AMOGRAW-HILL PUBLICATION ON THE SO CENTS

RUBBER "PLANTATION" IN MINNEAPOLIS

When we were developing a tank unit for one of our electronic fuel measurement systems, we needed rubber of especially high quality to use in spacing electrodes.

Upon investigation, we found no such material existed on the market.

So we called on the Honeywell Plastics Division to develop a synthetic rubber that would meet our requirements. They did, and for a time even produced it. That's why we dubbed the lab pictured here our "rubber plantation."

Today we obtain this rubber from an outside supplier – who uses the process and formula developed by the Honeywell Plastics Laboratory.

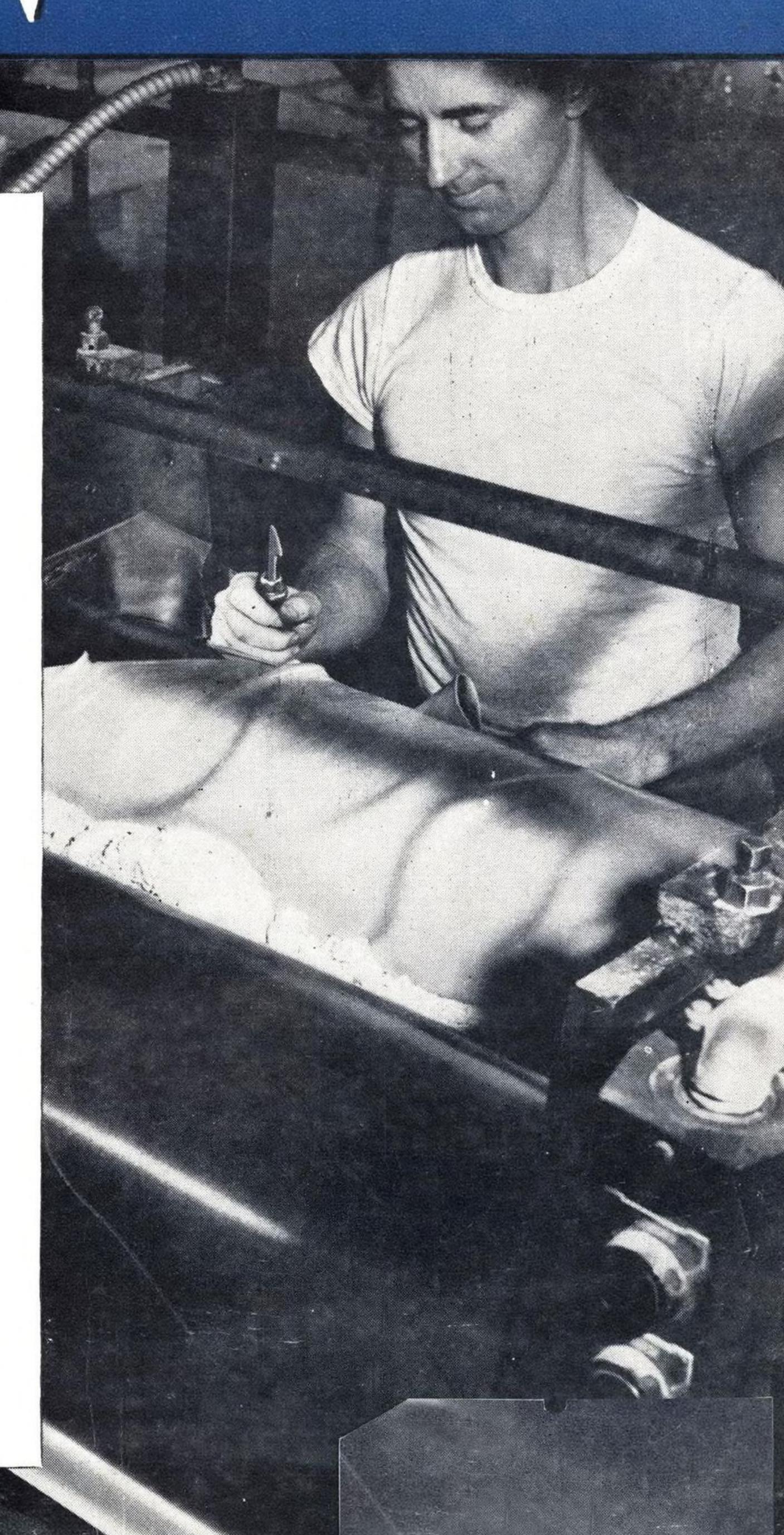
There have been many other occasions when the Aeronautical Division has received invaluable help from the diversified Honeywell organization — help with problems that seemingly were far removed from the aeronautical field.

We'll be asking for, and getting, this kind of help again and again in the years to come—because it's one of the best ways to make sure you keep on building automatic controls of the very highest quality for the aviation industry.

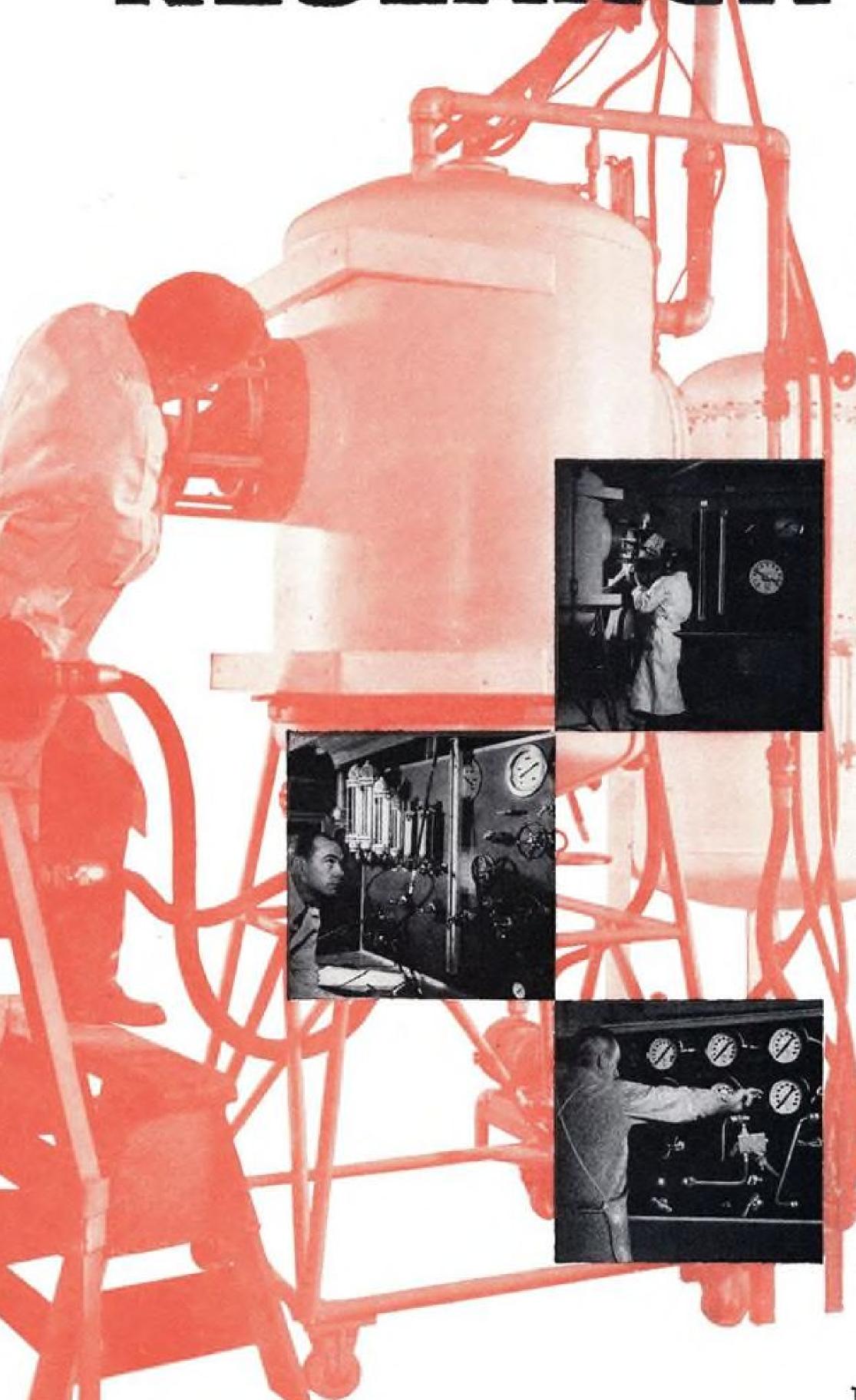
Honeywell



Aeronautical Controls



RESEARSH is the reason



The new Engineering Research

Laboratories at Hydro-Aire

are considered the finest and most
complete company-operated in

their field. This division is equipped
and manned to fabricate prototype
parts from preliminary design,
evaluate their performance under
conditions simulating actual
operation and to qualify the units
according to customer and military
specifications—all without
interference to general production

Yes, Research is an important
Reason why every fighter, every
bomber, every transport is
Hydro-Aire equipped.

HYDROAIRE,

Subsidiary of Crane Co.

B.F.Goodrich



New B. F. Goodrich cell weighs 38% less, carries more fuel

Thunderjet in production than designers start again on their perpetual job: shave every possible ounce of weight—make room for more armaments. Save every possible cubic inch inside for fuel—make way for longer flight range.

Republic engineers figured they could carry more fuel if they could use all the space in the wings . . . including odd-shaped corners and crevices. But this would add weight, and it looked as though the tricky shapes couldn't be built anyway.

They brought this dual problem to B. F. Goodrich. Here, engineers tackled the assignment three ways. A thinner wall was developed that would still seal as well under gunfire. A way was found for building shapes that would fill out the odd corners, carry more fuel. And finally, a lighter fitting was worked out that saved still more weight.

It all added up to more gallons of fuel and 38% less weight than cells in the early Thunderjets. The new B. F. Goodrich cells have been proved on the famous F-84G, will soon be seeing duty on the new F-84F and RF-84F.

The development of the lighter weight fuel cells is another example of BFG leadership in rubber research and engineering on the problems of aviation. Other B. F. Goodrich products for aviation include tires, wheels and brakes; heated rubber, De-Icers; Avtrim; Plastilock adhesives; Pressure-Sealing Zippers; inflatable seals; Rivnuts; accessories. The B. F. Goodrich Company, Aeronautical Division, Akron, Ohio.

B.F. Goodrich

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ROEBLING PRODUCTS for control in the air are available in a complete range of sizes and constructions...and all of them are built to the highest standards of quality. Cord is available in stock lengths or in complete assemblies as desired. There are fittings for every installation.

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Aviation Week



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Number 20

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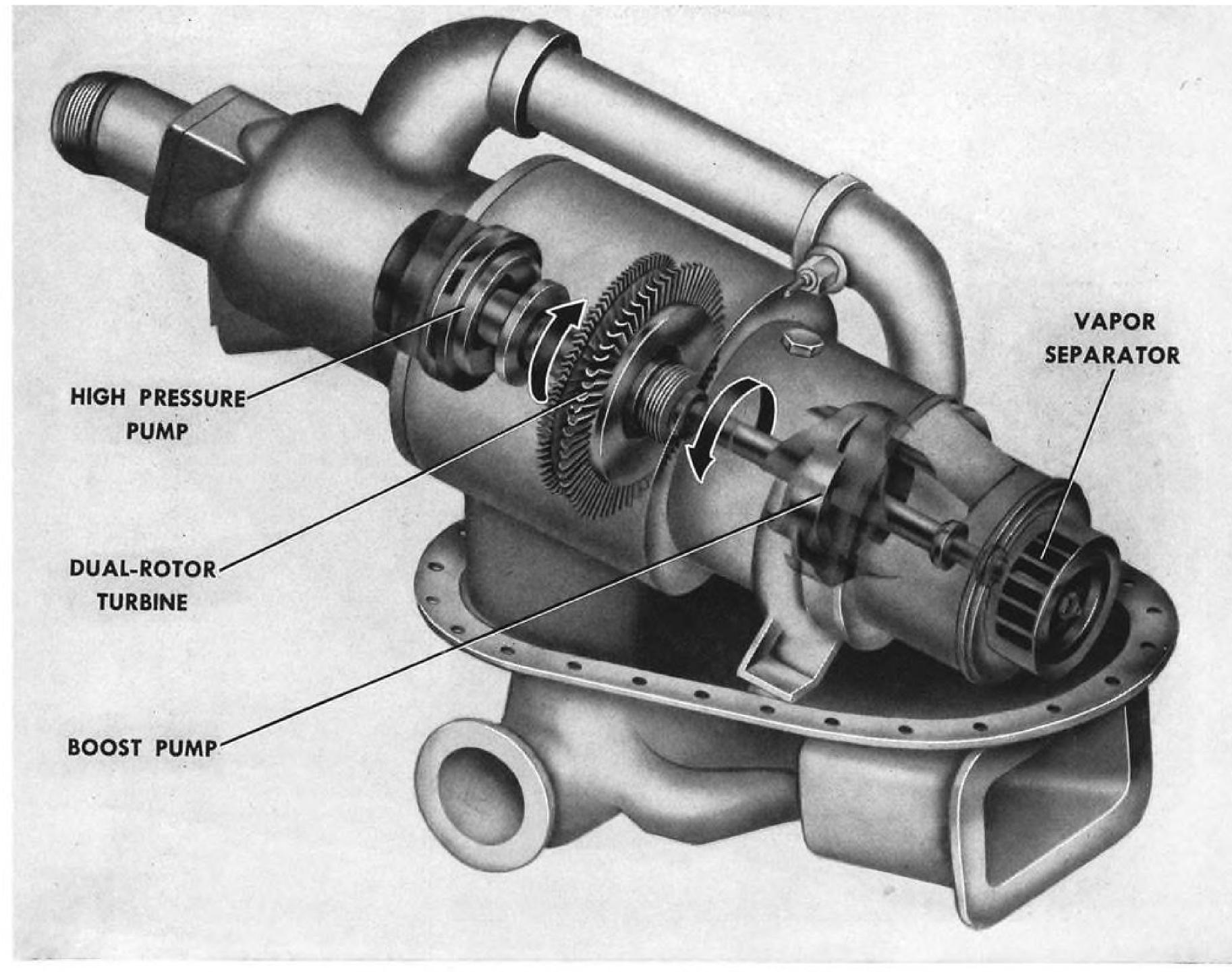
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AVIATION WEEK, November 17, 1952



THIS PUMP HAS PASSED THE OFFICIAL USAF QUALIFICATION TESTS

New G-E Afterburner Fuel Pump Saves Pounds, Eliminates System Complexity

3-in-1 Pump Is Light, Compact, Permits Climb Rates of Thousands of Feet Per Minute

To give you maximum efficiency in the smallest possible space, the boost pump, high pressure pump, and vapor separator are all combined in G.E.'s new reheat (afterburner) fuel pump. Because it is mounted in the fuel tank, the pump replaces boost pumps and their associated piping. This not only saves weight, but eliminates system complexity.

A built-in vapor separator permits climb rates of thousands of feet per minute. The pump is capable of delivering 86 gallons of vapor-free fuel every minute at a pressure of 550 psi.

Although operated on bleed-air, the turbo-pump can be turned off while the engine is operating. This eliminates recirculation and its accompanying energy loss.

GENERAL ELECTRIC

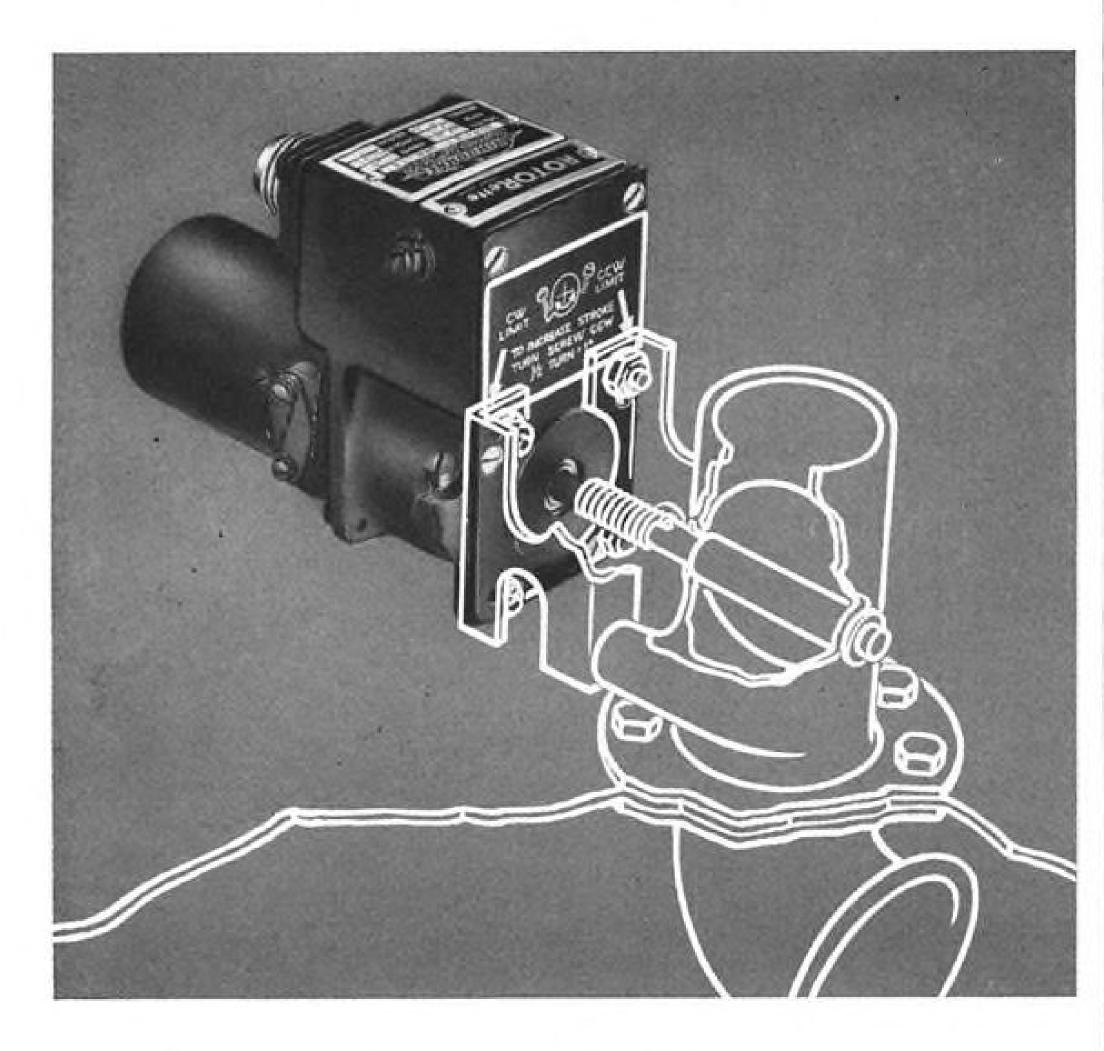
This pump can also be adapted for pumping various types of liquids to meet other pumping requirements. For information on G-E turbo-pumps contact your nearest General Electric Aviation Specialist or fill out the coupon and send to Section 210-65, General Electric Company, Schenectady 5, N. Y.

- 1	
ĵ	General Electric Company
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1	Schenectady 5, N. Y.
Ì	Please send me your bulletin GEA-5871, Aircraft Tur-
i	bine-driven Fuel Pumps
ì	For:
1	Reference Purposes
ı	Immediate Project

Immediate	Project
Name	
	(Please print)
Position	
Company	
City	

RAM AIR VALVE

ON REPUBLIC'S F-84 Airborne actuated



An R-430 type ROTORETTE® Electric Rotary Actuator operates the valve which controls ram air to the cockpit of Republic's F-84.

This Airborne actuator features adjustable positive stops, load sensitive limit switches, radio noise filter, and weight of less than 1.5 pounds.

Perhaps you have a similar application. Our literature in the I.A.S. Aeronautical Engineering Catalog gives complete information on ROTORETTE and other Airborne electromechanical actuators for the aircraft industry.



1414 Chestnut Avenue, Hillside 5, New Jersey

AVIATION CALENDAR

Nov. 17-18-First regular meeting Operations Research Society of America, National Bureau of Standards, Washington, D. C.

Nov. 17-20-National Aviation Trade Assn. annual convention, Hollywood-Roosevelt Hotel, Los Angeles.

Nov. 19-21-Fourth Annual Safety Seminar sponsored by Flight Safety Foundation, Hamilton, Bermuda.

Nov. 24-25-Joint Industry Conference on Preservation Packing, sponsored by General Motors Corp. R. M. Hollingshead Corp. host. Walt Whitman Hotel, Camden, N. J.

Nov. 30-Dec. 5-Annual meeting of ASME, Hotels Statler and McAlpin, New York,

Dec. 1-Fourth annual Air Cargo Day, (ASME), Hotel Statler, New York, N. Y.

Dec. 2-Symposium on light metal heavy forgings and extrusions for aircraft, SAE, ASME, IAS and AIME, Hotel Statler, New York.

Dec. 2-5-Aviation Distributors and Manufacturers Assn. tenth annual meeting. The Kenilworth, Miami Beach.

Dec. 3-5-American Rocket Society, Hotel McAlpin, New York, N. Y.

Dec. 3-5-Society for Experimental Stress Analysis, annual meeting, Hotel McAlpin, New York.

Dec. 4-6-Sixth annual Arizona Aviation Conference, Douglas, Ariz.

Dec. 17-Annual Wright Bros. dinner, 7:30 p.m., Statler Hotel, Washington, D. C. Wright Bros. lecture to be presented by IAS 3 p.m., U. S. Chamber of Commerce

Jan. 12-16-Annual meeting and engineering display of Society of Automotive Engineers, Sheraton-Cadillac Hotel, Detroit.

Jan. 14-16-AIEE-IRE-NBS conference on High Frequency Measurements, Statler Hotel, Washington, D. C.

Jan. 19-23-Plant Maintenance Conference, Public Auditorium, Cleveland, O.

Jan. 19-23-Winter general meeting of the American Institute of Electrical Engineers, Hotel Statler, New York, N. Y.

Mar. 25-27-National Production Forum of the SAE. Hotel Statler, Cleveland, O.

Apr. 4-12—Second annual International Motor Sports Shows, Grand Central Palace, New York, N. Y.

Apr. 20-23—Aeronautic Production Forum, National Aeronautic Meeting and Aircraft Engineering Display (SAE), Hotel Governor Clinton and Hotel Statler, New York, N. Y.

PICTURE CREDITS

7-Wide World: 8- (center, bottom) Levy-Shipp; 10 - (Short, Tobey) Acme; (Taber, Bridges) Wide World; (Lodge) William Charles; (Wolverton) Harris & Ewing: 12 - Tommy Weber: 15-16 - Me-Graw-Hill World News: 21-22, 26-David Anderton; 33-National Bureau of Standards; 36-(top two, bottom left) General Electric; (bottom right) Signal Corps Lab; 62-64 - McGraw-Hill World News: 80 -Australian News and Information Bureau.

NEWS DIGEST

Domestic

Preliminary work toward development of the world's first atomic-powered aircraft will start soon, according to the Atomic Energy Commission's Idaho operations office. Notice was given contractors that tentative plans were to be available about Nov. 15 for construction of an assembly and maintenance area and an administration area for prototype aircraft reactor ground testing facilities at the National Reactor Testing Station near Arco, Ida. Detailed plans and specifications will be issued Dec. 15; bids will be opened Jan. 5. Consolidated Vultee has contracted to develop an airframe suitable for an atomic powerplant, and General Electric is developing the engine.

Recent Bell helicopter long-distance nonstop flight from Ft. Worth, Tex., to Niagara Falls, N. Y., has been accepted as an official world's record by the Federation Aeronautique Internationale. Corrected distance has been set officially at 1,217.137 mi. Test Pilot Elton Smith made the flight in a Bell 47D-1 in 12 hr. 57 min. on Sept. 17.

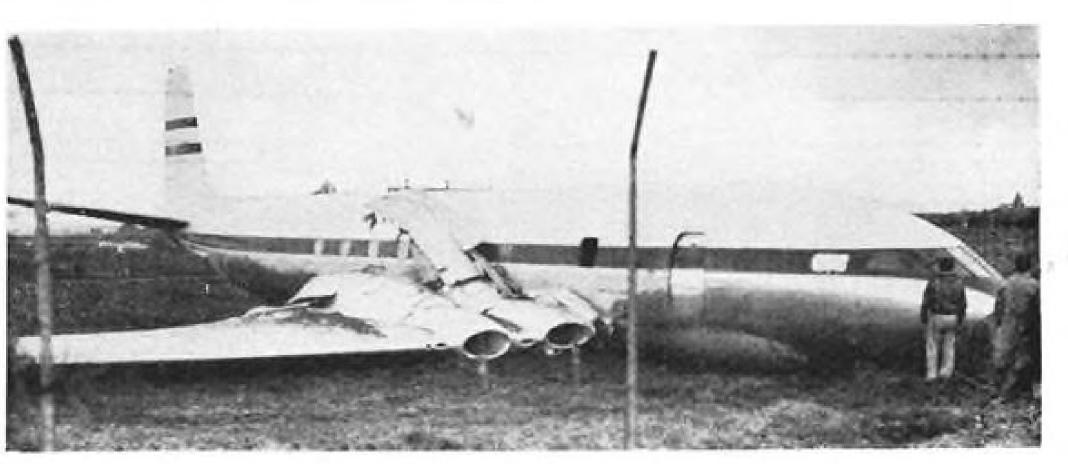
United Air Lines strike of 290 flight engineers was called off after a factfinding board had been set up by President Truman. The strike was called to force UAL to close the pay gap between flight engineers and flight captains on DC-6 and Stratocruiser

Mercer County Airport, Trenton, N. J., has been activated for commercial aviation. Built for Navy in World War II, it has four 4,000-ft. paved runways. a land area of 500 acres. Installation of runway lights will be completed in a few months.

Robert L. Turner has been appointed Acting Administrator of the Defense Air Transportation Administration, the post recently vacated by Ray W. Ireland, vice president of United Airlines.

A Convair-Liner 340, first of six ordered by Hawaiian Airlines for service on the carrier's 402-mi. island system. has been delivered to the carrier.

Helicopter passenger services are expected to be in operation some time in 1953 in Los Angeles, New York and Sept. 30. possibly Chicago, L. Welch Pogue, former Chairman of the Civil Aeronautics Board, predicts. Helicopter



1 lying on the ground just 10 ft. from the fence at Rome's Ciampino Airport shortly after it crashed on takeoff Oct. 26. There were no passenger or crew injuries. Accord- by the British Ministry of Civil Aviation ing to reports from Rome, the plane had gained only 50 ft. altitude when it went down. Although the kerosene fuel tanks Ghost jet engines. The plane was flying in the belly were ruptured, there was no from London to Johannesburg, So. Africa.

Corporation-owned aircraft now total same date amounted to \$426,391. Backabout 9,500 planes, some 1,700 of them log of unfilled orders amounted to multi-engine. Private corporations now \$28,400,000. own more multi-engine planes than all domestic airlines combined, according to Planes, Aircraft Industries Assn. publication.

Financial

Trans World Airlines plans to raise extra operating capital by selling 381,-916 shares of common stock, par \$5, to stockholders at the rate of oneseventh of a share for each share held. Hughes Tool Co., which holds 75% of the carrier's common, has agreed to buy enough of the new stock to insure TWA raising at least \$5 million.

Bell Aircraft Corp. reports net income of \$1,608,354 on gross sales and other revenues of \$86,422,420 for the nine months ended Sept. 30. Unfilled orders, as of that date, amounted to \$477 million.

Glenn L. Martin Co. shows net income of \$2,216,485 for the quarter ended Sept. 30, with a net of \$2,756.764 for the three quarters ending same date. Sales for the first nine months of 1952 amounted to \$101,680,468.

Flying Tiger Line had a gross revenue of \$6,197,580 for the quarter ending

Sundstrand Machine Tool Co. had net earnings of \$1,466,574 after taxes

BRITISH OVERSEAS AIRWAYS Comet fire. The Comet has an automatic switch that actuates methyl-bromide fire extinguishers when the bottom of the fuselage contacts the ground. A preliminary report stated that the crash was not caused by malfunctioning of the aircraft or its DH

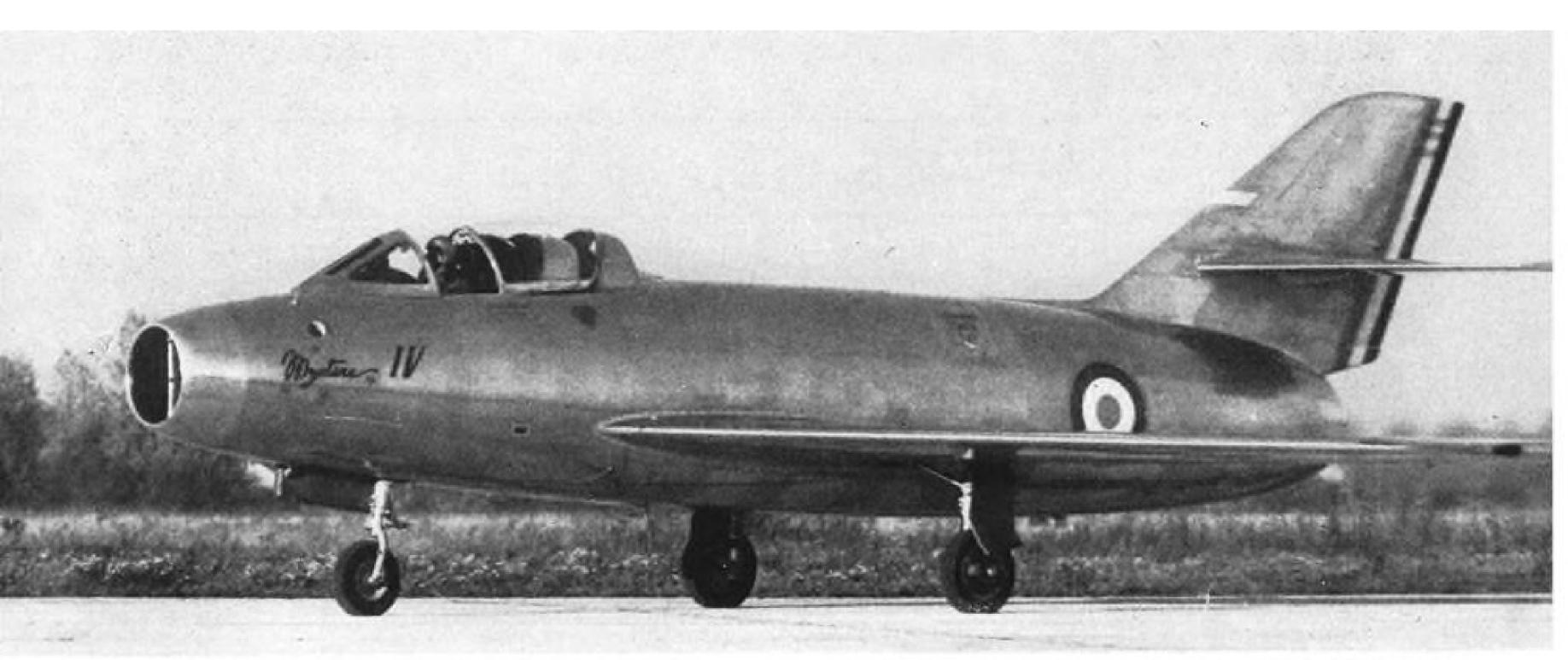
Jack & Heintz, Inc., reports net income after taxes of \$249,000 for the third quarter ending Sept. 30. Net income for the first three quarters of 1952 amounted to \$769,400. Backlog of unfilled orders Sept. 30 was \$52 mil-

United Aircraft Corp. earned a net income after taxes of \$3,977,271 for the quarter ended Sept. 30. Net profit for the nine months ended same date amounted to \$12,577,590. Unfilled orders and government Letters of Intent amounted to about \$1,395,000.-000 on Sept. 30.

International

The Dominican Republic has signed the International Civil Aviation Organization's new air law convention. regulating liability for damage done by foreign aircraft to third parties on the ground. Seventeen other nations have ratified the agreement.

A group of Trans World Airlines officials has departed for the Far East on a survey flight to study possibility of operating an air route between Bombay and Tokyo. Planned stops are Delhi. Calcutta, Colombo, Bangkok, Hong Kong, Okinawa and Formosa. The flight is being made in a Constellation. Warren Lee Pierson, chairman of mail service is now operating in 92 for the nine months ending Sept. 30. the board of TWA, is heading the American communities. Earnings in the three months ended survey group.



MYSTERE 4 HITS 687 MPH.—During a recent demonstration for Allied officials, this new Dassault Mystere 4 fighter did 687 mph. It has a Hispano-Suiza Tay with afterburner. U. S. has a provisional off-shore procurement order for 250 Mystere 4s.

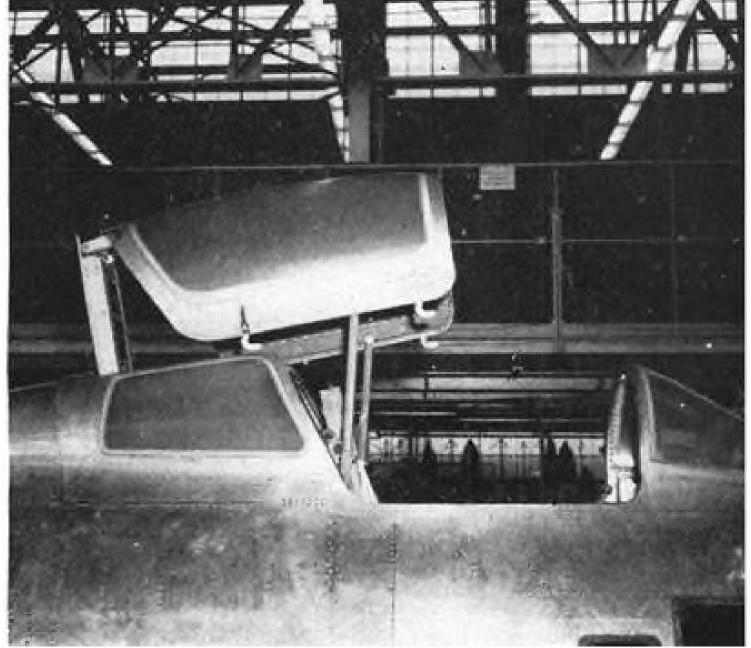
New Aircraft In the News

NEW KAMANS FLOWN—A pair of the latest model HTK-1 helicopters (right) in flight at the Kaman plant, Windsor Locks, Conn., showing their new tail assemblies. These craft have shorter tailbooms than previous HTKs and increased fin area. The new dorsal and ventral fins each have 8.3 sq. ft. area, and the outer fins have been increased 2.5 sq. ft. to 12.5 sq. ft. The blades have been aerodynamically modified.



PRODUCTION F-84F SHOWN-Below are first photos of a production sweptwing Republic F-84F displayed at a recent "open house" at Farmingdale, L. I., N. Y. Particularly noteworthy is the new cockpit canopy design. Fuselage brakes are behind wings.





WHO'S WHERE

In the Front Office

William W. Wood, chief engineer for Link Aviation, Inc., Binghamton, N. Y., has been named vice president-engineering by the firm. Wood joined Link in 1941 as a field engineer.

John F. Davidson has been designated a vice president of California Eastern Airways, Inc. He joined CEA last January and at one time was director of operations for Air Transport Assn.

E. R. Marlin has been named director of technical assistance of the International Civil Aviation Assn. His previous post was as external relations officer for ICAO.

Changes

Louis G. Raiche has been appointed works manager of American Car & Foundry's St. Charles, Mo. plant where he is responsible for B-47 fuselage sections.

Robert A. Earley has been promoted to superintendent of Hamilton Standard division experimental shop, Windsor Locks, Conn. Other promotions: Lawrence P. Nielson, assistant superintendent, experimental manufacture, and George W. Rice, materials and methods.

George Peterson, Jr., has been appointed director of aircraft sales for Camden Forge Co., Camden, N. J.

James M. Wallace has been named manager of the newly formed industrial relations department of Westinghouse Electric Corp.'s Aviation Gas Turbine division, Philadelphia, Pa.

