously aren't meant to be fired except on test sites and in the case of war. Field proficiency can be maintained by simulated or dry runs, using synthetic trainers developed particularly for the job.
- **Servicing,** for supplying hydraulic fluids, air under pressure, electrical power and other such needs during ground operations or pre-firing work.
- **Loading,** for fueling the missiles and installation of the warhead. Fueling will require a separate truck for each component, and probably another truck for pressurizing or supplying the propellant pump power source.
- **Launching,** for providing the initial firing site for the missile and in some cases, giving it its initial direction. Launchers have been designed as units combining transport, storage and other functions with that of the launcher.

Teaching School

The contractor has even further responsibilities under the weapons system concept. He can, in the broadest interpretation of the concept, suggest changes in the military service using the weapon. For example, he can recommend changes in squadron and battery organization, alter the number of specialist ratings required per missile unit, organize training courses for technical personnel.

After the weapon is in the field, there is another burning problem: should it be cycled through the usual field level and depot level maintenance routine? Under current USAF plans, separated prime depots have specific overhaul responsibilities: avionics at one, powerplant at another, airframe at a third.

Under the best interpretation of the weapons system concept, this is unacceptable. Repair and maintenance should be done under one roof. At least one systems contractor is now studying the many problems of organizing and operating a missile systems depot for the USAF.

Criticism of the service supply channels has also forced a second look at logistic support of field weapons systems. Such studies also fall within the broad framework of the systems concept, and active study of the problem is under way by at least two contractors.

More Than a Missile

The executive who said he started building missiles and wound up with trailers was, if anything, understating the case.

He could also wind up—before he is done—operating a supply and maintenance system, running a graduate school in propulsion and avionics, operating a technical school in maintenance, supplying an airlift for test personnel and vitally needed parts between the factory and the test center, publishing technical manuals, and administering a test range.

Thus the weapon he develops and produces is merely one part of the entire systems look. The half-hundred specialized mobile units that go along into battle to support one airplane or one missile have given a new dimension to the manifold problems of production.

The problems associated with the production of guided missile systems are typical for any air weapon. An interceptor, bomber or transport airplane is also only a part of an integrated unit which must be designed and built as an integrated unit.

But looking even deeper into the supporting equipment of weapons systems underlines the importance of even the smallest items. The fire that burns the factory of the only source of turbine blades stops production of every jet engine and the airplanes they power.

Knowledge of the interdependence of every item in the weapons system is the key to successful development.

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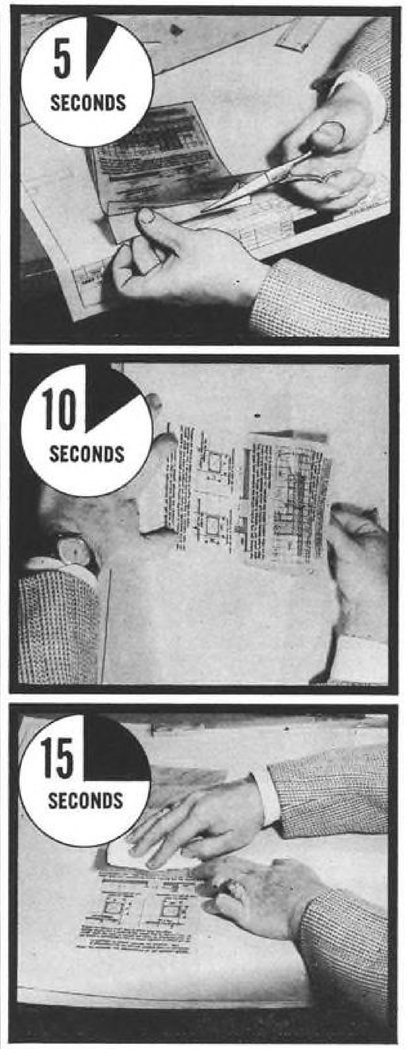

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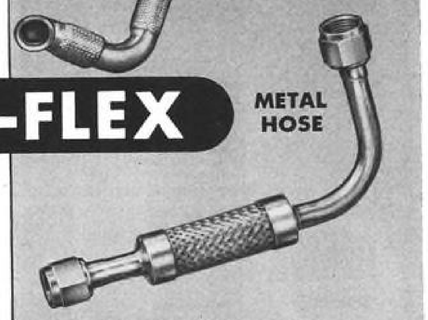
Spiral-flex is a helical type corrugated flexible metal hose of heat and corrosion resistant Stainless Steel for systems having a combination of high pressure and high temperature.



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*"Teflon" is the DuPont registered trade mark for its tetrafluoroethylene resin.

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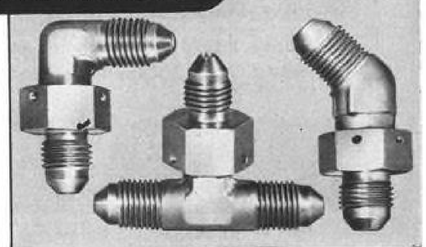

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DUNBAR KAPPLE Inc.

Batavia, Illinois

Phone: Batavia 5400
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McKay Co., 1005 Liberty Ave., Pittsburgh, Pa.
Metal Spinning Div., Phoenix Products Co., 4741 North 27th Street, Milwaukee 16, Wisc.
National Welding Equipment Co., 218 Fremont St., San Francisco, Calif.
Ruemelin Mfg. Co., 3915 North Palmer St., Milwaukee 12, Wisc.
Sciaky Bros., Inc., 4915 West 67 St., Chicago 38, Ill.
Standard Safety Equip. Co., 232 West Ontario St., Chicago 10, Ill.
Linde Air Products Co. Div., Union Carbide & Carbon Corp., 30 East 42nd St., New York 17, N. Y.
Unitek Corp., 275 No. Halstead Ave., Pasadena 8, Calif.
Utica Drop Forge & Tool Corp., Utica 4, N. Y.
Vacuum Tube Prods. Co., Inc., 506 South Cleveland St., Oceanside, Calif.

Welts

Schlegel Mfg. Co., 277 North Goodman St., Rochester 7, N. Y.

Wheel Balancing & Alignment Machines

Dean & Benson Res., Inc., 16 Richmond St., Clifton, N. J.
International Research & Devel. Corp., P. O. Box 1707, Columbus 16, Ohio

WIND TUNNEL

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American Diamond Saw Sales, 120 Northwest Ninth Ave., Portland 9, Ore.
Bay State Abrasive Products Co., 12 Union St., Westboro, Massachusetts
Behr-Manning Corp., 1356 Howe St., Troy, N. Y.
The Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Engis Equipment Co., 431 South Dearborn St., Chicago 5, Ill.
Hanson-Van Winkle-Munning Co., Church St., Matawan, N. J.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa.
Snap-On Tools Corp., 8020 28 Ave., Kenosha, Wisc.
United Buff Products Corp., 241 Oak St., Passaic, N. J.

Wicks

Amplex Div., Chrysler Corp., P. O. Box 2718, Detroit 31, Mich.
Auburn Mfg. Co., Middletown, Conn.
Dayton Aircraft Products, Inc., 812 North West First St., Ft. Lauderdale, Fla.
Trico Fuse Manufacturing Co., 2948 North 5th St., Milwaukee 12, Wisc.

Winches

All American Engineering Co., du Pont Airport, Wilmington, Del.
U. S. Gauge Div., American Machine & Metals, Inc., Sellersville, Pa.
Breeze Corporations, Inc., 700 Liberty Ave., Union, N. J.
Chicago Pneumatic Tool Co., 6 East 44 St., New York 17, N. Y.
Clyde Iron Works, Inc., Duluth, Minn.
Continental Can Co., 100 East 42 St., New York 17, N. Y.
Hyster Co., 2934 N. E. Clackamas St., Portland 8, Oregon
Fabricating Div., Kaiser Steel Corp., 7301 Telegraph Rd., Los Angeles 22, Calif.
Mercer-Robinson Co., 30 Church St., New York 7, N. Y.
Robbins & Myers, Inc., 1345 Lagonda Ave., Springfield, Ohio
Steel Products Engr. Co., 1205 West Columbia St., Springfield, Ohio
Talley Machine & Manufacturing Corp., 3525 East 16th St., Los Angeles 23, Calif.

Wind Tunnel Equipment

Aero Research Instrument Co., 1040 W. Grand Ave., Chicago, Ill.
Contour Co., 3162 North Rosenhead Blvd., Rosemead, Calif.
The Gaertner Scientific Corp., 1201 Wrightwood Ave., Chicago 14, Ill.
G. M. GIANNINI & CO., INC., 918 East Green St., Pasadena, Calif.
Fabricating Div., Kaiser Steel Corp., 7301 Telegraph Rd., Los Angeles 22, Calif.
Leeds & Northrup, 4970 Stenton Ave., Philadelphia 44, Pa.
John Mohr & Sons, Vacuum Process Div., 3200 E. 96th St., Chicago 17, Ill.
A. O. Smith Corp., 3533 North 27th St., Milwaukee 10, Wisc.
Roland Teiner Co., Inc., 134 Tremont St., Everett, Mass.

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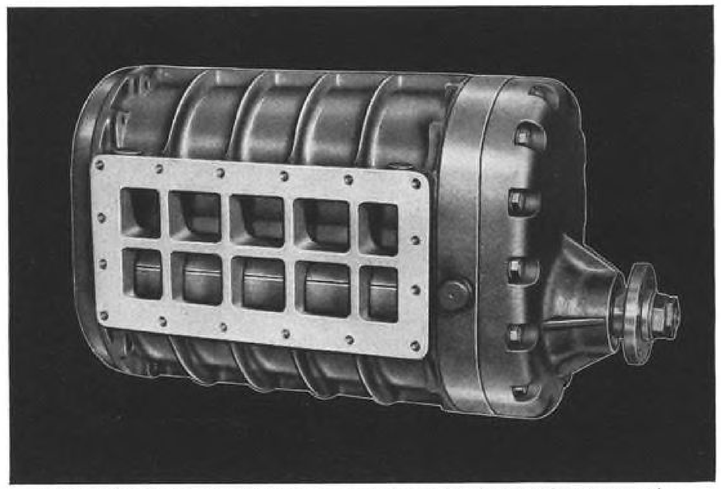

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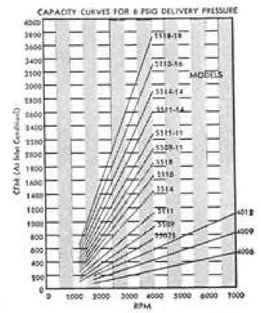

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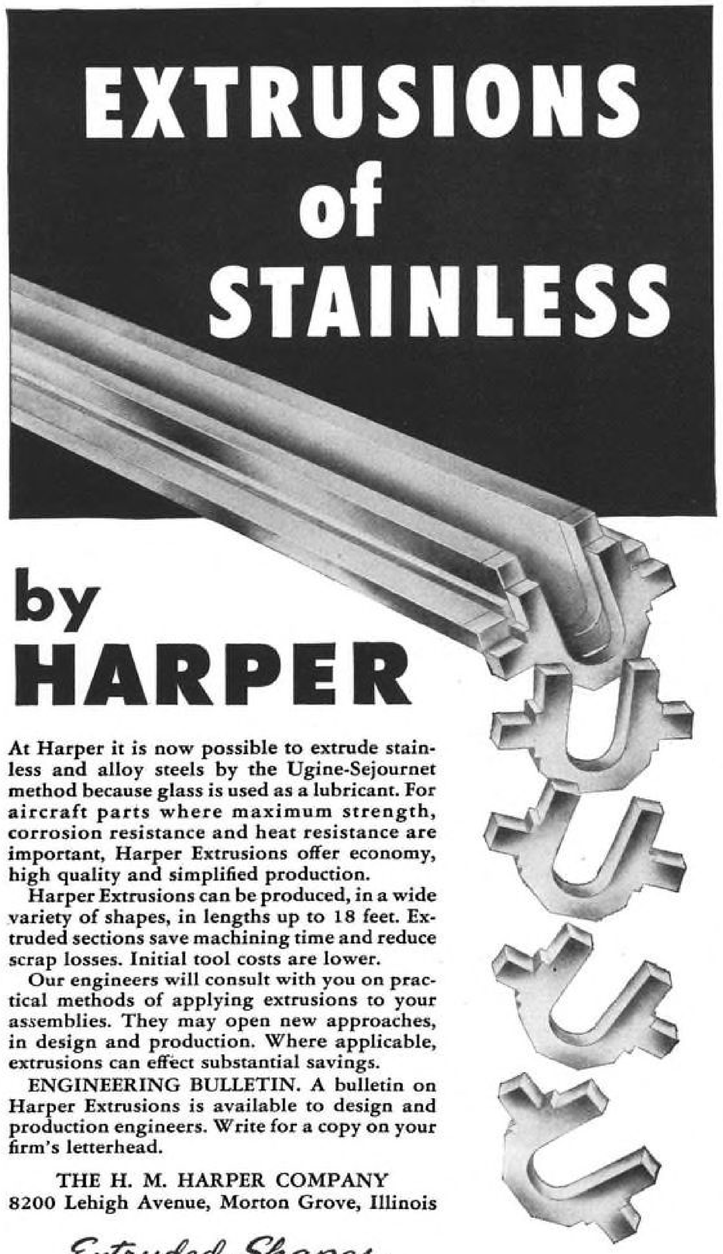
EXTRUSIONS of STAINLESS by HARPER



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Tinsley Labs., Inc., 2526 Grove St., Berkeley 4, Calif.
Topp Industries, Inc., 5255 West 102 St., Los Angeles 45, Calif.
W. S. Tyler Co., 3615 Superior Ave., Cleveland 14, Ohio
WESTINGHOUSE ELECTRIC CORP., P. O. Box 868, Pittsburgh 30, Pa.

Windows

Aircraft Components Inc., 755 Woodland Ave., Benton Harbor, Mich.
Aviaparts, Inc., P. O. Box 65, Miami 48, Fla.
DUMONT AVIATION ASSOCIATES, 1401 Freeman Ave., P. O. Box 4087, Long Beach 4, Calif.
Emerson Plastics Corp., 567 Third Ave., New York 16, N. Y.
Executive Aircraft Service, P. O. Box 7307, Dallas 9, Tex.
Aircraft Finishes Div., W. P. Fuller & Co., 222 North Ave. 23, Los Angeles 54, Calif.
Homalite Corp., 11-13 Brookside Dr., Wilmington 166, Del.
THE KAWNEER CO., Niles, Mich.
LEAR, INC., 3171 S. Bundy Drive, Santa Monica, Calif.
Luria-Cournand, Inc., Box 177, Havre de Grace, Md.
Modern Plastics, 2850 Northwest 40 St., Miami 42, Fla.
Pacific Optical Corp., 5965 West 98 St., Los Angeles 45, Calif.
Rawdon Bros. Aircraft, Inc., Wichita, Kansas
Swedlow Plastics Co., 6986 Bandini Blvd., Los Angeles 22, Calif.
Wesmont Manufacturers Corp., 222-228 West Oraange Grove Ave., Burbank, Calif.

Windshields

Aircraft Components Inc., 755 Woodland Ave., Benton Harbor, Mich.
Aviaparts, Inc., P. O. Box 65, Miami 48, Fla.
BRUNSWICK BALKE COLLENDER CO., 623 S. Wabash Ave., Chicago, Ill.
Cooper Industries, Inc., 3722 West North Ave., Chicago 39, Ill.
DUMONT AVIATION ASSOCIATES, 1401 Freeman Ave., P. O. Box 4087, Long Beach 4, Calif.
Executive Aircraft Service, P. O. Box 7307, Dallas 9, Tex.
Aircraft Finishes Div., W. P. Fuller Co., 222 North Ave. 23, Los Angeles 54, Calif.
Homalite Corp., 11-13 Brookside Dr., Wilmington 166, Del.
THE KAWNEER CO., Niles, Mich.
LEAR, INC., 3171 S. Bundy Drive, Santa Monica, Calif.
Luria-Cournand, Inc., Box 177, Havre de Grace, Md.
Modern Plastics, 2850 Northwest 40 St., Miami 42, Fla.
Northwestern Aeronautical Co., Holman Field, St. Paul 1, Minn.
Rawdon Bros. Aircraft, Inc., Wichita, Kansas
Safetee Glass Co., 4717 Stenton Ave., Philadelphia 44, Pa.
Swedlow Plastics Co., 6986 Bandini Blvd., Los Angeles 22, Calif.
Eastern Div., Van Dusen Aircraft Supplies, Teterboro, N. J.
Wesmont Manufacturers Corp., 222-228 West Oraange Grove Ave., Burbank, Calif.

WIRE, COPPER

Wire, Brass

Air Parts, Inc., 723 Sonora Ave., Glendale 1, Calif.
Bond Metal Co., 321 Canal St., New York, N. Y.
Boston Insulated Wire & Cable Co., 65 Bay St., Dorchester 25, Mass.
Metals & Minerals Div., Bram Chemical Co., 820 65th Ave., Philadelphia 26, Pa.
Chase Brass & Copper Co., 236 Grand St., Waterbury, Conn.
Cooper Industries, Inc., 3722 West North Ave., Chicago 39, Ill.
Mill Products, Bridgeport Brass Co., Bridgeport, Conn.
Scovill Mfg. Co., 99 Mill St., Waterbury 20, Conn.
Customer Service Div., Titan Metal Mfg. Co., Bellefonte, Pa.
Eastern Div., Van Dusen Aircraft Supplies, Teterboro, N. J.

Wire, Ceramic Insulated

Aero Research Instrument Co., 1040 W. Grand Ave., Chicago, Ill.
CONAX CORP., 7811 Sheridan Dr., Buffalo 21, N. Y.
Sprague Electric Co., North Adams, Massachusetts
Thermo Electric Co., Inc., 109 5th St., Saddle River Township, Rochelle Park P. O., N. J.