Anthony J. Kreiner has been appointed manager, Manufacturing division, Pacific Airmotive Corp., Burbank, Calif.

G. C. (Gabe) Danch has joined Ryan Aeronautical Co., San Diego, as executive assistant to the director of engineering. Al Deyarmond has returned to the company to fill the reactivated post of chief of structures and will also be chief of aerodynamics.

Thomas B. Moule has been named general sales manager for G. M. Giannini Co., Pasadena, Calif.

Lowell J. White has been designated Northwest Airlines' director of reservations and city ticket offices, succeeding Robert P. Brinkley, resigned.

Franklin D. Walker, formerly managing editor of Flying magazine, has joined Lowes Associates, N. Y., public relations firm. William Kroger, Ben Lee and William

William Kroger, Ben Lee and William Coughlin, whose names do not appear on AVIATION WEEK'S masthead this week, are engaged in a special project of the McGraw-Hill Publishing Co., which will be announced shortly.

Honors and Elections

Betty Gillies, San Diego, has been elected chairwoman of the board of the Ninety-Nine-sponsored all women annual transcontinental air race. The air race board has been reorganized following the resignation of the former chairwoman, Mardo Crane. Kay Brick is new vice president.

INDUSTRY OBSERVER

- ▶ Don't be surprised if Howard Hughes sells the Hughes Aircraft Co. at Culver City soon and withdraws from the aviation and electronics manufacturing field. Air Force is now quietly screening prospective purchasers to determine if they have the technical, financial and management resources to carry out Hughes' heavy commitments to USAF on airborne radar, guided missiles and jet helicopters. Internal management troubles is one reason for the impending sale.
- ▶ Watch for the Glenn L. Martin Co. to get back into the USAF picture with a design for a supersonic jet bomber aimed at low level attack work.
- ► Convair shortly will flight test its F2Y, supersonic water-based fighter, with hydrofoils—a retractable water ski developed for aircraft water landings as a result of joint research by NACA, Navy, Convair, Edo and All-American Airways.
- ▶ Navy's Bureau of Aeronautics doesn't anticipate the current bottleneck in production on the Wright J65 (Sapphire) turbojet will affect its recent order for the engine. Order was for relatively small quantities for a new fighter—the North American FJ-3. Present airframe schedules indicate the engines won't be required for at least another year. If Wright makes good on the initial Navy delivery schedules the J65 may be used in additional Navy fighter types.
- ▶ USAF and Navy finally have resolved their arguments over the size of future turboprop development with a decision to put engine builders to work developing turboprops in the 15,000-hp. class. Largest current development projects are the P&WA T52, aimed at about 8,500 hp., and the Wright T49, a turboprop variation of the basic Sapphire design.
- ► Avro 698 delta bomber has been named the Vulcan. It is powered by four advanced versions of the Rolls-Royce Avon and is capable of very high subsonic speeds.
- ▶ Airwork Ltd., one of the largest British nonskeds, has applied to the British Air Transport Advisory Council for a 10-year permit to operate trans-Atlantic freight service between England and Montreal-New York. Initial service would use York and Tudor airfreighters and begin in June 1953. Airwork expects to haul about a thousand tons of freight annually in each direction with a semi-weekly service to both American terminals.
- ▶ Naval Air Materiel Center at Philadelphia has developed a device for accurately and swiftly measuring the sinking speed of aircraft. An electronic impulse is transmitted from a radar altimeter in the aircraft and recorded by a Polaroid-type camera on the ground. Results are available as soon as the aircraft completes its landing.
- ► Pratt & Whitney Aircraft's latest version of the J48 centrifugal-flow turbojet with afterburner is now delivering more than 10,000 lb. thrust. It will be used in the Lockheed F-94C Starfire all-weather interceptor. J48's original thrust was 6,250 lb. without afterburner.
- ▶ British are extremely anxious to expand their production plans for the Gloster Javelin, delta-winged all-weather fighter. American technical advisers to the MSA off-shore procurement program feel the Javelin meets NATO night fighter requirements better than any now scheduled for procurement. Big snag blocking inclusion of the Javelin in the current off-shore procurement program is the 1955 delivery deadline set for NATO requirements.
- ▶ U. S. has tentatively agreed to buy 340 Supermarine Swift jet fighters under the off-shore procurement program, contingent on delivery by June 1955. As part of the contract, the British were required to up their Swift commitments by 140 planes, which has been done. The U. S. contract eventually may cover only 200 of the fighters, considering delivery deadline and fund limitations. Observers are saying RAF pilots will fly all the Swifts ordered under NATO aegis.

AVIATION WEEK

VOL. 57, NO. 20

New Names, but Few Policy Changes

Outlook for Aviation Under Republicans

- GOP expected to accept fiscal '54 defense budget.
- But there may be major cuts in CAA spending.

By Katherine Johnsen

Military aviation and commercial aviation, grown from infancy to maturity under 20 years of Democratic administration, now face for the first time the scrutiny and impact of a Republican President and Congress.

This is the outlook:

- Although there will be a wholesale change of faces in key posts, there will be no drastic change or redirection in policies affecting commercial or military aviation as a result of the election. The reason: Splits on aviation issues do not follow party lines. Republicans and Democrats have divided on such matters as money for land-based and carrier air power, foreign military aid, international air policy, and nonsked airline competition.
- Most major aviation developments on the horizon will be more a result of domestic and international trends than the election.
- A slash in Civil Aeronautics Administration programs does appear certain. The 80th Republican-controlled Congress slashed CAA's money for the 1948 fiscal year by \$70 million to \$119 million, and, the following year lopped off \$55 million leaving the agency a \$100million budget. These were years when the defense requirement was running under \$15 billion annually and there was not the pressure to economize on civilian programs that there is at the present time.
- Republicans, though, are expected to move cautiously on economizing on defense, which could have international repercussions. More likely, expenditures will be held down. This would mean a slowup in deliveries of planes, rather than in orders.

Defense

➤ How Much for Defense?—The Eisenhower Administration is expected to go along with the 1954 fiscal year budget





TABER



TOBEY

SHORT





BRIDGES

LODGE

WOLVERTON

Lovett, a Republican. It will run low compared with recent-year budgets. The total agreed upon by Lovett and the Bureau of the Budget is understood to be around \$39 or \$40 billion, with the largest slice, \$17 billion, for the Air

Last vear President Truman cut below the Defense Department-Budget Bureau figure.

In the campaign heat, conducive to exaggerated pledges, Eisenhower promised deep cuts in defense. But he stipulated that they must be made without loss of "defensive strength." His premise, laid out in a Baltimore speech, is that the cuts can be accomplished through greater unification of the armed services, elimination of duplication in weapons development and use, and more careful weapons selection. But this takes

It can't be reflected in the 1954 fiscal budget.

The 1954 fiscal year defense budget will be sharply reduced. But this is be- priations will be the drive to curtail that has been drawn up under the direc- cause the mobilization program has defense spending. It is actual expendition of Secretary of Defense Robert passed its scheduled peak on appropriations that

tions. It won't be because of slashing by the Eisenhower Administration. This is the view of most observers.

Defeated Sen. Henry Cabot Lodge, top prospect for Secretary of Defense in the new regime, is a strong defense advocate. He not only spearheaded the drive for an Air Force buildup to 143 wings, but also prodded the Administration to raise Ground Force goals. His appointment as liaison man to work with the Truman Administration on the defense budget increases the prospect he will be given the secretaryship. He will be the one Eisenhower man familiar with the military program. Lodge resigned from the Senate to serve as an Army officer in the African and European Theaters during the war. Undoubtedly there will be a drive by congressional Republicans, such as Rep. Taber and Sen. Ferguson, to cut back whatever defense budget is submitted.

► Cut in Military Expenditures?—Far stronger than the drive to cut appro-

AVIATION WEEK, November 17, 1952

immediately promote inflation, and expenditures that determine the deficit or surplus of the Federal Budget and the feasibility of tax reductions. This year the Democratic House overwhelmingly voted a ceiling on defense expenditures but it was lifted by the Senate. Rep. Frederic Coudert, outgoing Air Secretary Thomas Finletter's former law partner, who sponsored the House move, will be back next year.

► More Unification?—Eisenhower will definitely recommend drastic steps to unify the services by concentrating authority and responsibility with the Secretary of Defense and cutting back service authority. He was consultant to the Hoover Commission which recommended steps in this direction. But former Defense Secretary Louis Johnson's unpopularity and the services' influence with Congress were reasons they were only partially enacted.

Eisenhower, according to some speculation, may go so far as to propose elimination of the separate service secretaries and instead propose tiers of secretaries, all in the office of the top Secretary of Defense, along functional lines-such as research and development, procurement, production, manpower, etc.

The Hoover Commission's plan to promote unification by making the service secretaries responsible to the Secretary of Defense, and cutting them off from direct appeal to the White House has not accomplished its objective. The service secretaries seem invariably to become "advocates" of their service.

The ball started rolling this year more unification. Secretary Lovett, under congressional direction, gave the chairman of the Munitions Board unqualified authority over the services on all supply, procurement, and production matters.

► New Military Policy?—Internationalists are somewhat apprehensive over Eisenhower's reference in the closing days of the campaign to "a mobile force to provide air and sea support wherever and whenever needed." It sounded like Sen. Taft's isolationist position that the U. S. should whittle down the Army and rely almost wholly on Naval and strategic air strength.

But weighed against Eisenhower's record and other statements, it appears certain his administration will continue the military policy aimed at "holding the land" of friendly nations in fringe

This means strong emphasis on tactical air power and air transport.

Naval carrier aviation may be a casualty of Eisenhower's weapons evaluation and selection program. He is a strong advocate of land-based air.

► New Foreign Aid Agency?—The mili-
The Key Men?—Here are some prostary aid program, now largely concentrated on Europe, will become global . Vice President-elect Richard Nixon. The post might be claimed by Sen.

and it seems likely a new agency will be established to direct it, possibly headed by former Economic Cooperation Administrator Paul Hoffman, who supported Eisenhower's campaign. The trend will be toward increased offshore procurement in order to get foreign nations on their feet, economically, and reduce the need for continued U. S. financial support.

Air Transport

► New Transportation Policy?—A new transportation policy is likely to develop. Two of its main features:

 Take Civil Aeronautics Board out of the "promotional" class and put it squarely in the "regulatory" class.

 Make each form of transportation stand on its own feet, without direct government subsidy, and paying for airways and other government-financed facilities through a system of user charges. Elimination of airline support, though, would be timed so as not to disrupt the industry.

Agricultural, business, financial, and transportation interests are supporting this policy. Scheduled airlines are going along with it. The policy would have been pushed next year, regardless of the election. The Republican Administration will probably push such a program much harder than a Democratic Administration might have.

► Undersecretary for Transportation—Although the position of Undersecretary of Commerce for Transportation to coordinate the activities of the regulatory transportation agencies was established as a result of a Hoover Commission recommendation, the post probably will have no more importance in the Republican Administration than it has now.

This is mainly an issue of Congress versus the Executive Branch, rather than a political issue. Congress is antagonistic to a political appointee "butting in" on jurisdiction of quasi-judicial agencies, derived from legislation.

► CAB: Up for Investigation-First order of business of House Interstate and Foreign Commerce Committee under its new chairman, Rep. Wolverton, will be a "sweeping investigation" of all regulatory agencies, including CAB. Wolverton wants to know how the agencies have used the authority conferred by Congress. His comment: "Some agencies have become alphabetical autocrats. Too great a chasm has been permitted to develop between the Congress-created agencies and Congress itself." Commercial aviation representatives will be invited to testify.

Leaders

- pects:

A Naval Aviation staff officer during the war, Nixon has voted against cuts in Air Force funds. He opposed the scheduled airline position down-the-line on airmail subsidy separation legislation, voting to open the subsidy field to certificated irregular carriers, against longterm subsidy contracts, and against a lenient formula for determining mail pay for international carriers.

• House Speaker-to-be, Rep. Joseph Martin. Though a great economizer, Martin is strong for strategic air, and, in the years before Korea and the mobilization program worked closely with House Armed Services Committee's Chairman Carl Vinson in building up support for USAF funds. He is remembered in aviation circles for his push a decade ago to have a standing committee on aviation established in the House. The airline industry, except Pan American World Airways, opposed the move and it flopped.

 Sen. William Knowland, a rising star of the Republican Party and the leading prospect for majority leader of the Senate. He has supported a strong defense program generally, and led the Senate fight against the Truman Administration's economizing on funds for a 70-group USAF. Knowland has bucked the scheduled airline industry on airmail separation legislation.

• Sen. Leverett Saltonstall, in line for chairmanship of the Senate Armed Services Committee. As a member of the group, he has generally followed Defense Department recommendations, unquestioningly, and, as a member of the Appropriations Committee, he has favored trimming money for USAF and Naval Air, as well as other defense items, but conservatively. Saltonstall is mentioned for the Senate leadership, a full-time job which would probably mean the Armed Services Chairmanship would go to unpredictable Sen. Wayne Morse, who bolted the party in the election. Senate Republicans will balk at such a development. Morse supported funds for a 70-group USAF program back when few senators did. But this year, he pushed for drastic cuts in USAF operational funds, with support from only a handful of colleagues.

• Rep. Dewey Short, chairman-to-be of the House Armed Services Committee. Like this year's chairman, Rep. Carl Vinson, and virtually the total membership of the committee, Short over the years has supported a strong defense program. Although generally considered "Navy man," he went along with Vinson's drive against cutting back the 70-wing USAF program.

• Sen. Homer Ferguson, one of the Senate's most ardent economizers, he's in line for chairmanship of the Armed Services Appropriations Subcommittee, which handles funds for the military.

Styles Bridges, who outranks him, but it's likely Bridges will choose to head the subcommittee handling State Department funds instead. This year Ferguson pushed for substantial cuts in Air Force procurement and research appropriations, but he didn't go along with some of the reckless slashing proposed by Morse. Ferguson headed the subcommittee which conducted the Hughes-Brewster investigation in 1947, and as an outcome of it developed evidence that later sent Bennett Mevers. the former USAF officer in charge of Wright-Patterson AFB during the war, to prison.

 Rep. John Taber, known as Congress' leading penny-pincher, is likely to head the Subcommittee on Armed Services, as well as the full House Appropriations Committee. This year, when the subcommittee was split in three to speed up action on the defense budget, Taber was ranking Republican on the group handling USAF funds.

• Sen. Charles Tobey, in line for chairmanship of Senate Interstate and Foreign Commerce Committee, has been sympathetic to the nonskeds in their fight with the scheduled industry. Ranking Republican on the Small Business Committee, Tobey may also take on the chairmanship of this group nopoly for international air service, advocated by PAA.

• Rep. Charles Wolverton, due to take over the chairmanship of House Interstate and Foreign Commerce Committee, has generally supported railroad positions. This year he led the minority group which objected to airmail subsidy separation legislation voted by the committee as being too lenient to the scheduled airlines. He wanted the subsidy field opened to the irregular certificated carriers.

► Three Senate Newcomers—These men have aviation backgrounds:

 Sen.-elect Stuart Symington. As first Secretary for Air, following enactment of the 1947 Unification Act, Symington launched USAF on its way to the dominance it now holds over Army and Navv in the defense structure. A target in the B-36 investigation three vears ago, he was given a clean bill by House Armed Services Committee. Symington was charged with favoritism to Emerson Electric Co., of which he was previously president, and Consolidated Vultee Aircraft Corp. The allegation was that Convair's chairman Floyd Odlum was to organize a giant aircraft combine and let Symington head it.

· Sen.-elect Barry Goldwater who de-McFarland. Commissioned in the Army paigned for Eisenhower.



WINS WRIGHT AWARD

James H. Doolittle, vice president of Shell Oil Co., has been named recipient of the Wright Brothers Memorial Trophy for 1952 by the National Aeronautics Assn. for his numerous contributions to civil aviation. He will receive the trophy at a formal presentation Dec. 17 during the annual Wright Memorial Dinner of the Aero Club of Washington, D. C.

which has spearheaded the nonsked in 1930, Goldwater served as a pilot case on Capitol Hill. Tobey has not in India from 1941 to 1945. He is now actively participated in aviation. The a lieutenant colonel in the Arizona one exception: opposition to a mo- National Guard, serving as Chief of Staff for Air.

 Sen.-elect John Kennedy who has battled for rigid airmail subsidy separation legislation, may get a spot on Senate Interstate and Foreign Commerce Committee, which will handle the matter. There are two Democratic

New Faces

In addition to Lodge, Eisenhower political supporters who may be the new faces at the Pentagon, running the defense program, include:

• Robert Heller, wealthy Cleveland management engineer. He headed the commission which worked out the 1947 reorganization of Congress, later advised the Hoover Commission on reorganization of the Executive Branch, and would be a logical appointee to reorganize the Pentagon.

• David Ingalls, a director of Pan American Airways, who managed Sen. Robert Taft's campaign for the presidential nomination, later campaigned for Eisenhower. He served as Assistant Secretary of the Navy for Aeronautics in the Hoover Administration.

• James H. Doolittle, famed Air Force flier and retired general, now assistant on research and development to the feated Senate majority leader Ernest Chief of Air Staff. He actively cam-

 Pierpont Morgan Hamilton, New York financier, former Air Force officer and winner of the Congressional Medal of Honor in Africa during World War II.

 Owen Brewster, defeated senator from Maine who was chairman of the 1948 Congressional Aviation Policy Board.

· Harry Cain, defeated senator from Washington who was a member of Senate Armed Services Committee, and served under Eisenhower in Europe as a colonel in an Army airborne division.

AF Criticized for **B-36 Tornado Loss**

A forthcoming Senate Preparedness Subcommittee report is expected to criticize the Air Force severely for concentrating most of the country's B-36 strategic air arm at the Carswell AFB near Ft. Worth which was hit by a 125-mph. tornado last Labor Day. One B-36 was destroyed and 106 were damaged at an estimated loss of \$48 million.

The report of the subcommittee headed by Sen. Lyndon Johnson has been drawn, but a final decision has not yet been made on releasing it to the

Meanwhile, in a letter to Sen. Alexander Wiley, who is slated to become chairman of the Senate Foreign Relations Committee next year, Maj. Gen. William McKee explained that the tornado was a "calculated risk" and developed "in a matter of seconds." He said USAF would like to disperse its strategic fleet as protection against attack and sabotage, as well as tornadoes, but cannot do so because of a lack of air base facilities.

"For the time being," McKee stated, "we must continue to take the calculated risk of putting 'many eggs in one basket."

"The fact of the matter remains," Wiley commented, "that the Air Force was dismally unvigilant. It displayed the same type of non-alert mentality which was displayed at Pearl Harbor on Dec. 7, 1941. Our poor showing at the Pearl Harbor attack was due to a disgraceful military and Naval attitude of mind, a superconfident attitude that nothing could hurt us, that everything was being done by 'all-wise' chiefs, that no further precautions were necessary. In this atomic age, such an attitude is not only reckless, it is downright sui-

Lockheed Strike Settled

The Lockheed wage strike, involving some 27,000 employes, has been settled but terms will not be announced until later, according to the Federal Mediation and Conciliation Service.

Some Policy Revisions Certain

GOP-controlled ACC to restudy foreign airline grants, development subsidies, zoning, other problems.

U.S. aviation policy is sure to change in some respects when Republicans take over the civil-military Air Coordinating Committee. ACC decides or at least coordinates U.S. air policy on matters of joint concern to more than one branch of government, such as jet transport prototype development, loans and grants to foreign airlines, and joint Air Forceairline use of airports.

ACC membership includes one toplevel representative each from Air Force, Army, Civil Aeronautics Board, Commerce (generally CAA), Navy, Post Office, State Department, Treasury, Budget Bureau and National Security Resources Board. All are political appointees.

Major policies to be reviewed:

 Grants to foreign airlines. The Republican Administration can be expected to scrutinize future applications by foreign airlines for more U.S. loans and grants. In the last six years, the ACC has approved Export-Import Bank loans of \$25 million to foreign airlines, or range joint civil-military navigation degovernments for airline use.

In addition, the ECA and its successor, Mutual Security Administration, have made grants totaling \$105 million for European nations to buy U.S. aircraft, engines and parts-mostly for airlines-in the four years from Apr. 3, 1948, to June 30 of this year; most of it (\$100 million) was made under ECA before Dec. 31, 1951. Since then, emphasis has been on military aid.

Most international airlines run at a loss and hence require subsidy from their governments. In the near future, the more the foreign airlines operate, the more subsidy they may need-judging by CAB estimates for U.S. international operators. Many small international airlines are uneconomic to an extreme. Their operations compete with U.S. operators, thereby causing in- in. creased U.S. subsidy needs.

A Republican State Department, CAB, Budget Bureau, etc., meeting at ACC, may take a dim view of more grants to continue this situation.

 Aircraft development subsidy. Should the government contribute direct subsidy to development of civil jet transports in addition to the mail pay subsidies given airlines to guarantee their investments?

Congress almost four years ago authorized \$12 million in a "prototype testing bill" for transport development. But when Commerce asked for money in 1951 and 1952 the appropriations requests were turned down. Then CAB that would guarantee to cover a large part of any manufacturer's risk in developing a civil jet transport. This came too late for congressional consideration last summer.

These proposals clear through the ACC. The Air Force and Navy have been lukewarm-to-cold on the idea of using government money to divert jet development facilities from urgent military projects at this time. ACC will be a focal point for further study of this policy problem.

 Avionic standardization. The new ACC will find civil-military cooperation on the previously planned "common system of air navigation and traffic control" going well in its present phase, but lagging in the long-range research and development phase.

Air Force-Navy-civil cooperation was excellent in the lean budget years between World War II and Korea. But the Korean war emphasis on immediate needs caused scrapping of some longvelopment programs in the works at Air Navigation Development Board.

The Administration in a special toplevel conference referred to it by ACC and ANDB cut the \$6-million ANDB research budget in half, despite the fact that economy and long-range efficiency was one reason for evolving the "common system" concept and coordinating its research through ANDB.

Problems of joint development of requirements and specifications are largely technical. Policy heads have trouble resolving the seemingly obscure differences among the technical and operational men in Air Force, Navy, CAA and the airlines. However, when technicians continue to disagree beyond the time when agreement might reasonably be expected, the policy makers may step

If the new Defense Department and its Research and Development Board renew the unification drive for a common navigation system, as started during the inter-war economy period, the ACC and Air Navigation Development Board may be expected to become more powerful in shaping inter-agency development of a civil-military navigation system.

 Joint use of airports. The ACC is the high court for decision on whether the military shall share or take over completely the civilian airports it wants. Chicago's new gigantic O'Hare Field, built for the airlines, is now a major point of controversy.

military air importance at vital airports is a question.

▶ Other Problems for ACC—There are also some new policy matters coming up for ACC decision.

• Federal zoning. One that will require an ACC recommendation for congressional action is a law to clarify federal zoning power in the air over municipal airport approaches, as recommended by the President's (Doolittle) Airport Commission. ACC will help draft legislation covering removal of obstructions to navigation in city areas around airports-including the right of the federal government to condemn municipal land in some instances.

The government wants exclusive right to control use of air space 500 ft. above all property near airports and airways.

There is no clear-cut law on this jurisdictional problem yet. Court decisions on it have varied over the years. So legislation is called for.

• U.S. Position in ICAO. The Air Coordinating Committee must approve any stand taken by the U.S. for agreements in the International Civil Aviation Organization of the United Nations. For instance, military disagreement with civil pilots on airport approach lighting methods has prevented world standardization on this important issue for years. So the rest of the world has gone ahead on the pilot's choice-centerline lighting-without the

Whether a Republican ACC will alter the U.S. stand on such matters remains to be seen.

▶ Present ACC Members—ACC members now are: Air Force, Edwin V. Huggins, assistant secretary specializing in installations and facilities; Commerce Department, Thomas W. S. Davis, assistant secretary for domestic affairs and formerly Washington representative for United Air Lines; Navy, John F. Floberg, Assistant Secretary for Air and comptroller, specializing in procurement; Post Office, John M. Reading, Assistant Postmaster General; Treasury, John S. Graham, assistant secretary with supervision of Coast Guard; Army, Earl D. Johnson, undersecretary, favoring any move to speed development of helicopters; Civil Aeronautics Board (vacant, as of last week, but slated temporarily for Oswald Ryan, new CAB Chairman); State Department, J. Pau! Barringer, director of Office of Transport and Communications, having replaced former Undersecretary James E. Webb. Barringer, a Republican, stands a good chance of rising at State and maintaining his seat at ACC. Nonvoting members are Budget Bureau, J. Weldon Jones, asst. director, and National Security Resources Board, Alvin B. Barquests were turned down. Then CAB

How a Republican ACC under Eisenber, director of transportation, production resources office.



NIGHT STRIKE ENDED, a B-29 Superfortress formation returns to base, then . . .



DAYLIGHT BOMBING is taken up by F-84s to maintain 'round-the-clock aerial pounding.

Combat Report From Korea

AF Switches Tactics in Korea

Saturation raids by B-29s, B-26s have destroyed Red powerplants, stopped railroads and industry, G-2 says.

By R. P. (Pepper) Martin (McGraw-Hill World News)

Tokyo—On June 24, 1952, the eve of the second anniversary of the Korean war, a flight of 25 B-29s made a saturation raid on Communist gun emplacements, troop concentrations and supplies in an erupting sector of the Korean front. In a sense it was the Air Force's farewell gesture to a piecemeal pattern of close support and assaults in "Operation Strangle," a confined type of air war dictated by the United Nations. Command's concern with keeping the peace talks on a fairly even keel.

Within a few hours the Air Force was engaged in a business operation that it knows and understands: a carefully planned campaign to destroy the Communist war-making facilities, supply lines, storage dumps and, if possible, undermine civilian morale in the wild mountain areas between the Yalu River and the front.

By the last week of October, the Air

Force had dropped 42,000 tons of bombs, 18,000 rockets and 200,000 gallons of napalm on selected targets. B-29s flew 1,500 sorties; B-26s, most of them during night intruder raids, flew

Combat Reports

Two front-line stories in this issue by Aviation Week's Far East correspondent, R. P. Martin, are significant to the aviation industry and particularly timely in light of the projected visit of President-elect Eisenhower to Korea. The accompanying story, containing information just taken off the secret list, details transition of USAF in Korea from confined and limited objectives to saturation bombing. Starting on p. 62 is Martin's description of how the C-124 is meeting combat tests in Korea.

5,000, and the remainder were by fighter-bombers. Although the total does not include numerous F-86 and close-support missions, the assault north of the lines represented 80% of the total air effort during the four-month period.

The Results—In capsule form, here are the results of the effort based on hitherto top-secret intelligence summaries from undercover agents and refugees, bomb damage assessment photographs, and other secret reports made available to Aviation Week by General Mark Clark's UNC headquarters:

• 50% of all hydroelectric generating plants in North Korea have been destroyed.

• Industry in general is virtually at a stand-still.

 North Korea's excellent railway network is operating at less than 25% of its pre-war capacity.

• A decline in civilian morale and a near-desperate shortage of food is placing a heavy strain on the Communist economic and military establishment.

The raids have not materially reduced the enemy's capability to provide logisti-cal support for units under present combat conditions, but they have prevented the Reds from accumulating reserves needed for a sustained ground offensive. ► Answers to Criticism—The air offensive was a logical development in the Korean war. The battlefront was static and the Communists were using the lull during the peace talks to rebuild a forbidding industrial establishment south of the Yalu River. Some military architects believed that renewed air pressure, at a negligible cost of lives, might also make the Reds more amenable at the conference table.

Air Force was bitterly aware of the growing criticism arising from its failure to shut off completely the flow of men and supplies to the front. The theory that air power can be decisive in war was being questioned. At the same time, Far East Air Force headquarters realized that effectiveness of the campaign would be limited by the rigid ban on strategic attacks against the enemy's primary sources of supply and reinforcements. One general commented, "It's difficult to put an unbearable strain on the enemy's resources by hitting the products only after they arrive in the combat or support zone."

Despite this handicap, the Air Force welcomed the opportunity to unleash its striking power. Now, General Clark's G-2 reveals what air power can do despite the unnatural limitations.

Hit at Outset—Prior to the war, North Korea had a fairly efficient industrial plant inherited from the Japanese: an iron and steel plant that in its peak year had produced 150,000 metric tons of finished steel: a chemical industrial

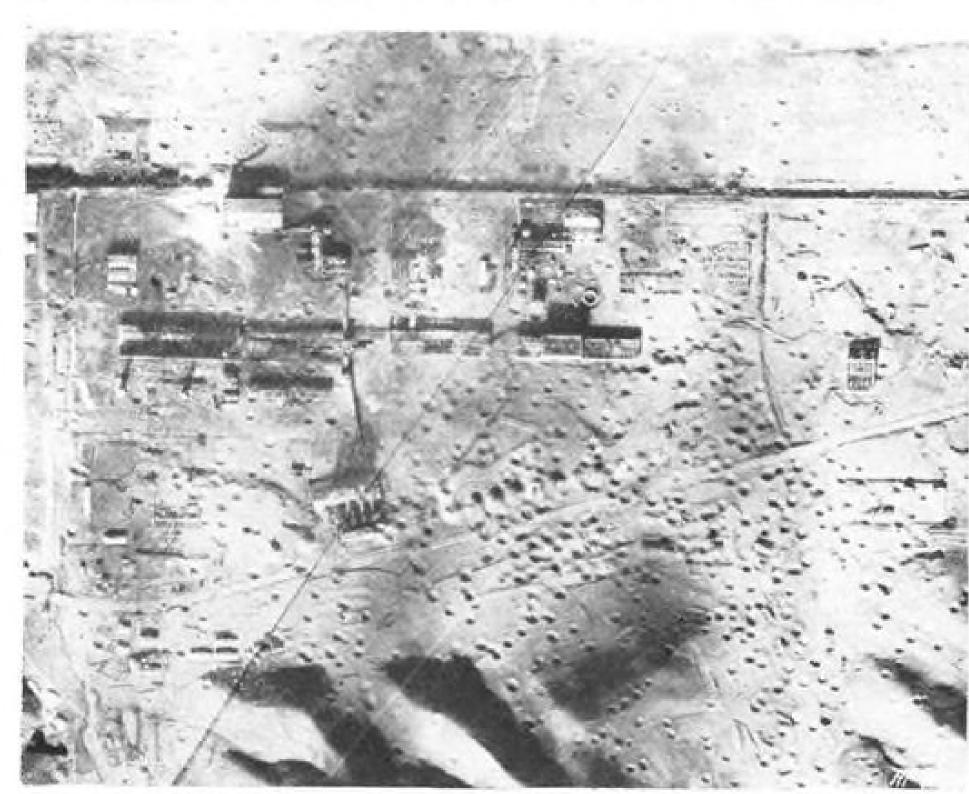


SUPPLY DUMPS near Anak undergo saturation treatment by B-26s.

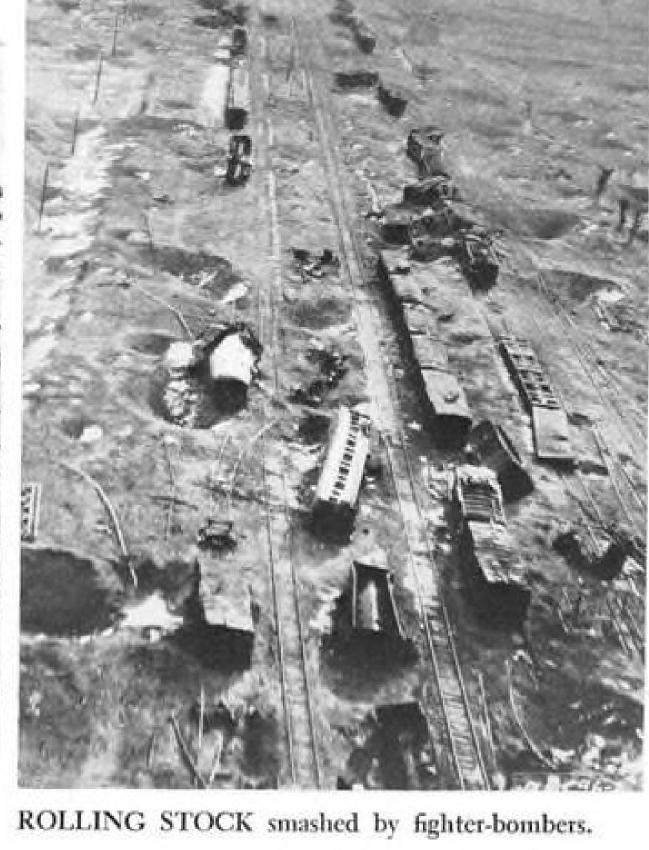
PAUL BOATS PRINCE and the ball to Page

RAILROAD BRIDGE precision bombed by B-29s.

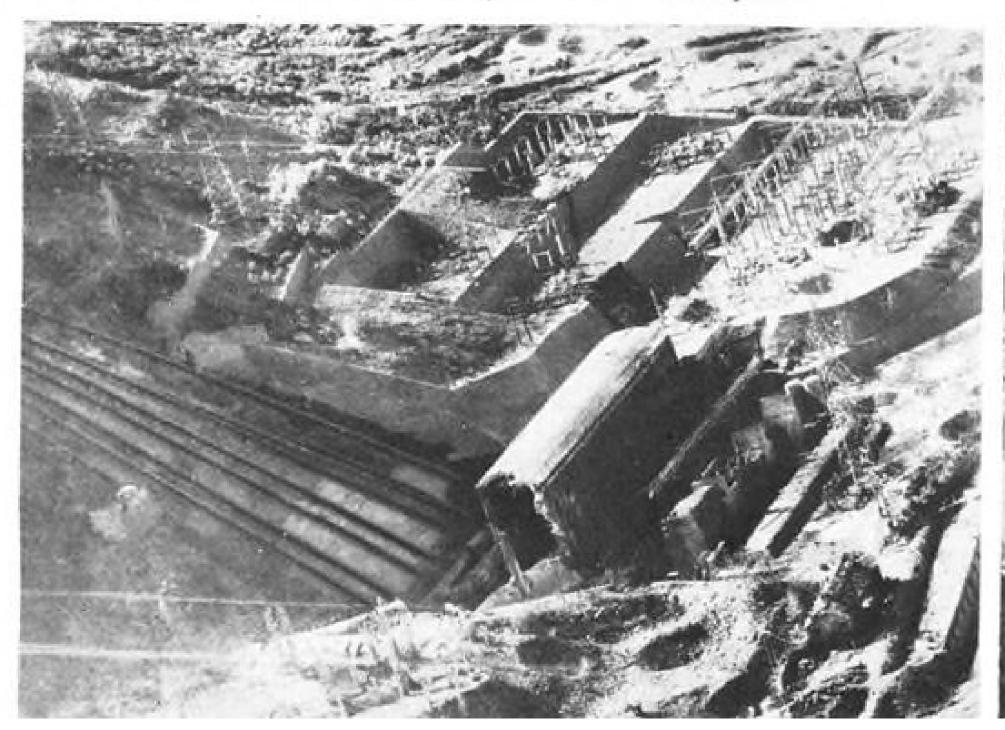
Bombers Raze North Korea



CHEMICAL PLANT, on southeast bank of Yalu, devastated by B-29s. ELECTRIC POWERPLANT visited by U. S. carrier-based planes.



GOLD MINE was 90% destroyed by Superforts.





try at Hungnam that produced 300,000 tons of fertilizer, 210,000 tons of acid, 9,900 tons of caustic soda and 700,000 tons of carbide; a petroleum refinery capable of producing annually 125,000 metric tons of refined products.

UN air attacks in the first three months of the war destroyed the largest proportion of this industrial plant. A top-level decision, however, placed the huge North Korea hydroelectric power complexes "out-of-bounds" to UN aircraft. These complexes, including small plants, had a rated capacity of 2.5 million kilowatts, far in excess of domestic requirements. Surplus power was normally diverted to Manchuria.

► Two Problems—Red China's intervention in the war drastically changed the strategic picture. About one-third, or 100,000 kw. of the Suiho output alone went to Manchuria, providing power for repair and maintenance of the air facilities and MiG-15 units at Antung. Takushan and Tatungkou airfields, and for Communist war plants in Mukden, Dairen and Port Arthur.

During the truce lull, the Chinese busily developed numerous small manufacturing and repair facilities throughout North Korea. This industrial development was prompted by the search for a solution to two problems:

 The Chinese army brought in its own supplies from Manchuria, but North Korean troops in the combat zone needed small arms and grenades, mortar shells and small arms ammunition, uniforms, canteens, bayonets, footwear and other items.

• The second problem was the repair of tanks, guns, vehicles, locomotives and railway rolling stock in close proximity to the battlefield.

The Reds solved both problems by building small plants throughout North Korea. These were located along or close to the transmission lines from the hydroelectric plants. The majority of them were tied into the Suiho transmission lines. But others began mushrooming along transmission lines from the Choshinko and Fusenko systems when the minor damage they suffered during the fighting of late 1950 had been repaired.

▶ Reds Protest—Most of North Korea's present industrial effort is small, underground and widely dispersed. The only method of attacking it was through direct assault on the power complexes.

Once the assault began, the Reds clamored that the powerplants were not military installations and that the UN was attacking civilian targets. Actually, intelligence surveys indicate that only a minute quantity of power was diverted to rice polishing mills and the operation of irrigation facilities. The remainder fed directly into the war effort.

destroyed about half of all hydroelectric generating plants and damaged an additional 25% to 45%. Intelligence reports indicate that all power output in North Korea was halted after the initial attack. Many of the manufacturing and repair installations were closed down completely. Enemy communications were out until small generator units were brought in from Manchuria. Radio stations went off the air, and gasoline, kerosene and carbide were shipped in from Manchuria to provide light in underground installations.

► Recuperation Is Slow-Soviet and Chinese technicians were dispatched to repair the plants. In early August, auxiliary power-producing facilities were brought into North Korea, and transmission lines were erected to bring in power from southern Manchuria. Intelligence reports state that there has been some but not material recuperation of these facilities.

The destruction of the Suiho complex has increased demands on the industrial and military potentials of the countries supplying the Communist armies in Korea. Auxiliary power equipment, vehicles, locomotives, rolling stock, small arms, ammunition, tanks and guns which temporarily can no longer be produced or repaired in North Korea must be supplied from the outside, by Russia or by China.

The UN air attacks against the North Korea rail system have been continuous since the first week of the war, and it is difficult to measure the effects of the recent assault. However, every rail vard of importance has been destroyed or severely damaged. The destruction to repair and servicing facilities has been so great that at the present time the only repair work performed on transport equipment is in tunnels, carefully hidden from and defended against air at-

▶ Rail Traffic Hit Hard—The most sig-

nificant destruction has been accumulated in the networks that would normally feed directly into the front lines. G-2 points out that rail traffic south of the 39th parallel, roughly the Pyongyang-Wonsan line, has been for practical purposes almost totally suspended. From the military viewpoint, the Pyongyang-Kaesong line is the most important artery in North Korea. Before the war, this line had a capacity of 10,000 tons every 24 hours. Now G-2 reports that it carries an average of about 100 tons a day, and then only through shuttling and truck transfers around the blownup sections of the line.

The second most important line, that running from Pyongyang to Wonsan, would be an invaluable supply line feeding into every part of the eastern front. Before the war, it had a capacity of 3,000 tons every 24 hours. Today, nothing moves on that line.

The Communists now rely primarily on trucks, pack animals and human pack transport in the areas within 50 miles of the front lines. The situation is somewhat better farther north. New or repaired equipment is brought in from Manchuria for use on those lines constantly being repaired by the Reds. This has placed a considerable burden on the Communist world's economy because rolling stock and locomotives are items in short supply throughout the Communist Far East sphere.

► Red Offense Hurt-G-2 frankly admits that about 10,000 tons can be moved each day into Korea from Manchuria. But the difficulty of transporting each ton southward increases with each passing mile. The G-2 report adds: "As yet these raids have not been reflected in a reduction of the enemy's capability to logistically support his combat units in the static situation in the forward areas, but they certainly have affected his capability of mounting a sustained allout ground offensive."



NEW PIPER FLIES ON HALF POWER

Piper Twin-Stinson light transport is seen during a single-engine trial at 9,000 ft., its starboard engine dead. Of interest is change to a single fin and rudder; the plane origi-The bombing attacks since June 24 place Piper is powered by 150-hp. Lycoming feathering props.

engines. First deliveries are scheduled in mid-1953. The company is procuring materials now for an initial production run of 100 planes. Company reports tests of the nally appeared with twin tails. The four- new aircraft will be made using Hartzell

Destruction of the powerplants had an immediate effect on North Korea's economy. Farmers, already suffering from lack of fertilizer, seeds and heavy taxation (as much as 75% of an individual's production is taken away in taxes, dues and "voluntary donations") found their irrigation systems knocked out when power was unavailable for the pumps. The North Korean army, following a pattern successfully initiated by the Chinese Communists during the civil war, organized numerous quasimilitary farm units from over-age and physically unfit military personnel. They tilled the land and also acted as local home guard units.

Intelligence reports indicate conclusively that near-famine conditions exist in many areas of the war-devastated country. There is as yet no widespread starvation but the subsistence level is dropping below the danger point. G-2 estimates that the fall harvest probably offset any further immediate deterioration of the food situation. But civilian consumption is not expected to im-

► Targets Listed—Civilian morale in wartime and under air bombardment is always a speculative intangible. But G-2 reports indicate that the morale of the For Newark Airport North Korean population is at its lowest point since the beginning of the war. Even the farmers, who are not often subjected to direct attack, are feeling the air blows. They are conscripted to repair bridges and railroads, and to construct fortifications. A farmer furnishes his own food and clothing during the period of work conscription.

The Air Force listed 78 areas in North Korea as targets, and warned civilians to leave these areas. On occasions, a warning was broadcast from an airplane or over Seoul radio only 15 minutes before the target was bombed. Either the warnings or the raids themselves resulted in a decided exodus from populated centers to the rural areas. Pyongyang, the capital, has approximately one-tenth of its pre-war population.

The North Korean government tried to end the exodus by initiating a frantic propaganda campaign stating that power would quickly be restored and jobs again would be available.

Civilian morale is probably not of top concern to Red leaders. In World War II. Germany continued resistance until it was occupied despite several years of smashing air blows. The Japanese were prepared to fight for their homeland even though most of their industrial centers were in ruins.

► No Peace—Civilian pressure is not likely to force the Communist leaders to sue for peace any more than it did Hitler or Tojo. In fact, G-2 states that the Reds, with their police state methods, probably can keep the situation are similar to the commercial versions being by two P&WA R2800s.

well under control and "security measures exercised by the army" are rigid enough to prevent any interference in the war effort.

The greatest single weakness in the summer's air effort is that it has not affected morale of the Chinese and North Korean troops. A G-2 evaluation states that "the morale of the enemy forces as reflected by their combat effectiveness is considered good, and morale of the hard core groups is excellent."

The average soldier in the front lines receives a daily ration of approximately 2½ pounds of food, supplemented with sporadic rations of meat and fish. This ration is more diversified than Red troops received during 1951.

This higher standard, according to G-2, "has been at the expense of the civilian population. It is expected that should the food supply in the future. either for the military or civilians, reach the point where military operations are imperiled, these supplies would be immediately augmented by importation of food from China and the Soviet

New Flight Rules

In preparation for the scheduled reopening of Newark Airport (N. J.) for full-scale airline operations Nov. 15, a set of flight rules has been developed Rolls in Australia by the National Air Transport Coordinating Committee to increase the safety factor for residents of nearby populated

These new procedures are also aimed at lowering aircraft noise levels, also a major item of complaint from people living near the field.

Feb. 11 following several crashes into from Britain.

nearby Elizabeth, has hinged on completion of a new 7,000-ft. instrument runway by Port of New York Authority costing \$9 million.

Here is the way the runway preference system is laid down:

• First choice for landings is to be over

the Kearney Meadows onto Runway 22 or over Newark Bay onto Runway 28. Next, over Arthur Kill onto Runway 8 and Elizabethport. Final choice, over Weequahic Park onto Runway 28. First priority for takeoffs will be over Newark Bay on Runway 10 or over the Kearney Meadows on Runway 4. Next choice, over Arthur Kill and Elizabethport on Runway 22, lastly, over Wee-

quahic Park using Runway 28. The system will be used when visibility is three miles, ceiling 1,200 ft. and cross winds on the runways are not more than 15 mph. The committee has estimated that such conditions will prevail annually more than 85% of the time.

Ground testing of engines will be done in areas farthest from populated sections and training flights will be reduced to the minimum required by CAA to familiarize pilots with the airport. Pilots are being told to maintain ,200 ft. altitude until as near to the field as possible and to get the 1,200 ft. as soon as they can after takeoffs.

(McGraw-Hill World News)

Sydney-Rolls-Royce plans to set up engineering offices in either Sydney or Melbourne to provide servicing facilities for British airliners which are expected to begin operations in Australia soon. A number of key men and con-Reopening of the field, closed since siderable equipment will be obtained



MARTIN 4-0-4 JOINS COAST GUARD

Here's one of the two Martin 4-0-4s ordered used by Trans World Airlines and Eastern by the U. S. Coast Guard in its new military Air Lines: The two RM-1s will be used by guise at Baltimore, Md., prior to delivery. the Coast Guard for logistics operations as Designated RM-1, the Coast Guard planes well as transport services. They are powered

CAB Setup to Remain Intact

Principal change under GOP will be filling vacancy on Board; staff members are protected by Civil Service.

By Lee Moore

The Civil Aeronautics Board organization-like those of the Interstate Commerce Commission, Federal Communications Commission and other quasi-judicial regulatory commissionswill not change materially when President-elect Eisenhower takes over.

The 566-man CAB staff reporting to the Board and its Chairman is fully protected by Civil Service.

The only sure personnel change at CAB is the appointment by Eisenhower of one man to fill the present vacancy on the Board-left by resignation of former Chairman Donald Nyrop. The only other sure change is a modification of CAB procedures to restore more membership control over the Chairman's administration of the staff. Thus, no matter who is appointed as fifth member and who is designated Chairman, the continued tenure of the four present Board members guarantees always on policy and personnel.

That was the exact intent of Congress in passing the Civil Aeronautics Act of 1938. The act provides that a maximum of three of the five members shall be of one political party. This is designed to place the Board above partisan politics. The act provides sixyear tenure to membership appointments-to put them individually as far above "influence" as possible.

► CAB Members to Stay—Congressmen and Washington airline and government attorneys scoffed at an early postelection suggestion that all CAB members should "make available their resignations and thus give the new Chief Executive a free hand in making up a new Board," and that "it would make a lot of sense to leave the choice up to the White House."

These observers pointed to the bipartisan theory of all regulatory commission memberships set up by Congress in the past half century. If CAB members could be expected to leave because a new President comes in, so also could ICC and other quasi-judicial commissioners.

The key section of the Civil Aeronautics Act, Sec. 201(A), is clear on that point. It states that the authority, now the Board, "shall be composed of five members who shall be appointed by the President, by and with the consent of the Senate. . . . The successors of ... may be removed by the President to fill the job without reference to any five-man Board.

for inefficiency, neglect of duty, or malfeasance of office (exclusively). No more than three of the members shall be appointed from the same political party."

CAB decision is the last word except for the courts on domestic aviation regulation. In international cases, where the President has superior powers under the Constitution, he can and often does overrule CAB.

So the five-man CAB is set up by act of Congress as a continuing body, with only one member per year coming up for reappointment, except that every sixth year no member's tenure shall expire. But every year one member is designated or re-designated as Chairman.

Aside from appointment of a fifth member to fill the existing vacancy, there is also a chance for another change. Republican member Chan Gurney's term expires Dec. 31. But observers believe he is assured of re-AVIATION WEEK he likes his CAB job.

Democratic members Joseph Adams Oswald Ryan also like their jobs and have shown no signs of resigning.

► CAB Staff Unaffected—The entire staff of the Board is on Civil Service status. Board officials say there is no factual basis for a hasty post-election report that CAB staff executives jobs

No CAB staff appointment has ever been cleared through the White House, according to Board Secretary Minot C. Mulligan and Executive Director James Verner. Nor is there any statute or executive order providing for appointment of CAB staff by any but the Board Chairman and members.

appointments," under Civil Service. This means they can be moved to ansympathetic with the overall policies of the 1930s. the Board majority.

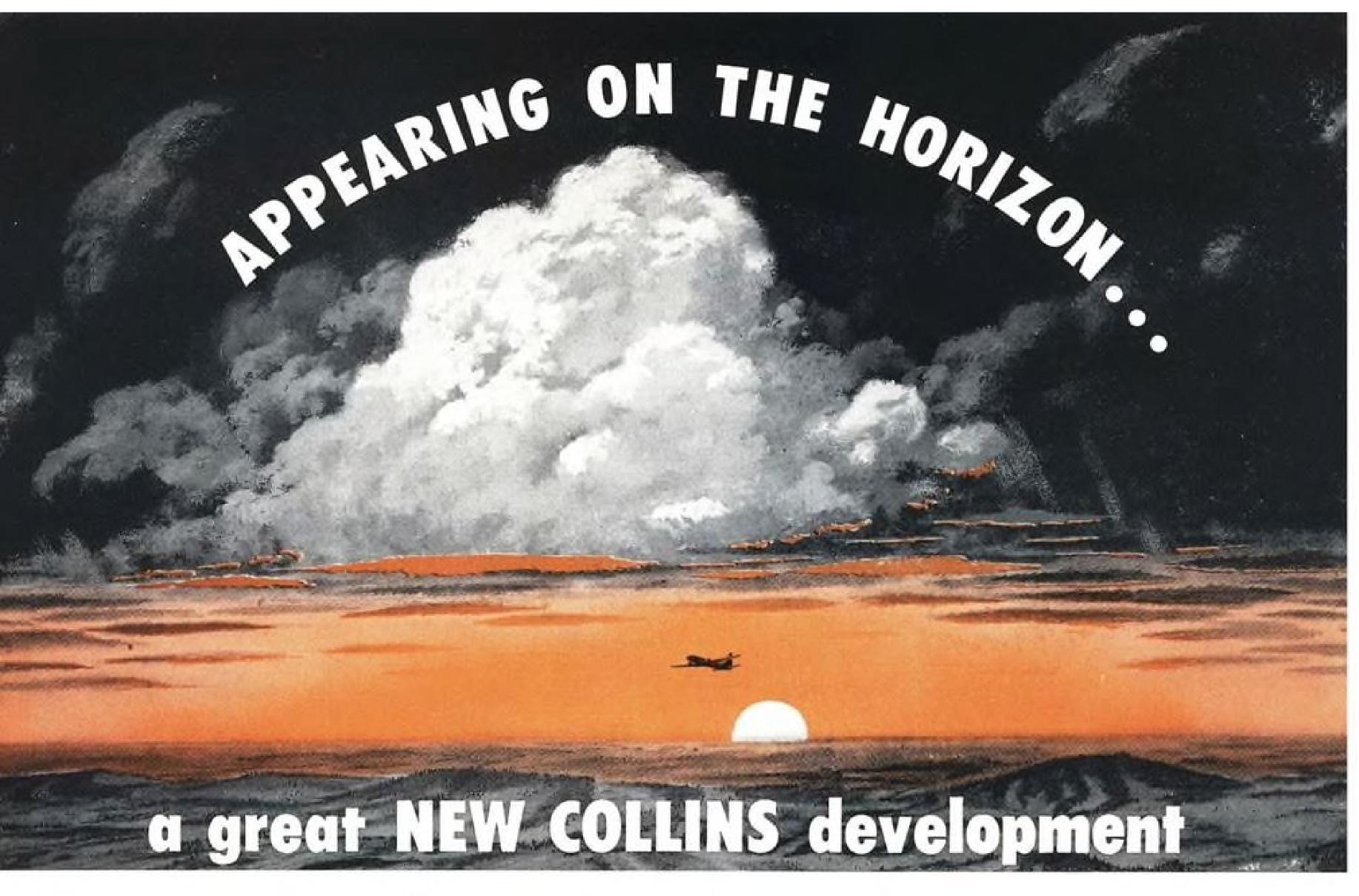
outside government agency. Three out of the five members must approve the appointment, and in practice all five members approve a man before he is appointed for a top CAB staff job. The "super grade" appointments subject to CAB majority (not White House) decision to change are General Counsel Emory T. Nunneley, Jr., and Bureau of Air Operations Director Gordon Bain (\$12,000-\$12,800 a year) and Executive Director James Verner (\$13,000-\$13,-800 a year).

The expected CAB modification of the Chairman's staff administration responsibilities also will have little or no effect on the staff, except to make sure that their hiring and firing is directly or indirectly up to a five-man Board rather than the possible whims of one man, the Chairman. Otherwise CAB goes on as before. Policy changes will vary only as the membership majority concensus swings with new member appointments over the years by individual Presidential appointments in accordance with the Civil Aeronautics Act. The staff and the trial examiners are protected by Civil Service and by the Administrative Procedures Act of 1946. ► Efforts to Change Policy—While CAB appointment and perhaps the chair- members and staff are protected for the CAB will go along pretty much as manship, unless he prefers some other foreseeable future by the Civil Aeronau-Republican appointment which might tics Act, there will be strong efforts by be available to him. Gurney told airline interests to work the switch to GOP to advantage.

The big airlines are about to engage and Josh Lee and Republican member in a fight for profits considerably higher than the 7% to 8% historically considered by CAB as "fair and reasonable" under the Civil Aeronautics Act. They argue that they need big profits in the present prosperity to make sure they can buy expensive jet transports later. If the Republicans are more favorably are "open at the discretion of the White inclined toward business profits, as their platform states, the airlines want to get in on it. However, the influence must be indirect under the letter of the Civil Aeronautics Act. CAB makes its own decisions, except on international matters where the White House may dis-

The nonsked airlines looked for further help from the Sparkman Small Top staff executives are "Schedule A Business Committee under a Democratic Administration. Now, without any known friends in the Republican other Civil Service job, but may not be setup, they will stress their free enterfired except for cause. This "Schedule prise position, fighting against federal, A" freedom in filling and changing its bureaucratic restrictions passed by CAB top spots is provided to enable the to protect the "certified airlines" mostly Board to select executives who are nurtured by the Democratic regime of

Congressional observers forecast it Even the three top Civil Service will take at least a year and perhaps "super grade" jobs at CAB were allo- more for airlines, big or small, to change cated by permission of the Civil Service the Civil Aeronautics Act to their ad-Commission, not the President. Once vantage. Their best bet appears to be the (first members) shall be appointed the job and salary are permitted by the influencing the President's appointment for terms of six years. . . . The members CSC, the Board itself appoints the men of CAB members to vacancies on the technical bulletin New Motor
With variable speed range fulfills inverse requirement ★ EEMCO has designed and built a new motor with a minimum operating speed of 5,850 rpm and a maximum of 15,000 rpm. Ordinarily such a motor would carry its heaviest load at low speed . . . a light load at high speed. This motor built to an opposite requirement runs at low speed under a small load (25 watts at 5,850 rpm) and at high speed under high load (200 watts at 15,000 rpm). Weighing five pounds and operating at 261/2 volts, this motor performs under continuous duty with a ram of cooling air. **EEMCO** designs and ★The problem was to weaken the field and at the builds for same time increase speed the future without the undue stability loss which normally accompanies this situation. EEMCO's unusual ability to design and build for highly specialized requirements solved the problem and made a highly restricted aircraft application practical which before had not been possible. ELECTRICAL ENGINEERING & MANUFACTURING CORP. 4612 WEST JEFFERSON BOULEVARD LOS ANGELES 16, CALIFORNIA



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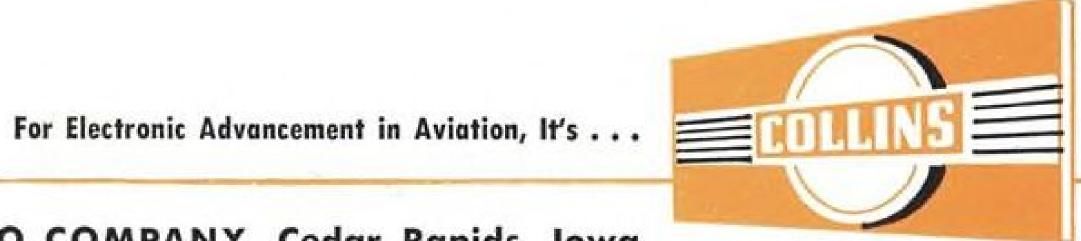
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We have prepared a descriptive booklet on the Collins Navigation Computer and will be glad to mail you a copy on request. Also available are 16-mm demonstration films of the Collins Flight System.



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AERONAUTICAL ENGINEERING

New Frontiers of Aeronautic Engineering

PRIMARY AIR THRU ENGINE BY- PASS AIR

ENGINE

- Here are the guideposts to tomorrow's advances.
- By-pass engine, wing schemes are rich fields.

By David A. Anderton

The frontiers of aircraft engineering have never been static and aren't now.

New developments, new techniques, new approaches have pioneered, explored and finally mapped large areas of aeronautical knowledge.

But with the penetration into each new held comes the certain understanding that there are larger fields ahead, and another hill beyond that hill.

Today aircraft engineers are looking ahead to their explorations of tomorrow. Here are some or their guideposts-new developments in aircrart powerplants, aerodynamics and structures.

By-Pass Engines

The recent disclosure of the Rolls-Royce Conway (RCo.2)-believed to be the world's first by-pass engine-has added that new term to the lexicon of powerplant terminology.

Rolls says that the engine was designed primarily for long-range transports and bombers. This tips off the design aim of the by-pass powerplant, which is to improve fuel economy. It is not a thrust booster.

Where range is the prime consideration, there are three ways to reduce the specific fuel consumption of the gas turbine:

 Drive a propeller, in the now-familiar turboprop layout.

• Use a split compressor (AVIATION WEEK Oct. 20, p. 13).

By-pass some of the intake air.

The by-pass engine lies somewhere between the turbojet and turboprop engine, and shows some characteristics of both types. This engine has improved cruise economies compared to the turbojet; it produces somewhat higher thrusts at low and medium speeds than the turbojet. But in both respects its performance is inferior to that of the turboprop.

This group of powerplants takes its name from the treatment of air in the thermodynamic cycle. Some of that air -which would normally be compressed, passed through burners and turbine Many Ways-There is a variety of craft of tomorrow.

stages and out the tailpipe-is by-passed around the compressor and burner and turbine sections, to be remixed with the primary air stream in the exhaust.

BY-PASS

a fan driven from the turbine stages of the primary engine. If this fan is multibladed, and of large diameter, the engine generally is called a ducted-fan type. If the fan is multi-staged and of small diameter, the engine is called the by-pass type.

But the essential difference between these two types is one of degree and not of principle. If high mass flow by-passes the engine, you generally have a ducted fan; if the engine by-passes a low mass, then you have a by-pass type.

► How It Works—Diverting air around the engine increases the over-all propulsive efficiency of the jet system. It does this by lowering the discharge velocity of the jet to a value which approaches the aircraft speed.

Propulsive efficiency of a jet system is a function of inlet and outlet velocities of the air. Efficiency reaches its maximum when the discharge speed is the same as the flight speed. Current turbojet exhaust speeds are on the order of 1,000 mph. Transport or bomber flight speeds of 400 or 500 mph. result in efficiencies of only 50 to 67% with such jet velocities.

The discharge velocity is lowered by the power requirements of the fan, which must be met by the turbine. This takes power-and therefore jet velocityout of the gas stream. The cooling effect of the by-passed air also tends to reduce the jet velocity, as does the mixing of the primary and secondary gas streams.

ways to handle the flow geometry, because there are a number of places in the cycle where air can be diverted.

- TURBINE - DRIVEN

BY- PASS FAN

MIXING OF PRIMARY &

BY-PASS

STREAMS

For example, the secondary air stream By-pass air is moved mechanically by can be pulled out of the engine ahead of the compressor, after a couple of stages of compression, or at the rear of the compressor. It can be diverted from a common inlet with the primary stream, or from separate or even remote

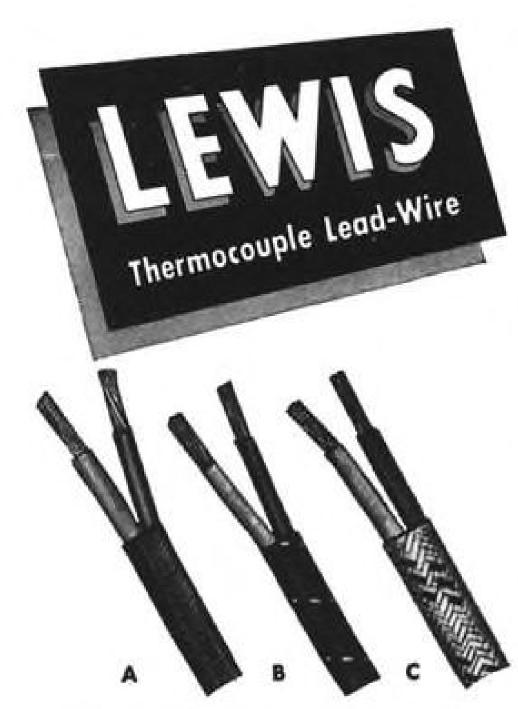
But as always, you don't get something for nothing. The by-pass engine is heavier, although as an installation of engine plus fuel for a given range, it will be lighter than a comparable turbojet installation. Operating brackets are narrow-the engine is designed for a specific set of conditions, and if the conditions change, the engine has to be redesigned.

The mechanical drive for the fan is complicated, and so is the ducting which handles the diverted flow. Not enough is known about mixing of cold and hot gas streams to be able to predict characteristics of the exhaust with any degree of exactness.

History-As a class, the by-pass engine first came into being during World War II. Simultaneous studies by the Germans and British were carried to the stage of test articles.

In England, Metropolitan-Vickers developed its F.2 gas turbine to the F.3 ducted fan and the F.5, an open-fan (by-pass) augmenter. The French firm of Turbomeca has recently built, tested and flown its small Aspin ducted-fan turbojet.

The R-R Conway is the latest in this series of powerplants which will find wide applications in the far-ranging air-



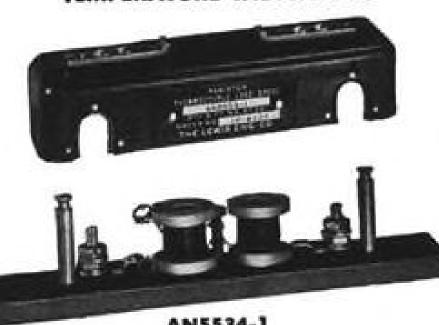
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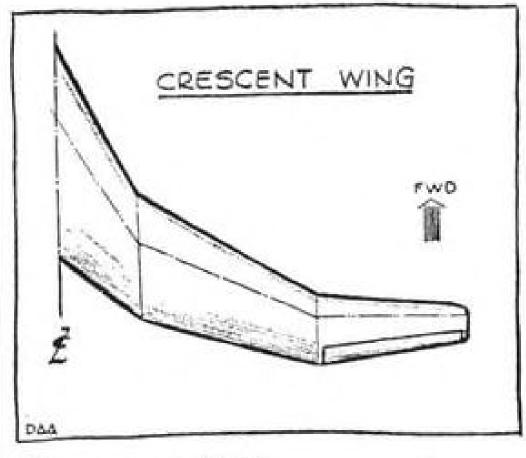
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Crescent Wing

At the SBAC air display at Farnborough, England, a model of the Handley Page jet transport was displayed, shorn of its wings. The reason: military secrecy shrouding the "crescent" wing. At about the same time, David Keith-Lucas, chief designer at Short Brothers and Harland, was presenting a lecture on wing developments, which contained a section devoted to an explanation of the crescent wing. Further, the lecture pinned the wing to Handley Page development.

This new kind of wing planformsometimes called the "scimitar" wingis a layout in which the angle of sweepback varies from a maximum at the root to a minimum at the tip. It can be a continuous variation, which produces curved leading and trailing edges, or a step function, which produces straightline segments of wing.

Aeroelastic problems-for example, aileron reversal-prompted the consideration of this unusual wing form.

▶ Reasoning—Think of a highly swept wing with a load applied at the tips, such as would result from aileron deflection. The wing starts to deflect; the point of load application is well behind the neutral axis of the wing. Thus the wing begins to twist. In the case of aileron reversal, the loss of tip incidence due to this twist causes a loss of wing lift. This more than balances the increase in wing lift due to aileron deflec-

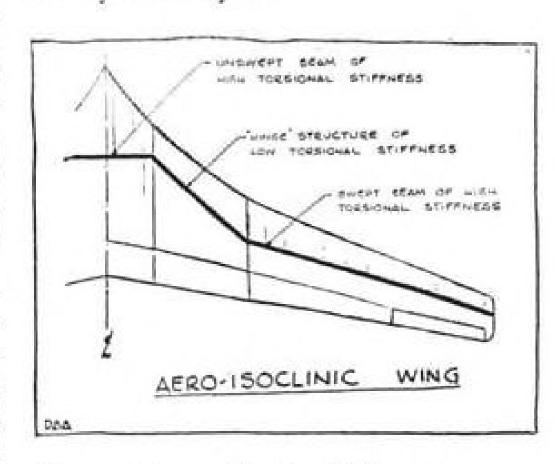
The crescent wing sidesteps some of this problem, because the wingtip load is applied forward of the wing axis. Torsional deflections due to tip loads produce lift forces which add to those produced by ailerons.

There's a dividend in the crescent geometry which is paid off in reduced tendency to tip stalling. Reason for this is the reduced angle of sweep at the outer portion of the wing. Consequently, ailerons stay solid in the lowspeed portion of the flight range, and behave like ailerons on a straight wing. ► The Cost-You pay for these aerodynamic advantages in structural coin. The wing is bound to be a little heavier because of the layout. Wingtips have

to be very thin in order to compensate for their lack of sweep.

This layout can be expected to apply to wings of high aspect ratio, wings for airplanes in the bomber and transport category.

The pioneering work on the crescent wing was done by Arado in Germany during the war. In the postwar years, Handley Page picked up the chain of development and linked it to the H.P. 80 long-range bomber and the drawingboard H.P. 97 jet transport. A development airplane-built from a Supermarine Attacker fuselage and fitted with modified tail and a crescent wing-was designated the H.P. 88. This craft crashed after the pull-up from a lowlevel, highspeed pass, indicating that there is more to the problem than aerodynamic layout.



Aero-Isoclinic Wing

This cumbersome name describes a structural strategem for maintaining constant wing incidence, regardless of loading on the surface, and regardless of flexure.

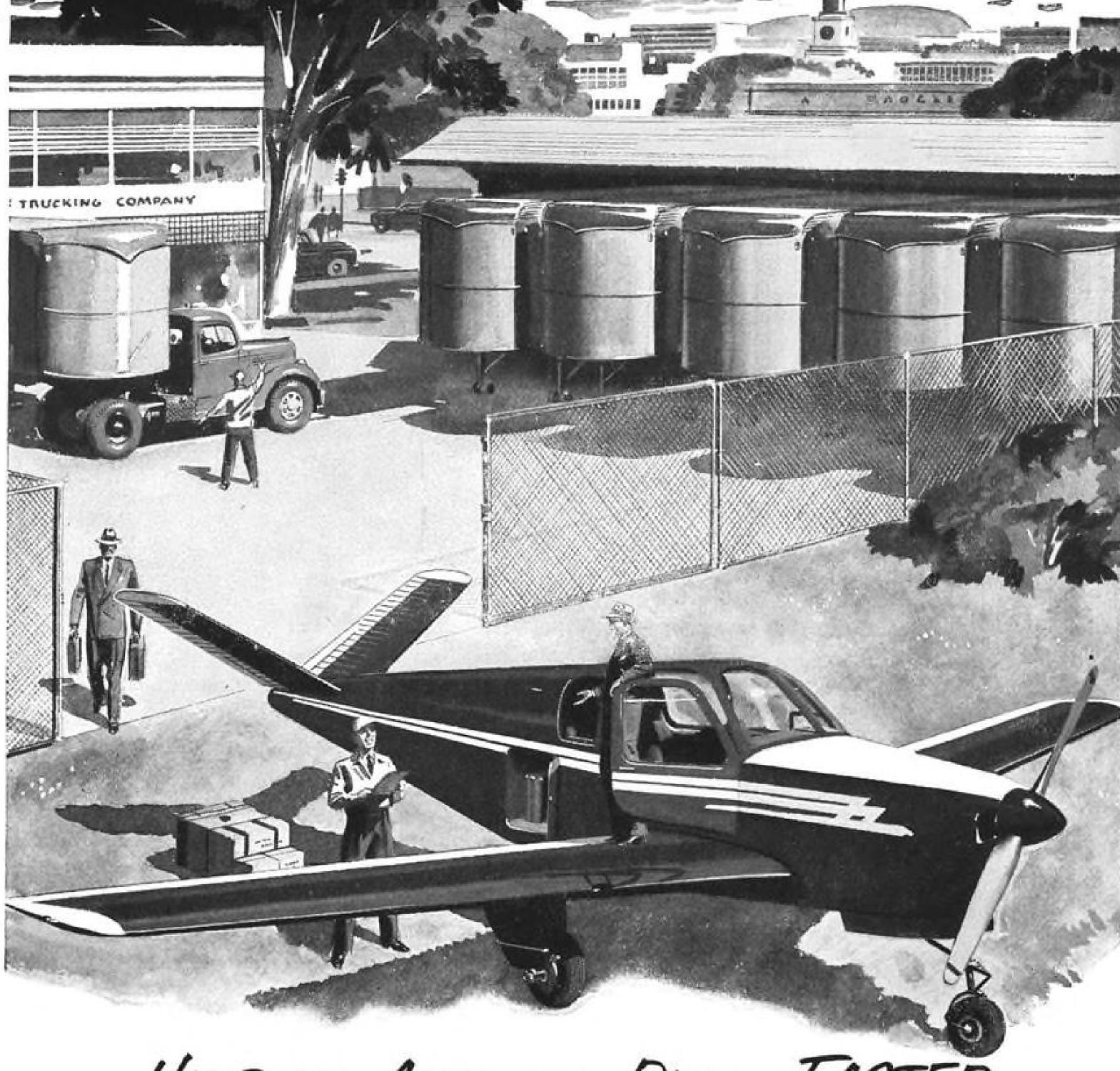
The stratagem consists of making the wing structure with a combination of torsional stiffnesses, low in one area, high in another.

This unusual arrangement of loadcarrying members permits a combina-tion of wing bending and torsion which results in no spanwise change of incidence under flight loads.

One proposed layout of such a wing is to build a torsion box which has the main beam as far aft as possible, perhaps at 50 or 60% of the chord. Since normal flight loads are applied somewhere around the quarter-chord point, an increase in air load will produce a nose-up twist of the wing around that torsion box.

This is important in accelerated Hight which builds up air loads on the wing above their normal value, such as a pullout from a dive. In a sweptwing aircraft with constant incidence in the unloaded wing, spanwise bending un-der load tends to reduce the incidence toward the tip. This is a simple matter of geometry, and occurs with a stiff, untwisted wing.

As the tip sections decrease incidence,



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they also lose lift. This loss of lift is behind the airplane center of gravity because of the sweep angle, and the airplane feels a nose-up pitching from the altered lift distribution. This tends to tighten the pullout, and increase the lift further because of increased G on the aircraft. Further increase in lift bends the wings more, sheds more lift at the tips, produces more nose-up trim change and tightens the pullout. Destruction can follow.

► English Idea—H. H. Gardner, assistant chief designer of Vickers-Armstrongs, advanced one layout for an aero-isoclinic wing. It is, in effect, a structural hinge, placed at about the quarter-span of the wing panel. The hinge line is so inclined that the loss of incidence from bending is balanced by increased incidence due to rotation.

The root portion of the structure is based on a beam which is upswept, carries bending loads and has high torsional stiffness. This is the "anchor" for the hinge.

The hinge is next outboard, and is a highly swept bending member with low torsional stiffness. To the outboard side of the hinge is fastened a swept beam of high torsional stiffness. This scheme connects two structural elements of high torsional stiffness with a hinge of low torsional stiffness.

The hinge area could be a two-spar structure, if necessary, and the space between spars used to house landing gear.