Wire, Copper

Acme Wire Co., New Haven 14, Conn.
Belden Mfg. Co., 4673 West Van Buren St., Chicago, Ill.
Berkshire Electric Cable Co., Main St., Leeds, Mass.
BIRNBUCH RADIO CO., INC., 145 Hudson Street, New York 13, N. Y.
Bond Metal Co., 321 Canal St., New York, N. Y.
Boston Insulated Wire & Cable Co., 65 Bay St., Dorchester 25, Mass.
Metals & Minerals Div., Bram Chemical Co., 820 65th Ave., Philadelphia 26, Pa.
Chase Brass & Copper Co., 236 Grand St., Waterbury, Conn.
Chester Cable Corp., Chester, N. Y.
John A. Roebling's Sons Co. Div., Colorado Fuel & Iron Corp., 640 S. Broad St., Trenton 2, N. J.
Wickwire-Spencer Div., Colorado Fuel & Iron, 575 Madison Ave., New York, N. Y.
Wire & Cable Div., Copperweld Steel Co., 1000 Monongahela Ave., Glassport, Pa.
Diamond Wire & Cable Co., 445 Park Ave., Sycamore, Ill.
THE ELECTRIC AUTO-LITE CO., Champlain & Mulberry Sts., Toledo, Ohio
General Cable Corp., 420 Lexington Ave., New York 17, N. Y.
Robert L. Hall Co., Air Ignition Div., 3318 West Burbank Blvd., Burbank, Calif.
Lewis Engineering Co., 52 Rubber Ave., Naugatuck, Conn.
Mill Products, Bridgeport Brass Co., Bridgeport, Conn.
Milo Radio & Electronics Corp., 200 Greenwich St., New York 7, N. Y.
National Electric Prods. Corp., 140 Stanwix St., Pittsburgh 22, Pa.
National Wire & Cable Corp., 136 San Fernando Rd., Los Angeles 31, Calif.
New England Electrical Works, Inc., 365 Main St., Lisbon, N. H.
Packard Elec. Div., General Motors Corp., Warren, Ohio
Rea Magnet Wire Co., Inc., 3610 East Pontiac St., Ft. Wayne 4, Ind.
Rome Cable Corp., Ridge St., Rome, N. Y.
Scovill Mfg. Co., 99 Mill St., Waterbury 20, Conn.
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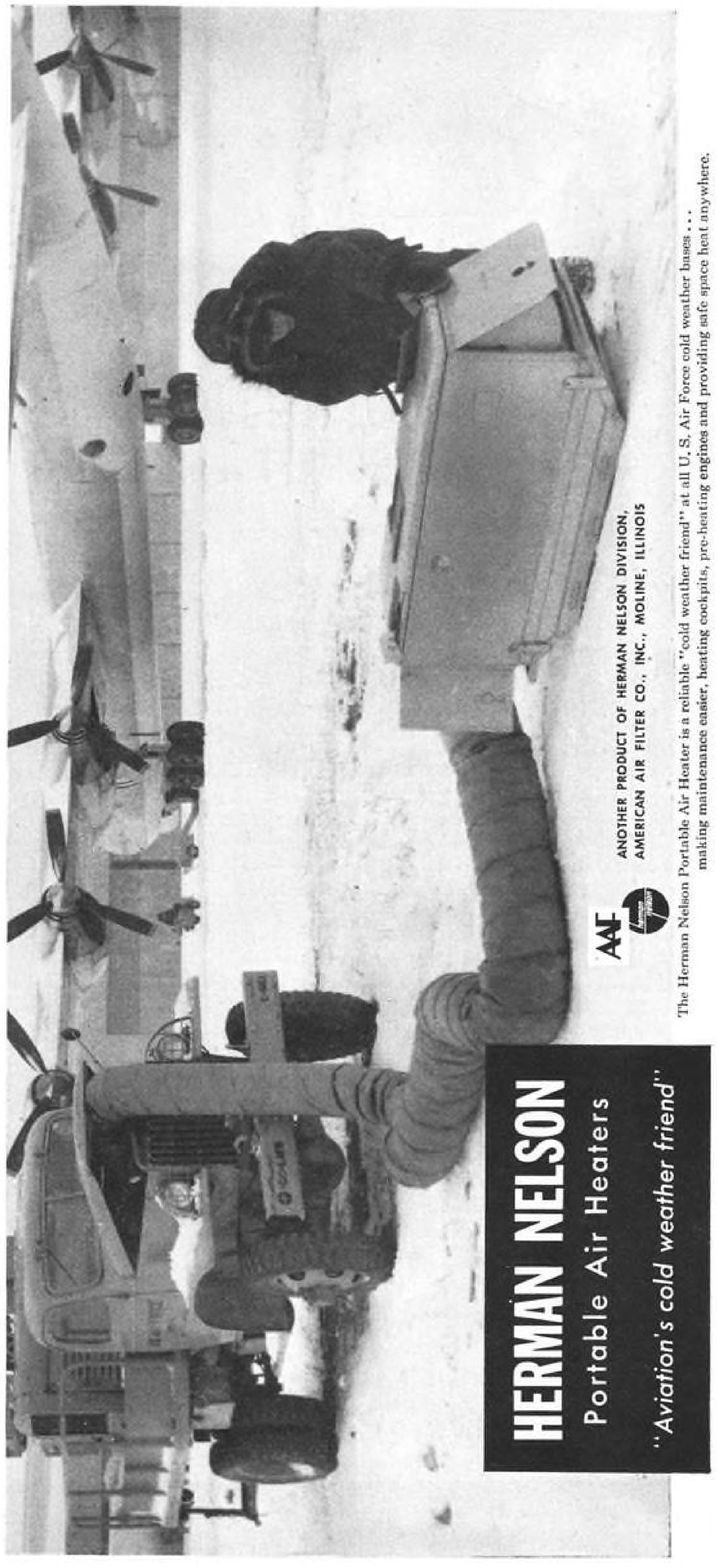

WIRE, COPPER

Suprenant Mfg. Co., 199 Washington St., Boston 8, Mass.
WARREN WIRE CO., Pownal, Vermont
Whitaker Cable Corporation, 1301 Burlington Ave., North Kansas City 16, Missouri
Eastern Div., Van Dusen Aircraft Supplies, Teterboro, N. J.

Wire, Lead & Tin

Berkshire Electric Cable Co., Main St., Leeds, Mass.
Chester Cable Corp., Chester, N. Y.
Division Lead Co., 7742 West 61st Place, Summit, Ill.
Robert L. Hall Co., Air Ignition Div., 3318 West Burbank Blvd., Burbank, Calif.
National Electric Prods. Corp., 140 Stanwix St., Pittsburgh 22, Pa.
Rome Cable Corp., Ridge St., Rome, N. Y.

Wire, Locking

National Standard Co., Niles, Mich.

Wire, Nickel

Bond Metal Co., 321 Canal St., New York, N. Y.
Boston Insulated Wire & Cable Co., 65 Bay St., Dorchester 25, Mass.
Metals & Minerals Div., Bram Chemical Co., 820 65th Ave., Philadelphia 26, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Sq., Pittsburgh 30, Pa.
Driver-Harris Co., 201 Middlesex St., Harrison, N. J.
Wilbur B. Driver Co., 150 Riverside Ave., Newark, N. J.
The International Nickel Co., Inc., 67 Wall St., New York 5, N. Y.
Lewis Engineering Co., 52 Rubber Ave., Naugatuck, Conn.
Sylvania Electric Products, Inc., 1740 Broadway, New York 19, N. Y.
Thermo Electric Co., Inc., 109 5th St., Saddle River Township, Rochelle Park P. O., N. J.

Wire, Piano

Wickwire-Spencer Div., Colorado Fuel & Iron, 575 Madison Ave., New York, N. Y.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Sq., Pittsburgh 30, Pa.
National Standard Co., Niles, Mich.

Wire, Precious Metal

Industrial Div., J. M. Ney Co., 71 Elm St., Hartford, Conn.

Wire, Stainless Steel

Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, Pa.
Bond Metal Co., 321 Canal St., New York, N. Y.
Boston Insulated Wire & Cable Co., 65 Bay Ct., Dorchester 25, Mass.
Carpenter Steel Co., 128 West Bern St., Reading, Pa.
Chase Brass & Copper Co., 236 Grand St., Waterbury, Conn.
Chester Cable Corp., Chester, N. Y.
Wickwire-Spencer Div., Colorado Fuel & Iron, 575 Madison Ave., New York, N. Y.
Elgin Watch Co., Elgin, Ill.
Cooper Industries, Inc., 3722 West North Ave., Chicago 39, Ill.

WIRE, MISCELLANEOUS

Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Sq.. Pittsburgh 30, Pa.
Driver-Harris Co., 201 Middlesex St., Harrison, N. J.
Wilbur B. Driver Co., 150 Riverside Ave., Newark, N. J.
Lewis Engineering Co., 52 Rubber Ave., Naugatuck, Conn.
MacWhyte Company, 2905 Fourteenth Ave., Kenosha, Wisc.
National Standard Co., Niles, Mich.
Republic Steel Corp., Republic Bldg., Cleveland, Ohio
Joseph T. Ryerson & Son, Inc., 16 & Rockwell Sts., P. O. Box 8000A, Chicago 80, Ill.
Sylvania Electric Products, Inc., 1740 Broadway, New York 19, N. Y.
Eastern Div., Van Dusen Aircraft Supplies, Teterboro, N. J.
E. R. Wagner Mfg. Company, 4611 North 32nd St., Milwaukee 16, Wisc.

Wire, Steel

Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 128 West Bern St., Reading, Pennsylvania
John A. Roebling's Sons Co., Div., Colorado Fuel & Iron Corp., 640 S. Broad St., Trenton 2, N. J.
Wickwire-Spencer Div., Colorado Fuel & Iron, 575 Madison Ave., New York, N. Y.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Sq., Pittsburgh 30, Pa.
Dayton Aircraft Products, Inc., 812 North West First St., Ft. Lauderdale, Fla.
Robert L. Hall Co., Air Ingnition Div., 3318 West Burbank Blvd., Burbank, Calif.
MacWhyte Company, 2905 Fourteenth Ave., Kenosha, Wisc.
National Standard Co., Niles, Mich.
Republic Steel Corp., Republic Bldg., Cleveland, Ohio
Joseph T. Ryerson & Son, Inc., 16 & Rockwell Sts., P. O. Box 8000A, Chicago 80, Ill.
The Youngstown Sheet & Tube Co., Youngstown 1, Ohio
Ziegler Steel Service Corp., 7022 Baldini Blvd., Los Angeles 22, Calif.

Wire, Stitching

Acme Steel Co., 2840 Archer Ave., Chicago 8, Ill.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Sq., Pittsburgh 30, Pa.
National Standard Co., Niles, Mich.

Wire, Miscellaneous

American Electric Cable Co., 181 Appleton St., Holyoke, Mass.
Boston Insulated Wire & Cable Co., 65 Bay St., Dorchester 25, Mass.
Dielectric Materials Co., 5315-7 North Ravenswood Ave., Chicago 40, Ill.
National Standard Co., Niles, Mich.
Plastoid Corp., 42-61 24th St., Long Island City 1, N. Y.
Arklay S. Richards Co., Inc., 104 Winchester St., Newton Highlands 61, Mass.
Rockbestos Products Corp., 285 Nicoll St., New Haven 4, Conn.
Secon Metals Corp., 7 Intervale St., White Plains, New York
Suprenant Mfg. Co., 199 Washington St., Boston 8, Mass.
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Wire, Aluminum

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Bond Metal Co., 321 Canal St., New York, N. Y.
Boston Insulated Wire & Cable Co., 65 Bay St., Dorcester 25, Mass.
Colonial Alloys, Ridge Ave. & Crawford, Philadelphia, Pa.

Wood

Aero Supply & Equipment Co., 3041-43 Fairfax Rd., Fairfax Municipal Airport, Kansas City, Kan.
Keller Products, Inc., 41 Union St., Manchester, N. H.
Mercer-Robinson Co., 30 Church St., New York 7, N. Y.

Wrenches

Aircraft Mechanics Inc., 3200 North Nevada St., Colorado Springs, Colo.
Airdraulics Engineering, Inc., New Canaan, Conn.
Allen Mfg. Co., Drawer 570, 131 Sheldon St., Hartford 2, Conn.
Associated Co., Inc., 1211 East Douglas Ave., Wichita 7, Kans.
Auburn Spark Plug Co., Inc., York St., Auburn, N. Y.
Buckeye Tools Co., 5005 Springboro Pike, Dayton 9, Ohio
BUFFALO METAL CONTAINER CORP., 35 Roetzer St., Buffalo 11, N. Y.
Special Products Div., Capewall Manufacturing Co., 60 Governor St., Hartford 2, Connecticut
Chicago Pneumatic Tool Co., 6 East 44 St., New York 17, N. Y.
Duro Metal Products Company, 2649 North Kildare Ave., Chicago 39, Ill.
Gabb Special Products, Windsor Locks, Conn.
Genex, P. O. Box 665, Sun Valley, Calif.
Greene, Tweed & Co., North Wales, Pa.
Ingersoll-Rand Co., 11 Broadway, New York, N. Y.
Jo Line Tools, Inc., 8442 Otis St., South Gate 1, Calif.
Kell-Strom Tool Company, 214 Church Street, Wethersfield, Conn.
Lapeer Mfg. Co., 1144 West Baltimore, Detroit, Mich.
Tools Div., New Britain Mach. Co., East St. & South St., New Britain, Conn.
Owatonna Tool Co., 450 North Cedar St., Owatonna, Minnesota
Proto Tools, 2209 Santa Fe Ave., Los Angeles 54, Calif.
Richmont, Inc., 922 South Myrtle Ave., Monrovia, Calif.
Roddick Tool Co., 1023 Pauline St., Anaheim, Calif.
Snap-On Tools Corp., 8020 28 Ave., Konasha, Wisc.
Utica Drop Forge & Tool Corp., Utica 4, N. Y.
J. H. Williams & Co., 400 Vulcan St., Buffalo 7, N. Y.

Yokes, Cable & Wire

All-American Aircraft Prodt. Inc., 1311 West Pacific Coast Highway, Harbor City, Calif.
Associated Co., Inc., 1211 East Douglas Ave., Wichita 7, Kans.
F. W. Sickles Div., General Instrument Corp., 165 Front St., Chicopee, Mass.
Kickhaefer Manufacturing Co., 901-03 Second St., Milwaukee 4, Wis.
DOUGLAS ROESCH, INC., 2200 So. Figueroa Street, Los Angeles 7, California
Taffet Radio & Television Co., 2530 Belmont Ave., Bronx 58, N. Y.

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Avia. Div. Federated Metals Div., American Smelting & Refining Co., 120 Broadway, New York, N. Y.
Belmont Smelting & Refining Works Inc., 330 Belmont Ave., Brooklyn 7, N. Y.
Eagle-Picher Co., American Bldg., Cincinnati 1, Ohio
Mkt. Development Div., New Jersey Zinc Co., 160 Front St., New York 38, N. Y.
Rigidized Metals Corp., 650 Ohio St., Buffalo 3, N. Y.
Roovers Bros., Inc., 3611 14th Ave., Brooklyn 18, N. Y.
M. Seligman Co., 1949 North Clybourn Ave., Chicago 14, Ill.

Zippers

The B. F. Goodrich Co., 500 South Main St., Akron 18, Ohio
Grieff Brothers, 518 Broadway, New York, N. Y.
National Parachute Loft, Inc., Washington National Airport, Hangar 8, Washington 1, D. C.
Scovill Mfg. Co., 99 Mill St., Waterbury 20, Conn.

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Belmont Smelting & Refining Works Inc., 330 Belmont Ave., Brooklyn 7, N. Y.
Metals & Minerals Div., Bram Chemical Co., 820 65th Ave., Philadelphia 26, Pa.
The Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Sq., Pittsburgh 30, Pa.
Metals & Controls Corp., Attleboro, Mass.
Rigidized Metals Corp., 650 Ohio St., Buffalo 3, N. Y.

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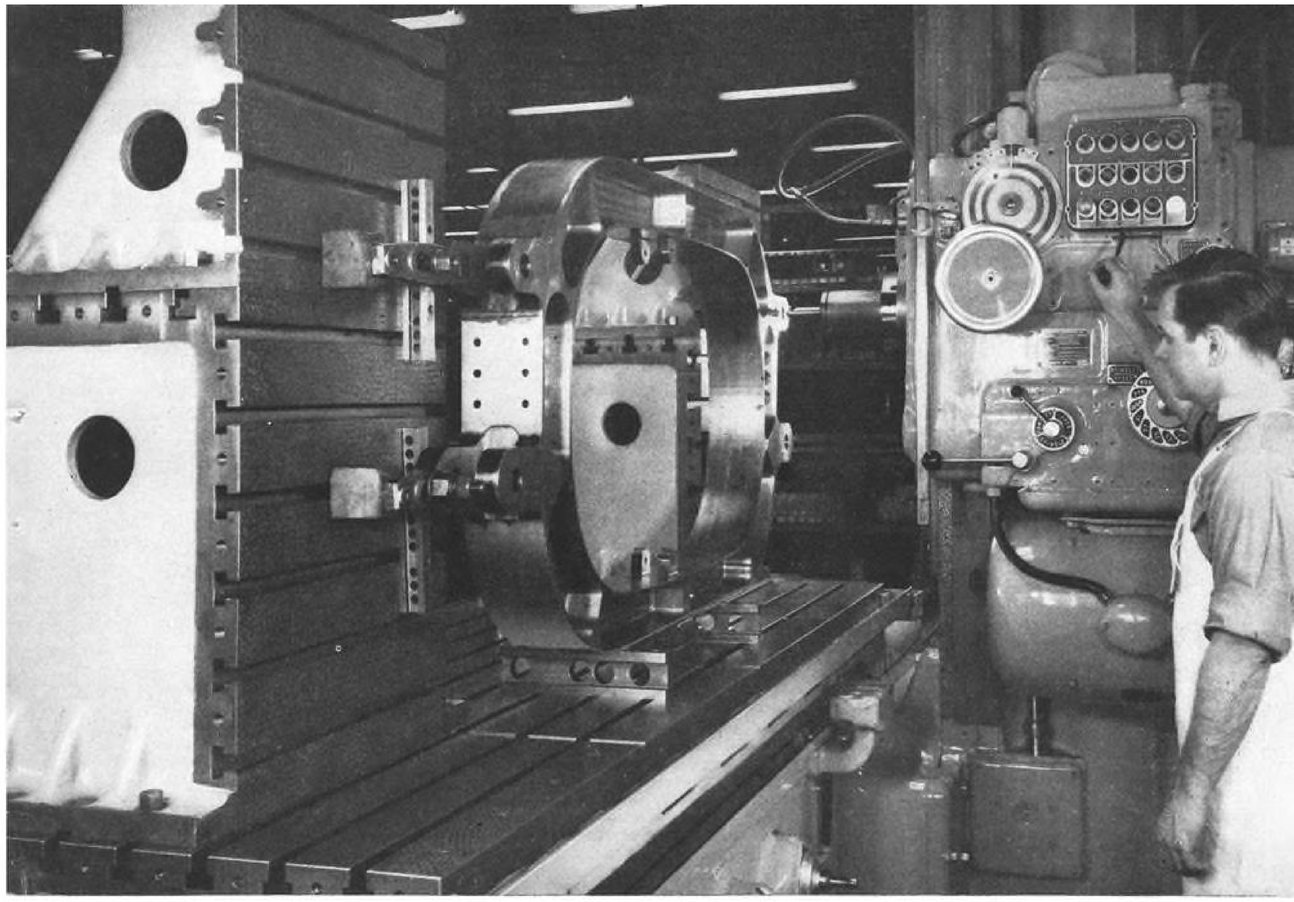

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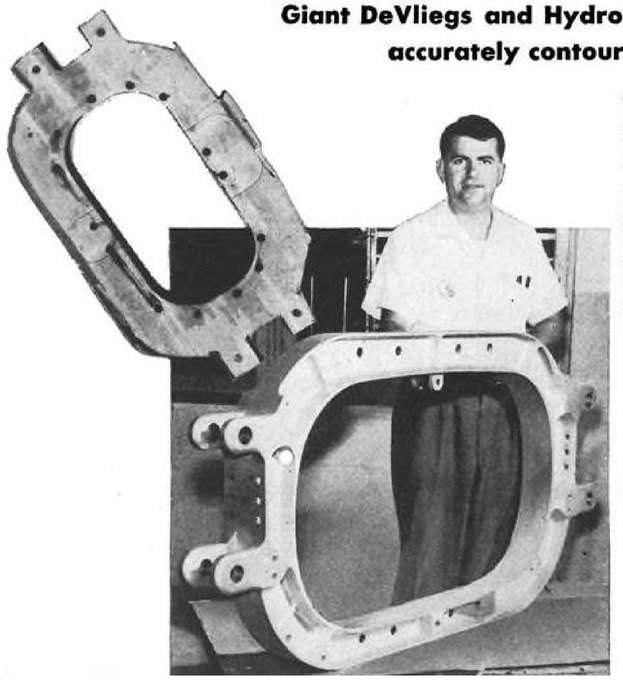

This massive 2,800 lb. tough steel billet, which was contour-precision-milled to 310 lbs. is an example of the difficult assignments that are almost daily routine at Orenduff & Kappel, Inc. We specialize in the precision machining of aircraft castings and forgings—huge or tiny—steel, aluminum or titanium. Inquire about us at any leading airframe manufacturer in the U.S.A., then ask us. Write for a free copy of our Facilities Brochure and get a picture of the engineering, tool designing and machining facilities of Orenduff & Kappel, Inc. Let us help you solve your critical aircraft machining problems.

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Davies for RECORDING, REPRODUCING and ANALYZING EQUIPMENT

STANDARD HEADS

Series	Gap Width	Track Width	Track C. to C.	L mh.	Maximum Number of Tracks for Various Tape Widths ¼"	½"	¾"	1"	1¼"	1½"	1¾"	2"
700A	.00025	.055	.140	70	2	4	5	7	9	11	13	14
800A	.00025	.040	.125	50	2	4	6	8	10	12	14	16
1000A	.00025	.040	.100	50	3	5	8	10	13	15	18	20
1300A	.00025	.026	.078	20	3	6	10	13	16	19	22	26
1400A	.00025	.040	.072	30	3	7	10	14	17	21	24	28
1600A	.00025	.026	.062	20	4	8	12	16	20	24	28	32
2100A	.00025	.026	.047	20	5	10	16	21	26	32	37	42

Precision multi-track instrumentation heads, developed to meet the rigid standards set for our equipment; gaps precisely in line (within 0.3 mil, 7½ microns), fully shielded for negligible cross-talk (except 2100 series digital head), completely encapsulated in thermosetting resin, high resolution. Table shows wide range of track widths and spacings available—special modifications can be furnished at little or no additional cost. Bulletin 55-B gives complete details.

PORTABLE RECORDERS

Data recorders for all airborne, mobile, and other applications subject to extreme environmental conditions; will withstand and record under vibration, shock, temperature extremes, and high altitude. Operation from 12 or 24 volts DC and/or 115 volts 400 cps. Self-contained units incorporating all electric recording circuitry, or separate tape transports and electronic unit housings. Miniature 7" cube recorder (left) handles six channels, records for one hour at 1½ inches per sec. Larger units provide for longer times or higher speeds, furnish more data channels. Plug-in and unitized assembly design provides extreme flexibility, permits easy modification of characteristics in field. Tape speeds—1½ to 30 inches per second standard, others on special order. Direct recording, FM carrier, PWM, or digital pulse. Provision for Davies perfected wow and flutter compensation in all units. Bulletin 54-D covers the larger recorders, 54-E the miniature unit.

REPRODUCERS and LABORATORY RECORDERS

Provide all facilities for laboratory recording of data by any available technique, plus reproduction of tapes made on our portable recorders. Davies perfected wow and flutter compensation gives unparalleled data reproduction accuracy in FM carrier systems; Speed Control Servo accurately reproduces recorded frequencies with tapes made on portable recorders. Equipment is specifically designed for data and instrumentation work, not audio. Playback amplifiers for direct recorded, PWM, or digital signals, high stability discriminators for FM carrier systems. Tape speeds 0.3 to 30 inches per second standard, others on special order. Two, four, and six speed transports available—speed selection by panel switch—100 to 1 speed range. Unitized assemblies and plug-in components for maximum flexibility, particularly with respect to tape speed changes. Systems available completely assembled and wired in standard relay racks—console assemblies on special order. Bulletin 54-D gives more specific information. We shall be glad to quote on your requirements.

AUTOMATIC WAVE ANALYZER

Heterodyne type analyzer provides completely automatic fourier analysis (amplitude versus frequency) of vibration, seismic, power line, transient, noise, shock, and similar data. When necessary, an amplitude versus time plot for a given frequency can be obtained. Suited for operation from any source supplying a repetitive signal, such as a magnetic tape loop. Frequency range 3 to 2000 cps., variable bandwidth ½ to 45 cps, amplitude accuracy ±5% of reading on logarithmic scale, frequency accuracy ½% of reading, output voltage range 60 db, input impedance 2½ megohms. Analysis recorded, and up to 14 inputs can be handled and selected automatically.

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Equipment meeting the needs of a particular application can be designed and manufactured to order. Inquiries are invited.

FOR INFORMATION ON PRODUCTS LISTED BELOW, WRITE FOR BULLETINS:

- Recording Amplifiers—Bulletin 54-D, Bulletin 108
- Crystal Oscillators—Bulletins 106 and 107
- Frequency-Modulated Oscillators—Bulletins 103, 104, 105
- FM Discriminators—Bulletin 113

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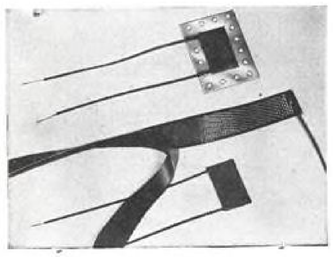

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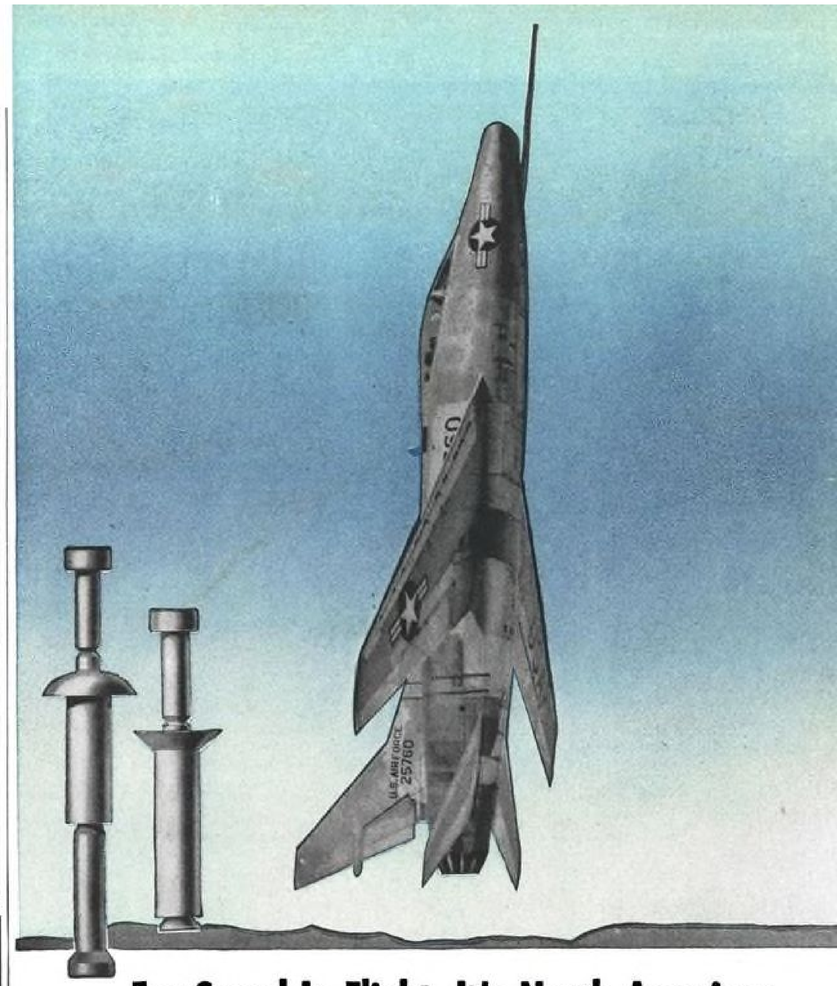

For Speed In Flight, It's North American—
For Quality In Fasteners, It's CHERRY RIVETS

The supersonic record holder pictured above, the North American F-100 Super Sabre is capable of supersonic speeds in level or climbing flight. Recently an Air Force Super Sabre set the world's first official supersonic speed record of 822.135 miles per hour.

Personnel at North American is justly proud of this achievement. Likewise, Townsend Company is pleased that the blind rivets produced in its Cherry Rivet Division plant at Santa Ana, California get a modest share of the credit for this performance.

The thousands of Cherry Rivets used in the F-100 made it possible to accomplish fastenings which otherwise would have been difficult or impracticable. This contributed to the sleek, ultra-streamlining and was also a factor in reducing weight.

The consistently reliable quality of Cherry Rivets is maintained through extensive control of every step in the manufacturing process in the Santa Ana plant which is devoted exclusively to production of aircraft material. That is why the aircraft industry depends upon Cherry Rivets to achieve better design, speed production and reduce unit costs. A special bulletin describing the wide variety of types and sizes available is yours for the asking. Write today.

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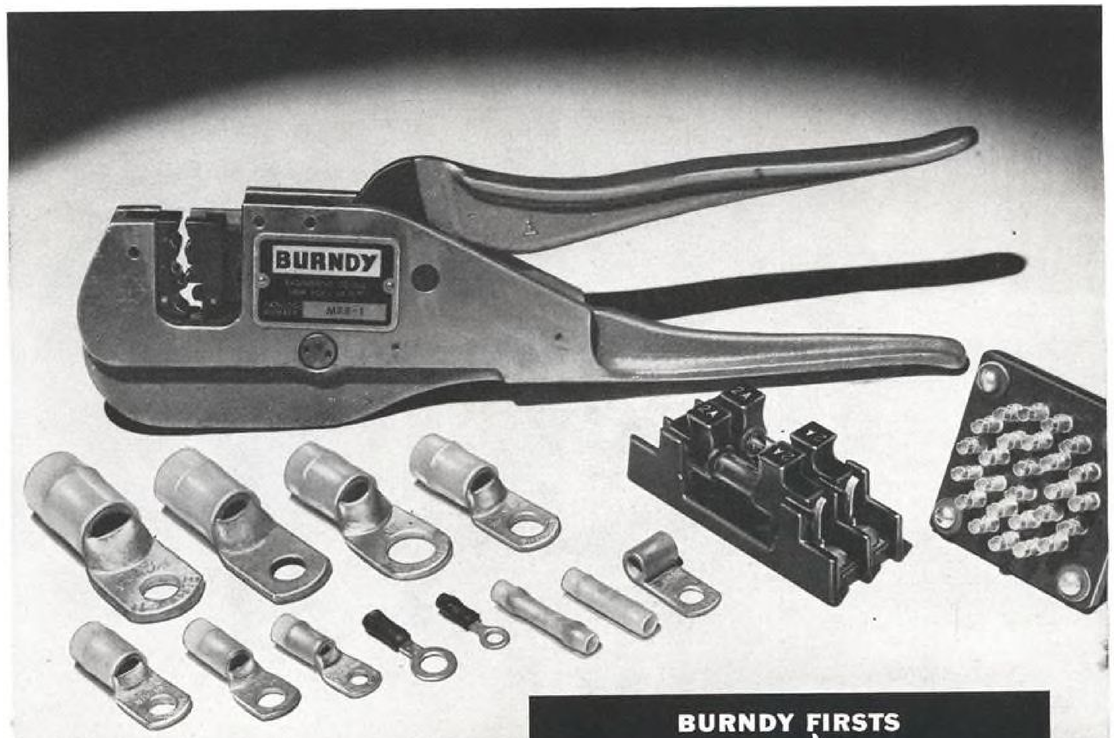

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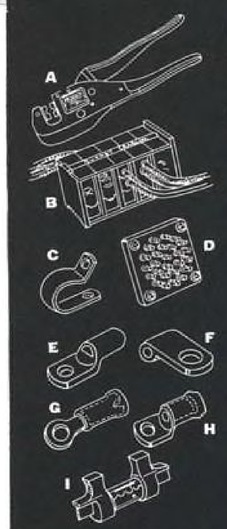
TOMORROW — Products now under development at Burndy will help make future planes still faster, lighter, safer.

BURNDY FIRSTS



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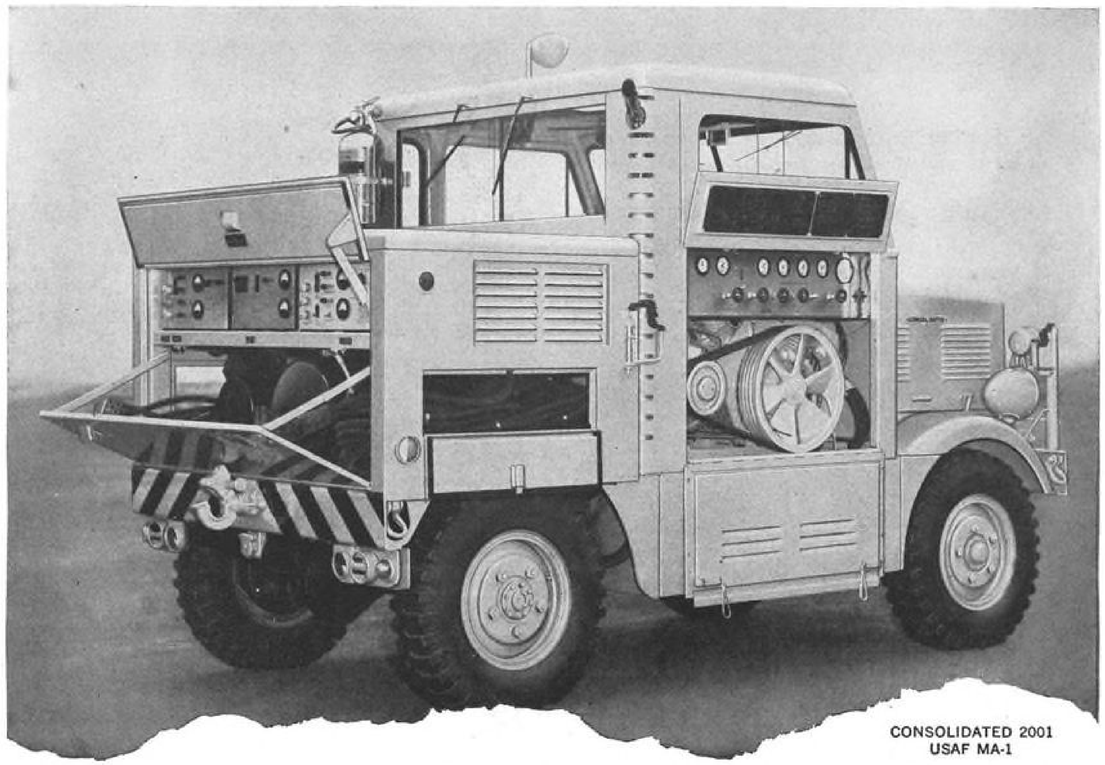

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USAF MA-1

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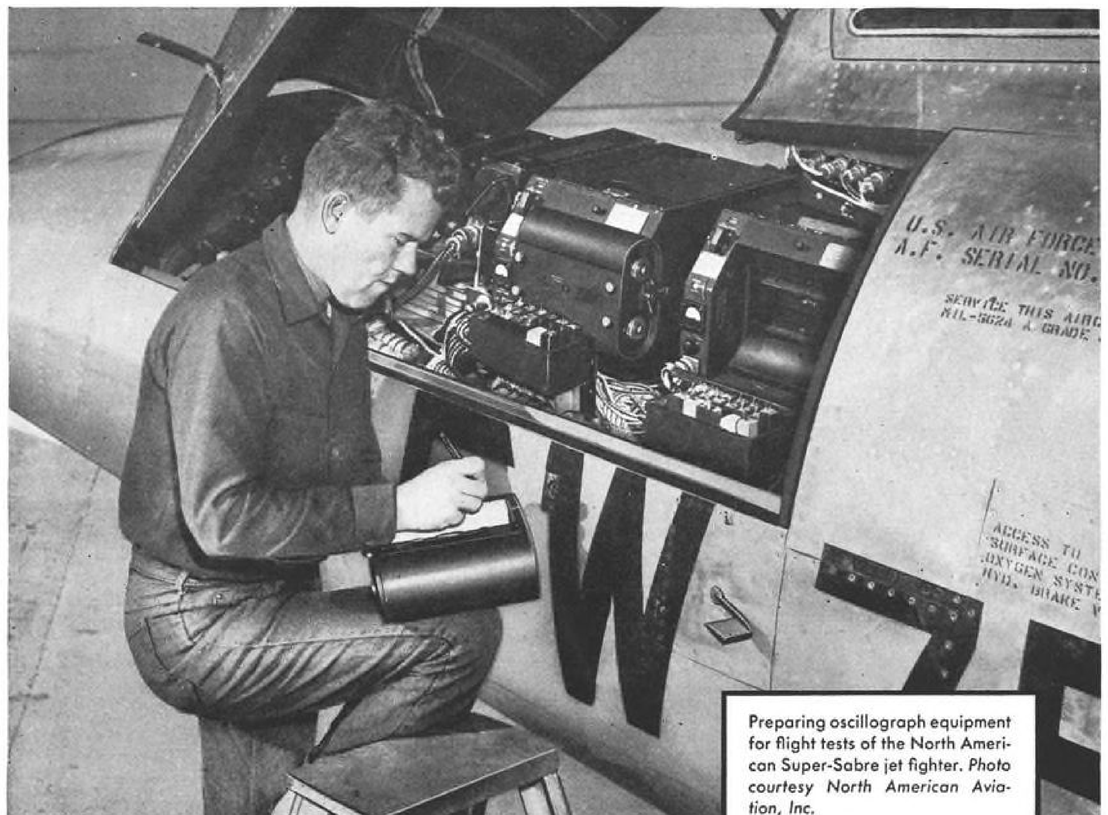

Preparing oscillograph equipment for flight tests of the North American Super-Sabre jet fighter. *Photo courtesy North American Aviation, Inc.*