Origin—The first thinking on the aero-isoclinic wing was advanced by Prof. G. T. R. Hill, of University College, London. Gardner and Keith-Lucas mentioned the type in recent lectures, with the added indication that the largest advantage would be gained when the requirements called for a wing of high aspect ratio.

This points the way to future applications of the aero-isoclinic wing in longrange bombers and transports, with sharply swept wings. Certain classes of missiles—turbojet-powered, sweptwing airframes—designed for intercontinental ranges, might also benefit from such a structure.

Hydrofoils and Skis

Tomorrow's flying boats, be they huge freight and passenger carriers or lithe fighters, will not resemble the stepped-hull configurations that are familiar today.

Instead, landings and takeoffs will be made with combinations of airfoils to operate under water, and planing areas to skip across the top surface. These new water-handling aids for the seaplane designer go under the names of hydrofoil and hydro-ski.

Current interest in these developments stems from U. S. Navy position on the highspeed flying boat for fighter

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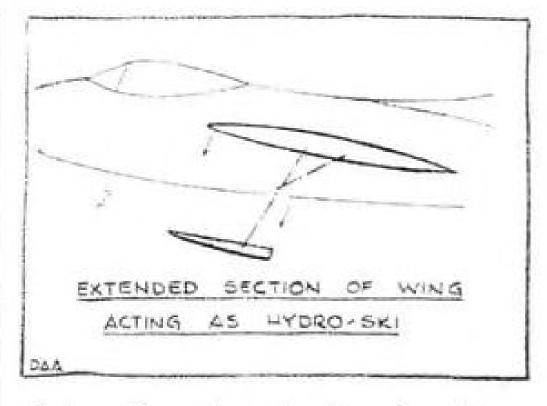
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design. Some investigations have been underway for a long time now on the application of hydrofoils and hydro-skis to contemporary aircraft, and more research and tow-tank time is being piled up every day.

▶ Description—These new developments are pretty well described by their names. The hydrofoil is an underwater airfoil; it generates a lifting force when it is moved through the water, and this lifting force raises the attached aircraft out of the water for the takeoff.

The hydro-ski is a planing surface resembling the standard water-ski familiar to sport enthusiasts. Its function is to support the aircraft on the surface of the water; it does not act as an airfoil except at very low speed.

The difference between the two ideas is about like the difference between ducted fan and by-pass engines—a difference of degree.

There is no reason, for example, why a surface can't function as a hydrofoil first, and then as speed increases, function as a hydro-ski until the plane is airborne.

Such a combination surface was tried by the Italians in the 1930s on a Piaggio racer intended for the Schneider Trophy races. The landing gear legs held a pair of smallish surfaces, inclined outward and forward.

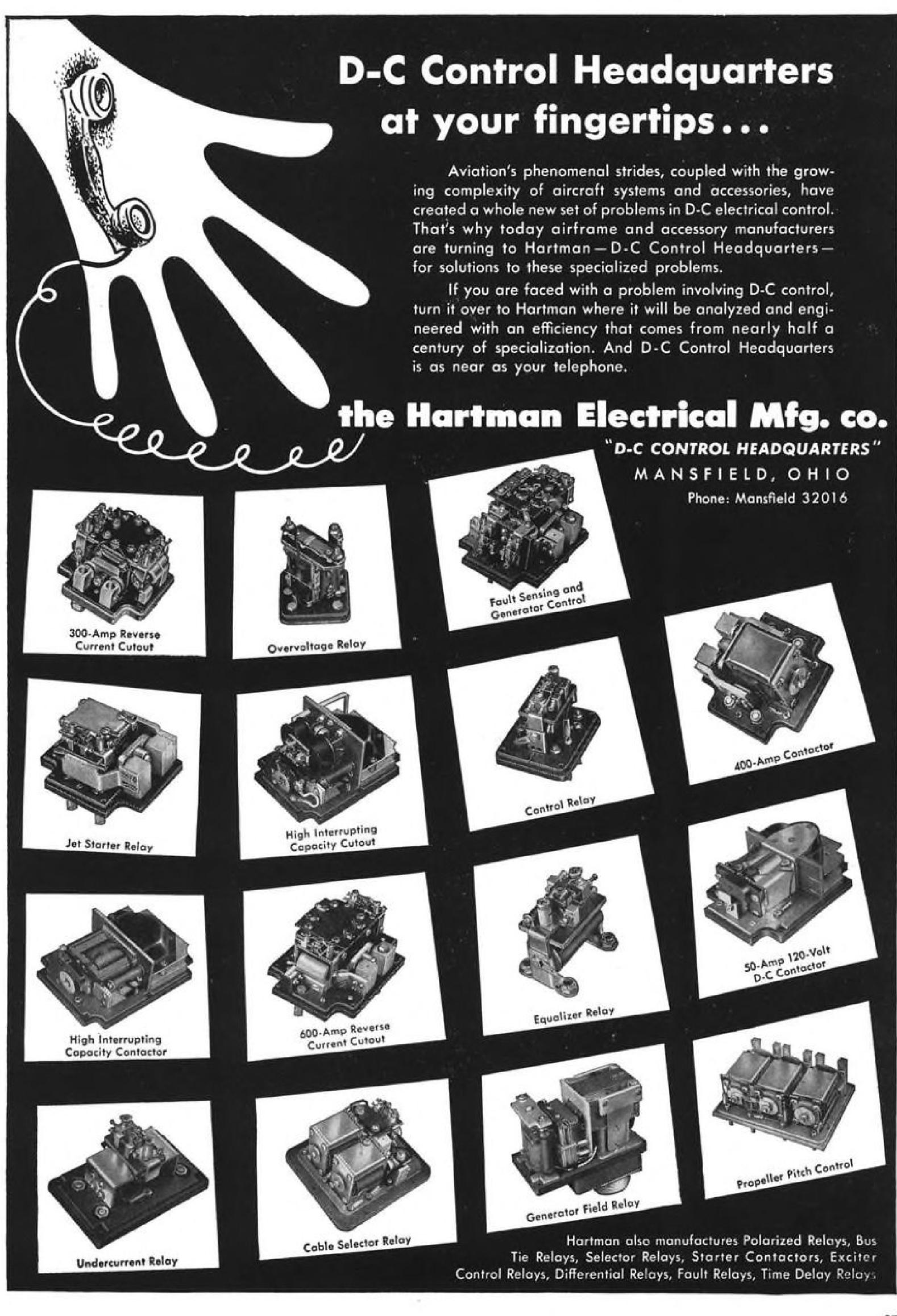
Normally the plane started off in a semi-submerged attitude, with its prop braked to a horizontal attitude. Some engine power went into a small marine propeller, which served to get the works moving. Once underway, lift was generated and the plane climbed out of the water to ski across the surface until airborne.

► Applications—These surfaces will find increasing application in flying boat designs planned with highspeed characteristics.

The small size and the two-dimensional appearance of hydrofoils and hydro-skis make them ideally suited for retraction into fuselage or wings.

There are problems—loads on landing, for example, are very high compared to the kinds of loads imposed by a water landing on a conventional hull bottom. And transition phases from submerged to skating may mean compromise designs of a single surface.

But these problems will eventually



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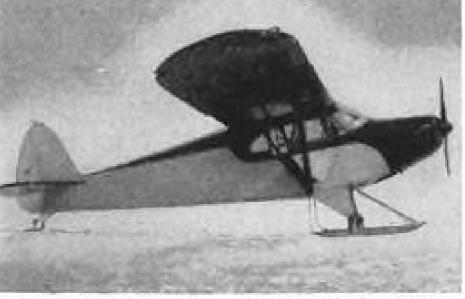
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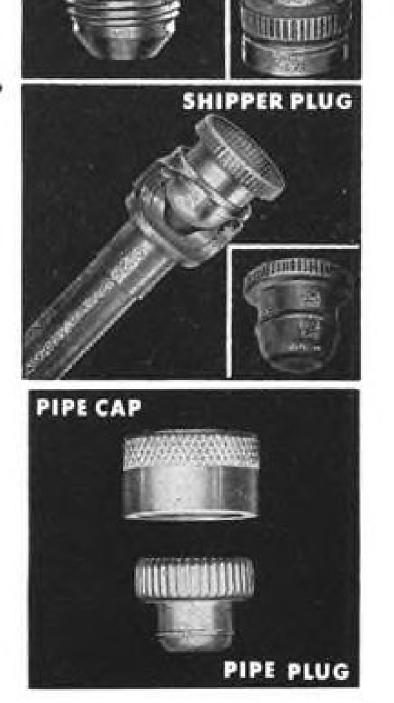
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SHIPPER CAP

be solved, if they have not been already. The heavy cloak of Navy security around these surfaces seems to indicate that their importance is great.

So for the future, it is not unreason-

able to expect that a fighter designed for a watery base will not be greatly different in looks from one designed for a 10,000-ft. concrete runway.



DOWTY landing gear for Avro 698 is light and rugged, features eight small wheels on bogie assembly.

Avro Delta Bomber Landing Gear Design

Small feet on a large leg is the gen-eral description of the bogie landing gear designed for the Avro 698 deltawing bomber by Dowty Equipment Ltd.

Each main landing gear leg mounts eight light wheels of small diameter on a bogie arrangement attached to a rugged tubular strut.

Front axle of the bogie is attached to the strut end and is the pivot point for the bogie assembly. Midpoint of the bogie frame is shock-mounted to the main leg with a long liquid spring shock strut.

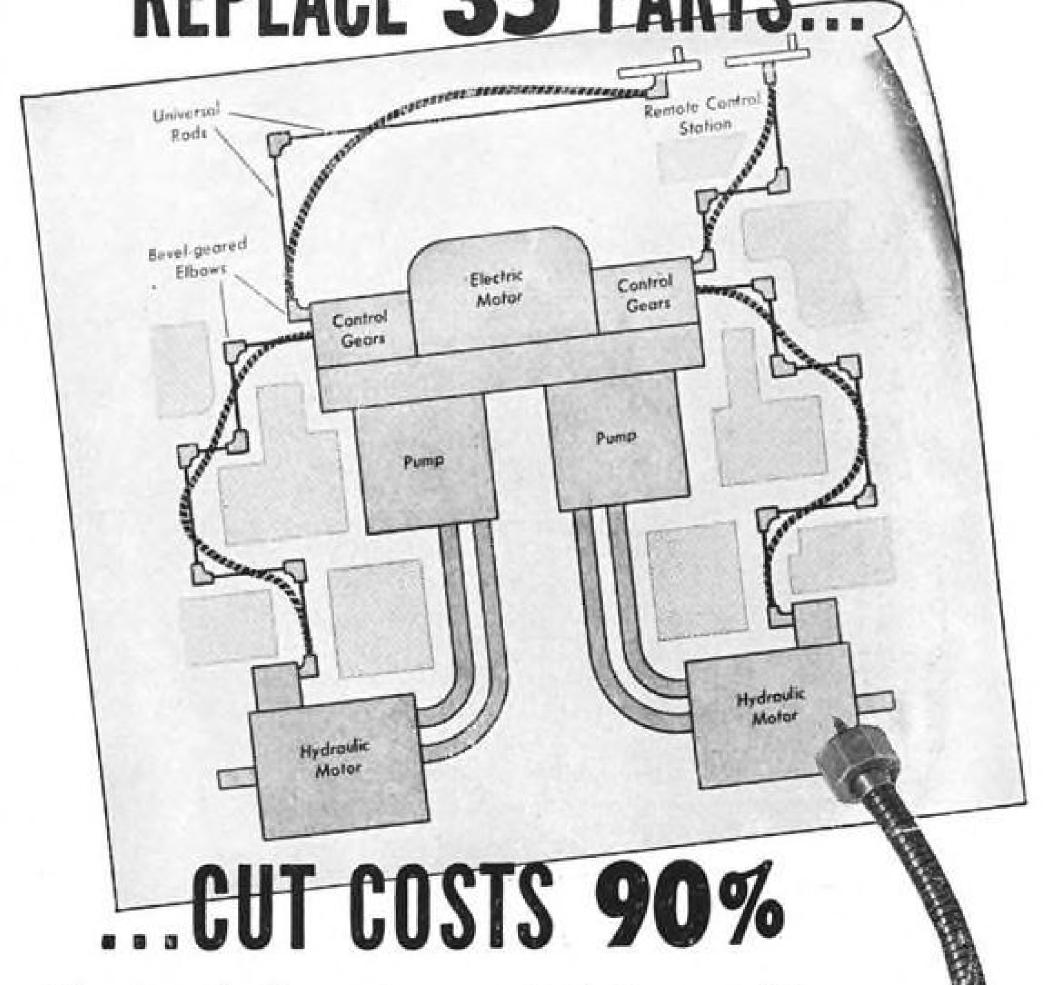
To retract the undercarriage, the tubular strut is telescoped into the main leg structure, drawing up the front axle of the bogie as it does so. With weight off the shock strut, it extends, and the rear axle of the bogie pivots around the front to give horizontal stowage.

The tubular strut can move up into the main leg, but its outward travel is limited by stops. There is no shock absorber in the main leg.

When the gear is lowered, the bogie assumes an inclined position and the trailing wheels make first contact with the runway. Upward movement of these wheels only pivots the bogie about the front axle-which cannot move downward-and does not add any vertical velocity to the front axle.

Thus there is no slamming of the

4 S.S.WHITE FLEXIBLE SHAFTS REPLACE 35 PARTS....



The schematic diagram shows an electrically-operated hydraulic power system in which 17 universal rods and 18 bevel-geared elbows were used to carry control from a remote point to the control gears of the hydraulic pumps and from these gears to the hydraulic motors. This set-up proved both costly and troublesome. The desired tolerances were difficult to maintain, and manufacturing and assembly operations were time-consuming and expensive. S.S.White engineers went to work on the problem and recommended the use of four standard ?" diameter S.S.White flexible shafts to replace the universal rods and the bevel-geared elbows. The result — a 100% improved application — a 90% reduction in costs — and a vastly superior control set-up that easily provided the desired sensitivity.

It will pay you to consider S.S.White flexible shafts on all your power drive and remote control problems - and to take advantage of the experienced cooperation of S.S.White engineers in working out the most suitable application for your needs.

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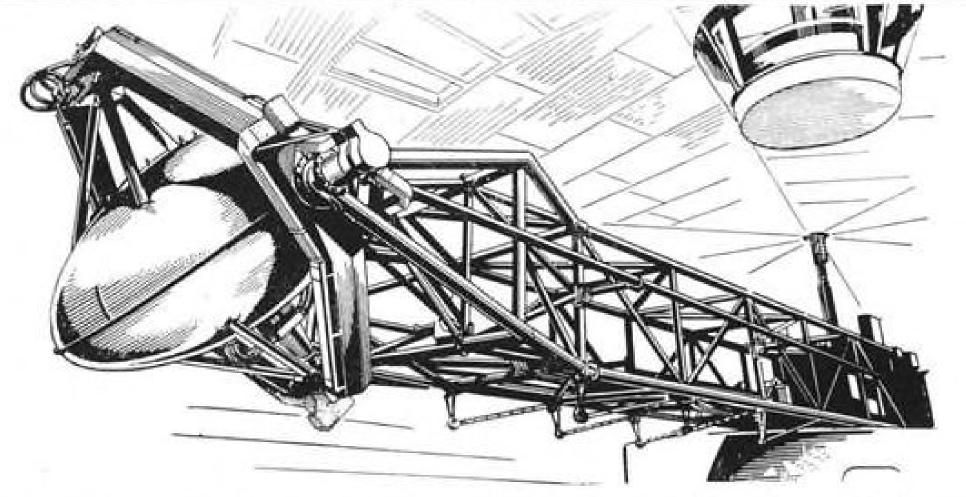
Western District Office . Times Building, Long Beach, California



Fastener Problem of the Month

HUMAN CENTRIFUGE

NOVEMBER, 1952



PROBLEM Acceleration forces up to 40g are developed by the world's largest human centrifuge, a device for testing high speed maneuvers on jet-plane pilots and equipment. Built by the McKiernan-Terry Corp. for The Naval Air Development Center, Johnsville, Pa., this giant machine whirls a gondola horizontally, can move from dead stop to 173 mph in 7 seconds. When the 50' arm rotates, huge tensile loads tend to pull the different sections apart. The fastenings selected had to be not only exceptionally strong, but also *sure* to hold fast in spite of the fluctuating stresses and the vibration involved.

SOLUTION The largest tensile load on any of the arm's four joints is 225,000 lbs and is carried by eight one-inch bolts and selflocking, vibration proof Elastic Stop Nuts. A strength test of a sample joint showed that the steel tubing failed first, without damage to the joint flanges or the bolts and nuts. Another vital spot is the airtight seal between the two halves of the gondola. These shells are clamped together with 288 bolts and / Elastic Stop Nuts. In fact, all important sections of the centrifuge-the four arm sections, the counterweights, the gondola, the three outrigger arms supporting the gondola drive shafts-all are fastened with Elastic Stop Nuts. The holding quality of these nuts during vibration enables them to resist unlocking and destructive interplay. Where strength and foolproof security are needed, they provide it.



LET US HELP solve your fastening problems. Our engineers, here at ESNA, should be able to suggest the one best fastener to meet your specific needs. No obligation, of course.

Dept. N31-1125	Loine
불어나의 아이들이 들어 내내가 그 살 같아요. 그리는 살이 되었다면 하고 있다.	rporation of America
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on ESNA self-locking	fasteners:
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Here is a drawing	of our product. What self-locking fastener do you recommend?
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Firm	
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front wheels onto the runway surface, and the main shock strut takes up some of the impact energy during rotation of the bogic assembly.

Flexible piping is entirely eliminated in the Dowty design, and there is no external plumbing of any type.

cxternal plumbing of any type.

There is only one shock absorber—
which simplifies maintenance problems—and moving parts are at a minimum,
says the company.

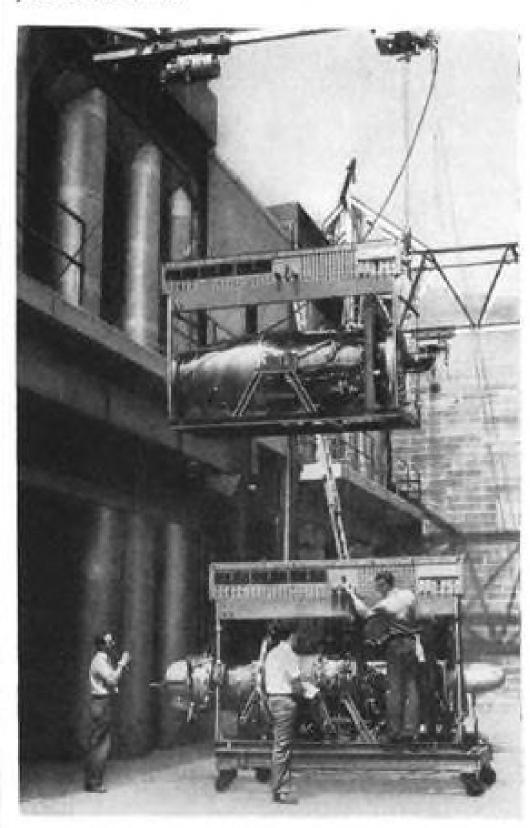
Dowty uses magnesium alloy castings extensively in the gear, and that fact, plus the use of a single shock strut have "... resulted in a unit that in spite of its necessarily large over-all dimensions is extremely light in relation to the aircraft weight."

New Turbojet Alloy

A comparatively new cast-aluminum alloy, developed at Wright-Patterson AFB, Dayton, is being used for lightweight, high-temperature applications

weight, high-temperature applications Known as ML aluminum alloy, the material contains approximately 4% copper, 2% nickel, 2% magnesium and small percentages of titanium, manganese, chromium and vanadium, according to International Nickel Co., Inc.

Wright Aeronautical division of Curtiss-Wright Corp. is using the ML material for the center main bearing support and miscellaneous parts of its J65 Sapphire engine. Photo below shows J65 test cells.



TWO-STORY TEST CELLS

Double-decker jet test cells save space at Curtiss-Wright Corp.'s Wright Aeronautical division. Photo shows J65 Sapphires being readied to go into two-story test house for proving runs. Circular columns fronting the building (left) are extremities of sound-deadening installations.



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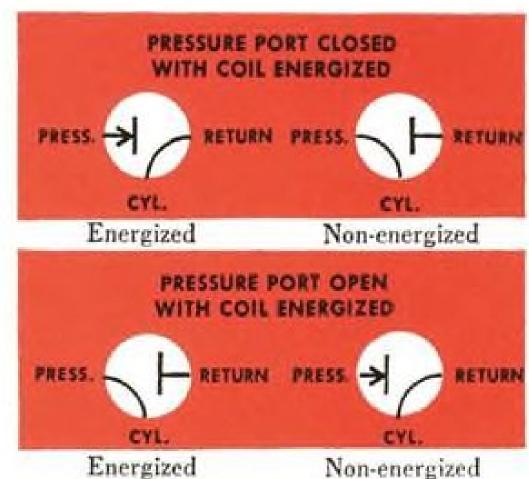
Two Port ... Three Port

Normally Open...Normally Closed

Valve No. 413945 Weight, pounds.....9

Valve No. . .413945-1 Ports3

Weight, pounds.....9



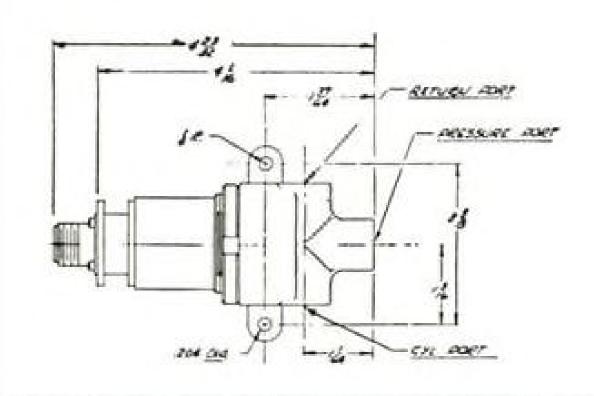
Valve No. 410250 Ports2 Weight, pounds.....8

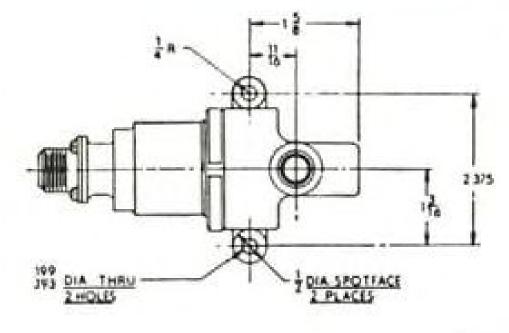
PRESSURE PORT OPEN TO RETURN WITH COIL ENERGIZED

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hese solenoid-operated two and three port control and depressurization valves are now in volume production.

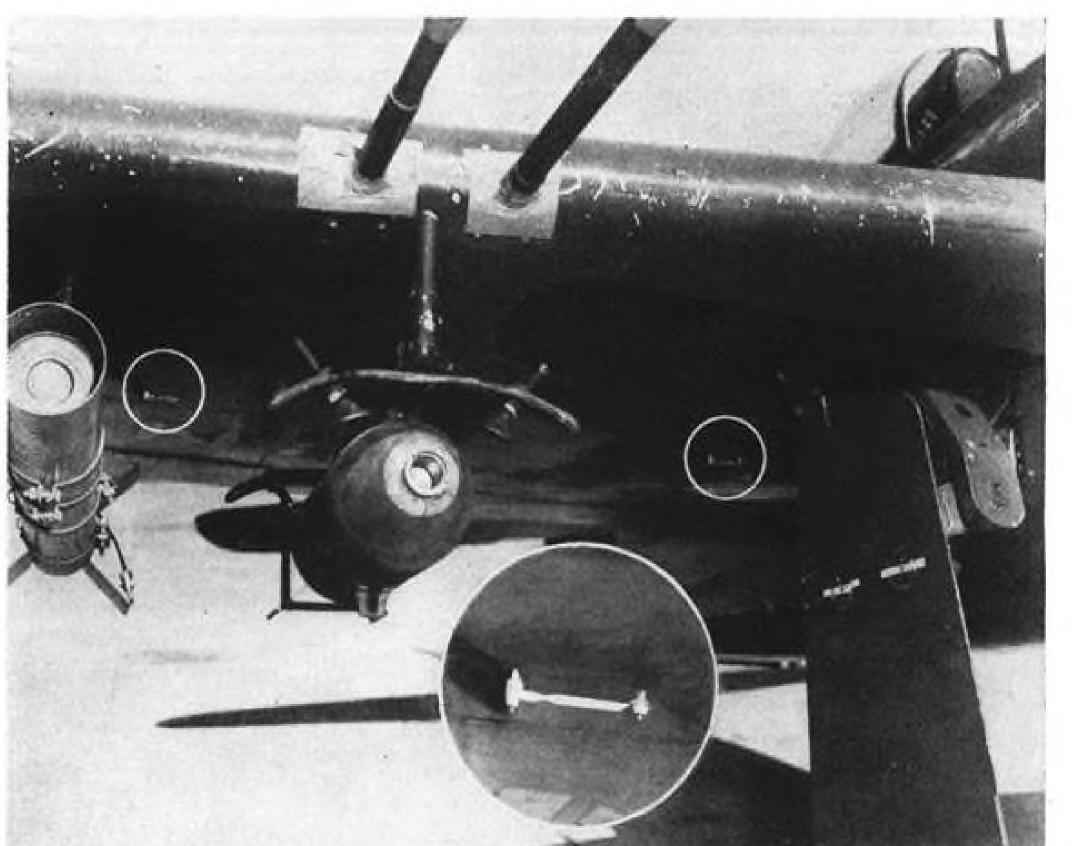
Designed specifically for low flow application where pressure drop is not a problem, these valves offer the rugged simplicity of direct acting ball poppets. They are designed for 3000 PSI operation (proof pressure 4500 PSI) and the solenoids operate at 18-28 volts D.C. Some models are immediately available from stock.





Complete information will be furnished on request

Pacific Division Bendix Aviation Corporation NORTH NOLLYWOOD, CALIF.



GAGES INSTALLED on underside of F8F Bearcat wing. Large circle (lower center) is enlarged view of the limit load gage installation.

Simple Gage Shows Plane Stress

A simple device has been developed at the National Bureau of Standards for safety-checking aircraft structures. It is a limit load gage that indicates visually whether basic structural components of operational aircraft have been stressed beyond values which are considered safe.

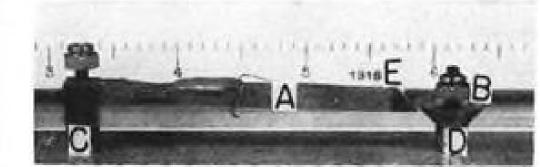
Developed for the Navy Bureau of Aeronautics by the NBS aircraft structures group, the unit has proved its worth in extensive tests on highspeed jet and piston fighter planes. The gage should find use in other types of aircraft; other potential applications include determination of overload conditions on bridges and other heavy structures.

► Gage Parts—Components of this load instrument are an arm, cam and gage points (small photo). The device spans only about 3 in.

Gage points are hardened steel members with knife edges for proper engagement with the structural component, to avoid loosening in flight.

Arm is made of 75S-T to reduce thermal expansion effect when the gage is used on the same material. It has a hardened steel tip to prevent erroneous indications resulting from tip wear.

Cam also is made of hardened steel, is divided into 20 divisions for 180 each division approximating 2,500 psi. for one type of gage, 5,000 psi. for another type, when used on aluminum alloy structures. There is a ▶No Wear Effects-Because apprecilinear relationship between lateral dis- able wear of the cam or arm tip would



LIMIT LOAD GAGE'S main components: A, arm, B, cam: C and D, gage points; E, steel arm tip. Tip E is set to overlap horizontal part of cam B by distance equal to the elongation to be indicated. When setting is exceeded, as it has been in this photo, arm springs clear of cam.

placement of the cam and the cam divi-

► How It Works-Operation is simple: Arm is initially set above the cam in a cocked position. The gage indicates overload when elongation is such that arm flips past the cam edge.

The gage is mounted on a structural member by means of two drilled and tapped holes at the desired location. The holes are spaced to insure that the arm tip will contact the cam. The cam zero setting is obtained by placing the arm tip on the horizontal cam surface, then rotating the cam until the arm springs clear.

The required overlap setting can be determined from a calibration curve of the gage, Young's modulus of the material to which the gage is attached and the stress level at which indication is

give a change in zero setting and in the calibration curve, wear tests were performed.

The gage was mounted on a specimen suitable for use with an Avery fatigue testing machine, then given a pulsating load a little lower than the value required for the gage to indicate. After 30,000 cycles, arm tip and cam were examined for wear and the calibration also checked. There was practically no evidence of wear, and the calibration curve remains the same.

But it was found that the gage points would loosen if they were not carefully seated initially.

▶ Setting Not Hard-NBS checked the accuracy with which the gage could be set by different installers. A set of stress values and a calibration curve were given to each person tested, to set the gage. The gage indicating load was determined by applying a tensile force to a test bar carrying the gage.

After a few trials, is was shown that an operator, entirely unfamiliar with the gage, could set it to a given value within 500 psi.

► Agreement—The load limit gage generally is mounted on the tension surface of a beam subjected to bending. Effect of bending was determined, as well as accuracy of the correction necessary to account for the condition that the cam lip is nominally & in. from the beam surface.

Tests showed that to have the gage arm drop at a surface stress S, it had to be set for a stress of $S(C+\frac{3}{2})/C$, where C is the number of inches from the beam tension surface to the neutral axis.

In the highspeed fighter plane tests, the gages were mounted at three positions on the wing. On the wing surface, directly under gage locations were placed wire resistance strain gages. After flights of simulated dive bombing and strafing, the recorded outputs of the strain gages were compared with the strain values provided with the load limit gages and found to agree within

Centrifuges Test Missile Assemblies

A series of centrifuges that can be used for operational testing of components and assemblies is under development by the Rucker Co., 4228 Hollis St., Oakland 8, Calif.

A typical Rucker unit now being installed at a guided missiles development center will test components up to a weight of 600 lb. at centrifugal loadings of 60G. Lighter specimens can be loaded to higher values; test pieces up to 6 ft. long or of 24-in, section can be accommodated.

Test connections include 40 electrical



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signal circuits and eight electrical power leads, a coaxial cable, a waveguide and high-pressure hydraulic, air and fuel con-nections. These run from the centrifuge test mount to the remote test and control room.

Hydraulic drive of the rotor gives infinitely variable speed regulation. Safety controls prevent accidental starts unless the pits are clear of personnel; emer-gency stops are handled by either or both hydraulic and mechanical braking

Percival Developing Jet Copter Engine

Development of the lifting unit for a jet-powered family of helicopters is well under way at Percival Aircraft, Ltd. of Luton, England. The company is aiming at the motor-plus-rotor combination before it tackles the complete helicopter. With the heart of the copter proven, designers can then turn to the layout of functional containers for the accommodation of either passengers or cargo or both.

The powerplant will be a special gas-producer turbine, fitted in or near the fuselage. Discharge high-pressure gas from this unit will be piped through hollow rotor blades to the tips, where it will be ejected at high speed. The reaction to this discharge will rotate the blades. Afterburning will not be used in the new engine.

Percival will test the blades and powerplant in a special underground spin pit.

Building Program Pushed by McDonnell

New-facility projects are being pushed at McDonnell Aircraft Corp., St. Louis, to achieve an integrated production and experimental plant for aircraft and guided missiles.

Already completed is a new \$3.6-million flight test hangar, scheduled for partial occupancy in December. A new parking facility adjacent to the hangar is now ready for partial use. Another completed project is a microwave laboratory for electronic tests.

Under construction are a two-cell aircraft propulsion laboratory and a lowspeed, three-story windtunnel, each costing \$1 million. The propulsion lab is tagged for completion by December and the windtunnel by March of next

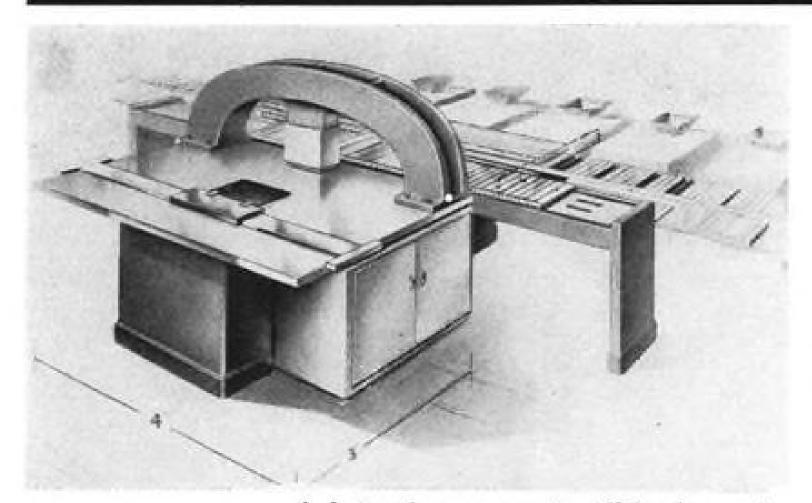
The propulsion lab will have an associated shop area accommodating about 50 people. Top loft of the windtunnel building will be used as an operations floor. Models will be lowered from the operations loft to the square



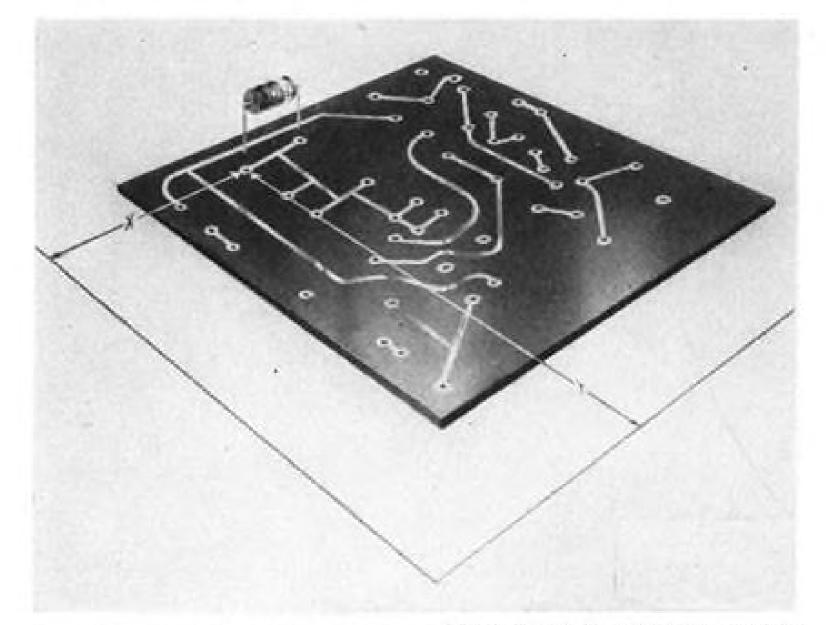
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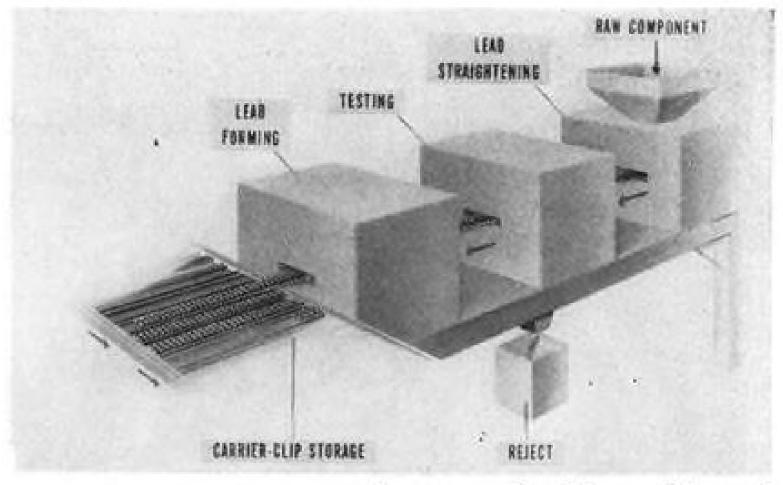
AVIONICS



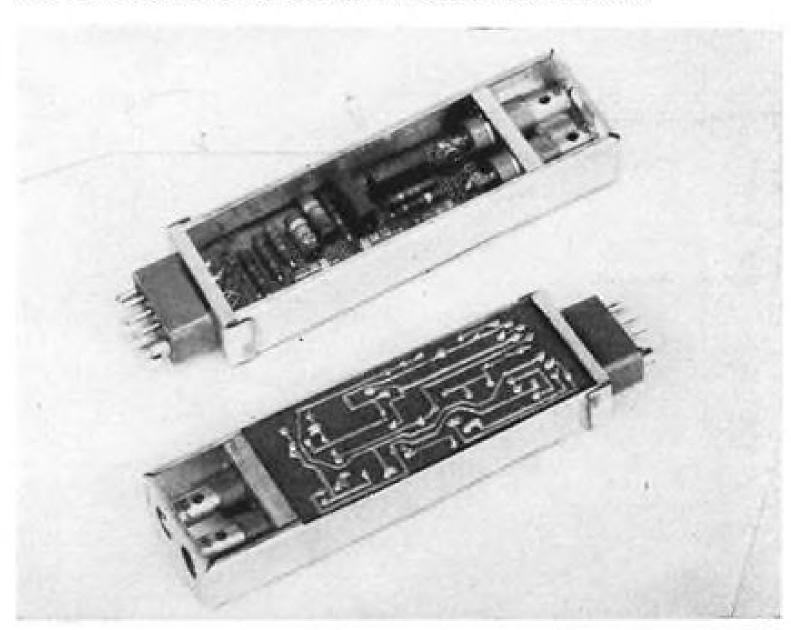
of electronic components will be done auto-**ASSEMBLY** matically on a GE-developed machine similar to this. First is to be delivered in late 1953.



PRINTED CIRCUIT fiber plate is base on which assembly machine will mount prepared components under guidance of punched card instructions.



COMPONENTS such as conventional-type resistors and capacitors will be tested, and have their leads cut and formed on a machine like this one.



SOLDER DIP will secure components and make elec-trical connections, after which fiber plate will be mounted in plug-in chassis, as illustrated above.

Automatic Factory Near for Electronics

GE developing machines to prepare, test and place conventional components in printed circuit units.

By Philip Klass

General Electric is developing machinery that should soon make possible the completely automatic manufacture of printed-circuit electronic assemblies using conventional-type components.

The disclosure that GE is working, for the Signal Corps, on machines for the automatic test, handling, and placement of conventional-type components in printed-conductor boards was made by R. A. Gerhold of the Signal Corps Engineering Labs in a paper delivered at the recent National Electronics Con-

dustry, by its very nature, has long defied mechanization.

GE expects to deliver the first experimental versions of the key automatic factory machines late in 1953, according to a spokesman.

► The Need-Growing military use of electronics in air, ground and sea operations, and the advent of expendable guided missiles which are crammed full of avionics gear, has long worried the experts. They recognize the high labor content which goes into electronics assemblies and they wonder where the U. S. would find sufficient manpower to meet the needs of a hot war. That ference in Chicago. It was particularly is why there is a lot of military interest out for lunch, rest periods, or shift noteworthy because the electronics in- behind the Signal Corps-CE program. changes, and only occasional down-

The Signal Corps has recently taken other steps to remove another obstacle to mechanized electronics production. The obstacle was the increasing use of tiny transistors to replace vacuum tubes. Whereas tubes have long been produced by fully or semi-automatic techniques, the new transistors have been manufactured by semi-laboratory methods. This explains recent Signal Corps contracts to GE, Raytheon, Sylvania and RCA to develop automatic machines for producing, assembling, and testing transistors.

► Advantages—Here is what makes the new automatic factory type equipment under development by GE so attractive: More production. Automatic machinery can be operated for 24 hours a day, seven days a week, with no time

Auto-Lite Nylon-Jacketed Wire



TODAY:
Auto-Lite is proud to have developed in cooperation with producers of basic materials a new kind of wire for the tougher, super-exacting demands of modern military aircraft. Nylon jacket, plastic insulation and a series of other perfections have gone into this pioneering achievement. Auto-Lite Nylon-Jacketed Wire is now available for use on defense orders.

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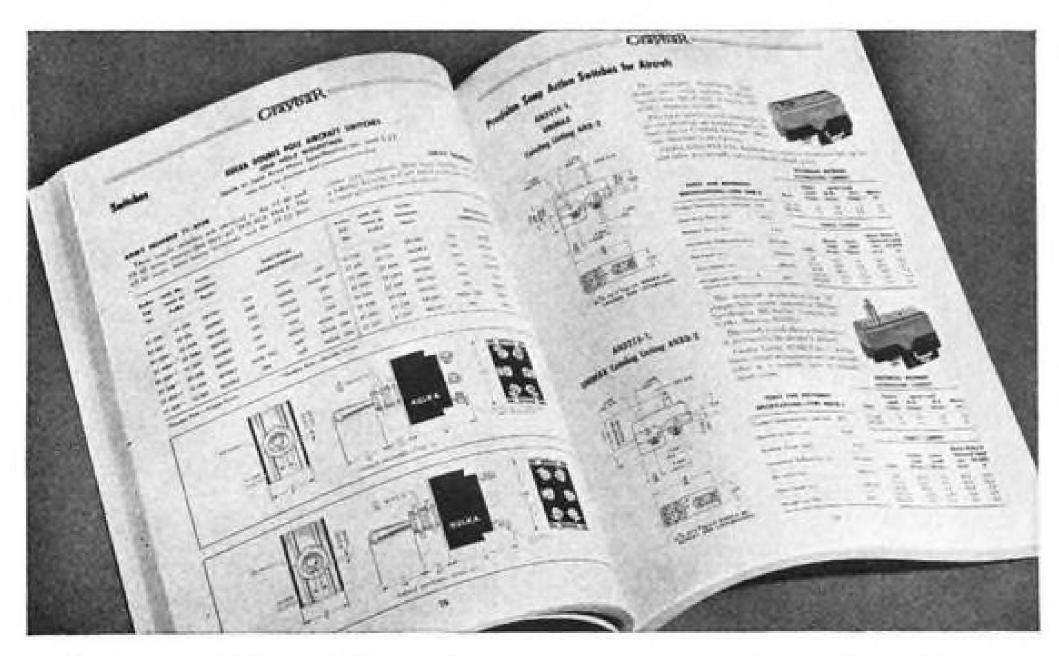
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constant use as components and on the assembly line. Written and edited for the convenience of men in the aircraft field the book represents the most comprehensive catalog now available to this highly specialized industry. In addition to test data, illustrations and easy-to-find index.

Published by Graybar Electric Com- specifications of parts and materials, pany. 224 pages. This 81/2" x 11" the book carries many reference tables volume, printed on coated stock and of great value and convenience. Tables illustrated throughout with half-tones, on wire, for example, list AN sizes, lists hundreds of electrical items in AWC sizes, number of strands, approximate bare diameter, shipping weight in pounds per thousand feet, maximum over-all diameter and nominal copper weight in pounds per thousand feet. More than 200 separate items are listed in an alphabetical,

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Call Graybar first for ... Fig

• Improved quality. As long as the machines function properly, every assembly should come out correctly wired and up to required quality standards. This should in turn reduce

inspection time.

• Flexibility. Because manufacturing instructions (for the machines) will come from punched (IBM-type) cards or tape, a production line can be quickly converted from manufacturing one type assembly to another. Changeover will require no "learning-time" for the machine, and the line can come up to full speed almost immediately.

• Less manpower. Practically all of the hand-labor operations associated with present-day manufacturing methods can be eliminated and lesser-skilled personnel can be used where operators

are necessary.

► Outgrowth of "Auto-Assembly" -GE's program is a logical continuation of the earlier-devised Signal Corps technique called "Auto-Assembly." Auto-Assembly uses a fiber mounting board, or "card," on which are printed or etched the conductors necessary to interconnect the components.

In its initial concept, conventionaltype components were mounted by hand on the card by inserting their leads through small punched holes in the card. After component installation, the entire bottom half of the card was quick-dipped into a hot bath of solder, securing the components and connecting them electrically to the printed conductors.

This technique has proven attractive because it eliminates:

· Major portion of hand labor operations (soldering interconnecting wires).

 Chance for incorrectly wired circuits and consequent rejections. As a result of this technique, Gerhold said, one manufacturer cut his rejection rate to



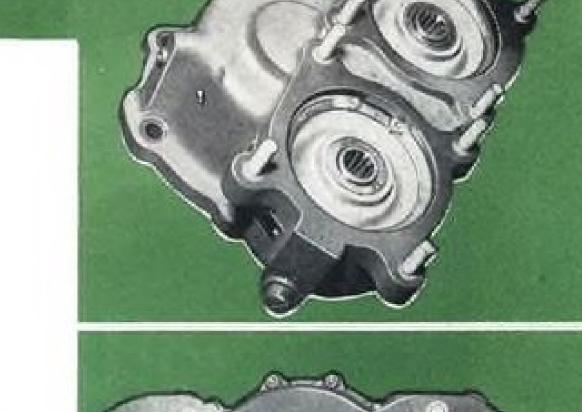
ANALOG AID

This non-linear function generator can be used to simulate the effects of backlash, dead-zone and limit stops in real-time analog computer studies of servo system design problems. Made by Computer Corp. of America, the new Model NLU-2 allows computer input signals to be continuously varied by panel adjustments. Device can be used with such analog computers as the REAC, GEDA or IDA, the latter manufactured by CCA., 149 Church St., New York.

HEADQUARTERS

AIRCRAFT ACCESSORY DRIVES





Design Development Prototype Production **Quantity Production**

Just a few of the many drives produced by Western Gear Works for aircraft-engine accessories are illustrated on this page.

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1/20 of that experienced in hand-wiring [operations.

General Electric itself applied the same technique commercially to a part of its line of television sets early in 1951 and has made increasing use of the auto-assembly technique, as have other manufacturers.

► Next Step—The Signal Corps has now taken the next logical, but the most difficult, step toward complete automaticity. That is the automatic placement of prefabricated components on the printed-circuit card. This might not seem too difficult until one examines the problem more closely.

The equipment must be designed with sufficient flexibility to handle a variety of different components and be capable of changeover from one type assembly to another in short order. A more fundamentally difficult problem arises in the components themselves.

Component manufacturers, long accustomed to meeting tight tolerances on the electrical characteristics of their products, have never attempted to precisely maintain the outer physical diponent dimensions can present a major

Conventional-Type Components -The Signal Corps decided to build its automatic factory around conventional types of resistors, capacitors, etc., because these components are reliable and proven. Considerable effort has already gone into improving their quality and reliability.

At least for the present, the Signal Corps appears to have rejected the printing of graphite and silver patterns on the fiber card to create resistors and capacitors, because these techniques are not yet sufficiently accurate or reliable for military equipment.

(Britain's John Sargrove developed an automatic machine in the late 1940s which could turn out five-tube-printedcircuit, printed-component superheterodyne receivers at the rate of 500,000 sets a year. Only the tubes, transformers, electrolytic capacitors and the loud speaker had to be installed by hand.) ► The New Machines—General Electric is developing three different types of machines for the Signal Corps:

- Component Preparation. This device will test each component electrically, reject defectives, and then cut and form the leads as required, delivering the component to the Component Carrier.
- Component Carrier. This device will load components into trays, code the trays to identify the specific type component, and deliver the trays to the Component Assembly machine.
- · Component Assembly. Printed cir-

"Se of HIGH SAMPLING RATE LONG LIFE!

mensions of their components. When components must be accurately positioned to within 0.005 in. for automatic installation, variation in com-

Commutation of telemetering subcarrier oscillator input voltages or pickup output at high sampling rates can now be provided with this new Bendix-Pacific TSC-18 Commutating Switch.

The TSC-18 Commutating Switch is a three pole switch having 60 contacts per section and shorting type contact wipers. Non-shorting type operation may be obtained by connecting to alternate contacts giving 30 circuits in each section with 60% duty cycle. The wipers are adjustable for synchronization of all sections.

Long life has been engineered into the switch through the use of heat treated precious metal contact pins and wipers. The contact plate and rotor are completely enclosed in an aluminum housing which is attached to a small permanent magnet motor having an integral gear train and governor.

SPECIFICATIONS

Motor Voltages: 6, 12, or 28 volts DC. Motor Current: 300 to 500 ma. Capacities: Adjacent pins: 2.8 mmfd. Alternate pins: 2.2 mmfd. Inner to middle slip ring: 19.2 mmfd. Outer to middle slip ring: 18.3 mmfd. Outer to inner slip ring: 16.7 mmfd.

Temperature range: -50°C to +100°C

Acceleration: Satisfactory to 40 G along any axis Vibration: Satistactory to 20 G at a

frequency of 55 cps or 10 G to 600 cps along any axis Dimensions: 3.5" max. diameter; 4.98" max. length Weight: 1.18 pounds

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cuit cards, with interconnecting conductors and pre-punched holes to receive component leads will be fed to this machine as will the trays containing tested components. This machine will lower components individually, positioning the printed-circuit card to receive component leads. Later the card will be automatically conveyed to a hot solder bath for dipping. The completed card will then be ready for installation in its plug-in chassis.

The Signal Corps has asked for polar (rotational) orientation as well as rectangular positioning of components on the card. This feature will permit more compact assemblies but will probably

cause many design headaches at GE.

▶ Initial Goals—GE says it is shooting for a component placement rate of at least 30 per minute. Making allowance for machine load-unload time, this would enable the device to turn out 2,900 10-component cards per day. A single machine could turn out 50-component assemblies at the rate of 750 per day, GE estimates.

Dr. W. R. G. Baker, GE vice-president and general manager of its electronics division, says that the component assembly machine design presents the major problem. The other two machines "are already on the drawing boards," Baker says.



SIMPLE SHELTER for low-cost TVOR.

TVOR system is a self-contained unit.

for AIRCRAFT ALLOYS

Specification	Shape	Analysis	Condition, etc.
MIL-S-5000A		4340	Rounds, Squares, Hex's, Flats, Billets, Annealed
MIL-S-5626	Bars	4140	Rounds, Hex's, Flats, Billets, Annealed, Normalized
MIL-S-6758	Bars	4130	Rounds, Squares, Hex's, Flats, Billets, Annealed, Normalized Normalized & Tempered, Hea Treated
AMS 6324	Bars	8740 Modified	Annealed Rounds Annealed & Normalized

AN-QQ-S-685...Strip....... 4130....... Annealed & Normanzed AN-S-11..... Strip....... 1020-25

AIRCRAFT STAINLESS

Specification	Snape	Wildlans:	Condition, etc.
MIL-S-5059	Sheets Hi-Tensile Sheets & Strip	Туре 301	2B and No. 4 Finish ⅓, ⅓ and Full Hard Temper
		Type 304	2D Finish
MIL-S-6721	Sheets	Type 321	
MIL-S-7720	Bars	Type 303	Rounds, Squares, Hex's
AMS 5510			
AMS 5521			
			Rounds, Squares, Hex's
			Rounds, Squares, Hex's
AMS 5645			
	1 (0 1	1 0	and the state of t

And also for Standard specification steels of every kind.

Gall RYERSON

Quick Shipment from Stock

Steel-Service Plants at: New York * Boston * Philadelphia * Detroit * Cincinnati Cleveland * Pittsburgh * Buffalo * Chicago * Milwaukee * St. Louis * Los Angeles

New TVOR Sells 'Under \$10,000'

The small shelter (top) at College Park, Md., airport houses a new low-cost TVOR (terminal VOR) station announced by Maryland Electronics Mfg. Corp. The new TVOR unit can provide low-power VHF omnirange and instrument approach facilities at small airports not equipped with CAA-furnished VOR and ILS facilities.

Low overall shelter and antenna height allows TVOR to be located on airfield, cutting installation costs and allowing it to serve as instrument approach localizer. Maryland Electronics says shelter can be built by average carpenter from plans it furnishes.

Complete TVOR equipment, including 50-w. transmitter and automatic monitor to shut off station in event of malfunction, is contained in this "package" which operates from standard 110-v., 60-cycle a.c. Unit provides for



WHAT'S AHEAD OF THE INFANTRY?

THE Cessna L-19 bird dog

... dependable, popular servant of the Infantry, itself!

Today, hundreds of these light L-19 reconnaissance planes roam over enemy lines, probing for targets, directing air and artillery fire, supplying isolated UN troops, transporting important military personnel and equipment, in short, serving as every infantryman's own personal "air force."

Equally proud of these sturdy L-19s are the men who fly them, veteran Army and Marine aviators who praise the Bird Dog's powerful 213 HP engine, its *all-metal* construction, visibility, shock-resistant landing gear, high-lift flaps and multiple-installation radio (for contact with both air and ground units!).

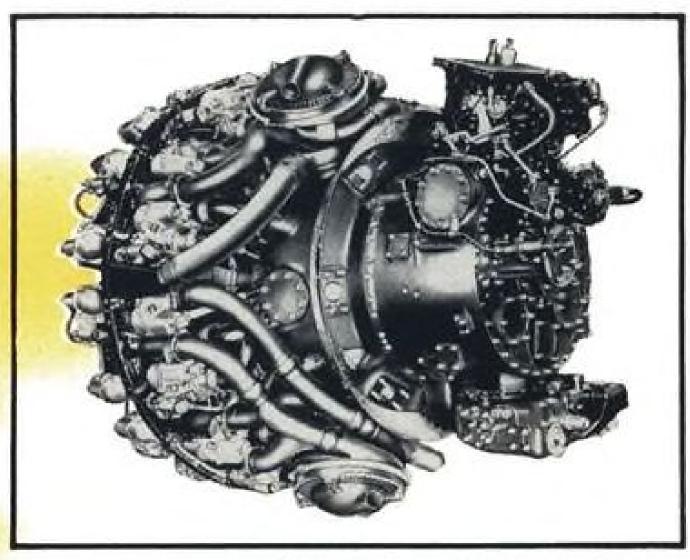
What does it all mean? First, more up-to-date, usable battlefield information. And that, of course, means easier missions. But most important, accurate intelligence saves GI lives. That's a combat-proved fact!

We at Cessna are tremendously proud of the L-19s and we're building them as fast as we can. A job? No . . . we think it's an honor.

CESSNA AIRCRAFT COMPANY, WICHITA, KANSAS







Wright Turbo Compound Aircraft Engine

they fly on Wright Engines...

Martin "Marlin"

with THOMPSON VALVES

For a Douglas "Skyraider", a Martin "Marlin" or a Lockheed "Super-Connie" . . . Wright engines deliver the power for smooth commercial flights or teeth-jarring combat maneuvers. And Thompson Valves are standard equipment for Wright engines of all sizes up to the super-

powered Turbo Compound.

Thompson's combination of metallurgical leadership, design excellence, and production capacity assures the owner of a Wright-engined aircraft of dependable service with fewer non-scheduled overhauls, and at minimum cost for valve maintenance.



VALVE DIVISION

Thompson Products, Inc.

CLEVELAND 17, OHIO

voice transmission on the TVOR frequency which can be tuned to any spot in the 108-to-118-mc. band. Any threeletter station identification can be set up on the equipment, the manufacturer

Low-cost TVOR, designed to make "all-weather" airports out of small municipal and low-density foreign airfields is an outgrowth of an Air Transport Assn. project completed earlier this year. ATA built a TVOR largely from existing components and tested it to prove practicality of such a low-cost installation (Aviation Week May 5, p. 68; June 9, p. 68). Wilcox Electric Co. has announced its own TVOR unit and Collins Radio is reported working on a TVOR.

available on 90-day delivery, the College Park, Md., manufacturer says.

New Potting Resin Quick to Harden

A low-cost resin which has good storage properties without refrigeration has been developed by the National Bureau of Standards for embedding or "potting" avionics assemblies.

Designated the type AN-5 casting resin, NBS says the resin has good physical and electrical properties at both high and low frequencies. The new resin was developed to replace the previous NBS-developed resin which used high-cost 2,5-dichlorostyrene.

The new resin can be cured (hardened) at room temperature within several days. If the temperature is raised Maryland Electronics' TVOR is to 50C, the resin will set in about 2 hours and be completely cured in 20 hours, NBS says.



Navy Gets New Instrument Trainer

Navy's first twin-piston-engine instrument flight trainer has been completed by Engineering and Research Corp. The trainer will go into service at Navy's Corpus Christi all-weather flying school.

The device does not mimic the flight characteristics of a specific type airplane and for that reason is called a flight trainer rather than a flight simulator. However, the Riverdale, Md., manufacturer has spared no effort to provide realism both in cockpit fitting and in the new trainer's "flight" characteristics.

For example, Erco says, the trainer is the first to use cockpit control knobs which are shape-coded and color-coded according to their function. It is also the first to use a new radio aids simulator and flight plotting board developed by the Navy's Special Devices Center and built by Technical Products, Inc. of Hollywood, Calif.

The radio aids unit provides for re-trainers.

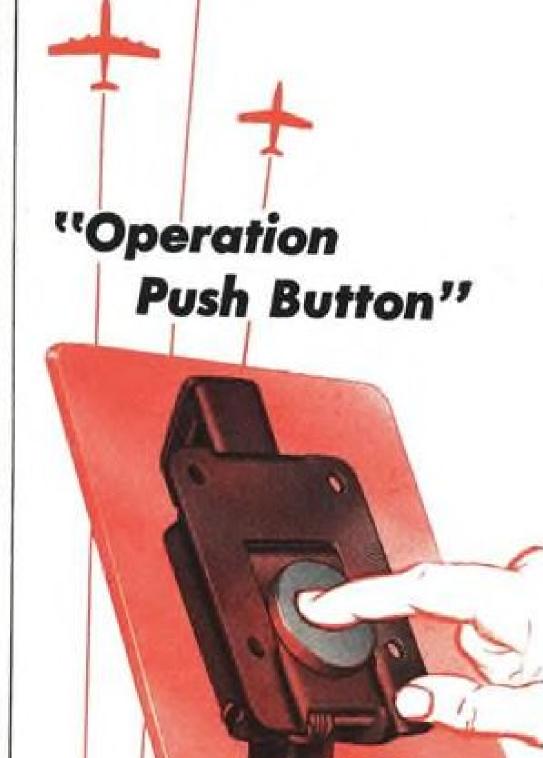
ception of two range stations, either the low-frequency A-N type or the VHF omnirange type. The trainer also provides simulated distance measuring equipment (DME) and instrument approach facilities, either ILS or GCA.

The Erco trainer can also simulate a multitude of airplane, equipment, and instrument failures to give the student pilot safe on-the-ground experience in coping with emergency flight conditions.

Erco says it has designed the new trainer for easy maintenance by pro-

- Swing-out panels on the computer cabinets.
- Built-in tester for checking computer voltage ratios.
- Terminal board layouts on interior wiring for handy voltage checks.

Engineering and Research Corp. is working on other Navy trainers, including several anti-submarine flight crew



H-4100 New HARTWELL PUSH BUTTON LATCH

- Flush
- Self Closing
- Easy to Operate
- Simple to Install

Latch is operated by a natural rotation of the hand for push-and-lift positive action. As the forward button is depressed, the rear button raises, providing a sturdy grip for opening the door. Your need for efficiency and economy today finds a powerful ally in the Flush Latch and Hinge talents of HARTWELL.

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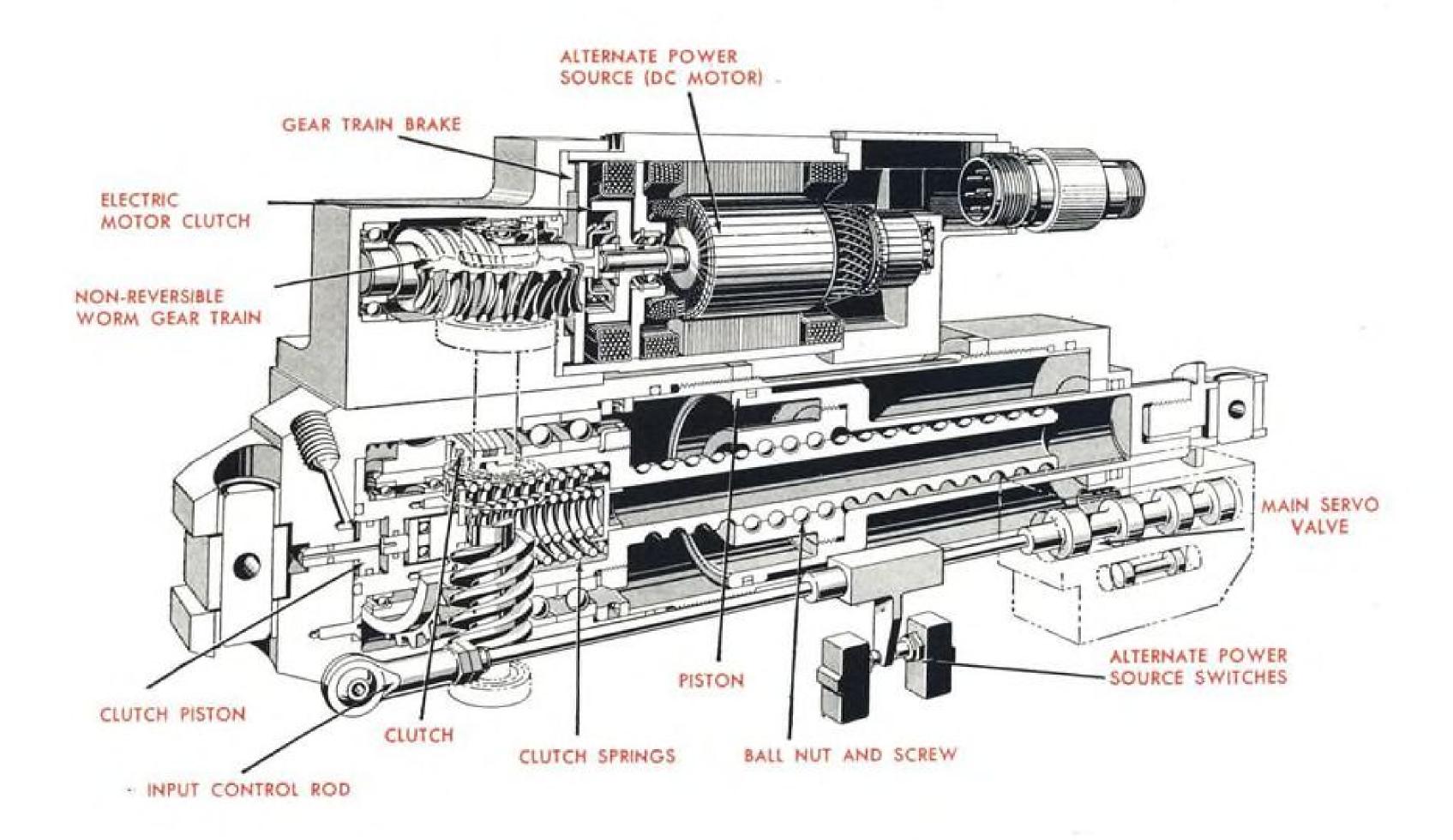
AVIATION SUPPLY COMPANY

Manufacturers of Aircraft Flush Latches and Hinges, Fittings and Cable Terminals.

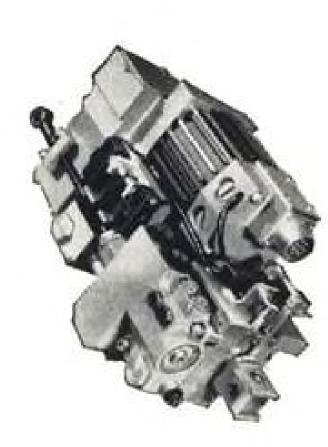
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- Variable Wing Sweep
- Bomb Bay Door
 Cargo Door
- Landing Gear
- Turret Control
- Canopy and Seat Control

Instantaneous and positive in action, the new Aeroproducts actuator automatically locks itself in any position. This self-locking feature gives absolute control of any movable part, eliminating design limitations that have heretofore prevented development of many aeronautical advancements.

Aeroproducts actuators may be coupled in series or tandem to give identical, simultaneous control of more than one movable part. The basic design is infinitely variable for hydraulic, pneumatic, electric or manual operation, or any combination of these.

Designs are already in use for variable control surfaces and jet engines. Others are in process for guided missile and various commercial applications.

Actuators now in production are for:

Republic F84F Flyable Tail

McDonnell F3H Horizontal Stabilizer

Others unannounced

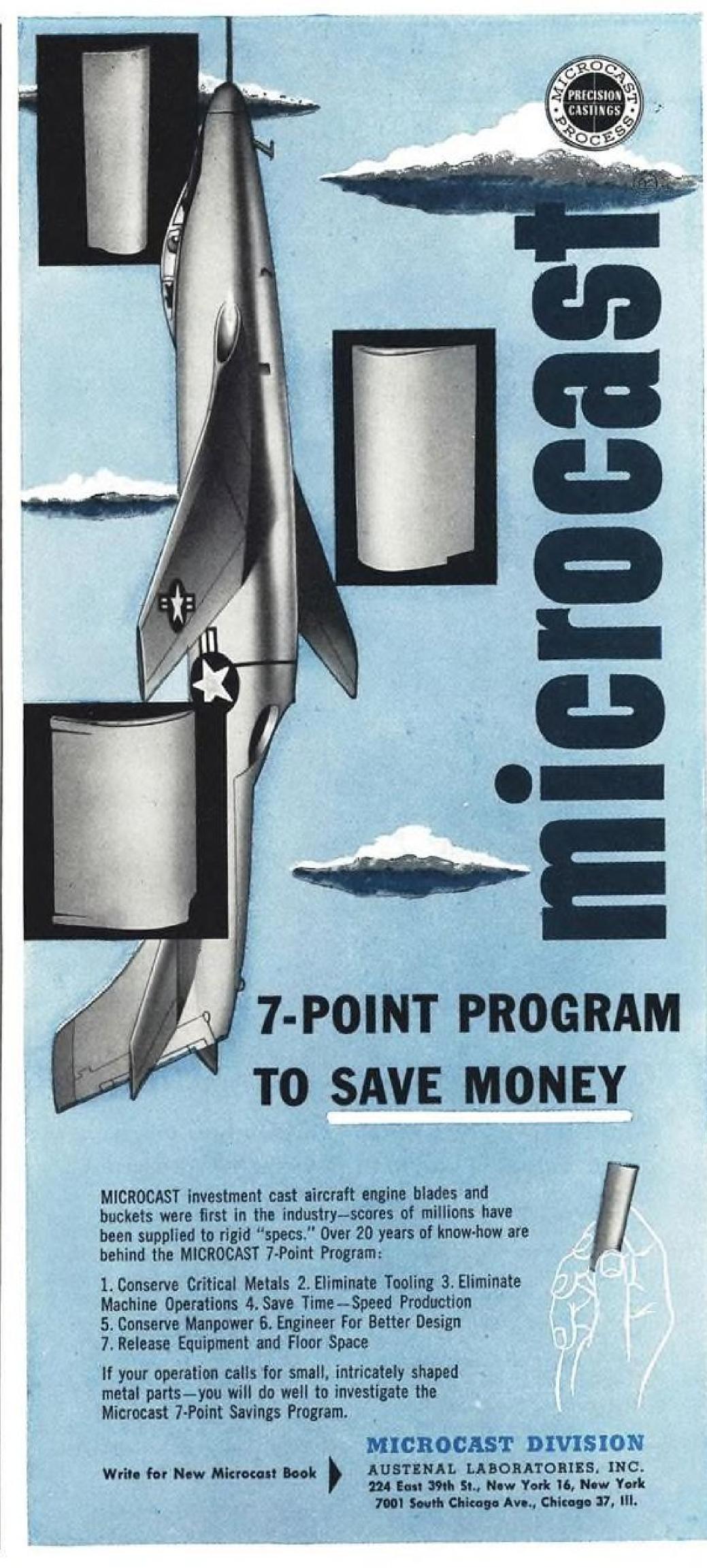


FILTER CENTER

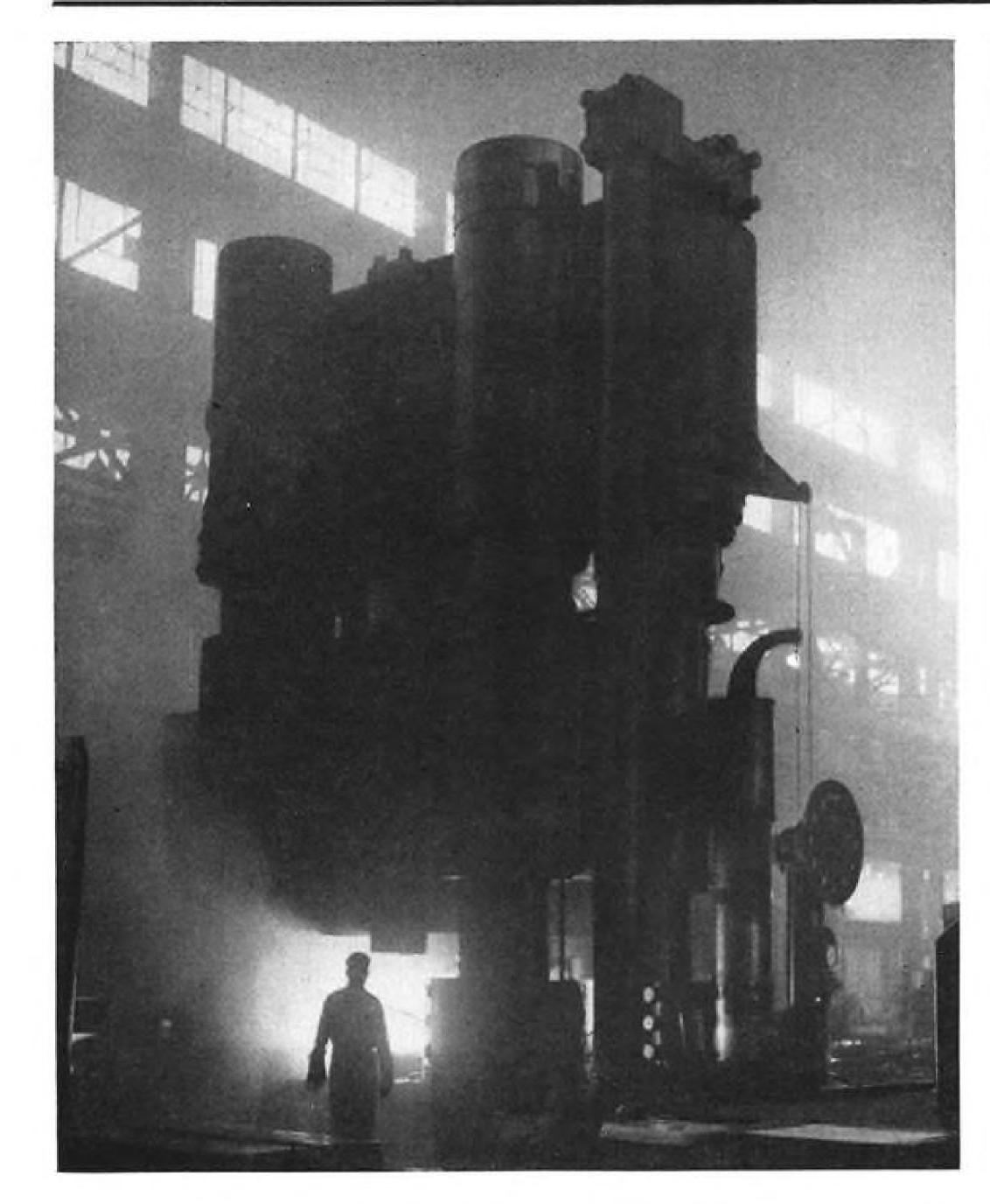
- ▶ Collins to Show New Autopilot—Collins Radio will soon enter a new field with an automatic pilot built around its Integrated Flight System (Zero Reader-type flight director). Design will permit an IFS to be converted into an automatic pilot by adding a servo amplifier, servo actuators, etc. Prototype is being installed in company's Beechcraft for demonstrations to military and airline personnel.
- ▶ Princess to Use Radar—Ekco search radar for use in storm and terrain warning has been ordered for the Saunders-Roe Princess flying boats, according to the British magazine, Flight.
- ► Must Close the Gap—"We must close the gap between the developer (of military electronics) and the user . . . (now) a matter of several years . . . (to) buy us additional technological lead time over our adversaries," Maj. Gen. George I. Back, Chief Army Signal Officer cautioned at the recent National Electronics Conference in Chicago.
- Missile Guider?—Norden Instruments, Inc., manufacturing associate of Norden Laboratories, has delivered its first production version of a "component for an aircraft fire control system" to Navy BuOrd. Photo of the device in a 4-ft. shipping case indicates it may be ship- or ground-based, possibly for guidance of ground-to-air missiles such as BuOrd's Terrier, built by Convair.