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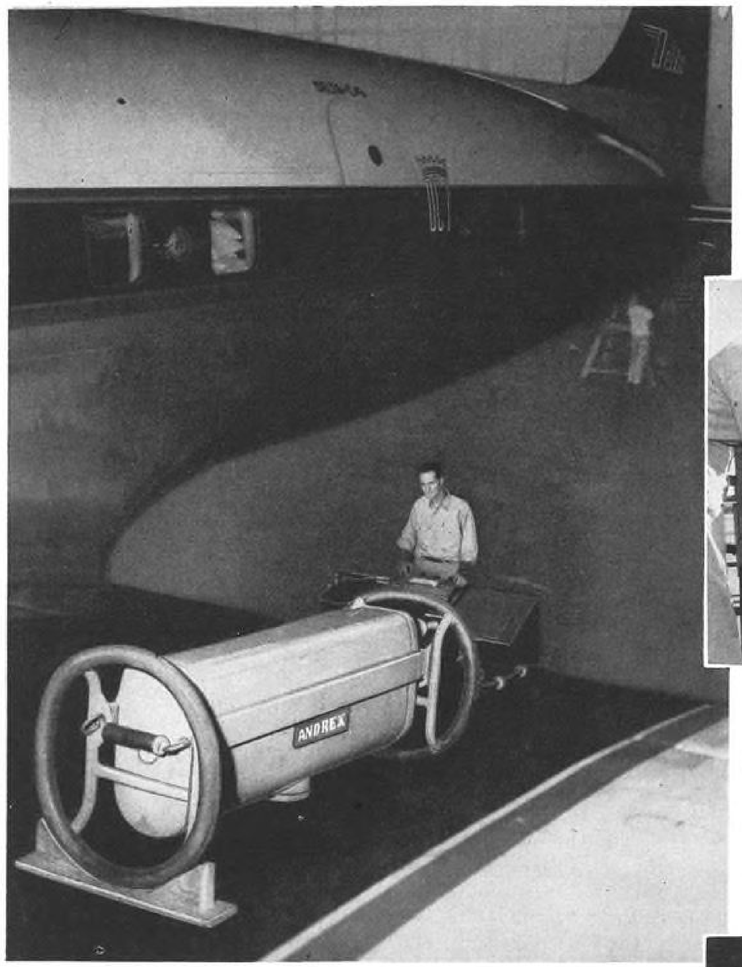

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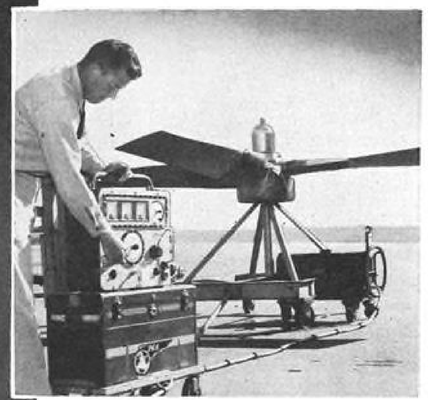

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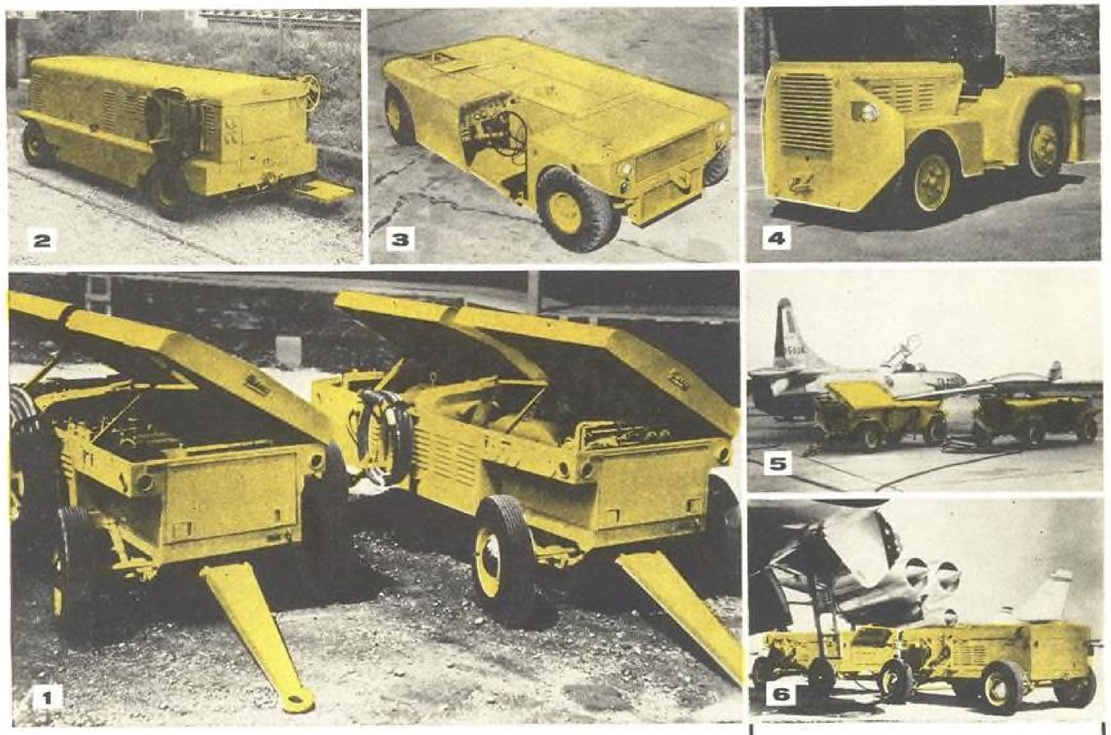

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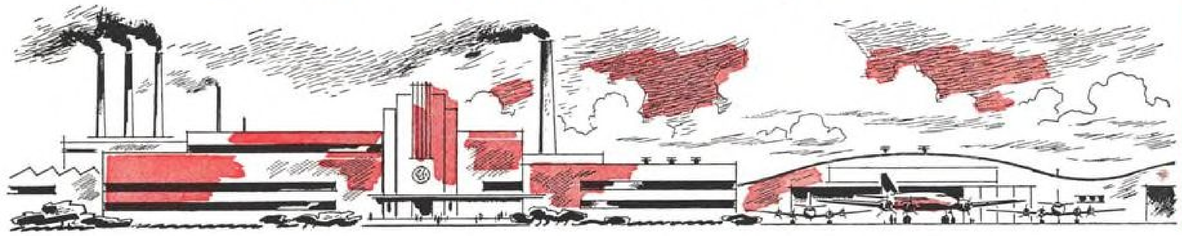

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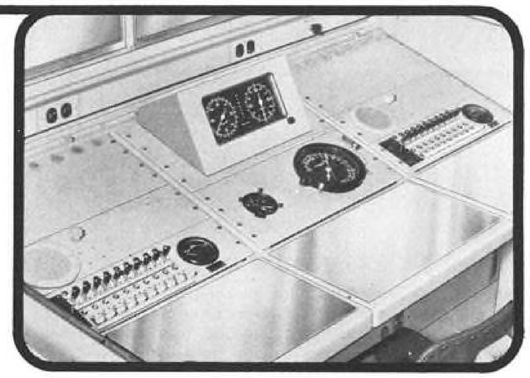
The ACC-10B Console (inset) is a part of the Wickes T-4 Portable Control Tower. The ACC-10B exemplifies the "building block" concept of console design. Such design offers a completely unitized, *functional* control system which can be expanded and adapted to meet any operating condition.



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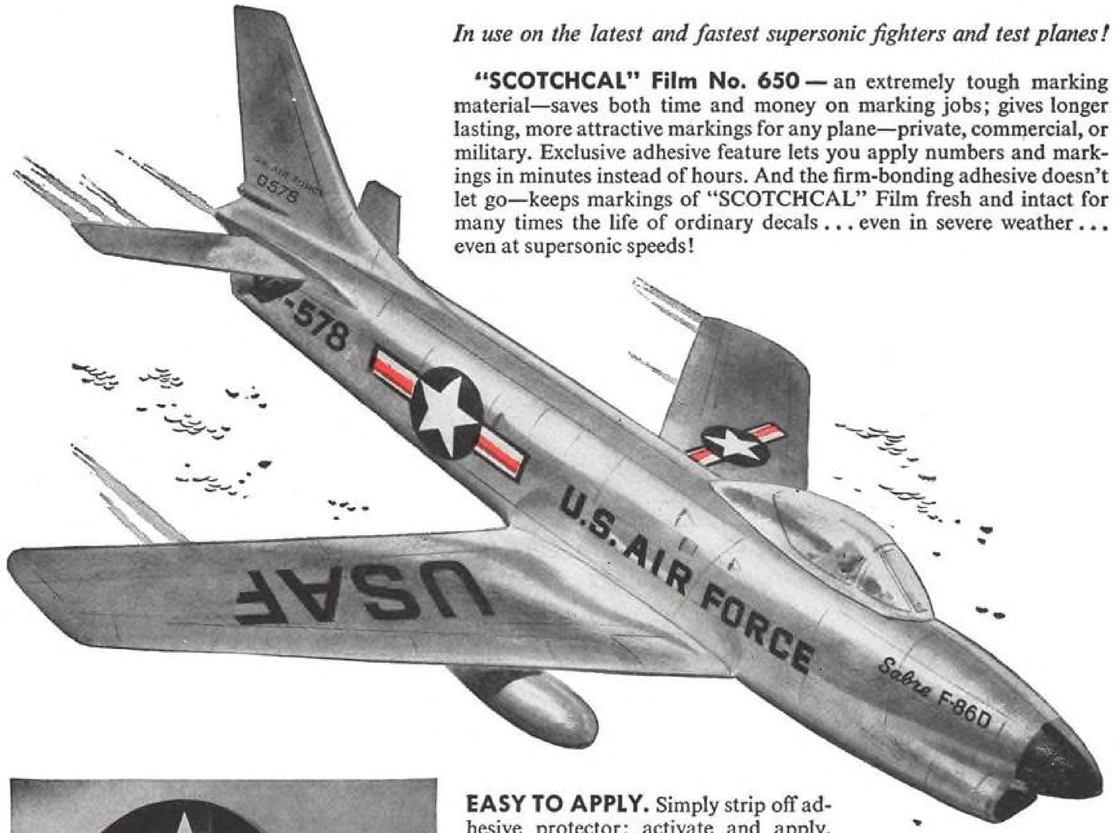

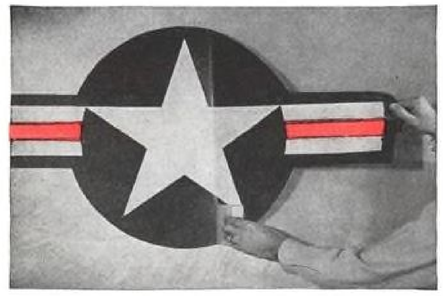

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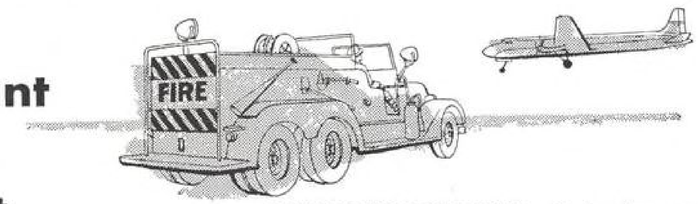
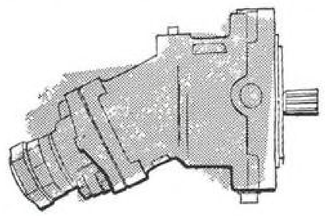
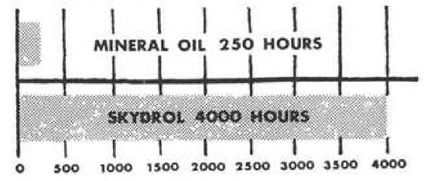
5 ways fire-resistant SKYDROL lowers cost of airline safety



1 **PREVENTS HYDRAULIC FIRES**—Costly, dangerous fire in flight can destroy an aircraft *in seconds!* Skydrol eliminates a major cause of these fires—flammable hydraulic fluid. The world's only fire-resistant hydraulic fluid approved by the C.A.A., Skydrol has logged over 4½ million flight hours.



2 **LENGTHENS PUMP LIFE**—Superior lubricity of Skydrol reduces wear on moving parts, lengthens service life of pumps up to 34%, cuts component overhaul costs up to 20%.



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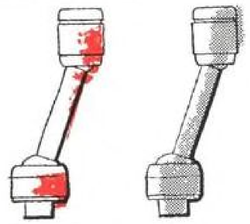

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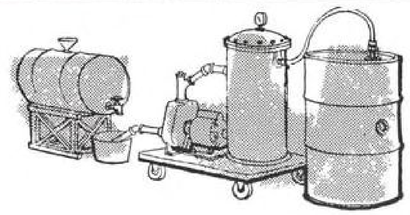

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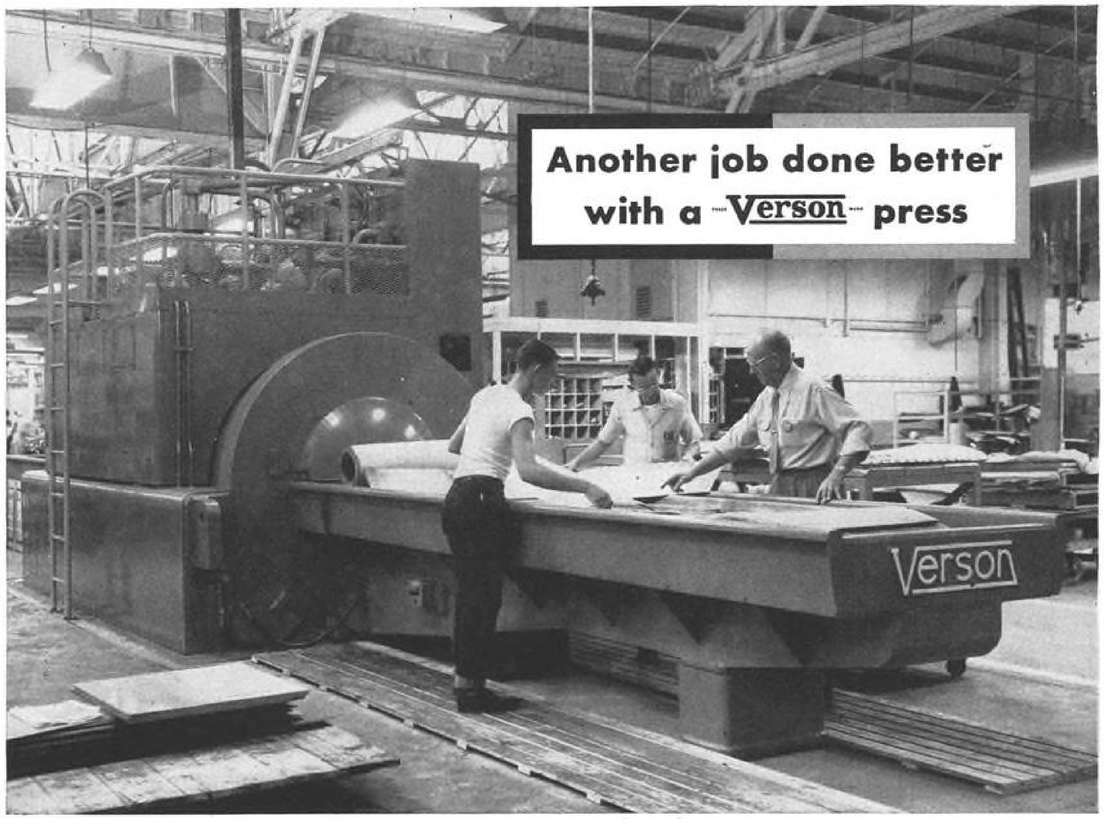

19,440 Tons of Force Forms F-89D and B-62 Parts in this Verson-Wheelon Press at Northrop . . .

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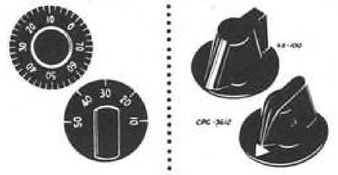

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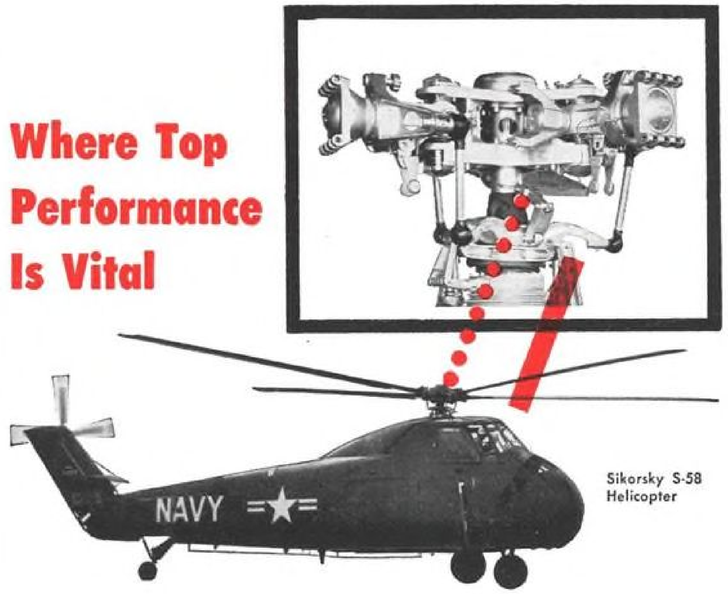

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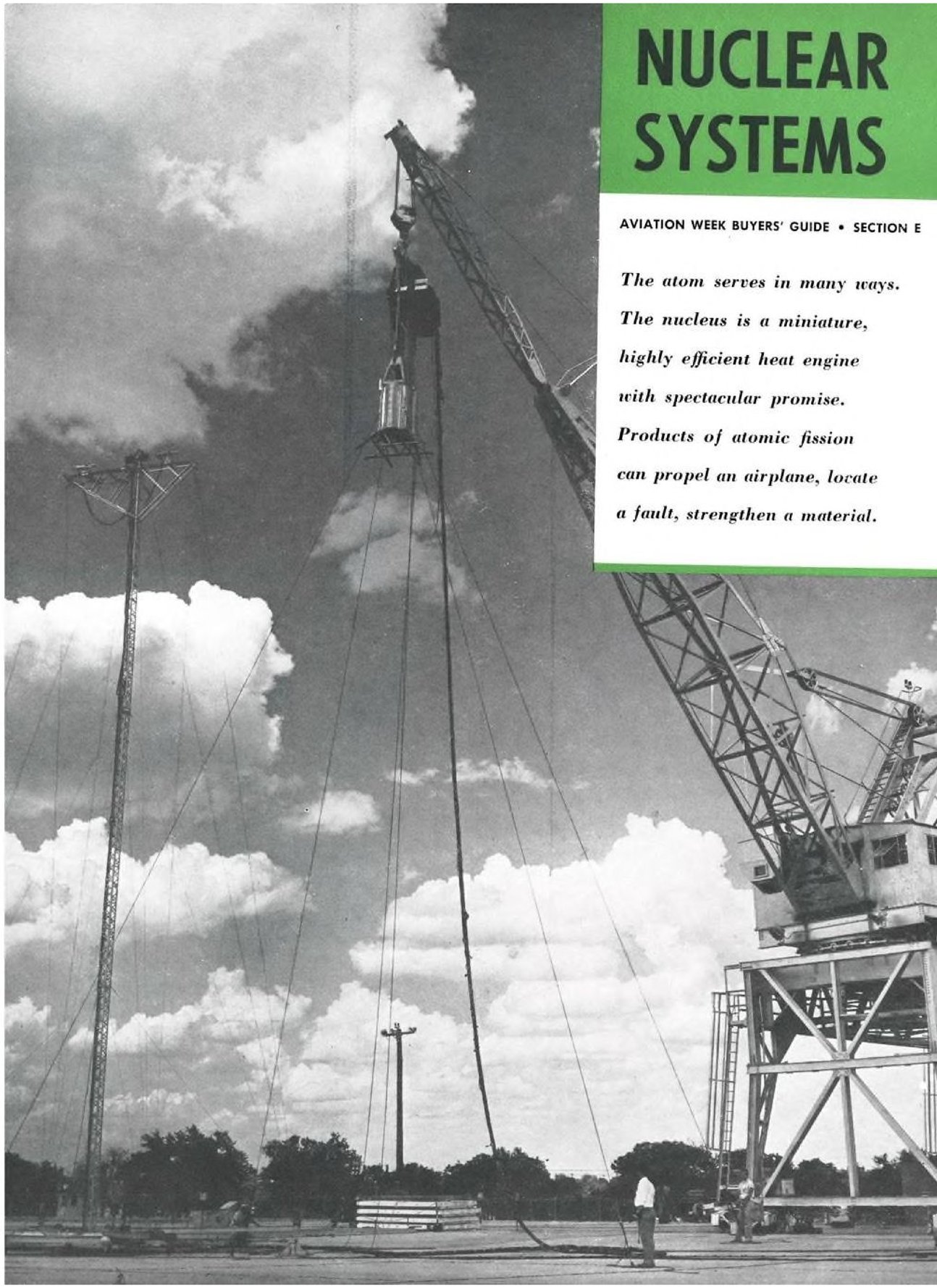

NUCLEAR SYSTEMS

The atom serves in many ways. The nucleus is a miniature, highly efficient heat engine with spectacular promise. Products of atomic fission can propel an airplane, locate a fault, strengthen a material.