► New Avionics Components—

- Small tach generator suitable for servo system stabilization has low starting torque and output voltage up to 1.7 volts per 100 rpm. Unit is about 2½ in. long by 1½ in. in dia. (Globe Industries, Inc., 125 Sunrise Place, Dayton 7, Ohio.)
- Chatterproof pressure switch which contains built-in relay to prevent diaphragm contact chatter under vibration is available as Series 451. Unit can handle up to 5 amp. and can be set to operate at any absolute or differential pressure up to 40 psi. (Colvin Laboratories, 12 Court St., Morristown, N. J.)
- Encapsulated wire-wound resistors with extremely low thermal expansion, said to be capable of withstanding extreme humidity, are available in \$-to-5-megohms ranges, \$\frac{1}{2}\tau-10-2\tau



PRODUCTION



U.S. Refinements

Contrary to popular belief, most major advances of the heavy forging art have come from this country, not Germany.

It is true that heavy hydraulic presses for die forging were first built in Germany. But production on the German presses-two 16,500-ton units and a 33,000-ton machine-was limited to parts of relatively simple configuration.

When existence of these machines became known, an experimental plant was set up at North Grafton, Mass., equipped with one 18,000-ton forge press built by Mesta Machine Co., Pittsburgh, Pa. Operation of this facility was begun by Wyman-Gordon Co., for the Air Force, in 1946. Forging results accomplished there, coupled with the demands of the mobilization program, led to the heavy press program calling for 17 large forge and extrusion presses.

Until recently, all the heavy press forgings produced in this country were turned out on Wyman-Gordon's 18,000-ton press. Parts produced have been large and intricate and go beyond German accomplishments on similar equipment. Experience gained points to even greater achievements on the larger units to come under the heavy press program.

Progress Made in Heavy Forge-Press Art

Know-how gained with 18,000-ton machine will prove valuable on new Wyman-Gordon units.

By Irving Stone

North Grafton, Mass.-A new era in the metal-forging art is beginning to shape up. In this small New England town, the Air Force is steadily readying a key segment of its heavy press forging program-launched to meet aircraft structural requirements for stronger, simpler, larger one-piece components (Aviation Week July 7, p. 38).

Gordon Co., already houses the largest equipment.

forge press in the country—an 18,000
These huge machines, first of the steel except for the cast side cylinders

tonner, which has been squeezing out big parts for military aircraft and engines on a production basis. Planes for which these forgings have been made include the Boeing B-52 and B-47, Republic F-84, Douglas C-124, and day. many other Air Force and Navy aircraft. Components have also been made for Allison, Westinghouse, Pratt & Whitney, Goodyear, and Bell.

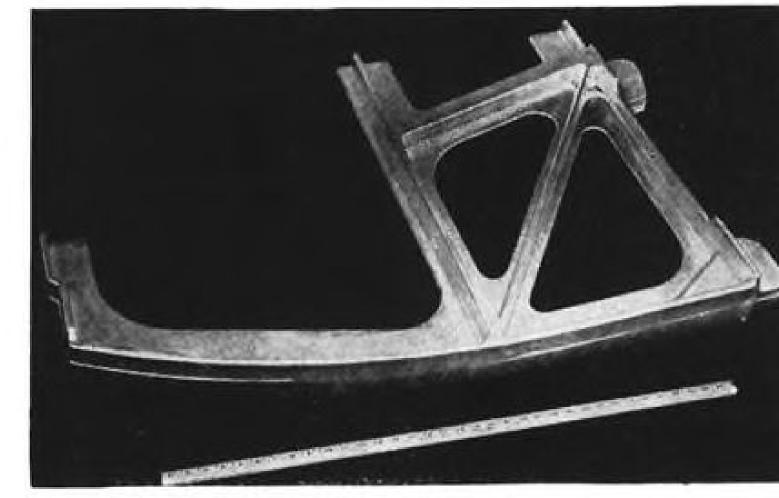
in the fast-changing aeronautical race New Presses Soon-Now the plant is being expanded to accommodate two This North Grafton facility, now new forge press giants-a 35,000- and being operated for USAF by Wyman- a 50,000-ton unit-and their supporting

heavy forge presses scheduled to go to work under the Air Force's expanded program, are expected to begin operation in the first quarter of 1954. The 50,000-tonner will be the first to operate, leading the 35,000-ton unit by a couple of months. Holes for the machines have already been excavated and the concrete will be poured any

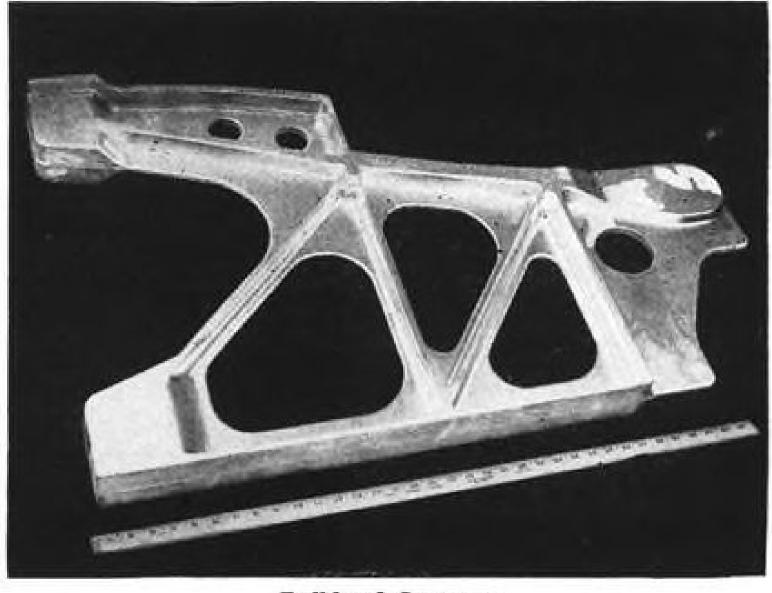
Both machines are being constructed by Hydropress, Inc. They will be the first of a new design, with actuating cylinders below ground instead of on top of the machine. This arrangement will provide a stabilizing force against the press bed and also allow shorter piping. For greater strength, the presses will be constructed entirely of forged

AVIATION WEEK, November 17, 1952

B-47 Forgings . . .



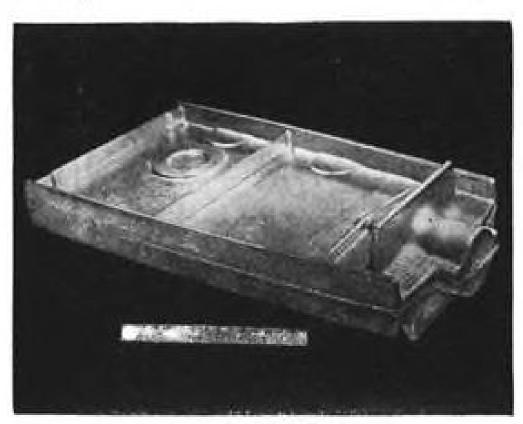
Bulkhead Segment 55 lb., 490 sq. in.; 14S aluminum alloy.



Bulkhead Segment 58 lb., 425 sq. in.; 14S aluminum alloy.



Bulkhead Segment 120 lb., 723 sq. in.; 14S aluminum.

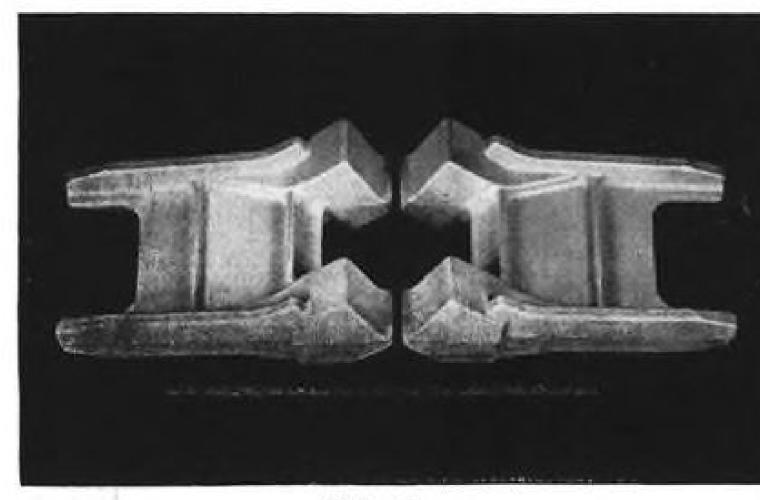


Wing Rib 139 lb., 845 sq. in.; 14S aluminum.

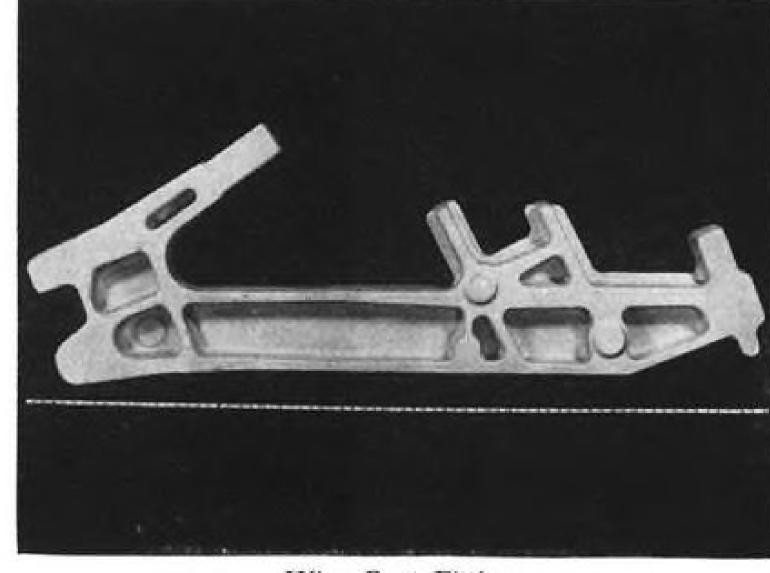


Landing Gear Trunnion 359 lb., 840 sq. in.; 14S aluminum.

Navy Fighter Forgings . . .



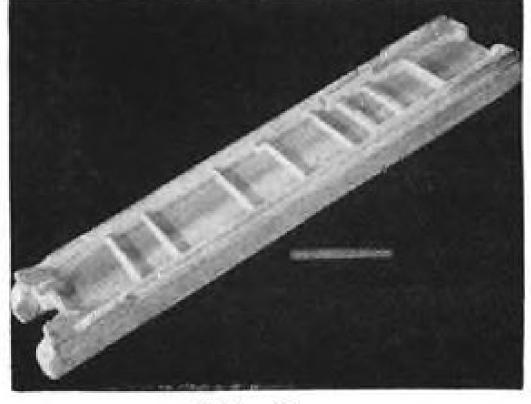
Wing Beam 81 lb., 325 sq. in.; 75S aluminum alloy.



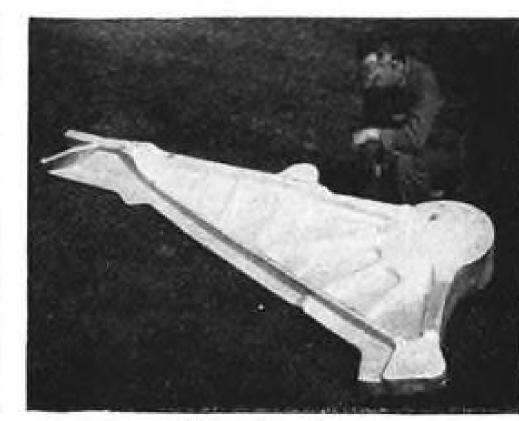
Wing Root Fitting 268 lb., 860 sq. in.; 75S aluminum alloy.



Wing Fitting 13 lb., 151 sq. in.; AZ80-X magnesium.



Wing Beam 480 lb., 1,650 sq. in.; 75S aluminum.



Wing Box Beam 786 lb., 1,760 sq. in.; 14S aluminum.



Dependability IS A MUST

... and anything less than the utmost in dependability can result in disaster. The electronic components that carry the pulse of ground-to-air communications and G.C.A.* must function perfectly at all times. In addition, the connectors that carry the power from the aircraft's generators to the electronic instruments and to the motors which operate the control surfaces etc., must not fail!

There is no resting on past laurels in the aircraft industry, quality and performance must be consistently maintained. The long list of aircraft and aircraft equipment manufacturers who specify Amphenol bears out the fact that Amphenol's reputation as a manufacturer of Quality Electronic Components is well deserved!

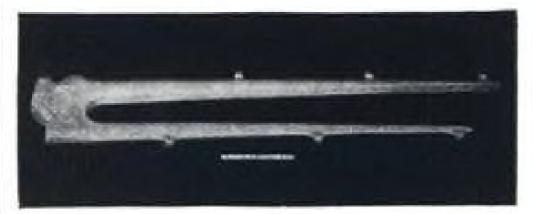
Write today for your copy of Amphenol General Catalog, B-2.

AMERICAN PHENOLIC CORPORATION 1830 SOUTH 54TH AVENUE . CHICAGO 50, ILLINOIS





F-84E Wing Fitting Weight, 29 lb.; 75S aluminum alloy.



Bell Copter Part Weight, 40 lb.; 14S aluminum alloy.

on the 35,000-ton unit, which are coming from Italy.

Expanded Facilities—In the existing Wyman-Gordon North Grafton set-up, in addition to the 18,000-ton Mesta forge press, which carries the bulk of the work, there is a 7,700-ton rebuilt German Schloemann press, ready to go into operation for die forgings on sizes below those normally made on the Mesta. There is also a 1,500-ton Wood press used mainly for preliminary operations such as cross-forging (kneading operation in open dies) and drawing. These facilities are housed in 82,000 sq. ft. of plant space.

In the expanded forge shop there will be an additional 183,000 sq. ft. (including stock storage and cutting), affording a total forge area of 265,000 sq. ft. Process and maintenance quarters for tool and die shop, heattreat and servicing will add another 531,200 sq. ft. An office building for housing an engineering staff, laboratory, administration, hospital and cafeteria will cover 81,672 sq. ft. Two new pump rooms will add 27,500 sq. ft., powerhouse another 10,300 sq. ft.

► Progress Gradual—Wyman-Gordon has been squeezing out airframe and engine parts on the 18,000-ton press since the latter half of 1946. These have not, in the main, been run-of-mill types, but have involved some unusual configurations, and have been made for aircraft and engines of numerous manufacturers engaged in military work. A wealth of knowhow has been accumulated in the heavy forging art.

This does not mean that the new 35,000- and 50,000-ton presses, with almost double and triple the force, respectively, of the 18,000-tonner, will usher in a forging regime that can be expected to produce extremely large or complete integrally stiffened wing panels anytime soon. This sort of achievement, despite loose talk that has been bandied about, isn't in the cards initially-and perhaps not even for a very long time. The smaller forgings

U·S·S Carilloy steel springs soak up 8 million lb.-ft. Torque!

Alloy springs cushion tremendous mechanical shocks in 200-ton short-circuit generators ... save expense of forgings

 In testing high-voltage circuit breakers, engineers at General Electric Company intentionally short-circuit two huge motor-driven generators. Each of these test generators is normally rated 125,000 kva, but provides short-circuit currents as high as 182,000 amp, instantaneous peak of the offset wave, corresponding to about 1,625,000-kva rms symmetrical short-circuit duty. Such operation causes tremendous mechanical stresses to build up inside each machine.

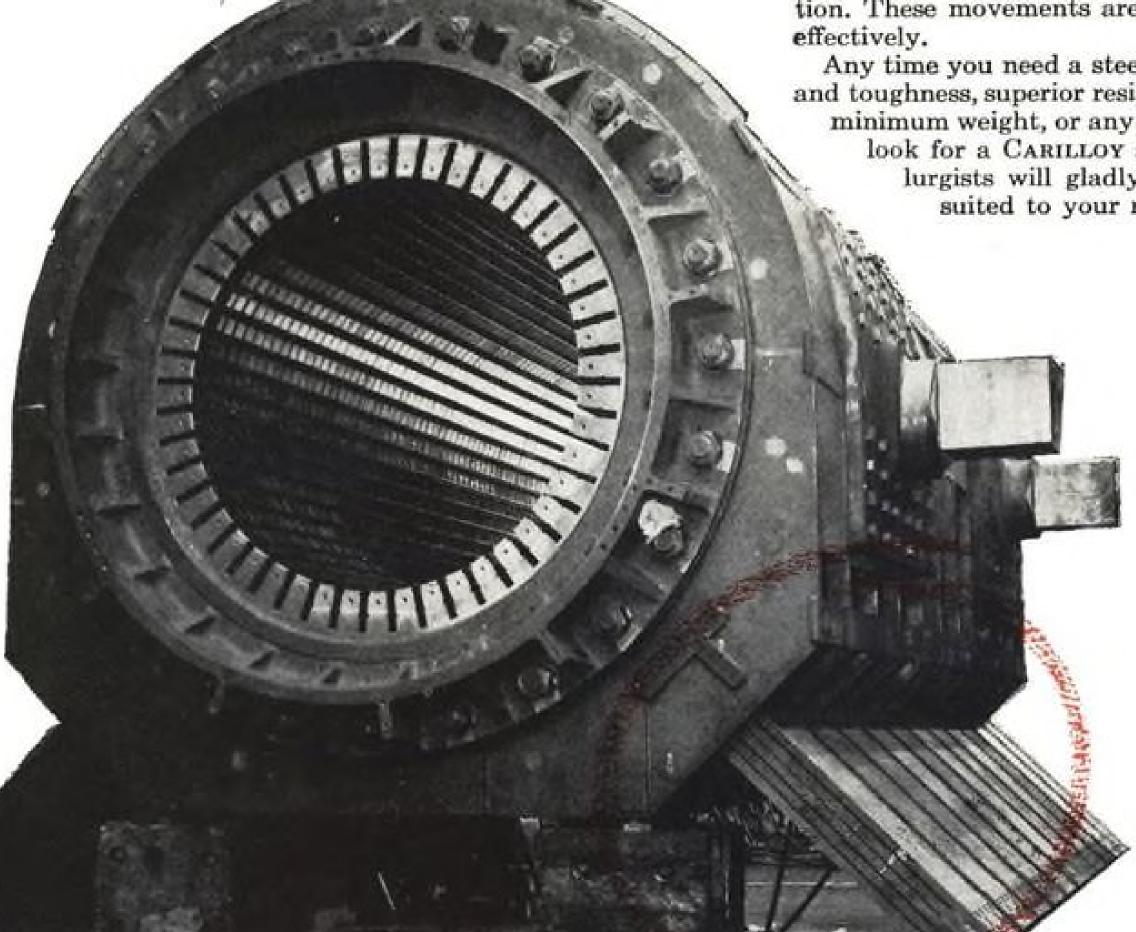
These stresses create a torque that tries to twist loose the 200-ton stator assembly.

But no damage is done! These powerful machines are mounted on U·S·S Carilloy steel plate springs that cushion the shock and then damp out any vibrations that follow. The springs must absorb these terrific shock torsion loads as often as 40 times an hour; so a tough, very durable steel is needed.

Forged springs were considered first. But GE engineers, with the cooperation of United States Steel metallurgists, found that a rolled alloy steel, U.S.S.CARILLOY 4340, provides the required mechanical properties at much lower cost. This steel is tough, even though extremely hard, and it assures good endurance at 40,000 psi. as required in this application. In addition, it is easy to heat treat.

This Carilloy steel is giving excellent service. Under the most severe short circuit, developing a whopping 8 million lb. ft. of torque, frame rotation is about 1/2 in. each way at the point of attachment of the springs. And the axial centerline of the machine stays within 30 mils of its normal position. These movements are sufficient to cushion the shock

Any time you need a steel that will provide high strength and toughness, superior resistance to shock and torsion with minimum weight, or any combination of these properties, look for a Carilloy steel. Experienced U.S.S metallurgists will gladly help you choose the one best suited to your requirements.



At General Electric Company's new switchgear development laboratory, this 1,625,000-kva shortcircuit test generator is protected from mechanical damage during short-circuit tests by plate springs made of U.S.S CARILLOY steel Rolled Carilloy 4340 stands up under the repeated shock torsion loads developed in these machines, and it costs less than forgings.

U·S·S Carilloy Steels

would be to take the



UNITED STATES STEEL COMPANY, PITTSBURGH . COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. . UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST UNITED STATES STEEL EXPORT COMPANY, NEW YORK



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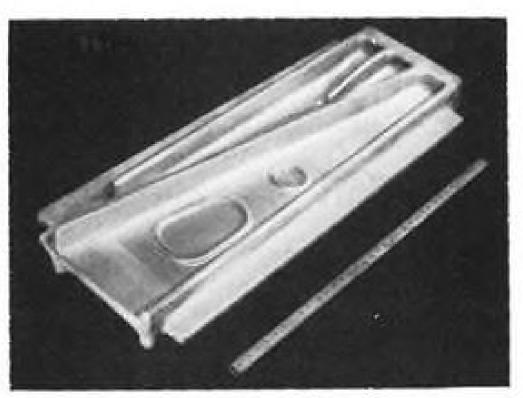
The RAINIER CO., Inc.
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Phone: EVERGREEN 7-1393



PENNA.



B-52 Spar Strut Weight, 155 lb.; 75S aluminum alloy.



C-124 Wing Fitting Weight, 129 lb.; 75S aluminum alloy.

still pose a lot of problems that have to be licked.

New Problems Ahead—However, the new presses will be milestones along the experience road, marking new opportunity for larger single pieces, closer tolerances, thinner walls. Operators will have to learn a lot about big-press capabilities and initially these machines will be experimental provers in a further extension of the forging art.

Airframe and engine men, too, will have to ease into the new forging regime design-wise. Most designs submitted today for execution by forging are considered reasonable, but with the new heavies, closer liaison will have to be maintained between designers and operators to establish a common ground of understanding as to the possibilities and limitations of the forging process on the big machines.

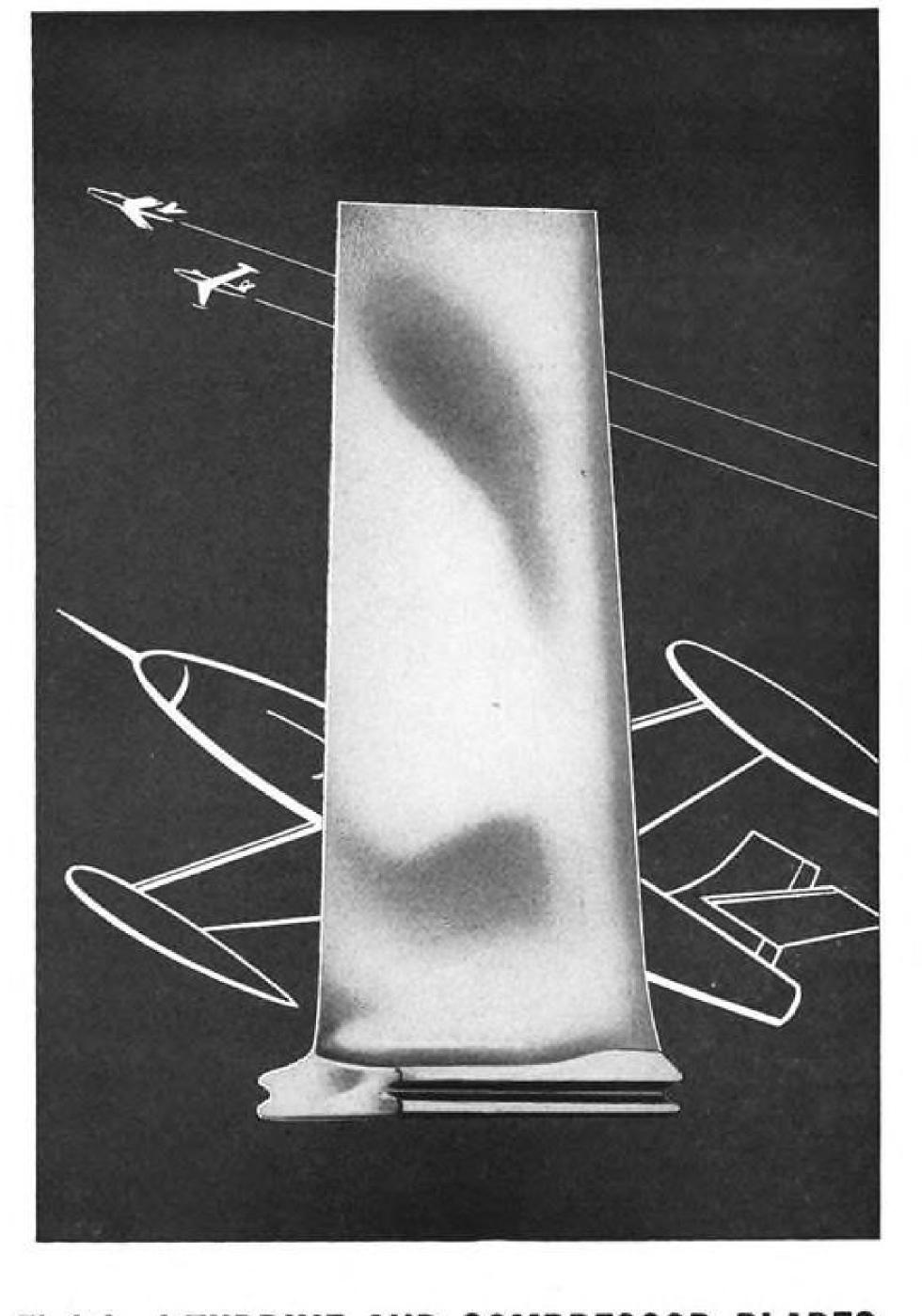
This essential teamwork between the two probably will begin with the inception of the design, progress through the drawing stage, and continue right down to the forging operation.

► Greater Interest Seen-With the new heavies on the way for Wyman-Gordon and other operators, interest in designing into the large forge press has been stimulated. Initially, many airframe men were hesitant to put all their production eggs into one basket-a limited source of heavy forge facilities -because machine breakdown could mean a serious curtailment of production. But the approaching availability of a large number of the heavy presses has worked to dispel designer objections, and reports are that if the bigtonners were available today, operators would have a flood of orders for large single-piece forgings.

► Other New Heavies—In addition to the 35,000- and 50,000-ton units for Wyman-Gordon, similar-size forge



UTICA HELPS



BY SUPPLYING *Finished* TURBINE AND COMPRESSOR BLADES

Utica is proud of its part in the forging of turbine and compressor blades for jet engines. And now a new step has been added. An important defense task has been taken from other hard working shoulders — and the country's all-important blade production for jet engines thus speeded and increased.

Utica's facilities now include an entirely separate and extensive plant for the *finishing* of blades. Giant precision grinders and broaches cut roots into hard-towork metal. Automatic polishers bring airfoil characteristics to perfection. The finest of metrological equipment gauges the finished product.

This is not work that can be done by rote. Many of these are "first-time" processes. They require the advanced and specialized knowledge of metallurgy and metalworking for which UTICA stands.



UTICA DROP FORGE & TOOL CORPORATION, Utica 4, New York
MAKERS OF THE FAMOUS UTICA LINE OF DROP FORGED PLIERS AND ADJUSTABLE WRENCHES



presses are going to Aluminum Co. of America at Cleveland; 25,000- and 35,000-tonners to Kaiser Aluminum & Chemical Corp. at Newark, Ohio, and to Harvey Machine Co. at Torrance, Calif.

These eight heavy forgers are not the only big machines in the works. Nine big extrusion presses ranging from 8,000 to 20,000 tons will be put into plants operated by Kaiser, Harvey, Alcoa, Reynolds Metals Co., and Curtiss-Wright Corp.

► Materials, Parts—Work at the North Grafton plant is devoted solely to aircraft parts—mainly airframe components and some engine pieces. Aluminum alloys forged include 14S, 25S and 75S. Some 51S has been forged in the past. Magnesium alloys used are AZ80 and ZK 60.

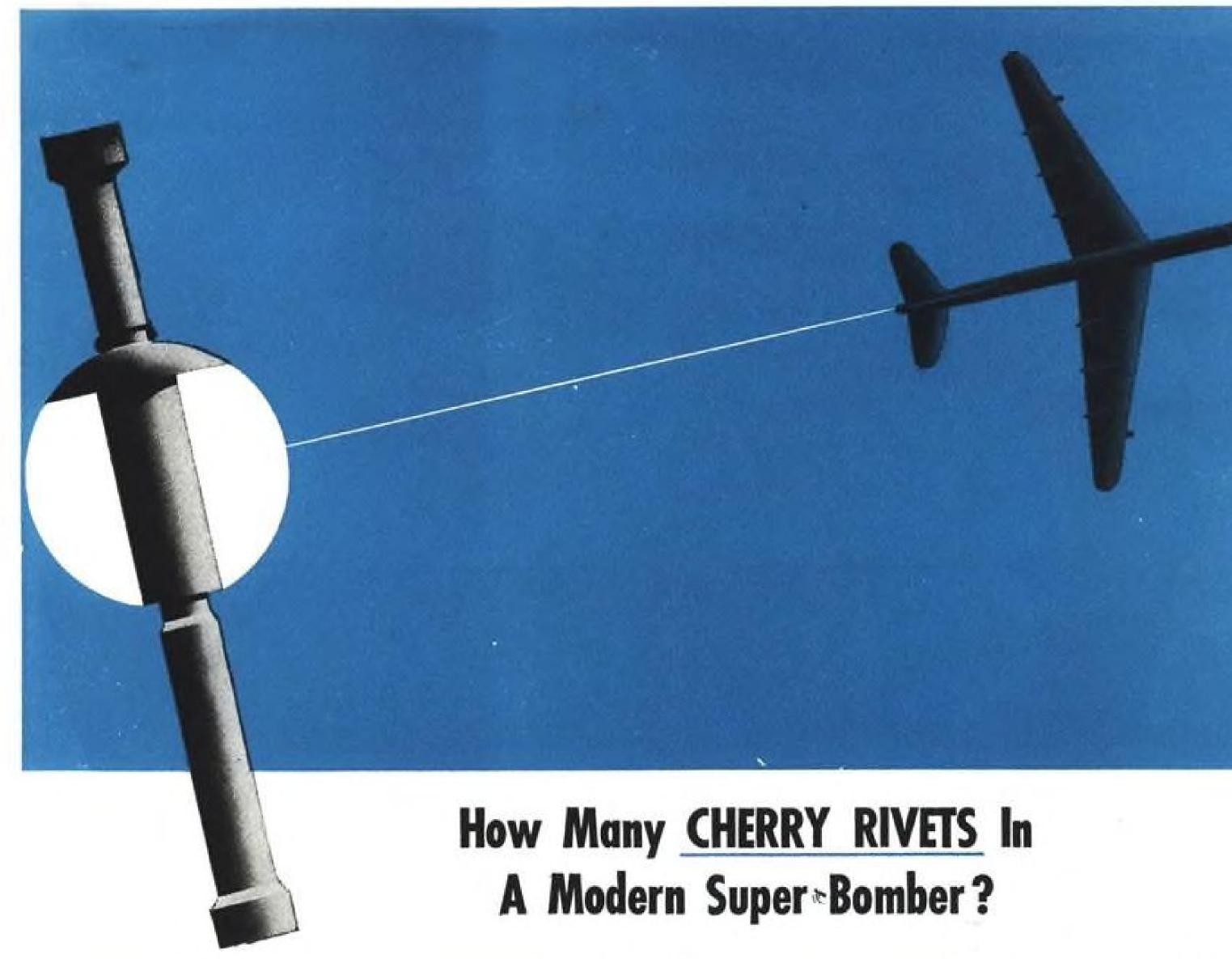
No titanium alloys have been forged at North Grafton, work on this metal so far having been restricted to Wyman-Gordon's Worcester, Mass., plant on an experimental basis. Large-press forgings of titanium will not be transferred to North Grafton until the Air Force directs the shift.

Parts that have been or are now being made in aluminum and magnesium alloys range in weight from about 25 to 500 lb. Surface of about 1,000 sq. in. is the limiting area processed on the 18,000-ton press, but this isn't a hard-and-fast figure-it depends on the forging configuration. Components include spars, beams, ribs, braces, bulkhead segments, centrifugal impellers, axial-flow rotors, heavy fittings, crankcase sections, helicopter rotor grip plates, and landing gear cylinders, forks, trunnions, and wheels. ► Longer Pieces—It is possible to make parts of considerable length on the press. One experimental T-section spar for a bomber is 17 ft. long and weighs only about 100 lb.

On the new presses with their 12x32ft. beds, greater possibilities are opened up, even though the bed size isn't a direct indication of the forging size obtainable. Size will depend mostly on the geometry of the part and the material used—the higher the strength, the greater the pressure required. For forging 75S, 35,000-40,000 psi. pressure is required.

Meanwhile, forgings up to 20 ft. in length are seen as probable with the new Air Force presses, and thinner walls, too, are in the picture if die materials will hold up. There is a possibility of going to lengths of 40 ft. and on some types of work even to much greater stretches through the use of multiple dies put through the press successively. But this capability is merely conjecture—the answers still lie in the problem-shrouded future.

In the final analysis the controlling factor for forging length will not be



In aircraft construction, Cherry Blind Rivets are virtually indispensable. Their practicability is demonstrated by the fact that more than a quarter-million of these ingenious rivets help stitch various components of the modern super bomber — as many as sixty thousand are used in the construction of a four-engine transport. Their use makes possible refinements of design and assembly methods of control surfaces and other components that speed fabrication with big savings in unit costs.

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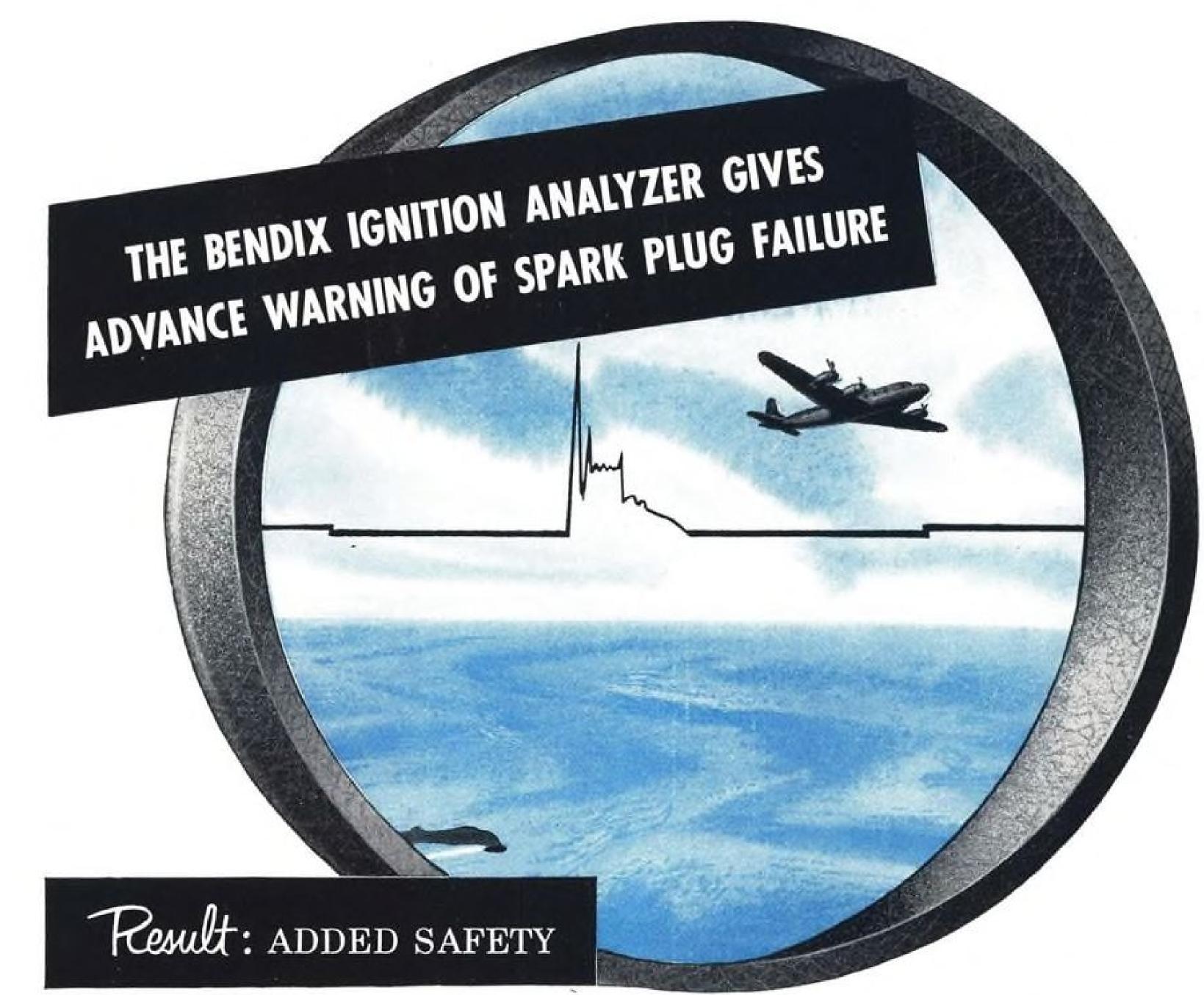
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AVIATION WEEK Name 1 17 1000

as a supporting piece of equipment.