Atom-Powered Flight by 1960 Is Goal

Only time lies between today's plans and tomorrow's realization of the atom-powered airplane.

Best estimates for a first flight of such an airplane point to 1960.

The race toward the goal of an airborne nuclear engine has been paced by technological developments all along the route. Specific contributions have been made in reactor design, in fuel arrangements, in shielding and in control of the fission process. Most notable achievement is the successful completion and shakedown runs of the atomic powerplant in the Navy submarine USS Nautilus, the world's first vehicle to be driven by the heat energy of atomic fission.

Any nuclear engine is basically a heat engine, with the fission process replacing the conventional combustion chamber. The heat made available by fission becomes useful energy by being transferred to some working fluid: molten metals, water or air. The hot fluid then becomes the direct source of energy to drive a turbine, a turboprop, or a pure jet engine.

Only the description of the cycle is simple. Nuclear fission produces enormous heat in a tiny space; heat transfer techniques must be highly refined and developed to take the energy of fission only slightly diminished to where it can do some useful work.

Nuclear fission also produces extremely dangerous byproducts: radiation at various energy levels which can kill, maim or sicken a man after a short exposure. Shielding has been devised to protect human organisms from the death-dealing particles; the major problems have sprung from the obvious need to make shielding as light as possible for the mobile powerplant.

A third set of problems comes from the sensitivity of the fission process. Started by a stray neutron, fission can become a chain reaction with disastrous or explosive results if it is not controlled with precision. The control is generally some form of a moderator, a material which has the peculiar mechanical ability of being a neutron trap; it seizes the neutrons produced during fission and by holding them captive, prevents them from starting any more fission processes.

Nuclear Engine

The fundamental components of a nuclear engine for an airplane include:

- **Heat source,** the fission process taking place in the fuel cans or other arrangement of fuel within the reactor.
- **Heat exchanger,** which takes the heat from the reactor core outside to the rest of the engine.
- **Power absorber,** which takes the heat energy out of the fluid and converts it to mechanical energy to drive the airplane.
- **Shielding,** to protect the human crew and possibly even the structure of the airplane from the harmful effects of radiation.
- **Controls,** to moderate the reaction and keep the heat output at a safe level.

Estimated sizes and weights for the combination of these units as a powerplant vary widely. Generally speaking, it would be possible to pack an experimental engine into an airplane the size and weight of the late versions of Convair's B-36 bomber.

The result: an experimental prototype powerplant in a flying testbed. The airplane would weigh about 400,000 pounds, assuming very few major advances in nuclear engine techniques between now and its flight date of 1960.

The atomic-powered airliner and a long-range missile powered by the nuclear rocket or ramjet are interesting technical speculation right now. In point of time, they are far distant, and rather far-fetched applications of nuclear energy.

Other Values

The aircraft industry is involved with several other phases of the nuclear program in this country. To cite one example, North American Aviation's work with reactor studies has won that firm a contract for a power reactor, now being built in the Santa Susana mountains behind Los Angeles.

From this reactor NAA will produce heat power which can be readily converted to electrical energy to supplement the power output of the local system. Although the NAA reactor is a very different kind of engine than an airborne powerplant, the company scientists and engineers should gain much valuable experience in fabricating and operating this new kind of powerplant.

Another facet of the atomic jewel is the work done with materials. Special reactors have been built and are in use, subjecting a wide variety of materials to the bombardment of the radiation products from the fission process.

There are two aspects to the program. The first is to determine the detrimental effects on the structural materials used to build reactors, to encase the fuel, and to handle the heat transfer medium. The second is to find—sometimes by accident—how to strengthen or improve materials by subjecting them to atomic radiation.

A case in point is a simple plastic bottle made by General Electric's plastics division. This bottle was, like many other plastics, limited in the amount of heat it could take. Hot liquids made it wilt and collapse. But after radiation had done its work, the bottle could take more than double its original temperature limit.

The implications of this work are tremendous. Learning how to control radiation and understanding its effects on metals, woods and plastics, can result in a completely new technique of radiation-treating to strengthen materials just as heat-treating does now. Radiation may permit reworking of the internal arrangements of the atoms making up the solid masses of metals so that optimum strength or fatigue or creep properties can be built in.

Nuclear Detective

Among the most useful properties of some of the radioactive products of fission is their radiation label. To the sensitive electronic ear of a Geiger counter, the radioactive material shouts.

Even minute traces of such a substance will set the counter clicking like castanets. From this peculiarity of radioactivity a new series of laboratory and inspection techniques were born.

One dramatic example of the use of tracer elements was in the comprehensive investigation done by Britain's Royal Aircraft Establishment on the ill-fated de Havilland Comet airliner jet transport. There was some belief that fuel had escaped from the engines and, collecting in the wing, had been exploded by a hot source.

A radioactive tracer was suspended in the fuel and the engines were run. After some time, scientists went over the entire trailing edge of the wing with detectors. The clicking pointed to the presence of fuel in places where it definitely should not have been, even though later events proved that the concentration of fuel there was not dangerous.

The world of the atom is a new one that offers enormous potentialities in weapons development, as a power source and as a means to improve materials. These courses, and others yet to be discovered, lie ahead.

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W. C. Robinette Co., 802 Fair Oaks, South Pasadena, Calif.
Sciaky Bros., 4915 West 67 St., Chicago 38, Ill.
J. P. SEEBURG CORP., 1500 Dayton St., Chicago, Ill.
Servo Corp. of America, 2020 Jericho Turnpike, New Hyde Park, N. Y.
Servo-Tek Products Co., 1086 Goffie Rd., Hawthorne 1, N. J.
Servomechanisms, Inc., Post & Stewart Aves., Westbury, N. Y.
Western Div., Servomechanisms, Inc., 12500 Aviation Blvd., Hawthorne, Calif.
Shavex Co., 3456 Glendale Blvd., Los Angeles 39, Calif.
Simmonds Aerocessories, Inc., 105 White Plains Rd., Tarrytown, N. Y.
JAMES S. SPIVEY, INC., 4908 Hampden Lane, Washington 14, D. C.
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KOLLSMAN INSTRUMENT CORP., SUBSIDIARY OF STANDARD COIL PRODS. CO., INC., 80-08 45 Ave., Elmhurst 73, N. Y.
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ELECTRONICS DIV., STEWART WARNER CORP., 1300 North Kostner Ave., Chicago 51, Ill.
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Taller & Cooper, 75 Front St., Brooklyn, N. Y.
Tech Laboratories, Bergen & Edsall Blvd., Palisades Park, N. J.
Telechrome, Inc., 88 Merrick Road, Amityville, N. Y.
Telectro Industries Corp., 35-16 37 St., Long Island City, N. Y.
Electronics Div., Thompson Products, Inc., 2196 Clarkwood Rd., Cleveland 17, Ohio
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West Coast Electronics Co., 5873 West Jefferson Blvd., Los Angeles 16, Calif.
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The Hart Mfg. Co., 110 Bartholomew Ave., Hartford, Conn.
Hydro-Aire, Inc., 3000 Winona Ave., Burbank, Calif.
Stairco Industries, 12942 Sherman Way, North Hollywood, Calif.
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Z & W Machine Products, Inc., 30240 Lakeland Blvd., Wickliffe, Ohio

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Avion Div., ACF Industries, Inc., 299 State Hwy., Route 17, Paramus, N. J.
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Burroughs Corp., 6071 Second Ave., Detroit 32, Mich.
Burton Mfg. Co., 11201 West Pico Blvd., Los Angeles 64, Calif.
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General Electric Co., Light Military Electronics Equip. Dept., French Road, Utica, N. Y.
General Electronic Lab., Inc., Ames St., Cambridge, Mass.
General Magnetics, Inc., 135 Bloomfield Ave., Bloomfield, N. J.
Electro-Mechanical Div., General Riveters, Inc., 785 Hertel Ave., Buffalo 7, N. Y.
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Hydraulic Research & Mfg. Co., 2835 North Naomi St., Burbank, Calif.
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L & M Engrg. Co., 5112 West Jefferson Blvd., Los Angeles 16, Calif.
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Servo-Tek Products Co., 1086 Goffle Rd., Hawthorne 1, N. J.
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Counter, Geiger

Scientific Radio Products, Inc., 215 South 11, Omaha, Nebraska

Detectors, Radioactivity

Atomic Instrument Co., 84 Massachusetts Ave., Cambridge 39, Mass.
INSTRUMENT DEPT., GENERAL ELECTRIC CO., W. Lynn, Mass.
REED-CURTIS NUCLEAR IND., INC., 307 Culver Blvd., Playa del Rey, Calif.
Vacuum Tube Prods. Co., Inc., 506 South Cleveland St., Oceanside, Calif.

Installations, Research and Development

Ames Laboratory (Iowa State College, contractor), Ames, Iowa.
Argonne Cancer Research Hospital (University of Chicago, contractor), Chicago, Illinois.
Argonne National Laboratory (University of Chicago, contractor), Chicago, Illinois.
Participating institutions:
Battelle Memorial Institute
Carnegie Institute of Technology
Case Institute of Technology
Illinois Institute of Technology
Indiana University
Iowa State College
Kansas State College
Loyola University (Chicago, Illinois)
Marquette University
Mayo Foundation
Michigan College of Mining and Technology
Michigan State College
Northwestern University
Ohio State University
Oklahoma Agricultural and Mechanical College
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Washington University (St. Louis, Missouri)
Wayne University
Western Reserve University
University of Chicago
University of Cincinnati
University of Illinois
University of Kansas
University of Michigan
University of Minnesota
University of Nebraska
University of Notre Dame
University of Pittsburgh
University of Wisconsin
Bettis Plant (Westinghouse Electric Corp., Atomic Power Division, contractor), Pittsburgh, Pennsylvania.
Brookhaven National Laboratory (Associated Universities, Inc., contractor), Upton, Long Island, New York.
Participating institutions:
Columbia University
Cornell University
Harvard University
Johns Hopkins University
Massachusetts Institute of Technology
Princeton University
Yale University
University of Pennsylvania
University of Rochester
Knolls Atomic Power Laboratory (General Electric Co., contractor), Schenectady, New York.
Los Alamos Scientific Laboratory (University of California, contractor), Los Alamos, New Mexico.
Mound Laboratory (Monsanto Chemical Co., contractor), Miamisburg, Ohio.
Oak Ridge Institute of Nuclear Studies (contractor), Oak Ridge, Tennessee.
Sponsoring universities:
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Alabama Polytechnic Institute
Catholic University of America
Clemson Agricultural College
Duke University
Emory University
Florida State University
Georgia Institute of Technology
Louisiana State University
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North Carolina State College
Rice Institute
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University of Oklahoma
University of Puerto Rico
University of South Carolina
University of Tennessee
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Oak Ridge National Laboratory (Carbide & Carbon Chemicals Co., Division of Union Carbide & Carbon Corp., contractor), Oak Ridge, Tennessee.
Radiation Laboratory (University of California, contractor), Berkeley, California.
Raw Materials Development Laboratory (National Lead Co., contractor), Winchester, Massachusetts.
Rochester Atomic Energy Project (University of Rochester, contractor), Rochester, New York.
Sandia Laboratory (Sandia Corp., contractor), Sandia Base, Albuquerque, New Mexico.
University of California, Los Angeles, Atomic Energy Project (University of California, contractor), Los Angeles, California.
University of California, Medical Center, Radiological Laboratory (University of California, contractor), San Francisco, California.
National Reactor Testing Station, Idaho Falls, Idaho.
Nevada Test Site, Las Vegas, Nevada.
Pacific Proving Ground, Marshall Islands.

Reactor Development

Air Reduction Company, Inc., 60 East 42nd Street, New York 17, New York.
Alco Products, Inc., 30 Church Street, New York, New York.
American Smelting and Refining Company, 120 Broadway, New York 5, New York.
Argonne National Laboratory, Chicago, Illinois.
Army Engineer Research and Development Laboratories, Fort Belvoir, Virginia.
Atomic Power Development Associates, 2000 Second Avenue, Detroit, Michigan, (Detroit Edison Company, chief company), (32 other associated companies).
Babcock & Wilcox Company, 161 East 42nd Street, New York, New York.
Bailey Meter Company, 1050 Ivanhoe Road, Cleveland 10, Ohio.
Brookhaven National Laboratory, Upton, Long Island, New York.
Carbide & Carbon Chemicals Company, 30 East 42nd Street, New York 17, New York.
Columbia University, New York, New York.
Convair Division, General Dynamics Corporation, General offices: 3165 Pacific Highway, San Diego 12, California, Fort Worth Division: Grant's Lane, Fort Worth 1, Texas.
Dow Chemical Company, Midland, Michigan.
Duquesne Light Company, 435 Sixth Avenue, Pittsburgh 19, Pennsylvania.
Electro Metallurgical Company, (Division of Union Carbide & Carbon Corporation), 30 East 42nd Street, New York 17, New York.
Ethyl Corporation, 100 Park Avenue, New York 17, New York.
Fluor Corporation, Ltd., 2500 South Atlantic Boulevard, Los Angeles 22, California.
General Electric Company, Schenectady, New York.
International Nickel Company, Inc., 67 Wall Street, New York 5, New York.
Walter Kidde Nuclear Laboratories, 975 Stewart Avenue, Garden City, Long Island, New York.
Knolls Atomic Power Laboratory, Schenectady, New York.
Los Alamos Scientific Laboratory, Los Alamos, New Mexico.
Glenn L. Martin Company, Baltimore 3, Maryland.
Merck & Company, Inc., 126 East Lincoln Avenue, Rahway, New Jersey.
National Carbon Company, (Division of Union Carbide & Carbon Corporation), 30 East 42nd Street, New York 17, New York.
National Reactor Testing Station, Idaho Falls, Idaho.
North American Aviation, Inc., Downey, California.
Nuclear Power Group (operating group—no central office)
American Gas and Electric Service Corporation, 30 Church Street, New York 8, New York.
Bechtel Corporation, 220 Bush Street, San Francisco, California.
Central Illinois Light Company, 316 South Jefferson Avenue, Peoria, Illinois.
Commonwealth Edison Company (Chief Company), 72 West Adams Street, Chicago, Illinois.
Illinois Power Company, 134 East Main Street, Decatur 70, Illinois.
Kansas City Power & Light Company, 1330 Baltimore Avenue, Kansas City, Missouri.
Pacific Gas & Electric Company, 245 Market Street, San Francisco, California.
Union Electric Company of Missouri, 315 North 12th Boulevard, St. Louis 1, Missouri.
Oak Ridge National Laboratory, Oak Ridge, Tennessee.
Pratt & Whitney Aircraft, 400 Main Street, East Hartford 8, Connecticut.
Rensselaer Polytechnic Institute, Troy, New York.
Sanderson & Porter, 52 William Street, New York 5, New York.

TUBES, GAMMA DETECTOR

Tennessee Valley Authority, New Sprankel Building, Knoxville, Tennessee.
Vanadium Corporation of America, 420 Lexington Avenue, New York 17, New York.
Westinghouse Air Brake Company, 3 Gateway Center, Pittsburgh 22, Pennsylvania.
Westinghouse Electric Corporation, 3 Gateway Center, Pittsburgh 22, Pennsylvania.

Reactors, Nuclear

APPARATUS SALES DIV., GENERAL ELECTRIC CO., 1 River Rd., Schenectady, N. Y.
Metals & Controls Corp., Attleboro, Mass.
NORTH AMERICAN AVIATION, INC., International Airport, Los Angeles 45, Calif.

Training Programs

Argonne Cancer Research Hospital, Chicago, Illinois.
Argonne National Laboratory, Chicago, Illinois.
Brookhaven National Laboratory, Upton, Long Island, New York.
Harvard University Medical Physics Laboratory, 25 Shattuck Street, Boston, Massachusetts.
Cancer Research Laboratory, New England Deaconess Hospital, 16 Deaconess Road, Boston 16, Massachusetts.
Oak Ridge Institute of Nuclear Studies, Oak Ridge, Tennessee.
University of California at Los Angeles, Los Angeles, California.
University of California: Radiation Laboratory, Berkeley, California; Medical Center Radiological Laboratory, San Francisco, California.
University of Rochester, Rochester, New York.
Western Reserve University School of Medicine, Cleveland, Ohio.
School of Nuclear Science and Engineering, Argonne National Laboratory, Chicago, Illinois.