From Two to One—One big job that

the new presses could perform would be in the production of larger one-piece forgings. Limitations of the 18,000-ton unit now make it necessary to forge large, heavy items (bulkheads and ribs) as two or more components, later machined at the joining ends and fastened with bolts. In some instances a large number of bolts would be required, adding substantial weight to the completed assembly, extra manhours and more costs.

As an example of what might be done on one of the new presses, a design for a rib which would now be made in two sections with respective lengths of 48 and 39 in. (87 in. total), projected areas of 1,030 and 845 sq. in. (1,875 sq. in. total) and weights of 143 and 139 lb. (282 lb. total), might be combined in a single forging of equivalent length and area and weighing only about 250 lb.

▶ Careful Analysis Needed—There is a point of diminishing return in the size of forgings that might be produced, because of the cost and time involved to produce the dies. It is felt in operator circles that the 35,000- and 50,000-ton presses will afford a much closer insight to the solution of this problem than has been possible with the 18,000-ton unit. Some people are even talking of presses in the 200,000-ton class, but others feel that a halt should be called, because of the tooling problem involved.

The thinking is that the 35,000- and 50,000-ton presses are limitations for the present—a stopping point to get the tooling answers first. Also, to meet metallurgical and mechanical specifications for larger forgings, properties of billet materials in the larger sizes must be perfected to take full advantage of the larger presses.

Fewer Passes—Operators would like to eliminate kneading with the larger presses, to cut production costs, but the report is that present materials will not permit this. Also, some forgings have to go through the press several times to get the required configuration, because press pressures available can't do the job with fewer passes. With the greater pressure of the new presses, fewer passes could mean a cut in production expense.

For example, for a simple part, the billet may have to go through the press only once. After this, the flash is removed on a trim press (if it is a quantity production part) or a bandsaw. Then, the part is cleaned in caustic (pickling), inspected and any surface defects ground out.

A more complicated part goes through a series of dies to bring it to the final configuration and the steps



Du Pont Aircraft Explosive Rivets are used in the assembly of the bottom section of the fuselage of a C-119 Aircraft made by Fairchild Aircraft Division of Hagerstown, Maryland.

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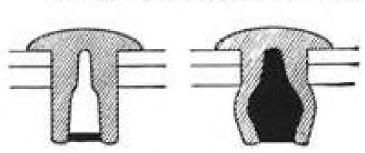
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 Cross-section shows cavity in rivet shank containing minute explosive charge.

 TIP of electrically heated Du Pont Riveting Iron is applied to rivet head, firing charge. Barrel-shaped head at shop end locks rivet securely in place.

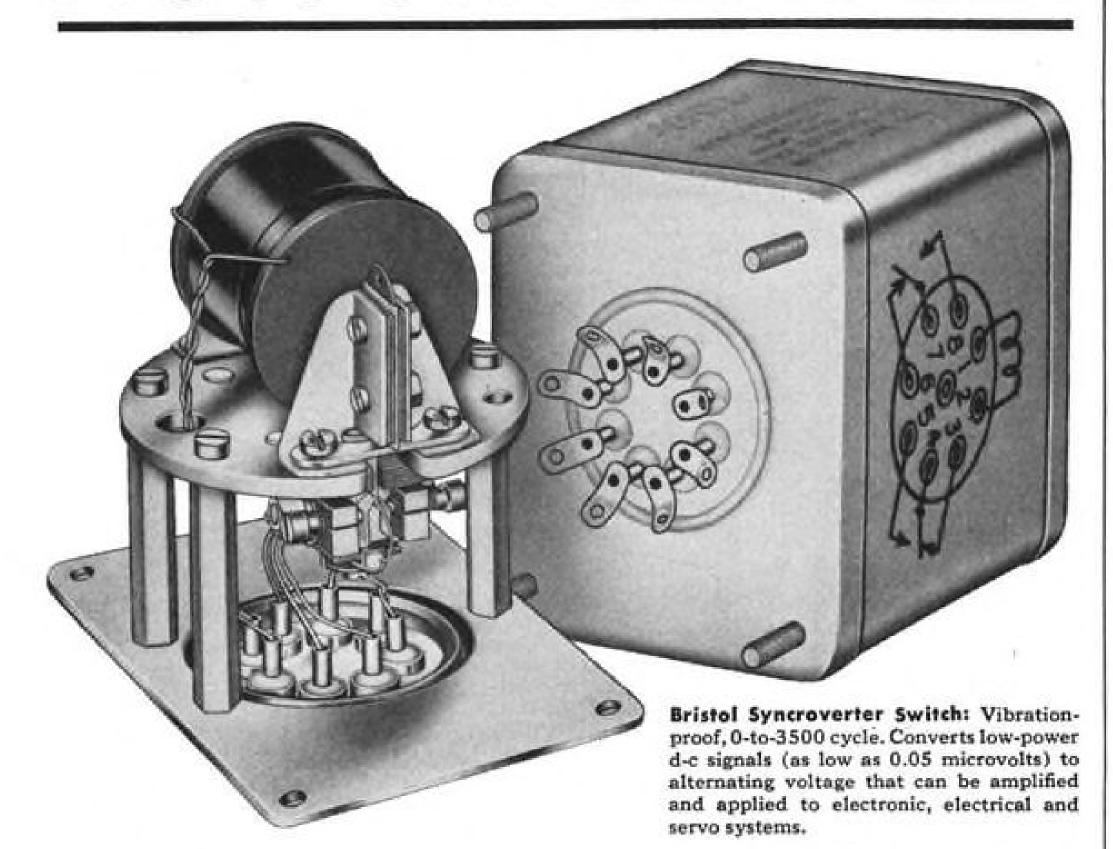
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previously mentioned would have to be performed between each forging operation. Obviously, if these successive forging steps and intermediate operations were lessened, production would be simplified.

► Thinner Walls—Another promising possibility with the bigger presses is thinner wall sections. One difficulty that has been encountered is that die materials up to this time are reported to have been unable to withstand the prolonged high pressures needed to cause the metal to flow and fully fill the cavities without the die being permanently deformed.

Since press forging action is the product of pressure multiplied by time, operators now see it theoretically possible to produce thinner sections, because with the greater pressures available, the pressure application time possibly could be greatly reduced.

able, the pressure application time possibly could be greatly reduced.

Better die materials, improved lubricants and the greater rigidity of the new presses can in some measure help in the solution to the problem.

Through this approach, closer tolerance forgings probably will result.

Strictly Military—The machines that will come into existence under the Air

➤ Strictly Military—The machines that will come into existence under the Air Force's heavy press program must be considered special equipment. Right now they are viewed as essential tools to meet aircraft, engine and some airborne artillery needs in an emergency build-up for a period the end of which cannot now be foreseen.

But when this military emergency is over, how will the giant machines figure in the industrial scheme? On this point it is generally agreed that the heavy press units will be relegated, generally to a standby status. There probably will be limited operation for very advanced aircraft and engine designs, to produce components with strength/weight ratios that will be "musts" for experimental military planes of the future.

There is always the possibility that the presses can be put to commercial uses, and operators already are racking their brains to justify these applications. But at this reading, the commercial outlook for these machines is not too promising, because of the economics involved—die costs would be high and large runs would be required to justify press operation.

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RUGGEDIZED INSTRUMENTS

EQUIPMENT

C-124 Passing Combat Test in Korea

- Giant transport plays a key role in airlift.
- Whole wing now flies the Douglas plane.

By R. P. (Pepper) Martin (McGraw-Hill World News)

Tokyo-In a modest revolution in combat cargo air transport, the giant C-124 Globemaster, a comparative newcomer, is beginning to replace C-54s in the Korean airlift.

The Globemaster, now about two years on the Douglas production line, has been used in the United States by the Strategic Air Command's Strategic Support Unit squadron. It was given a thorough test in Alaska. But the first real test in squadron strength and under actual war conditions came in Korea, where a whole wing has been converted to the huge plane.

Preliminary evaluation discloses that the Globemaster is suitable for use in normal combat conditions. It is, however, too early to evaluate how the plane stands up in sustained operations under grueling conditions.

▶ Payload Limits—Because of a shortage of gasoline in Korea, the Globemaster must carry enough fuel for the round-trip plus a safety margin. The payload is now just edging above 30,000 lb.

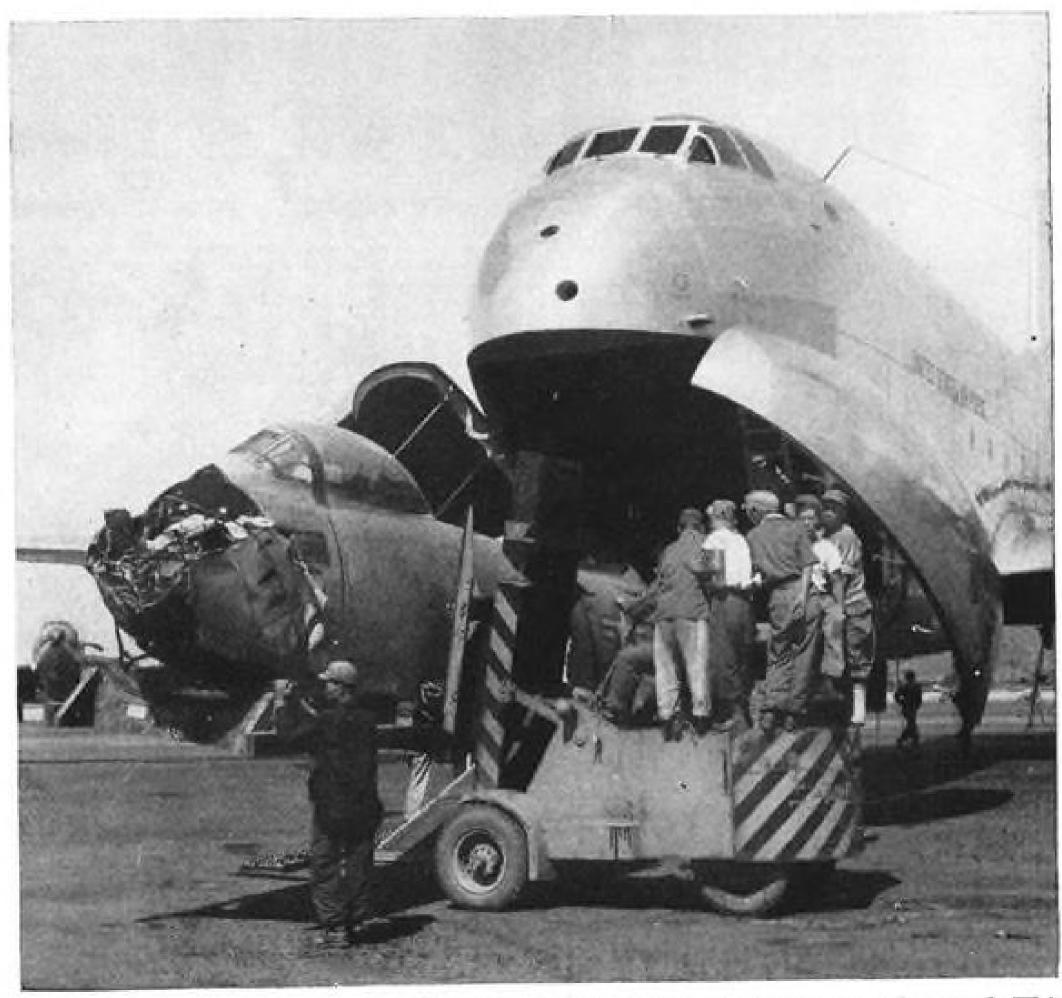
is now just edging above 30,000 lb. The Globemaster can get in and take off from short, rough fields—it can use a 3,000-ft. strip—but there is no cargo utilization under these conditions. It is an exceptionally sturdy plane. One landed short and hit a four-foot bank, knocking out its left landing gear. But the plane rolled 3,000 feet before the gear finally collapsed. That was the only major operational accident thus far.

The C-124 has by no means replaced the C-46s, C-47s, C-54s and C-119s that are the workhorses of the airlift. The smaller planes are far more suited for short or shuttle runs. The C-124 now, however, is a key part of the team that has carried more than 1.7 million passengers, more than 240,000 air evacuees and approximately 500,000 tons of cargo to and from Korea.

► C-124 vs. C-54—Mere size may be misleading in terms of operational efficiency, but here is a comparison of the C-124 and the C-54: The C-124 carries four times as much cargo and four times as many passengers as the



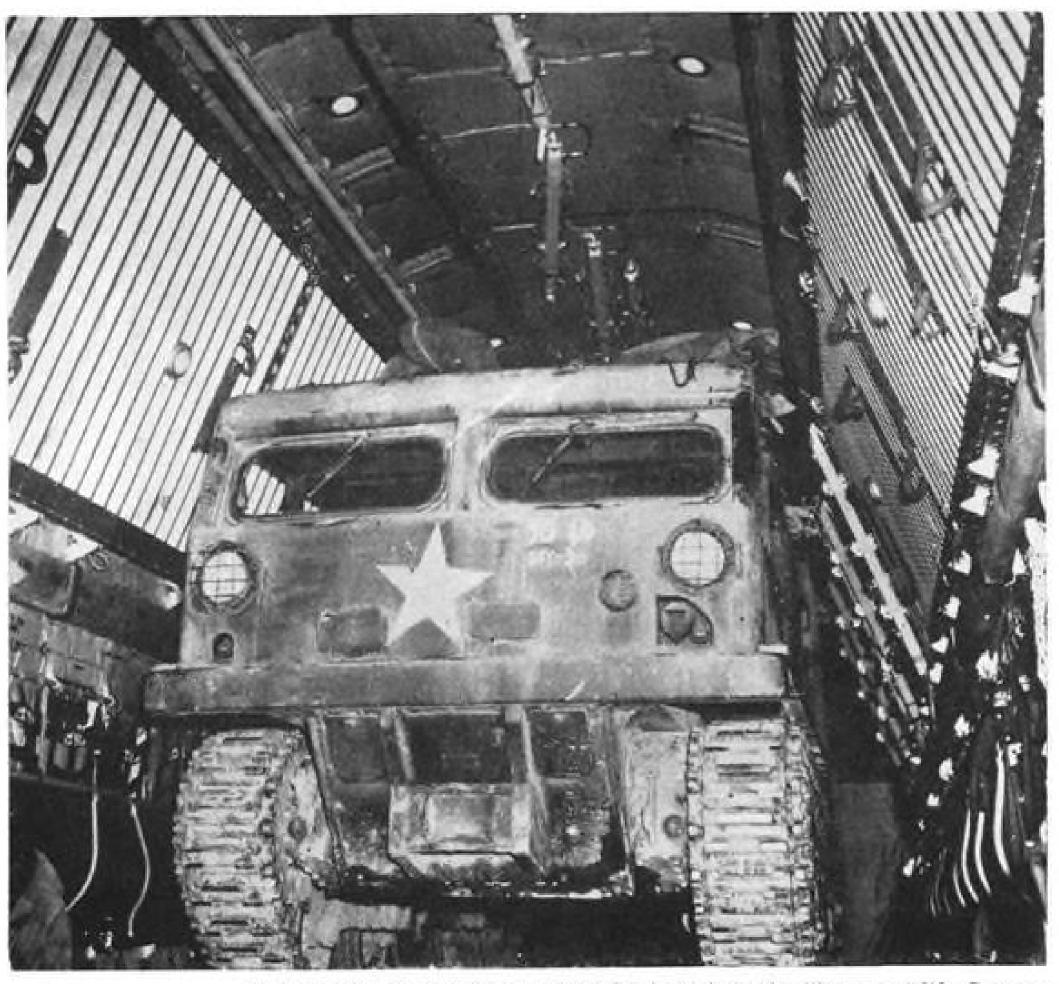
MANPOWER can be moved fast in the huge Douglas C-124 transport. About 200 combat-loaded men and their baggage can be carried in a flight.



carries four times as much cargo and four times as many passengers as the MAINTENANCE and repair of combat-damaged equipment is hastened. This F-86 is being loaded for flight to Tokyo to be rebuilt.



MEDICAL air evacuation of sick and wounded to points where proper treatment can be given is credited with saving many lives in the Korean war.



MATERIEL in huge chunks has been carried by C-124s in the Korean airlift. Largest single item was this 33,000-lb. prime mover tank for hauling artillery. Korea. There was "no sweat" on either maximum load. The heaviest single

C-54. It is the only cargo plane that can carry an M-24 light tank.

It has a gross takeoff weight of 175,-000 lb. and is driven by 3,500-hp. (rated) engines, compared to the 73,000 lb. and 1,450-hp. engines of the C-54. It consumes between 2,400 and 2,800 lb. of fuel an hour cruising at 170 to 175 knots on the Korean run. The C-54 uses 1,200 lb. af gasoline an hour. The C-124 is 127 ft. 1 in. long, has a wingspan of 173 ft. 4 in. and the tail stands 48 ft. 4 in. high. The C-54 is 93 ft. 11 in. long, spans 117 ft. 6 in. and stands 27 ft. 6 in. high.

► Troop Transport—The Globemaster's immense capacity (25 tons of cargo, or 200 combat troops, or any combination of the two) makes it ideal for cargo or troop transport on all but shuttle runs. Actually it has not yet been used to its full capacity. In the past, the 315th Air Division (Combat Cargo) moved entire units from Japan to Korea or from base to base in Korea. Some of these units have been moved 20 times or more.

But the only unit lift by the C-124 thus for has been a practice movement of 3,500 men. Four Globemasters were used in the lift, each averaging about 180 combat-loaded men, each man with a hundred-pound barracks bag. Fifty vehicles, 30 trailers and large quantities of supplies and parachutes were lifted at the same time.

Twenty-five of the C-124s could move 5,000 equipped combat troops one way with no wasted time or effort. By shuttling the planes back and forth, enormous numbers of troops could be moved quickly anywhere in the Far East.

▶ Evacuation of Wounded—While proud of the Globemaster's cargo capacity, Air Force men are also quick to point out how the plane has saved lives. In one air evacuation of wounded, it took only 20 minutes from the time the wheels touched ground until the last of nearly 100 wounded were aboard ambulances or a C-47 that carried them to a nearby hospital. Litter teams carried some patients down the ramp, while others were unloaded on the elevator.

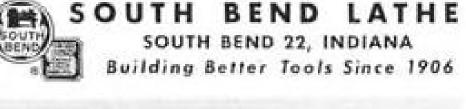
The history of the C-124 in Korea is an exciting study of frustration, experimentation, and finally, comparative success. Early in 1951, Brig. Gen. John P. Henebry, CG of the 315th Air Division, urged that they be tested on the Korea airlift. The first plane from the Air Proving Ground arrived in September. The crew had orders to test it under all conditions and with every type of cargo, passengers and air evacs.

The test was successful. A world's record load of 167 air evacs, 102 of them litter patients, was set. Two 25-ton loads of hand grenades and explosives were lifted from Japan to Korea. There was "no sweat" on either maximum load. The heaviest single



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SPECIFICATIONS:







SPECIAL DOCKS were built for C-124 maintenance, as hangars proved too small.

mover tank. Radar vans, a 31,000-lb. Air Force fire truck, the fuselage of a wrecked F-86, H-19 helicopter fuselages and extraordinarily heavy items that could not be carried in a C-119 were airlifted.

▶ Airlift Assignment—The Air Force accepted a recommendation that C-124s be assigned to the airlift. This spring a Mobile Training Unit from Chanute, Ill., arrived in Japan. Selected flying crew personnel were filtered in from the 374th Troop Carrier Wing. Classroom instruction ranged from three to six weeks. In addition to normal instruction and checking, pilots took 40 hours in the Loadmaster's school. They also flew C-54 missions to Korea to maintain their flying proficiency while training on the Globemasters.

The frustrations were primarily in maintenance. Boxes of spare parts and other equipment, which for some reason had not been given priority, were off-loaded at Travis field to make room for higher priority cargo. The C-124s arrived in Japan, some of them lacking even fly-away kits.

The Pacific pipeline and warehouses on both sides of the ocean are not yet filled with critical parts, thus complicating the already difficult problem of maintenance. The C-124s are inoperational a far greater proportion of the time than the C-54s, simply because of the shortage of parts and inexperience of the ground crews. On occasions, only four of the planes have been operational. Experienced officers suggest that a system be established to blueprint the backlog of parts that a unit will need to operate efficiently overseas.

► Too Big for Hangars—Parking space had to be reshuffled to accommodate the huge planes. There are no hangars in the theater large enough to accommodate them, so nose docks had to be built for maintenance, all of which is done outdoors. The orange-peel cowlings simplify repairs on the four Pratt & Whitney R-4360-20W engines. Most parts and all cables are plainly labeled so there is little chance of confusion or

item carried was a 33,000-lb. prime mistake. But ground personnel have mover tank. Radar vans, a 31,000-lb. not yet learned all the short cuts that Air Force fire truck, the fuselage of a speed up maintenance.

Fifth Air Force was somewhat worried at the thought of what the big planes might do to runways on the tactical fields. Actually, if some air is let out of the tires, the Globemaster has a lighter imprint pressure per square inch than a C-54. It is doubtful that the planes are harder on runways than heavily loaded B-26s and F-84s.

The first week of July, Brig. Gen. Chester E. McCarty, 315th Division commander, took to Korea the first load of supplies flown by a C-124 all-Combat Cargo crew. He carried five J33 jet engines on the outgoing trip and brought 117 passengers back to Japan. Since then, the C-124s have made regular flights to six bases in Korea, and have hauled cargo to Iwo Jima, Guam, Okinawa, the Philippines and Indo-China. ► Easy to Fly—A majority of the pilots now prefer the C-124s to the C-54s. They say it is an easy plane to fly. In the air, there is a tendency to oscillate sideways, possibly because the aileron boost is so sensitive pilots have not yet become accustomed to it. Passengers feel no discomfort, but the pilots admit experiencing "a weird sensation" on the flight deck.

The pilots sit 26 feet above the ground. In training, they quickly discovered that more accurate depth perception was needed, especially on night landings. They also had some difficulty adjusting themselves to the need for calculating ground roll in hot weather.

The more experienced pilots say the instrumentation leaves something to be desired. The position of the flight group of instruments forces "us to twist our necks too much," they say. But all of the pilots like the simplicity of the instrument panel. All engineering instruments are on the engineer's panel, so the pilot is concerned only with power and instrument flying instruments.

& Whitney R-4360-20W engines. Most parts and all cables are plainly labeled siderable maneuverability. Flippers on there is little chance of confusion or the top side of the ailerons go up 2½





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degrees with full flaps. This stops aileron flutter at low speeds, and gives the pilot much better control.

► Avionics, Equipment—Pilots praise the Globemaster's autopilot and the radio system. The Sperry automatic pilot holds the plane within ½ degree and a maximum rise or fall of 20 feet. Thus flying is more comfortable for air evacs. The Globemaster has omnirange equipment with 270 channels and UHF with 18 channels, plus one guard channel, far superior to the C-54's equipment. A plane-to-plane communications network can be established on UHF if ground contact is lost.

The engineer's panel is about the same as a B-36. A prospective C-124 panel engineer can pass the course in three weeks if he has had experience on the B-29, B-50 or B-36. A non-panel engineer goes to ground school for about 100 hours instruction at the panel, but a qualified panel engineer is ready after about 40 hours.

Unlike the C-54, the Globemaster has all-electric instrumentation. If a C-54 loses the two inboard engines, the pilot has no instruments. The electrical system must go out on the C-124 before the pilot loses his instruments.

Fuel gauges read in pounds rather balance and total weight, which are of utmost importance in the C-124. The earlier planes carried 66,000 lb. of fuel in six tanks, but those coming out of the factory now carry an additional 1,000 lb. and have 12 fuel tanks. Panel engineers seem to prefer the older planes because the manual fuel selectors have only six controls. There are 24 switches on the new electric fuel se-

The navigator's job is simplified by automatic computation of true air speed. But he must go to the lower deck to read the drift meter.

► In-Flight Safety—The C-124 emphasizes in-flight safety. If the elevator, front loading door or any fire-wall door opens, a warning light flashes. The pilot is warned if the autopilot goes off because of electrical failure. Lights in the fuselage illuminate wings and engines for in-flight examination. Lights in the landing gear provide illumination for pre-landing inspection.

All sections of the plane are readily accessible during flight. The prop synchronizer motor and the automatic pilot amplifier are in a compartment below the flight deck which also contains the radio equipment that is not on the flight deck. Automatic pilot gyros are in the tail and other compartments which are accessible.

A compartment provides access to the wing compartments, generator and power units. In-flight repairs cannot be made on the prop or leading edge of

pumps, gas lines and electrical system in each engine are accessible.

During the training sessions, an inflight emergency is simulated and all pilots and crewmen go into the wing separately to track down the trouble. In a recent flight from Korea with 138 passengers, the left outboard engine caught fire. The automatic fire extinguishers did not function properly, and a crewman, Sergeant Curtis Biggs, crawled through the wing and put out the blaze.

The plane has a 600,000-Btu. heater in a pod on each wingtip to prevent icing. Two others are in the massive 48-ft. tail, to prevent icing on the stabilizer and to warm the passenger compartment. A 200,000-Btu. heater keeps the flight deck comfortable. In the Alaska test, carburetor heat was sufficient to prevent icing even at outside temperatures of -40F.

► Load Handling—A fully loaded C-124 (weight empty is 95,000 lb. and maximum allowable weight is 210,000 lb.) is an awesome example of the "pushbutton age" as it rumbles up to the unloading ramp. The huge clamshell doors under the flight deck swing down and out. The double-treadway ramp (12 feet long when folded) drops slowly than gallons to simplify calculation of and then kicks out the wheel-mounted forward section. Fully extended, the ramp measures 27 feet. The treadway can be adjusted to any size vehicle the plane will carry. At night, lamps inside the nose floodlight the ramp and unloading area.

Loading and unloading is almost entirely mechanical. A snatch block is used to place cargo in position where it can be lifted on one of the two hoists. One cable of the hoist can carry 2,000 lb. All four can carry 8,000 lb. lifting straight up. With the aid of snatchblocks, they can lift 16,000 lb. The heaviest cargo is winched in from outside the plane, while big trucks winch themselves in. The hoist operates from four positions so that cargo can be picked straight up without placing excess strain on the hoist or the cables.

The treadway inside the plane can support a maximum of 50 pounds per square inch. The maneuvering area will support 30 pounds, while the "red" or danger area will support only 15 psi. This danger area must be shored over to support heavier cargo.

The electrically-operated elevator will lift, 9,300 lb. and will support 9,600 lb. in flight.

Safety is emphasized in handling cargo. The hydraulic pump that can be used to operate the nose doors and ramp (the hoist and winches are allelectric) has three controls-two on the flight deck for the pilot and engineer, and one at the nose door.

The lock in the clamshell door is a the nacelle, but the carburetor, fuel mechanical steel finger that reaches



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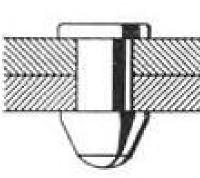
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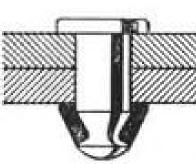


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over and clamps on the other door before pulling back into a locked position. A jam lock on each of the doors will hold them in place if the door locks should break. In an emergency, the entire clamshell can be dropped. The elevator can be dropped in flight, or lifted out and the hatch used to jettison cargo.

The hoists also have automatic shutoff to keep them from colliding during movement of cargo. A guard prevents them from being driven off the end through careless operation.

The C-124 is a two- or three-decker according to need. The lowest deck, about 5½ ft. deep, is for small cargo. The main deck will hold a single item measuring 12x12 ft. It can be divided into an upper and lower compartment by lowering a steel panel from each side. Headroom on both decks is 6 ft. 2 in. Two sets of web seats or stretchers are hung on removable posts in the center of the plane. Litters or seats are also fitted on each side of the plane on both decks. Safety gates hang from each end of the upper compartment. Fully loaded, the C-124 can carry 127 litter cases and eight attendants, or 200 combat troops with personal equipment.

▶ Time Studies—There is some criticism that the C-124 takes too long to load and unload, but much of the criticism seems unreasonable. The length of time spent on cargo, of course, depends on the type. Three 6 x 6 trucks fully loaded can be driven off or on in a matter of minutes. A full load of combat troops can be out of the plane in four minutes. Sixty-five ambulatory and 102 litter cases were unloaded in 33 minutes. The heaviest cargo can be loaded and unloaded from the Globemaster in about 3½ hours.

Experiments are being made with pile pre-loading to reduce the betweenflight time lag. Diagrams of cargo space are drawn on the ramp, and weight distribution is planned beforehand. But this uses up considerable ramp space, and there is a scarcity of this at Far East Air Force bases. Simple cables and fasteners which can be attached or released in a few minutes are standard equipment.

A major contradiction is the need for extreme care in cargo handling while speeding up the turn-around time. Each C-124 is valued at about \$3 million. All personnel has to be carefully and properly trained. Fewer hand laborers are used. Truck-drivers and forklift operators receive special training. Pilots took the Loadmaster course, including driving of trucks, so they could supervise unloading at fields where trained personnel might not be available to do

The C-124 provides comfort and

ways as well as forward and back, providing room for maneuver and a comfortable fit for any size pilot. The seats are also semi-Sleeperette, so that a pilot can relax on long hops. There are three permanent bunks and a large buffet to provide hot meals for the nineman crew.

All compartments, except the small cargo hatches, are accessible in flight. Two ladders connect the flight deck and other compartments. There is also a telescopic fireman's pole as an emergency escape hatch from the flight deck to the nose.

Eight latrines are provided for male passengers, and another for the flight nurses or female passengers. A portable buffet can be set up to provide hot meals. Portable oxygen bottles are aboard, and there is a built-in oxygen system and outlets for all passengers. A loud-speaker system provides instantaneous communication from the plane captain to crew men and passengers

Crewmen are dubious about passenger comfort in flights this winter. The nosc door is not insulated, and those sitting in the forward part of the ship may find it uncomfortably cool. Experiments are being made with a zipper curtain that will seal off the passenger compartment from the nose, but it has not yet been approved.

► Good Use-"We're making effective use of the C-124s," Gen. McCarty told AVIATION WEEK. "They are now in daily use, mainly on our high-density runs between Seoul and the Tokyo area. Most of the flights are made in about 3½ hours, plus and minus according to the strength of headwinds."

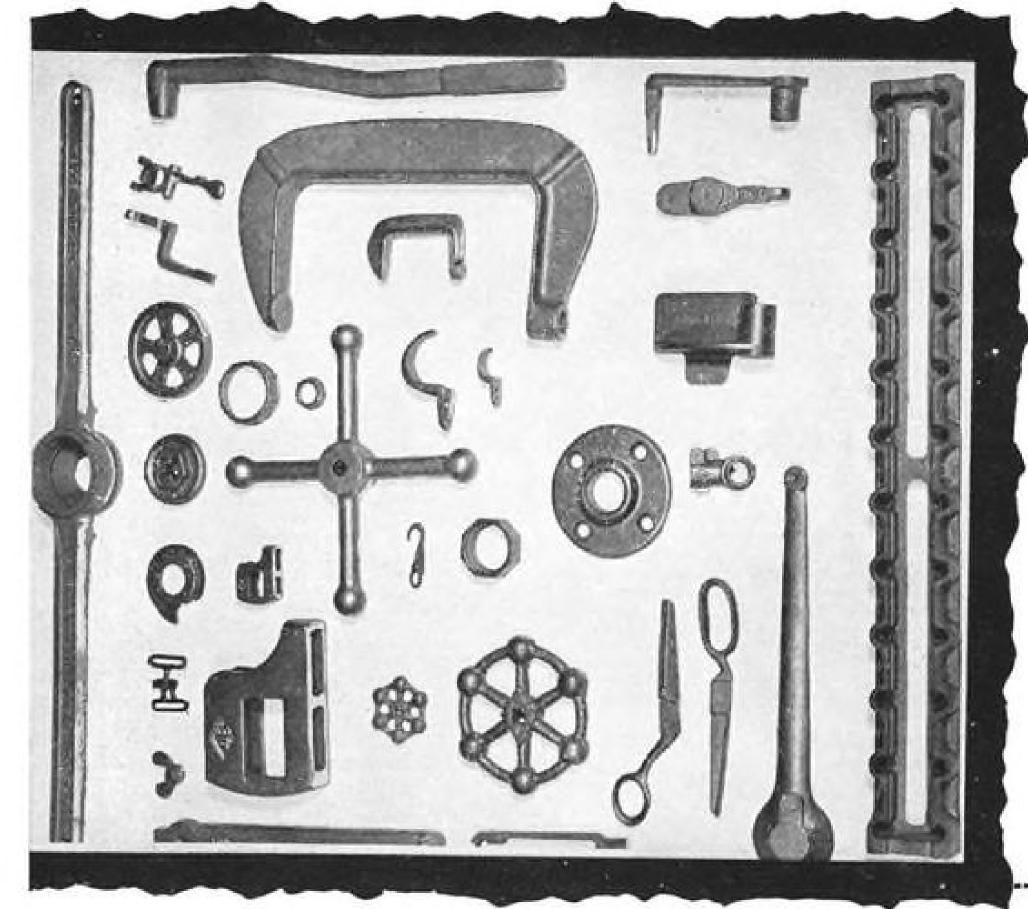
Passengers, most of them UN combat personnel coming to Japan on fiveday "R & R" (rest and relaxation) leave, "enjoy the trips. They feel as if they were being chauffered on the ground in a Cadillac or Lincoln. They like the roomy nature of the plane, since it gives them a lot of space to visit in and look out the windows. The C-54 is congested compared to the C-124. The men also like the flight compartment, which they are generally invited to visit," McCarty added.

He said the C-124 has proved "very adaptable" in handling unusual types of bulky and heavy cargo. Since rail and sea shipment to Korea takes a month or more, counting waiting time at the docks, the quick airlift is extremely important.

"One recent instance." said Gen. McCarty, "was when an F-84 wing moved from the States. Two big jet refueling trailers were needed at Iwo Jima. They were needed in a hurry and could never have arrived in time by sea. safety for both passengers and crew-men. The two pilot seats slide side-and had them there in 3½ hours."