Tubes, Gamma Detector

Scientific Radio Products, Inc., 215 South 11, Omaha, Nebraska

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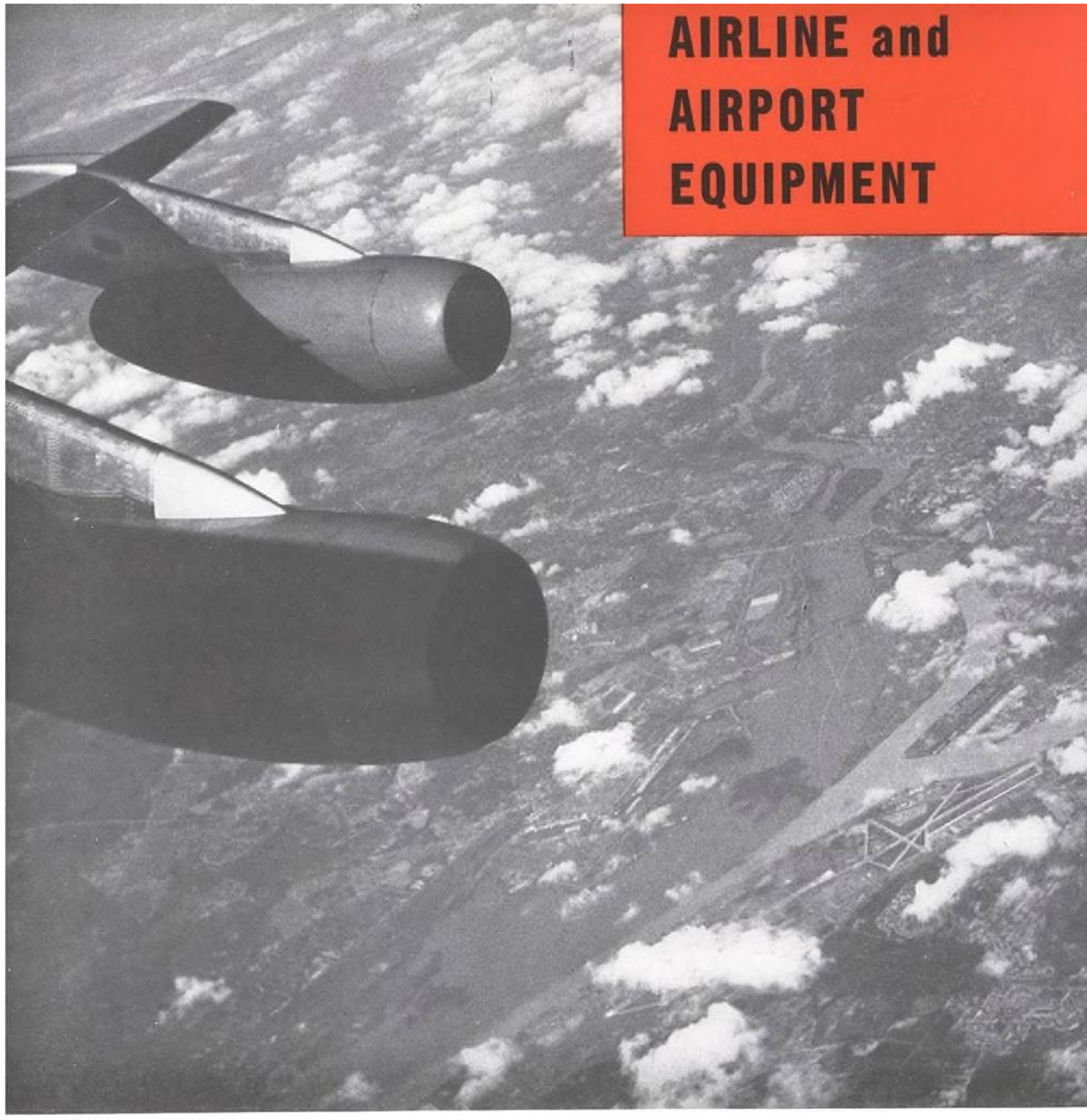

AIRLINE and AIRPORT EQUIPMENT

AVIATION WEEK

BUYERS' GUIDE

SECTION F

An airline's business is flying; airplanes on the ground are revenue dollars lost. Quick handling at terminals depends on efficient, highly developed servicing, aimed at reducing ground time as airspeeds increase in tomorrow's jet age.

How Airlines Buy Equipment

By George L. Christian

Airline purchasing practices follow well-defined patterns which differ from one another in basic procedural organization.

Pan American World Airways and Trans World Airlines, two largest U.S. international carriers, have similar purchasing policies in that both airlines segregate supplies and equipment purchased into several commodity classifications. They differ in that Pan Am centralizes all buying for its three divisions—Atlantic, Latin American and Pacific Alaska, (except for very small amounts of local purchasing done by line stations) in its Services of Supply offices in Long Island City.

TWA, while concentrating most of its purchasing in its Kansas City, Kan. offices, does also maintain an International Purchasing Office at Orly Field, Paris.

American Airlines and United Air Lines, largest transcontinental carriers, have purchasing departments whose organizations resemble each other but differ widely from the PAA/TWA system.

Both AA and UAL have two purchasing centers. One is located at the respective maintenance headquarters at Tulsa and San Francisco; the other at executive headquarters—American at New York, United at Chicago.

Most foreign airlines maintain purchasing offices in New York City; some also have West Coast procurement facilities.

Pan American

Pan Am's purchasing organization is headed by H. H. Berke, vice president —services of supply, who reports to Franklin Gledhill, vice president.

Under Berke are five managers, one for each of the functions of purchasing, fuel, shipping, stores and contracts. All are located at PAA's Services of Supply headquarters, 29-19 Bridge Plaza North, Long Island City 1, New York.

In each of Pan Am's three divisions are division supply managers who report administratively to their divisional managements but coordinate functionally through Services of of Supply in New York.

Purchasing Manager in New York is H. M. Blackwell. Under him seven senior buyers head up each of the seven commodity categories into which the airline divides all the material it buys:

• **Airframe and airframe accessories.** Included are all airframe spares such as wing tips, cabin and cargo hold doors, most system components (hydraulic, pressurization), cabin interior units such as seats, and galley.

• **Engines, engine accessories and propellers.** All engines, propellers and their respective accessories plus all engine instruments come under this category. Exceptions are engines, props and accessories that are delivered on original equipment.

• **Radio, radar and electrical.** All airborne and ground radio, electronic navigation components, electrical components, wire and associated equipment falls in this group.

• **Ground and shop equipment.** This takes in all rolling stock such as trucks, cars and tugs. Also included are loading ramps and baggage carts, shop tools and equipment.

• **Hardware.** Almost a catch-all category, hardware includes all raw materials such as sheet and bar stock, lumber, AN and regular hardware and fasteners, plus shop lubricants and oils.

• **Commissary.** Items include food, fabrics, clothing (uniforms), photographic equipment, insecticides, and aircraft emergency equipment items such as life vests and rafts.

• **Printing, stationery and office equipment.** All office printing jobs, letter paper, office forms, office furniture and equipment come in this last listing.

All aircraft fuel and oil is purchased by the fuel manager, P. S. Dickson. It is bought on a competitive bid system under certain specifications. Most fuel is bought on the basis of "delivered-into-aircraft."

Pan American has over 5,000 vendors.

Trans World

TWA's System Director of Purchasing is Frederick G. Betts; his headquarters are at 400 E. Donovan Road, Kansas City, Kan. Among men reporting to him are: Mills Chastain, Director—Fuel Administration; W. F. Griffith, Director—Purchasing—Domestic, both of the Kansas City address; and Basil Davis, Director—Purchasing—Overseas, 101 Ave. des Champs Elysees, Paris.

Chastain, as his counterpart Dickson in PAA, handles all aircraft fuel and oil contracts.

Under Griffith come seven commodity classifications, similar but not identical to Pan Am's.

Four groups are the same—airframe; engines, and propellers; radio, radar and electrical; printing, stationery and office equipment.

Three which differ from PAA's are:

• **Aircraft accessories,** under which comes such items as cabin heating and ventilating controls and lighting fixtures, and oxygen equipment.

• **Capital and subcontract.** This category include such capital expenditure items as automotive and ground handling equipment and all items made to TWA drawings. Among the latter are galley trays and liquid dispensing and serving units.

• **Miscellaneous.** Miscellaneous items run the gamut from sheet and bar stock to soft goods (cloth, pillow cases, uniforms) to chemicals and paints.

Under the Paris International office TWA purchases office supplies and stationery, some miscellaneous equipment such as soft goods, tube and bar stock, and ground electrical supplies—also staple food supplies.

American Airlines

American splits its buying between a purchasing office at its Tulsa Overhaul and Supply Depot and a similar office at New York's La Guardia Field. Responsibility for all purchasing and stores funnels into the office of G. J. Brandewiede, vice president—purchasing and stores.

Tulsa buys all equipment and supplies needed for its shops such as machinery, tools, parts, paints and liquids. It also buys system items controlled by Tulsa. These include: all aircraft and powerplant spares and equipment needed to keep AA's fleet airworthy and items needed by the stations over and above the certain designated items which stations are allowed to buy independently.

La Guardia buys virtually everything else except new airframes which are the responsibility of C. R. Smith, president, and aircraft fuel and oil, which come under A. F. Fontanelli, director of food, who reports to Brandewiede.

United Air Lines

United's purchasing boss is D. V. O'Leary, director, purchasing and stores. He reports to a vice president of finance and stores who is one of the UAL executives responsible for purchase of new aircraft.

Under O'Leary is a superintendent of petroleum products, reponsible for aircraft fuel and oil contracts. Additional superintendents of system purchasing and system stores respectively are responsible for setting up and maintaining standards and rules and coordinating procedures for the department.

Like American, United places the responsibility for procurement of all in-flight equipment for aircraft and powerplants in a purchasing office at its main overhaul base at San Francisco. The same office buys all machines, tools and other material needed by the maintenance base itself. Station equipment, recently transferred to San Francisco's responsibility, includes ground servicing and cargo handling units.

A system which UAL feels it has developed more than possibly any other U.S. carrier is that of negotiating national contracts for such general usage items as light bulbs and automotive equipment. All UAL stations are allowed to buy against this contract through local distributors of the product. Advantage is that United can take advantage of low prices resulting from mass purchasing, while flexibility and quick delivery result at the local level. Stations are also allowed to make limited local purchases up to $100.

Foreign Airlines

Most foreign airlines maintain purchasing offices in New York through which they procure aircraft and engine spares, system accessories and instruments for their U.S. aircraft.

Some, such as KLM Royal Dutch Airlines, maintain two separate offices, one in New York and one in Los Angeles. Both report directly to KLM headquarters in Amsterdam.

The New York office is concerned with buying East Coast items such as engine spares and aircraft accessories made by such companies as Bendix and Sperry.

The Los Angeles office is primarily concerned with airframe spares and equipment made on the West Coast by such companies as AiResearch.

Other foreign carriers, such as Air France, also have offices in New York and on the West Coast, but centralize all purchasing authority in New York. Air France's Burbank office reports directly to New York headquarters, called the North American Engineering and Procurement Department.

This department is responsible for all procurement on the North American continent except for equipment and supplies necessary to operate the region such as office equipment and supplies, and aircraft fuel and oil. Exception is aircraft petroleum products used on Air France's Mexico run, which are purchased by the New York office.

North American region equipment and supplies are procured by the Administrative department in New York. Aircraft fuel and oil are contracted for by the airline's head office in Paris.

The Procurement department also handles all invoicing, shipping and payments of material bought.

It also does a considerable amount of technical liaison work with the airline's airframe, powerplant and major equipment suppliers.

Other foreign carriers such as Sabena Belgian World Airlines do almost all of their purchasing through a New York Office of Technical Procurement which purchases, exports and pays for all spares bought here and in Canada. Sabena's 1955 budget, including pre-procurement items for new, undelivered aircraft, will exceed $6-million.

Sabena has an agent on the West Coast to coordinate information concerning new aircraft the company is buying, such as the Convair 404 and DC-7C. The agent can make emergency CFE purchases, subject to confirmation by the New York office.

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W. C. Leatherwood, Purchasing Agent, Houston International Airport, Houston 17, Texas

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Frederick G. Betts, System Director of Purchasing, 400 E. Donovan Road, Kansas City, Kan.

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D. V. O'Leary, Director of Purchasing & Stores, 5959 South Cicero Avenue, Chicago 38, Illinois

Western Air Lines, Inc.
K. W. Kendrick, Purchasing Agent, 6060 Avion Drive, Los Angeles 45, California

Wien Alaska Airlines, Inc.
Fritz Wien, Vice President-Operations, Box 649, Fairbanks, Alaska

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Smith-Nelson Corp., 36 East Mason St., Santa Barbara, Calif.

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Aircraft Tools, Inc., 9030 Bellanca Ave., Los Angeles 45, Calif.
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Holub Industries, Inc., 413 DeKalb Ave., Sycamore, Ill.
LUND AVIATION, INC., 230 Park Ave., New York 17, N. Y.
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Precision Associates, Inc., 354 Cumberland St., Brooklyn 17, New York
Proto Tools, 2209 Santa Fe Ave., Los Angeles 54, Calif.
Snap-On Tools Corp., 8020 28 Ave., Kenosha, Wisc.
George A. Terry Co., 356 South Elmwood, Buffalo, N. Y.
The Wagner Awning & Mfg. Co., 2658 Scranton Rd., Cleveland 1, Ohio
J. H. Williams & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Arnold Greene & Co., Airport Equipment, P. O. Box 425, 122 Hampshire St., Cambridge 39, Mass.
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Mercer-Robinson Co., 30 Church St., New York 7, N. Y.

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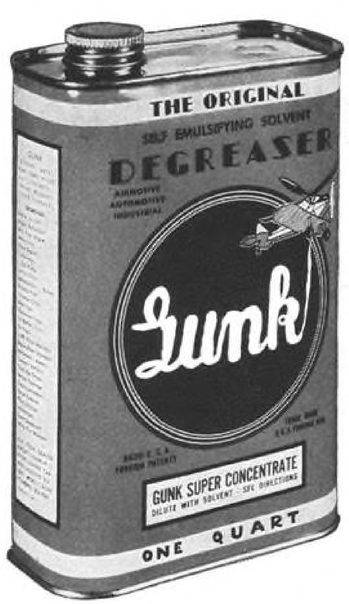

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Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, New York

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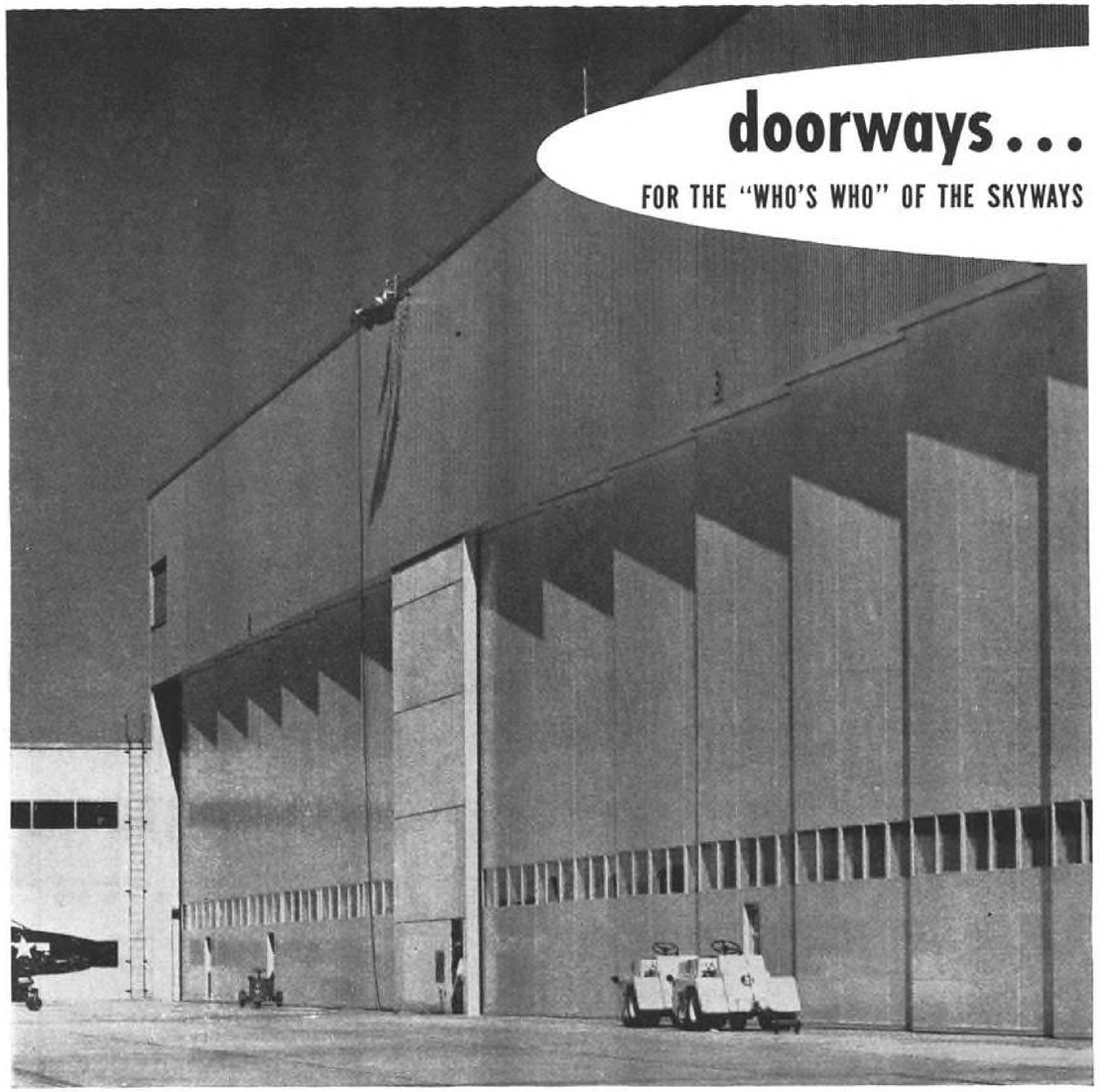

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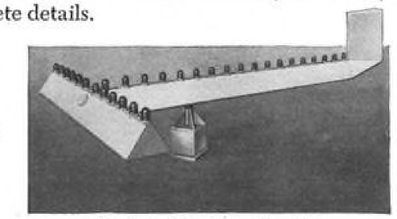

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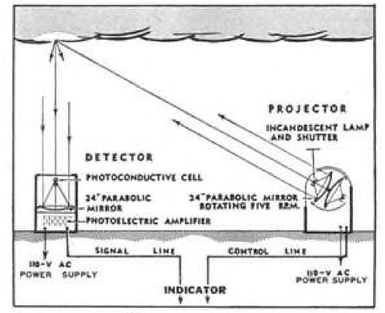

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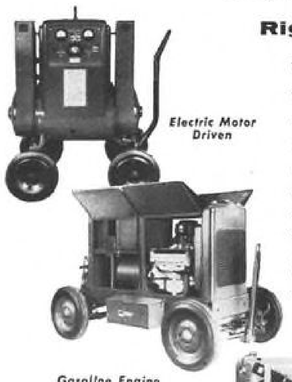

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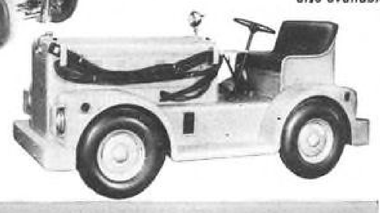

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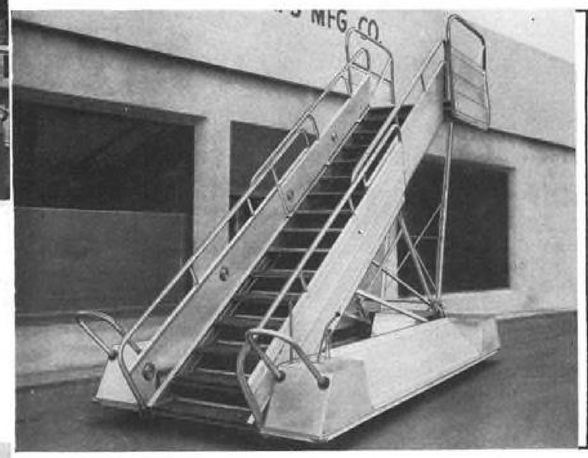

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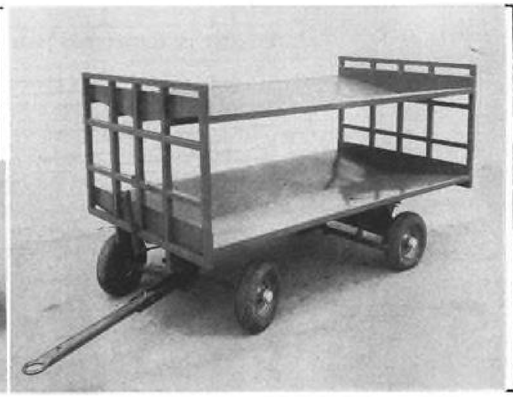

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1955-56 AVIATION WEEK BUYERS' GUIDE

SECTION G: DISTRIBUTORS

This listing of distributors serving the aircraft industry has been compiled from data furnished by the distributors. Firms belonging to the Aircraft Distributors and Manufacturers Association are indicated by asterisk. Advertisers in the Guide are indicated by heavy capitals.

*Adams Aircraft Engineering Co., Bradley Field, Windsor Locks, Conn.

Aerodex Inc., P. O. Box 123, International Airport Br., Miami 48, Florida

*Aero Service & Supply Co., Municipal Airport, Birmingham 6, Ala.

Aero-Spares Co., 69-06 Woodside Avenue, Woodside, New York

*Air Accessories, Inc. (AMC Supply Division and Delta Products Division), 1400 Henderson St., Box 1440, Fort Worth, Texas

*Air Associates, Inc., (Home Office) Teterboro, N. J.

Branches:
Industrial Ave., Teterboro, N. J.
5315 West 63rd St., Chicago 38, Ill.
3214 Love Field Drive, Dallas 9, Texas
1231 Air Way, Glendale, Calif.
P. O. Box 241, International Arpt. Branch, Miami 48, Fla.
Arpt. Station, Atlanta Municipal Arpt., Atlanta, Ga.
Industrial Ave., Teterboro, N. J.

Aircraft Components, Inc., Woodland Ave., Twin Cities Arpt., Benton Harbor, Michigan

Aircraft Dynamics Corp., 545 Fifth Ave., New York 17, N. Y.

Aircraft Equipment Corp., 7 West 44th St., New York 36, N. Y.

Aircraft Hardware, 2071 47th Street, Astoria, New York

Aircraft Radio Industries, Inc., 15 E. 40 Street, Room 604, New York, N. Y.

Aircraft Supplies, 44 Park Avenue, Nutley 10, N. Y.

*AIR-PARTS, INC., 723 Sonora Avenue, Glendale 1, Calif.

Branches:
15 Park Row, New York 38, N. Y.
1346 Connecticut Ave., N. W., Washington 6, D. C.
San Francisco International Arpt., San Francisco, Calif.

*AIRWORK CORPORATION, Millville Municipal Arpt., Millville, N. J.

Branches:
2705 S. Oakland St., Arlington 6, Va.
International Arpt., Miami 48, Fla.
Bldg. No. 8, Newark Arpt., Newark, N. J.
Municipal Arpt., Atlanta, Ga.

Amnor Aviation Corporation, 514 Halstead Ave., Mamaroneck, New York

Anchor Rubber Company, 840 S. Patterson Blvd., Dayton 2, Ohio

*Aviation Electric Ltd., 200 Laurentian Blvd., Montreal 9, P. Q., Canada

Branches:
International Arpt., Vancouver A.M.F., B. C.
P. O. Box 1412, Halifax, N. S

*Aviation Supply Corp. of Florida, 1544 N. Franklin St., Tampa 2, Fla.

Aviquipo, Inc., 25 Beaver St., New York 4, N. Y.

AVNET ELECTRONIC SUPPLY CO., 34 N. Moore St., New York, N. Y.

B & B Distributors, 218-222 Fulton St., New York 7, N. Y.

Beemer Engineering Company, 410 North Broad St., Philadelphia, Pa.

Butler Aviation, LaGuardia Arpt., Flushing 71, N. Y.

*Coastal Corporation, 443-451 Calvert Ave., Alexandria, Va.

Collins Engineering Co., 9050 Washington Blvd., Culver City, Calif.

Continental Metals, Inc., Los Angeles Aviation Supply Co. Div., 7001 Santa Monica Blvd., Los Angeles 38, Calif.

Coolidge, John E., Co., 2508 W. Slauson Ave., Los Angeles, Calif.

Cosa Corporation, 405 Lexington Ave., New York 17, N. Y.

Crane & Company, Old Country Road, Mineola, N. Y.

*Denver Airplane Supply (Division of Clinton Aviation Co.), Clinton Aviation Hangar, Stapleton Airfield, Denver 7, Colorado

Donalico Inc., 6244 San Fernando Rd., Glendale, Calif.

*DURHAM AIRCRAFT SERVICE, INC., 56-15 Northern Blvd., Woodside 77, N. Y.

Branches:
International Arpt., (Idlewild), Jamaica 20, N. Y.
199 East 2nd St., Mineola, N. Y.

Early, Edward A., P. O. Box 216, River Rd. at Washington St., Rumson, New Jersey

*Eastern Airmotive Corporation, P. O. Box 8044, Byrd Arpt., Richmond 23, Va.

Branch:
Hybia Valley Arpt., Route 4, Box 185, Alexandria, Va.

Efra Export Company, 15 Park Row, New York 38, N. Y.

Electric Steel Foundry Co., 2141 Northwest 25 Ave., Portland 10, Oregon

Fisher Aircraft Co., Lindbergh Field, San Diego 1, Calif.

Frathom Company, 33 West 42nd St., New York 36, N. Y.

Garron Aircraft Supply Inc., 1133 Broadway, New York 10, N. Y.

*General Aircraft Supply Corp., City Arpt., Detroit 13, Mich.

*General Aviation Supply Co., Lambert Fld., St. Louis 21, Mo.

Branches:
8244 Lockheed Ave., Municipal Arpt., Houston, Tex.
S. W. 63rd St. & MacArthur Blvd., Will Rogers Field, Oklahoma City, Oklahoma

Genex, P. O. Box 665, Sun Valley, Calif.

Global Aero Supply, North Olmsted, Ohio

Graybar Electric Co., Inc., Aviation Dept., 420 Lexington Ave., New York 17, N. Y.

Harrison Radio Corp., 225 Greenwich St., New York 7, N. Y.

*Hendry, C. J., Co., 27 Main St., San Francisco 5, Calif.

*Horn, Don, Co., 353 Madison, Memphis, Tenn.

Hudson Radio & Television Corp., 37 W. 65 St., New York 36, N. Y.

Hyde Aircraft Supply Co., 303 First Ave., New Hyde Park, N. Y.

Industry Services, Inc., 2705 S. Oakland St., Arlington 6, Va.

Interair Parts Corp., 200 W. 57 St., New York 19, N. Y.

Jaros, Walter K., Aircrafters, 48-00 Astoria Blvd., Astoria 3, N. Y.

Kallman, Raymond M., Lumber Road, P. O. Box 104, Roslyn, New York

Kennedy Aircraft, 29-15 Francis Lewis Blvd., Flushing 58, N. Y.

Lafayette Radio, 100 Sixth Ave., New York 13, N. Y.

Larson, Norman, Co., San Fernando Valley Arpt., Sherman Way at Havenhurst, Van Nuys, California

Lectronic Research Laboratories, 715 Arch St., Philadelphia 6, Pa.

Lucas Aircraft Supply Co., 132 North Ash, Inglewood 1, Calif.

Maltby, Edward D., Co., Inc., 1718 South Flower St., Los Angeles 15, Calif.

Manhattan Lighting Equipment Co., Inc., 16 Warren Street, New York 7, N. Y.

Morey Machinery Co., 389 Lafayette St., New York, N. Y.

*National Aviation Supply Co., 906 Bowen St., Pittsburgh 12, Pa.

Branch:
Governor's Airpark, Chicago Heights, Ill.

Niagara-Concord Corp., 45 Warren Street, New York 7, N. Y.

Northwestern Aeronautical Co., Holman Field, St. Paul 1, Minn.

O'Dei Electronics Corp., 291-293 W. Broadway, New York 13, N. Y.

On-Mark Engineering Co., 3210 Winona St., Burbank, Calif.

Pacair, Inc., 3411 Tulare Ave., Burbank, Calif.

*Pacific Airmotive Corporation, 2940 North Hollywood Way, Burbank, Calif.

Divisions:
Chino Arpt., Chino, Calif.
Oakland International Arpt., Oakland, Calif.
Boeing Field, Seattle, Wash.
Fairfax Arpt., Kansas City, Kansas
Stapleton Airfield, Denver, Colo.
Linden Arpt., Linden, N. J.

Pan American Navigation Service, Inc., 12021 Ventura Blvd., North Hollywood, Calif.

Payne and Company, Inc., 841 E. Monument Ave., Dayton, Ohio

*Piedmont Aviation, Inc., Smith Reynolds Arpt., Winston-Salem, N. C.

Branch:
Municipal Arpt., Norfolk, Va.

HAROLD H. POWELL CO., 2102 Market St., Philadelphia 3, Pa.

*Precision Aeromotive Corporation, Municipal Arpt., Houston 17, Tex.

Raway Sales, 4 Forsyth St., New York 2, N. Y.

Rocket Distributors, Inc., 214-27 Northern Blvd., Bayside, N. Y.

Ruart Sales Company, 4525 W. Jefferson, Los Angeles 16, Calif.

*Salt Lake Aircraft Parts, Arpt. No. 1, Salt Lake City 16, Utah

DISTRIBUTORS LISTING

Sanford Aircraft, Inc., 1015 West Manchester Blvd., Inglewood, Calif.

*SCHWEBER ELECTRONICS, 122 Herricks Road, Mineola, L. I., N. Y.

*Sky-Store (Incorporated), 500 North Prairie Ave., Hawthorne, Calif.

Smith, Kirkpatrick & Co., 46 Trinity Place, New York, N. Y.

SMS Sales & Service, N. Y. International Airport, Jamaica 30, N. Y.

*SOUTHWEST AIRMOTIVE COMPANY, Love Field, Dallas 9, Tex.

*Standard Aero Engine Limited, P. O. Box 764, Stevenson Arpt., Winnipeg, Manitoba, Canada

Branches:
Vancouver AMF, British Columbia
No. 13 Hangar, Municipal Arpt., Edmonton, Alberta

*Standard Aircraft Equipment Co., Inc., 241 Old Country Road, P. O. Box 271, Mineola, N. Y.

*Standard Products, Inc., 650 E. Gilbert, P. O. Box 695, Wichita, Kansas

Branches:
220 N. Sheridan Road, Tulsa, Oklahoma
Fairfax Field, Kansas City, Kansas

Terminal Radio Corp., 83 Cortlandt St., New York 7, N. Y.

Tube Distributors Co., Inc., Garden City, New York

*Tuscarawas County Aviation, Inc., Municipal Arpt., New Philadelphia, Ohio

U. S. Steel Corporation, U. S. Steel Supply Div., 208 South La Salle St., Chicago, Illinois

*Van Dusen Airport Supplies, Inc., Northwest Area (Home Office), 2004 Lyndale Ave. S., Minneapolis 5, Minn.

Branches:
Teterboro Air Terminal, Teterboro, N. J.
Logan International Arpt., East Boston 28, Mass.
Beacon Fld., Alexandria, Va.
Export Department, Teterboro, N. J.

V & H Electronic Industries, 2033 West Venice Blvd., Los Angeles 6, Calif.

*Washington Aircraft & Transport Corp., Boeing Field, Seattle, Washington

*Western Aero Supply Corporation, P. O. Box 6527, Alamo Heights Station, Municipal Arpt., San Antonio, Tex.

*Whitaker Art, P. O. Box 1811, Portland 11, Oregon
Pearson Airpark, Vancouver, Wash.

WOODS AIRCRAFT SUPPLY, 309 W. Elmwood Ave., Burbank, Calif.

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. . . to Companies offering Special Services, and Used, Surplus-new Equipment to the Aviation Industry.

These listings were compiled from the advertisements appearing in the SEARCHLIGHT SECTION . . . pgs. H25—H32

AIRCRAFT INSPECTION & REPAIR
Atlantic Aviation Service, Inc.
New Castle County Airport, Wilmington, Del.
See Adv. H 28
Maintenance & Service Aircraft, Inc.
Marine Terminal, P. O. Box 68, La Guardia Field, N. Y.
See Adv. H 28

AIRCRAFT PARTS & SUPPLIES
Aero Spares Co.
69-06 Woodside Ave., Woodside 77, N. Y.
See Adv. H 31
Hyde Aircraft Supply Co.
303 1st Ave., New Hyde Park, N. Y.
See Adv. H 32
Maintenance & Service Aircraft, Inc.
Marine Terminal, P. O. Box 68, La Guardia Field, N. Y.
See Adv. H 28
Mineola Aircraft Company
P. O. Box 173, Mineola, L. I., N. Y.
See Adv. H 30
Northwestern Aeronautical Co.
Holman Field, St. Paul 1, Minn.
See Adv. H 32
Paramount Aviation Sales
121-23 Jamaica Ave., Richmond Hill 18, N. Y.
See Adv. H 29

AIRCRAFT SERVICE
Atlantic Aviation Service, Inc.
New Castle County Airport, Wilmington, Del.
See Adv. H 28
Lund Aviation, Inc.
230 Park Avenue, New York 17, N. Y.
See Adv. H 29
Wiplinger Aircraft Service
Fleming Field, South St. Paul, Minn.
See Adv. H 30

AIRCRAFT SERVICES—EXECUTIVE
Pan Maryland Airways, Inc.
Friendship International Airport, Maryland
See Adv. H 31

BROKER—AIRCRAFT
William C. Wold Associates
516 Fifth Avenue, New York 36, N.Y.
See Adv. H 32

CABLE—ASSEMBLIES
Kennedy Aircraft Supply Company
29-15 Francis Lewis Blvd., Flushing 58, N. Y.
See Adv. H 31

CABLE—BONDING
Atlantic & Pacific Wire & Cable Co., Inc.
112-01 Northern Boulevard, East Elmhurst, L. I., N. Y.
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CABLE—COAXIAL
Atlantic & Pacific Wire & Cable Co., Inc.
112-01 Northern Boulevard, East Elmhurst, L. I., N. Y.
See Adv. H 26
Progress Electronics Co.
222 Fulton St., New York 7, N. Y.
See Adv. H 30

CABLE—ELECTRIC
Atlantic & Pacific Wire & Cable Co., Inc.
112-01 Northern Boulevard, East Elmhurst, L. I., N. Y.
See Adv. H 26

CABLE—MECHANICAL
Atlantic & Pacific Wire & Cable Co., Inc.
112-01 Northern Boulevard, East Elmhurst, L. I., N. Y.
See Adv. H 26

CABLE—SWAGING
Kennedy Aircraft Supply Company
29-15 Francis Lewis Blvd., Flushing 58, N. Y.
See Adv. H 31

CABLE—TERMINALS
Kennedy Aircraft Supply Company
29-15 Francis Lewis Blvd., Flushing 58, N. Y.
See Adv. H 31

CARBURETORS & PARTS
A. & E. Accessories
55 Maple Ave., Sea Cliff, L. I., N. Y.
See Adv. H 30

CHARTER SERVICE
Air Service Incorporated
Bridgeport Municipal Airport, Stratford, Conn.
See Adv. H 28

COMPONENTS—ELECTRONIC
Merrick Aviation Electronics
166-08 Douglas Ave., Jamaica 33 N. Y.
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Progress Electronics Co.
222 Fulton St., New York 7, N. Y.
See Adv. H 30
Schweber Electronics
122 Herricks Rd., Mineola, N. Y.
See Adv. H 28
Telecirad
148 Chambers St., New York 7, N. Y.
See Adv. H 30
Wilgreen Industries
99 Murray Street, New York 7, N. Y.
See Adv. H 25

COMPONENTS—RADIO
Aircraft Radio Industries, Inc.
15 East 40th St., N. Y., N. Y.
See Adv. H 32

CONNECTORS—VARIOUS
Connector Corporation of America
137 Hamilton Street, New Haven 11, Conn.
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Harold H. Powell Company
2102 Market Street, Philadelphia 3, Pa.
See Adv. H 27
Progress Electronics Co.
222 Fulton St., New York 7, N. Y.
See Adv. H 30
Schweber Electronics
122 Herricks Rd., Mineola, N. Y.
See Adv. H 28
Wilgreen Industries
99 Murray Street, New York 7, N. Y.
See Adv. H 25

CONNECTORS—COAXIAL
Connector Corporation of America
137 Hamilton Street, New Haven 11, Conn.
See Adv. H 26

CONNECTORS—ELECTRICAL
Connector Corporation of America
137 Hamilton Street, New Haven 11, Conn.
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Cook Aircraft Products Co., Inc.
P. O. Box 241, Hicksville, New York
See Adv. H 32

CONVERSIONS—AIRCRAFT
Lee Mansdorf & Co.
2009 Parmelee St., Compton, Cal.
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Minnesota Airmotive, Inc.
Wold Chamberlain Field, Minneapolis, Minn.
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Skymotive Inc.
O'Hare Field, Chicago International Airport, Box 448, Park Ridge, Ill.
See Adv. H 30
Wiplinger Aircraft Service
Fleming Field, South St. Paul, Minn.
See Adv. H 30

CUSTOM EXECUTIVE INTERIORS
Air Service Incorporated
Bridgeport Municipal Airport, Stratford, Conn.
See Adv. H 28

DEALER—AIRCRAFT
Graubart Aviation
677 N. Michigan, Chicago, Ill.
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Lund Aviation, Inc.
230 Park Ave., New York 17, N. Y.
See Adv. H 29
Lee Mansdorf & Co.
2009 Parmelee St., Compton, Cal.
See Adv. H 29

DEALER—ENGINES
Lund Aviation, Inc.
230 Park Ave., New York 17, N. Y.
See Adv. H 29
Lee Mansdorf & Co.
2009 Parmelee St., Compton, Cal.
See Adv. H 29

ENGINES—AIRCRAFT
Harold E. Happe
P. O. Box 407, Hicksville, N. Y.
See Adv. H 32

ENGINE INSPECTION & REPAIR
Maintenance & Service Aircraft, Inc.
Marine Terminal, P. O. Box 68, La Guardia Field, N. Y.
See Adv. H 28
Northwestern Aeronautical Co.
Holman Field, St. Paul 1, Minn.
See Adv. H 32

ENGINE—REBUILDING
Lee Mansdorf & Co.
2009 Parmelee St., Compton, Cal.
See Adv. H 29

EQUIPMENT—AIRCRAFT
Paramount Aviation Sales
121-23 Jamaica Ave., Richmond Hill 18, N. Y.
See Adv. H 29
Tallen Co. Inc.
159 Carlton Ave., Brooklyn 5, N.Y.
See Adv. H 30

EQUIPMENT—COMMUNICATION
Airborne Electronics Inc.
155 First St., Mineola, N. Y.
See Adv. H 28
Aircraft Radio Industries, Inc.
15 East 40th St., N. Y., N. Y.
See Adv. H 32

EQUIPMENT—ELECTRONIC
Tallen Co. Inc.
159 Carlton Ave., Brooklyn 5, N.Y.
See Adv. H 30
Telecirad
148 Chambers St., New York 7, N. Y.
See Adv. H 30

EQUIPMENT—NAVIGATION
Airborne Electronics Inc.
155 First St., Mineola, N. Y.
See Adv. H 28

EQUIPMENT—RADIO
Aircraft Radio Industries, Inc.
15 East 40th St., N. Y., N. Y.
See Adv. H 32
Merrick Aviation Electronics
166-08 Douglas Ave., Jamaica 33, N. Y.
See Adv. H 27

EXPORT PACKING & FORWARDING
Lund Aviation, Inc.
230 Park Ave., New York 17, N. Y.
See Adv. H 29

EXTERIOR PAINT
Air Service Incorporated
Bridgeport Municipal Airport, Stratford, Conn.
See Adv. H 28

FACILITIES—MANUFACTURING
Peerless Products, Inc.
2460 Dixwell Ave., Hamden, Conn.
See Adv. H 31

FERRYING
Lund Aviation, Inc.
230 Park Ave., New York 17, N. Y.
See Adv. H 29

FINANCING—AIRLINE
Aviation Assistane Group
Suite 2500, 33 N. La Salle St., Chicago, Ill.
See Adv. H 30

FITTINGS—AIRCRAFT
Barton Aircraft Supply Corp.
138 Livingston St., Brooklyn 1, N. Y.
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Cook Aircraft Products Co., Inc.
P. O. Box 241, Hicksville, N. Y.
See Adv. H 32

FITTINGS—HYDRAULIC
Cook Aircraft Products Co., Inc.
P. O. Box 241, Hicksville, N. Y.
See Adv. H 32

GAUGES—VARIOUS
Vosler Associates, Inc.
34-06 Union St., Flushing, N. Y.
See Adv. H 28

GOVERNOR SERVICE
H & S Prop Shop
25210 Ryan Rd., Centerline, Mich.
See Adv. H 26
Pester's Propeller Service, Inc.
99 State St., Westbury, N. Y.
See Adv. H 28

HANGER FACILITIES
Pan Maryland Airways, Inc.
Friendship International Airport, Maryland
See Adv. H 31

HARDWARE—AIRCRAFT
Aero Spares Co.
69-06 Woodside Ave., Woodside 77, N. Y.
See Adv. H 31
Barton Aircraft Supply Corp.
138 Livingston St., Brooklyn 1, N. Y.
See Adv. H 25
Long Island Aircraft Supply
P. O. Box 182, Maspeth 78, L. I.,
See Adv. H 31

INSPECTION & APPRAISALS
Lund Aviation, Inc.
230 Park Ave., New York 17, N. Y.
See Adv. H 29

INSTRUMENTS & ACCESSORIES
Instrument Associates
351 Great Neck Rd., Great Neck, N. Y.
See Adv. H 29
Instrument Service
455 B. 67 St., Arverne, New York
See Adv. H 31

INSTRUMENT—OVERHAUL
Atlantic Aviation Service, Inc.
New Castle County Airport, Wilmington, Del.
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Instrument Associates
351 Great Neck Rd., Great Neck, N. Y.
See Adv. H 29
Instrument Service
455 B. 67 St., Arverne, New York
See Adv. H 31
S. M. S.
New York International Airport, Jamaica 30, N. Y.
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INSTRUMENT—REPAIR
Atlantic Aviation Service, Inc.
New Castle County Airport, Wilmington, Del.
See Adv. H 28
Instrument Associates
351 Great Neck Rd., Great Neck, N. Y.
See Adv. H 29
Instrument Service
455 B. 67 St., Arverne, New York
See Adv. H 31
S. M. S.
New York International Airport, Jamaica 30, N. Y.
See Adv. H 28

INSTRUMENT SERVICE
Atlantic Aviation Service, Inc.
New Castle County Airport, Wilmington, Del.
See Adv. H 28
Instrument Associates
351 Great Neck Rd., Great Neck, N. Y.
See Adv. H 29
Instrument Service
455 B. 67 St., Arverne, New York
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Lund Aviation, Inc.
230 Park Ave., New York 17, N. Y.
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Minnesota Airmotive, Inc.
Wold Chamberlain Field, Minneapolis, Minn.
See Adv. H 30
S. M. S.
New York International Airport, Jamaica 30, N. Y.
See Adv. H 28

INVERTERS
Clarence Carruthers, Inc.
79 Wall St., New York 5, N. Y.
See Adv. H 30

MACHINE TOOLS—CONVERSIONS
S & S Machinery Co.
130-53rd St., Brooklyn 32, N. Y.
See Adv. H 30

MACHINE TOOLS—USED, REBUILT
Kings County Machinery Exchange
408 Atlantic Ave., Brooklyn 17, N. Y.
See Adv. H 31
Montgomery Engineering Company
1778 W. Philadelphia, Detroit 6, Mich.
See Adv. H 28
Production & Equipment Co.
3500 West Fort St., Detroit 16, Mich.
See Adv. H 25
S & S Machinery Co.
130-53rd St., Brooklyn 32, N. Y.
See Adv. H 30

MACHINERY—AIRCRAFT
Kings County Machinery Exchange
408 Atlantic Ave., Brooklyn 17, N. Y.
See Adv. H 31
Production & Equipment Co.
3500 West Fort St., Detroit 16, Mich.
See Adv. H 25
S & S Machinery Co.
130-53rd St., Brooklyn 32, N. Y.
See Adv. H 30

MAINTENANCE SERVICE—AIRCRAFT
Pan Maryland Airways, Inc.
Friendship International Airport, Maryland
See Adv. H 31

MATERIALS—AIRCRAFT
Barton Aircraft Supply Corp.
138 Livingston St., Brooklyn 1, N. Y.
See Adv. H 25
Mineola Aircraft Company
P. O. Box 173, Mineola, L. I., N. Y.
See Adv. H 30

NUTS—STOP
Theodore J. Martin
20-71, 47 St., Long Island City, N. Y.
See Adv. H 31

OVERHAUL SERVICES
Atlantic Aviation Service, Inc.
New Castle County Airport, Wilmington, Del.
See Adv. H 28
Lund Aviation, Inc.
230 Park Ave., New York 17, N. Y.
See Adv. H 29
Skymotive Inc.
O'Hare Field, Chicago International Airport, Box 448, Park Ridge, Ill.
See Adv. H 30

POTENTIOMETERS
Legri S Company
591 Riverdale Ave., Yonkers 5, N. Y.
See Adv. H 26

PROPELLER—OVERHAUL
H & S Prop Shop
25210 Ryan Rd., Centerline, Mich.
See Adv. H 26
Pester's Propeller Service, Inc.
99 State St., Westbury, N. Y.
See Adv. H 28

PROPELLER SERVICE
Lund Aviation, Inc.
230 Park Ave., New York 17, N. Y.
See Adv. H 29
Pester's Propeller Service, Inc.
99 State St., Westbury, N. Y.
See Adv. H 28

PUMPS—CALIBRATED
Airponents Incorporated
660 Rockaway Turnpike, Lawrence, Long Island, N. Y.
See Adv. H 26

PUMPS—OVERHAUL
Airponents Incorporated
660 Rockaway Turnpike, Lawrence, Long Island, N. Y.
See Adv. H 26

PUMPS—TESTED
Airponents Incorporated
660 Rockaway Turnpike, Lawrence, Long Island, N. Y.
See Adv. H 26

RADIO INSTALLATION
Atlantic Aviation Service, Inc.
New Castle County Airport, Wilmington, Del.
See Adv. H 28
Usher Aviation Radio
Municipal Airport, New Haven, Conn.
See Adv. H 27

RADIO—OVERHAUL
Atlantic Aviation Service, Inc.
New Castle County Airport, Wilmington, Del.
See Adv. H 28
Usher Aviation Radio
Municipal Airport, New Haven, Conn.
See Adv. H 27

RADIO—REPAIR
Atlantic Aviation Service, Inc.
New Castle County Airport, Wilmington, Del.
See Adv. H 28
Usher Aviation Radio
Municipal Airport, New Haven, Conn.
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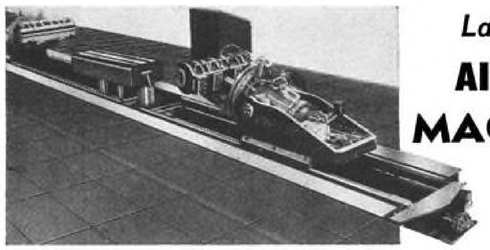

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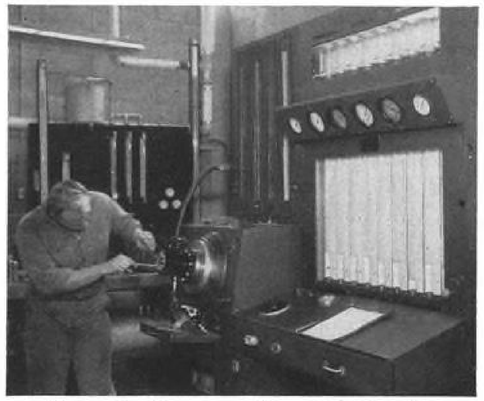

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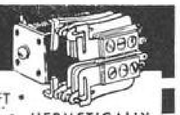

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Will this blot spread... or shrink?

NOTHING STRIKES so brutally at human lives as a slum.

Yet of America's many millions of homes, the blot that is a slum covers more than 1 out of every 10... and nearly one-half of all our homes are urgently in need of repair and basic improvements.

Will the blot go on spreading? Or will a concerted, nationwide attack on the causes of slums shrink it, year by year, until it is wiped out? Today, this is a challenge to every American... a challenge that *must* be met.

Your community... your problem!

A slum reaches across blocks, across miles, to sit on your doorstep and demand a price.

You pay it in the threat of crime and juvenile delinquency to your family. You pay the price in higher personal property taxes to fight the disease and crime and poverty that are slum-bred. You pay personally when the value of your home sinks as community deterioration takes another step closer.

Your *firm* pays when the community where you do business goes downhill. Slums automatically mean lower purchasing power and less effective labor.

Good citizenship is good business

It's good citizenship and good business both for your firm to join efforts to check housing decay... to stop slums before they start. In fact, it's the *responsibility* of every business, as it is of every other good citizen, to support community improvement efforts.

Some slums are beyond repair. They should be torn down and a fresh start made. Others can be remodeled, made to conform to better living standards. So it is up to you to get behind every sound program which seeks to provide adequate housing for all our people.

Adding your support to the efforts of the millions already attacking the problem, your firm can help stop slums cold and put America's housing standards at a new height.

How to get into action

A group of Americans from every walk of life has formed a new, non-profit organization to help combat home and community deterioration — The American Council To Improve Our Neighborhoods... A.C.T.I.O.N.

Send for a free copy of "ACTION." It explains what A.C.T.I.O.N. is and proposes to do. It also lists booklets, research reports, check-lists, and other material which can help you protect the housing health of your community. Address P. O. Box 500, Radio City Station, New York 20, N. Y.

ACTION

American Council To Improve Our Neighborhoods

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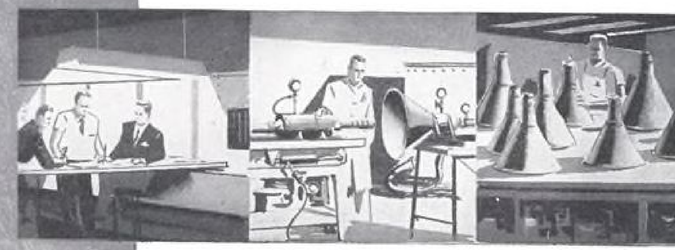

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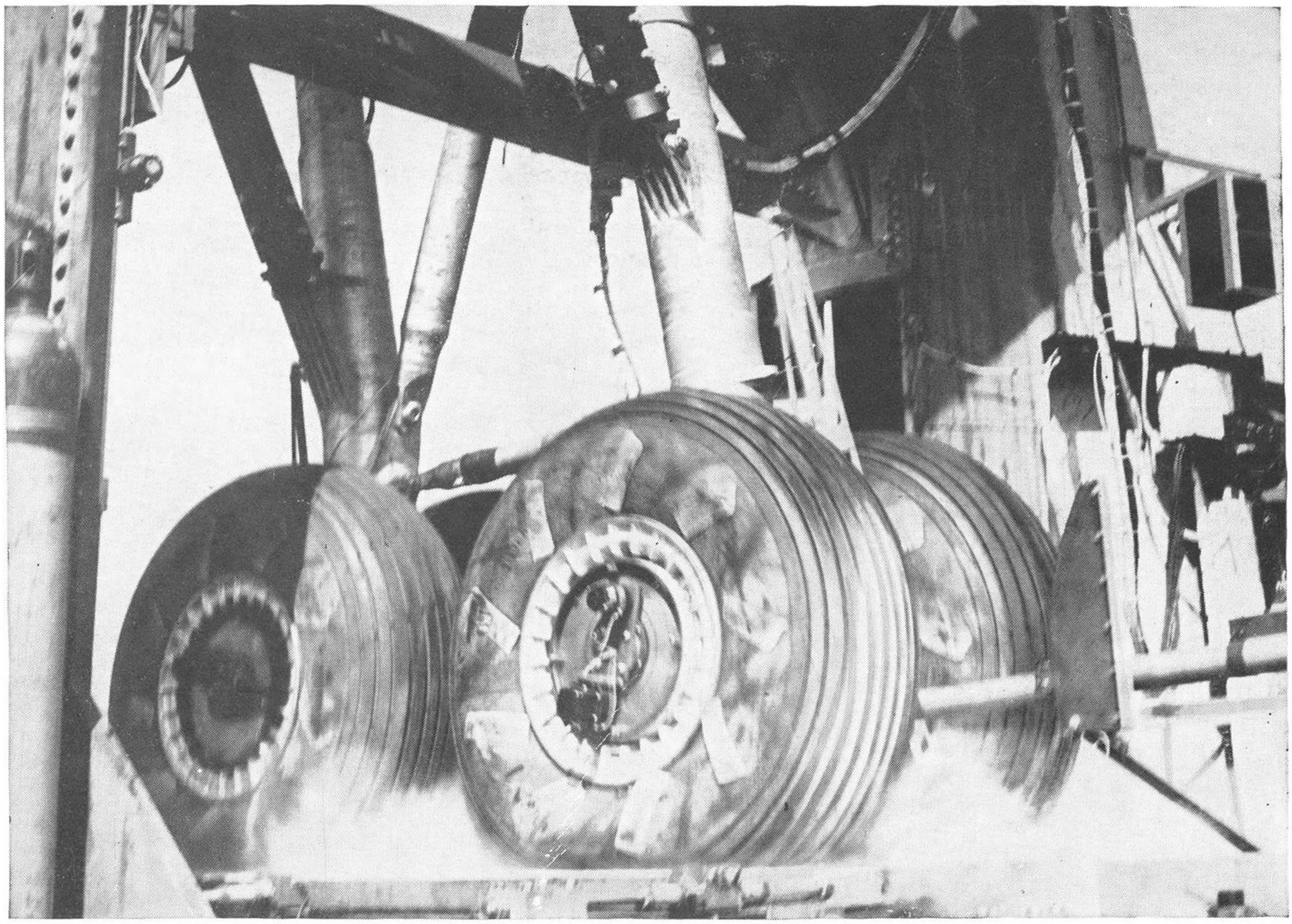

On *TWA's* **SUPER-G** Lockheed Constellation's landing gear . . .

Elastic Stop® nuts pass this brutal drop test

Like a bladeless guillotine, this 40-foot-high Lockheed test stand hoists landing gear assemblies aloft, spins their wheels backward 100 miles an hour, and crashes them down on its concrete base. Tons of lead weights simulate the big plane the landing gear is designed to carry.

The Lockheed experiments are directed toward development of lighter, stronger landing gear. These new units in turn demand fasteners designed for maximum resistance to fatigue failure plus the utmost dependability in terms of rated tensile performance and resistance to loosening under severe vibration and extreme shock and impact loads. Among the planes to benefit from data already secured by these punishing tests is the new Lockheed Super G Constellation, already placed in service by TWA. The Super G Connie's landing gear is only one of the many structural sections of the new plane fastened with vibration-proof Elastic Stop nuts.

Elastic Stop nuts with their familiar red locking collars have been used on every new air frame developed during the last two decades. They have performed satisfactorily under the most unpredictable test conditions . . . under normal operating conditions . . . and throughout millions of hours of rugged combat service. You can rely on flight-tested Elastic Stop nuts!

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- adaptability to all shapes and sizes of aircraft fittings
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