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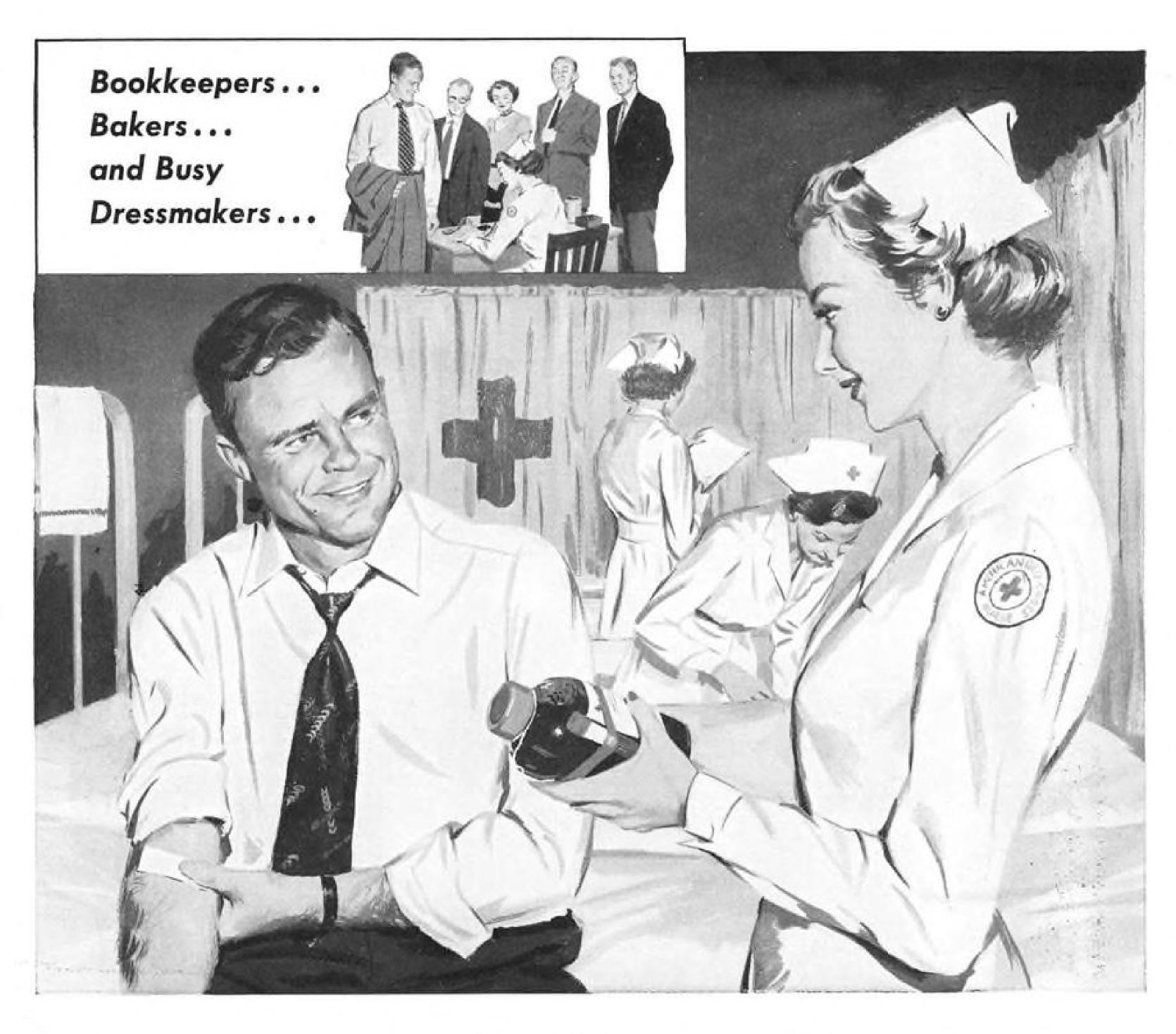
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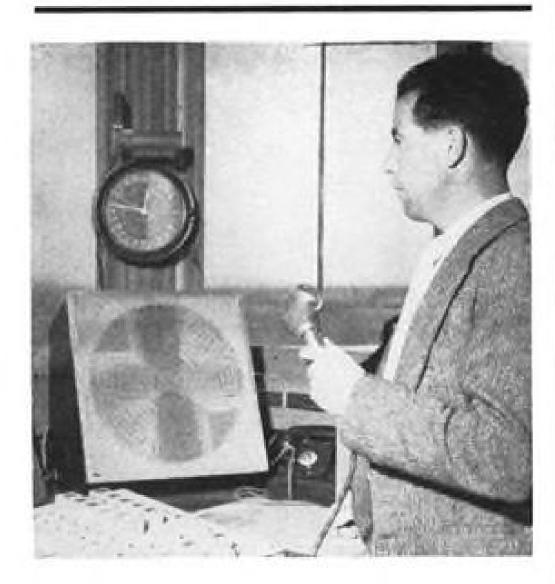
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NEW AVIATION **PRODUCTS**



Tower System Speeds Aussie Airport Traffic

(McGraw-Hill World News)

Melbourne-An automatic indicating system which enables tower operators at a glance to select the safest runway for aircraft to land and take off on has been developed in Australia.

It is being evaluated operationally at Essendon Airport, Melbourne. The equipment has enabled the airport to handle higher density traffic.

Appearance is simple, consisting of a chart-like, circular diagram over which moves a thin beam of light to indicate wind direction and wind strength. This is hooked up via selsyn inductors with a Dines anemometer. Head-wind and cross-wind components on the duty runway are indicated by scales and runway markings on the diagram. The line of light varies in length, depending on wind strength.

The chart, or Runway Selection Console, is drawn up in polar coordinates, with straight lines emanating from a center point indicating true bearing, as on a compass card.

Radial coordinates (circles of increasing diameter emanating from the center point and intersecting the angular coordinates) give the speed of the wind. Each radial is numbered to indicate wind speed value and the farther the line of light reaches out from the center, the higher the speed.

Colored areas on the chart represent runways and define the wind conditions under which takeoff or landings are to be conducted. Red colored areas signify operations are not permitted at the airport.

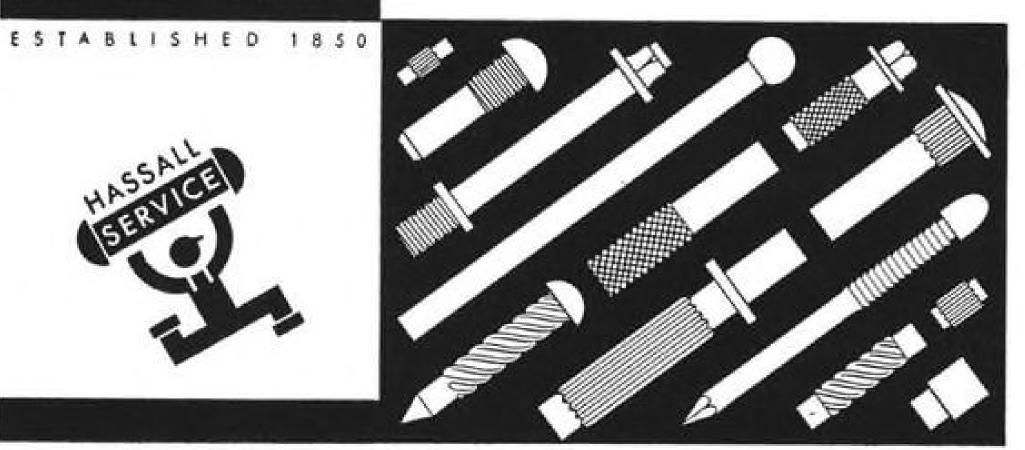
The equipment was conceived by S. Tenenbaum, senior aeronautical engineer in Australia's Dept. of Civil



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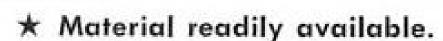
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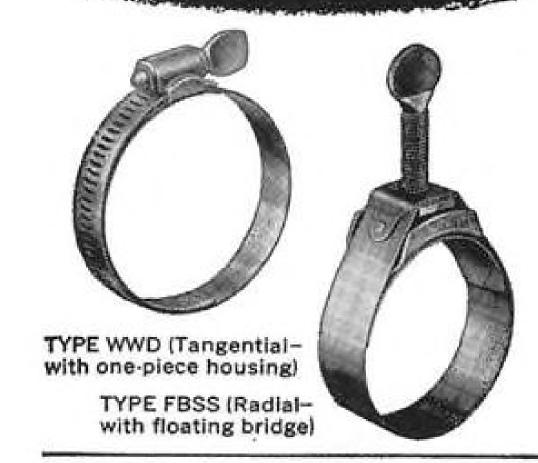
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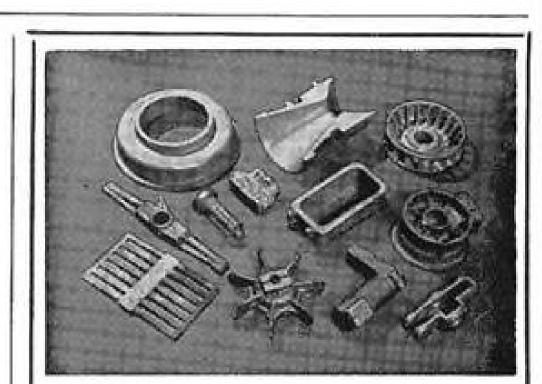
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Aviation. It was constructed by the government's Division of Airways Re-search Laboratories.

Flying Aids Improved

Improvements in the design of two air navigation aids, a plotter computer and a protractor computer, have met with enthusiasm among pilots, their manufacturer claims. Both feature white opaquing behind the computer section, which contributes to good visibility under all lighting conditions.

The protractor computer has a grid large enough to line up with any meridians or parallels on all aeronautical charts; a separator washer prevents scratching when computer is rotated.

The plotter computer provides a straight edge with scales for distance, a 360 deg. protractor and a computer for figuring time, speed and distance problems, converting nautical miles, statute miles, etc., and solves regular problems in multiplication, division, proportion, ratio and percentages and altitude and air speed corrections.

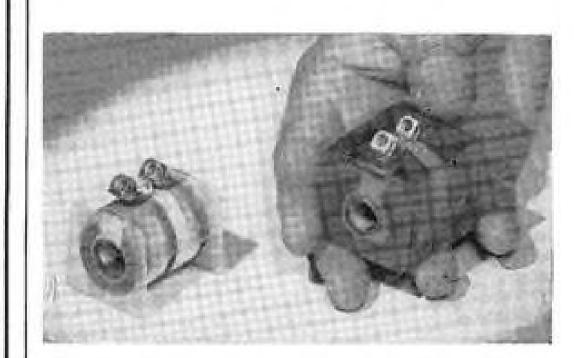
Warner Sales Co., 333 N. Michigan Ave., Chicago, Ill.

Drill Redesigned

A two-spindle, 20-in.-swing drilling machine has recently been redesigned and is recommended for a variety of production drilling jobs by its manufacturer. Designated as Model MC-20, the new machine's capability of 14-in. drilling in mild steel is matched by a stronger column and a heavier base to provide the necessary solidity and endurance. Sensitivity for small size drills

makes possible a variety of drilling jobs. Operator efficiency is improved by a dial indicator for easy selection of power feeds, the maker says, and a convenient ever to alter spindle speeds saves time.

Sibley Machine & Foundry Corp., South Bend, Ind.



'DUNKING' COMPONENTS

Electrical components are now dunked in resins which harden into a solid block to provide a protective coating, electric insulator, hermetic seal and shock-resistant housing. Hot- and cold-pouring "Scotchcast" resins for temperatures up to 250F have been announced by Minnesota Mining and Mfg. Co., 900 Fauquier St., St. Paul.



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FINANCIAL

Avionics Maker Hits Profit Peak

Sharply rising sales and earnings are reflected in annual reports currently being released by various segments of the aircraft industry.

Collins Radio Co., a leading supplier of avionic equipment, displays new peaks in sales and profits for the fiscal year ended July 31, 1952. Total sales for the current period reached \$64.3 million, up some 230% over the \$19.5 million reported for the fiscal year ended July 31, 1951. Net earnings more than doubled from \$737,682 to \$1,685,651 during the same period. After giving effect to the 25% stock dividend paid at the end of the 1952 fiscal year, earnings were equivalent to \$4.24 per share on 387,645 shares of common stock outstanding, contrasted to only \$1.78 per share for the 1951 fiscal year.

► Redetermination Helps—Price redetermination on military contracts for most manufacturers has meant a reduction in earnings. Not so for Collins. Included among current assets is an item of \$2,-469,786 representing "unbilled price revision adjustments." Analysis discloses that this reflects estimated net increases under contract price revisions as estimated for the 1952 fiscal year. This upward contract price revision more than covers the company's reported earnings for the year. Significantly, net profit margins on sales for the 1952 period average only 2.6% as compared with 3.8% for 1951.

The net worth position of the company was at a new high of \$7,528,835 at the 1952 fiscal year-end. The net equity per common share was equivalent to \$17.50 at that point compared to an adjusted \$13.68 a year earlier.

Sustained production for Collins is indicated with a reported backlog of \$250 million at July 31, 1952, contrasted with \$175 million a year earlier. To finance its requirements the company increased its V-loan to \$15 million and the maturity of this revolving bank credit was extended to Oct. 31, 1954. Total long-term borrowings aggregated \$12,210,000 at July 31, 1952.

► Lots of Customers—A fuller measure of Collins' activities can be gleaned from the nature of its backlog. Production programs of "about equal size" are reported for the Air Force, Army, Signal Corps, and the Navv. Also, contracts are being fulfilled for the Atomic Energy Commission, State Department, Bureau of Standards, Treasury Department, and Coast Guard.

company's production activities, indications of expanding commercial volume are clearly evident. The management reports that sales of airborne communication and navigational aids have more than doubled, and the "outlook for continued growth in this field is excellent."

An example of additional diversification by Collins is found in its entry into the relatively new field of microwave radio communications. Users of microwave equipment include the oil and gas pipeline companies, electric power utilities, mining and lumbering activities.

▶ Profitable Research—There is no doubt that the successful current accomplishments of Collins stem from the quality of its engineering and research work. Significantly, the company reports "every product now being manufactured . . . began as a development in its laboratories.'

There are indications of even newer products to come. For example, the field.

company notes considerable work is in process on stabilization and guidance systems for automatic flight control of aircraft and automatic distance-measuring air navigation equipment, as well as on system components ranging from antennas to instruments. Some of these projects are under sponsorship of the armed services while others are being conducted independently by the com-

The development of the Mechanical Filter, a device which makes possible full utilization of available frequency channels (Aviation Week Nov. 3, p. 61), has recently been completed. This component is currently being incorporated in both military and commercial equipment as well as being sold to other manufacturers.

The second of two 60-in. cyclotrons, popularly referred to as "atom smashers," designed and installed under contract with the Atomic Energy Commission, was completed during the year and placed in operation at Argonne Laboratories. The first Collins cyclotron is at the Brookhaven lab.

Development work in these various new fields denotes a very aggressive engineering program which assures Collins of a leading position in the avionics -Selig Altschul

Northrop's Gross Up, Net Down

ings were revealed by Northrop Aircraft, Inc., in its annual report for the fiscal year ended July 31, 1952. Sales amounted to \$187.5 million, up 109% over the \$89.9 million shown for the 1951 fiscal year. Operating profit, before taxes, doubled to \$7.5 million for 1952 from the \$3.8 million reported

Net income, after taxes, however, was down to \$2,420,605, equivalent to \$4.22 per share on the 574,039 shares outstanding. This compared to \$3,-276,053, or \$5.70 per share, for the 1951 fiscal period. In view of Northrop's cumulative losses of prior years, sufficient tax credits were available to be applied against 1951 taxable income. This obviated the liability for all excess profits taxes and part of net income for 1951. Earnings in fiscal 1952, however, were fully subject to excess profits and normal taxes.

▶ Profit Pattern?—Northrop's net profit margin of 1.3% on sales for fiscal 1952 may well be indicative of a pattern to be revealed in subsequent annual reports by other aircraft builders. Volume deliveries, however, promise to be a major offsetting factor, to sustain, if not increase, the prevailing earnings

Encouraging results in sales and earn-stantial additional orders . . . received since that time."

To meet its expanding requirements, the company increased its borrowings to \$7 million at July 31, 1952, under its \$9-million revolving bank credit agreement. A reminder of past financial difficulties is indirectly reflected in the Reconstruction Finance Corp. indebtedness amounting to \$3,260,000 at July 31, 1951. Repayments to RFC during the year totaled \$960,752, but an additional \$1.5 million was borrowed from the same source to finance the construction of new facilities.

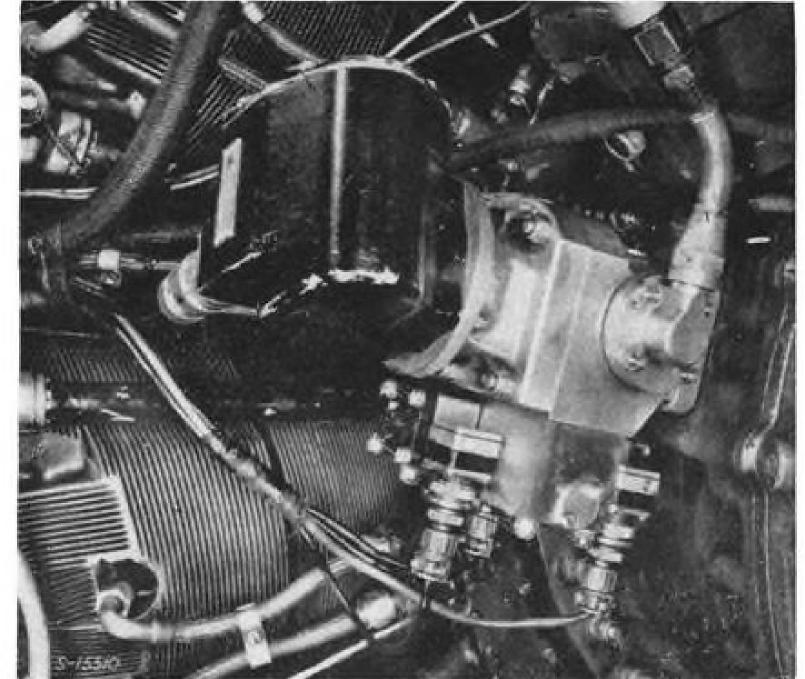
▶ Diversification—While the backbone of the company's backlog is represented by production contracts of the F-89, various diversification activities prevail in the company's operations. The acquisition last year of the Radioplane Co., a manufacturer of radio-controlled target planes with a backlog of \$16 million, was a step in this direction.

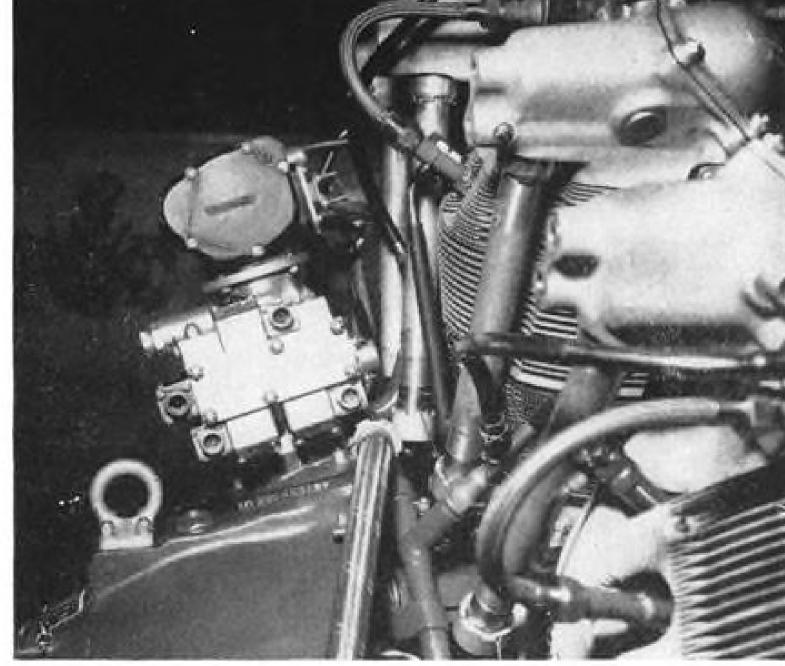
Northrop also reveals its recent entry into the manufacture of precision instruments. The company has long been a factor in guided missile development and the management anticipates that this program will continue to grow.

A continuous research program also appears prominent in Northrop's plans as a means of sustaining future produc-While government contracts presently comprise the major portion of the aggregated \$416 million, with "subteristic of aircraft builders. —SA

75

AIR TRANSPORT





R-2800 INSTALLATION of Hamilton Standard safety device.

R-3350 INSTALLATION of propeller reversal governor.

Aviation Safety

New Safeguard Against Prop Reversal

- Hamilton Standard hydraulic device is designed to prevent short circuits, errors in cockpit.
- Mechanism requires two signals from pilot before valve closes to build up pressure for reversal.

By Alexander McSurely

guard against the hazard of inadvertent propeller reversal will be ready for airline service test at the end of November, Erle Martin, general manager of Hamilton Standard division, United Aircraft Corp., told AVIATION Week.

dispute is the most serious of the reversal accidents, the National Airlines persons in an apartment building were killed.

flight of No. 3 propeller with relafeathering of No. 4 propeller."

safety valve on a steam engine. It is rect it. Windsor Locks, Conn.-A new safe- a low-pressure relief valve in the hydraulic line which actuates the mechanism turning the propeller's blades into reverse pitch.

► How It Works—To twist the propeller blades back into reverse pitch the system requires additional higher hydraulic pressure than for normal pitch The new device is designed to safe- control operation. To get such pressure guard hydraulically against short-circuit this new relief valve must remain closed of electrical relays or a faulty throttle in the hydraulic line. The new arlock mechanism, both of which have rangement provides that the propeller been blamed for several recent cases governor has to get two separate signals, of inadvertent prop reversing. Still in one at the new valve and one at the other low-pressure valve already in the system, to function. Unless both signals-an DC-6 crash at Elizabeth, N. J., Feb. 11, arming signal and an actuating signal in which 29 plane occupants and four come through, the valve doesn't close and there isn't enough pressure to make the propeller reverse.

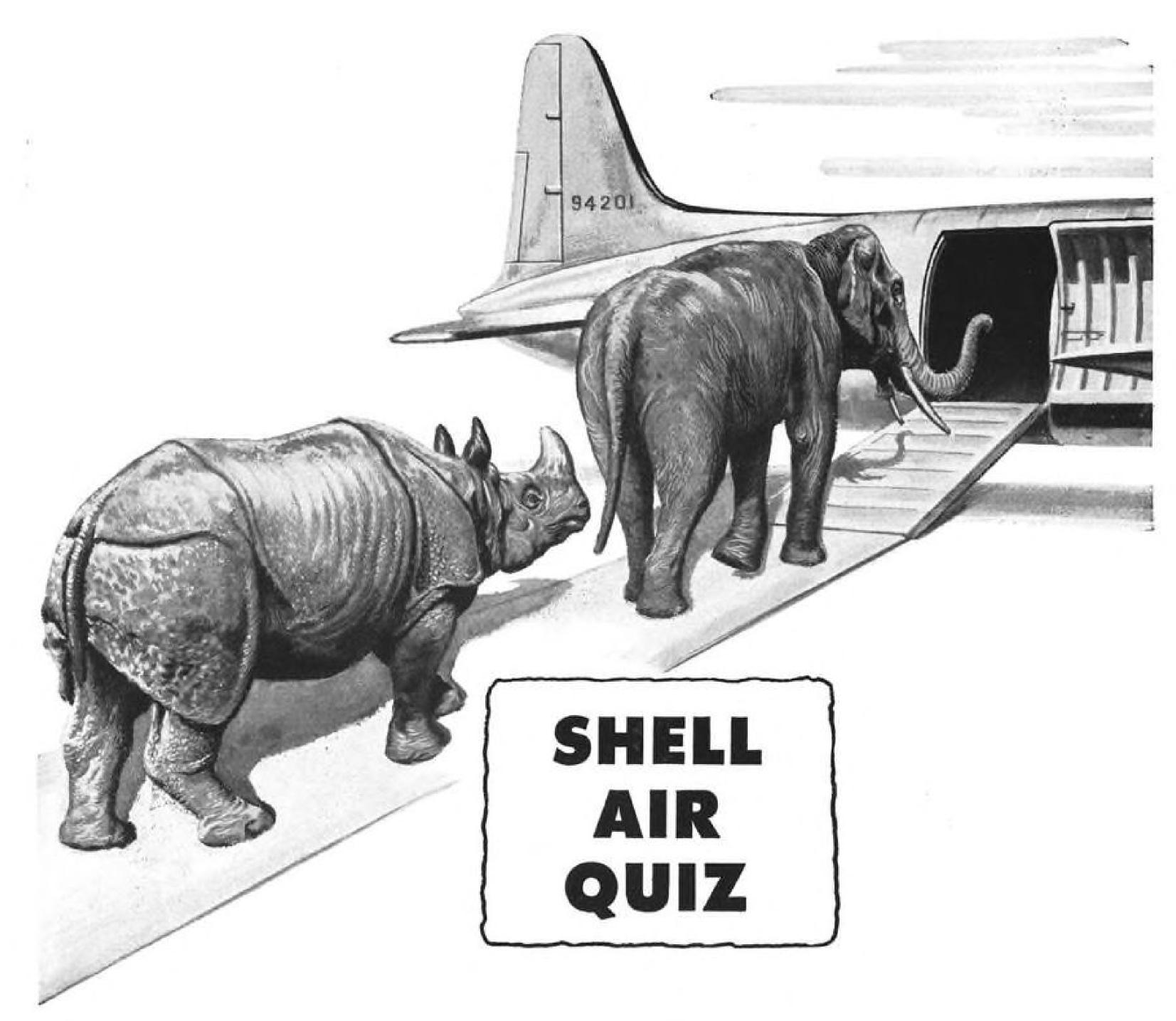
CAB has issued a finding that ALPA Proposal-Hamilton Standard's the probable cause was "reversal in chief engineer, Carl Baker, and chief product engineer, Ray Lambeck, say high power, and subsequent that the new valve arrangement going The new mechanism is a valve serv- original Air Line Pilots Assn. proposal proposal to use a mechanical means of

for a safety valve, which led to this engineering development. Under the original suggestion, when the propeller received a reversing signal it would go to low pitch before it stopped the pitch change. This would mean that there could be a period of overspeed condition in low pitch with possible damage ing somewhat the same function as the to the engine until the pilot could cor-

The new arrangement does not change the constant speed control until the complete double signal is given. It allows no period for overspeed in low

Feathering Override—The hydraulic safety valve is one of two new features which Hamilton Standard is incorporating into its newest constant speed control. The other feature is an overriding control which makes it possible for the pilot to feather the propeller directly from reverse pitch. Previously it has been necessary to de-energize the reversing control before the pilot could feather the prop if it was already reversed.

Making these two changes and incorporating them within the narrow confines of the propeller governor means a replacement of about 50% of the pieces of the current DC-6 governor. The major changes involved in the governor are still far less complicated into service test is a step ahead of the and more foolproof than an alternate



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safeguarding propeller reversal, the Hamilton Standard engineers say.

Such a mechanical control (involv- conditions. ing push-rods or similar actuation) would require rigging the controls out to each of the nacelles through the wings with attendant problems of jamming or inadvertent actuation due to wing deflection, etc. Added to that would be additional weight and the problem of providing an arrangement to support the mechanical control at the governor, Baker and Lambeck point out. ►DC-7 Governor—The first of the governors with the two new features already has been ground-tested on two engines, the Wright R3350 compound engine which will go on the DC-7 and the Pratt & Whitney R2800 used on the DC-6.

However, it is only a prototype installation and some changes are being made in the service test quantity of DC-6 propeller governors now being manufactured.

Demonstrations recently were held by Hamilton Standard at its test cells at East Hartford for CAA, CAB and airline observers in which the DC-7 governor showed how it could perform its two new functions. The governor also has been run on the Wright engine at the Wright Aeronautical Corp. plant which is located at Wood-Ridge, N. J.

The DC-7 governor was in design stage at the time the ALPA proposal came through last spring for a relief valve arrangement. It was selected as the fastest way of getting the new features into test.

The main difference between the DC-7 and DC-6 governors is in the fact that the DC-7 equipment uses a larger pump to actuate the bigger propeller. Hamilton Standard is satisfied that the demonstration with the DC-7 governor is sufficient test to warrant going ahead with the service-test quantity of DC-6 governors.

Since the idea came from American Airlines pilots, Hamilton Standard expects that the first tests will be made by American on a DC-6. However, all the airlines operating this equipment have been notified that the new type governors are being made available in service test quantity.

Hamilton Standard points out that the original pilot proposal was made to them nearly a month after the Na- ized. tional Airlines crash and not before, as has been implied in a True Magazine article.

The Hamilton Standard engineers point out that the new safety device is subject to the limitations of all hydraulic devices, but is as foolproof as they can make it.

safety valve system are components flights at a later date to South Africa which already have had long reliable and Japan.

service experience and have been proved for varying temperature and vibration

None of the cases of inadvertent reversal reported, they point out, has shown any evidence of malfunctioning in the hydraulic system. The new mechanism means relying on proven hydraulic dependability as a protection against malfunctioning in the airplane control system.

While some other means for preventing inadvertent reversals are still under consideration, Hamilton Standard does not plan to make the new relief valve a mandatory addition on the new governor, but makes a provision for its inclusion at the airline's option. The other new device to allow feathering from reverse pitch will be made a standard feature of the new governor.

Airline pilots have expressed some concern because both new features are not listed as mandatory in the new governor.

New German Airline Seeks U. S. Planes

(McGraw-Hill World News)

Frankfurt-Dr. H. C. Seebohm, German Federal Minister of Transport says that a German airline will be in business by Apr. 1, 1953 provided contractual agreements with the Allies are ratified according to schedule.

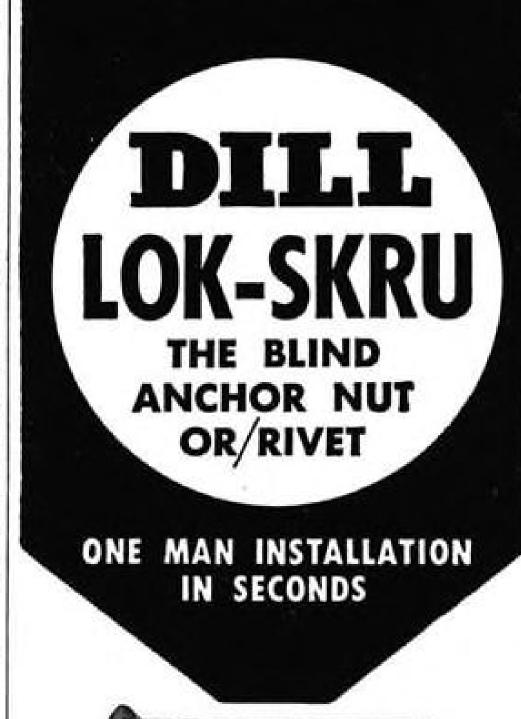
The West Germans have turned down British offers to supply Comets and Viscounts and decided to buy U.S. planes, say well-informed sources. Preferences have been expressed for the Convair 340. The U.S. Import-Export Bank allegedly has been approached for necessary funds for buying the necessary equipment.

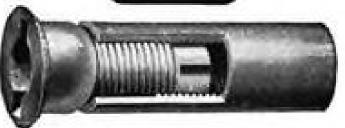
▶ Private Capital—Dr. Seebohm has said that the new carrier is getting planes of "the most modern design" early next

Industry and banking representatives have conferred recently with Dr. Seebohm on the possibilities of raising private capital for financing the new West German airline. A firm, to be named the Aviation Equipment Corp., is to be formed soon to act as an interim agency for the carrier until contractual agreements have been formal-

According to reports from Bonn, the German government will hold 51% of the shares of the carrier, and private capital the remainder.

In addition to connecting principal European cities, the new carrier expects to have services to Rio de Janeiro, Buenos Aires, New York, Calcutta, Other features used in the new Bangkok and Teheran. Plans include

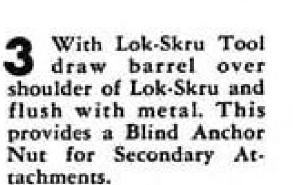




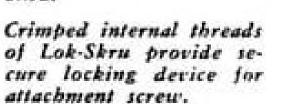
THE AVIATION STANDARD for Screw Locking Anchor Nut Uses and Metal to Metal Fastening.

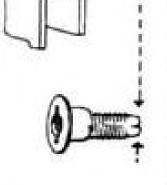
Drill one (1) hole.

2 Insert Lok-Skru with either Hand or Power Lok-Skru Tool.



4 TO FASTEN ATstandard Machine Screw through hole in attachment and into Lok-Skru. As machine screw is tightened into Lok-Skru it is securely locked by means of the "Specially Crimped" locking-end of the Lok-





Write for Folder Handy information on the many uses and application of Lok-Skrus in airplane construction with complete data on types and sizes.



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USCG Sets Up Civil Air Unit in Hawaii

An all-civilian air auxiliary in the Hawaiian Islands has been organized by Commander Robert Leary, USCG.

The auxiliary is made up of many small boats and planes sprinkled all over the Territory. Purpose is to get to a crash in the shortest possible time. Because of the geographical layout of the Islands, the Coast Guard's planes or boats might take a while to reach an accident in some remote corner of the Territory.

When they go out on an emergency, members of the auxiliary have all the privileges and authority of the Coast Guard. And the service takes care of all fuel and oil expenses incurred in any rescue and stands behind any liability claims which might arise.

New Route to Brazil

(McGraw-Hill World News)

Rio de Janeiro-Permission to establish an air service between Vancouver, Canada, and Brazil, which will provide a direct link between South America the Canadian Pacific Airlines. The new route, expected to be in operation before the end of 1953, will run from Vancouver to Rio via Mexico City, Lima and Sao Paulo, connecting up with CPA's flight routes to Asia at Vancouver.

SHORTLINES

- ► Annapolis Railroad Co. has asked a CAB certificate for copter service, Baltimore, Washington, Wilmington, Philadelphia, and New York. All-American Airways, local service airline serving these cities already, may claim first rights to such a service.
- ▶ Braniff Airways domestic mail rate has been set by CAB at a "temporary" 53 cents a ton-mile retroactive to Oct. 1 of last year, pending formal decision as the permanent rate proposed by CAB but opposed by the Post Office Dept. Unless CAB will force Braniff to create an "earnings equalization reserve." Company started Convair 340 service Nov. 1-has so far received 7 of the 30 ordered.
- ► California Central Airlines plans to install a new radio marker beacon receiver with "superior performance" and "half the cost" of present types. It's made by Flite-Tronics, Inc., of Bur-
- and the Far East, has been granted to Civil Aeronautics Board is studying aircoach potentiality of the Stratocruisers owned by Northwest and Pan American. Over 100 passengers are contemplated. . . . CAB has warned all airlines it will investigate interlocking directorships of companies applying for merger. National charges of Eastern



NEW AUSTRALIAN TERMINAL PLANNED

Here's a photo-diagram showing Stage 1 of the proposed revision of runways at Kingsford-Smith (Mascot) Airport, Sydney, Australia. The first stage of the big operation, will see an 8,000-ft. runway and taxi strip Work on the new terminal began Decemready for traffic in March 1953. The field is ber 1948.

being planned to take jet transport planes. A major task is diverting Cook's River, which now winds through the site, to the course indicated by dotted lines at left.



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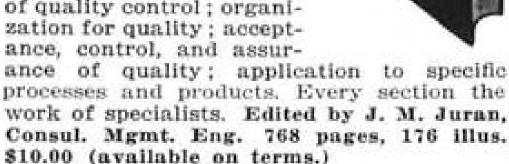
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control of Colonial are the most immediate application-expected to delay the service. Colonial merger case. Similarly, American charges nonsked North American with being a combine in violation of not to be granted a name change from Twentieth Century Airlines.

- ► Colonial Airlines' domestic mail rate was 35% over a year ago. is set by CAB at base rate of 43½ cents a mile based on load factor of 45%, with sliding scale change for changing monthly load factors, based on a 21-seat DC-3 and 50-seat DC-4. Effective date is Apr. 1 of this year.
- ► Commerce Department Secretary ► Mohawk Airlines' (formerly Robin-Charles Sawyer has asked CAA to figure son) new route to Boston, acquired out how to speed up airport construct through dissolution of Wiggins Airtion through revision of the federal aid program. Since 1946, Congress has appropriated a total of \$195 million. CAA says a September survey showed Springfield, Westfield and Worcester, need for another \$150 million, which Mass. local communities would match with another \$150 million.
- ► Eastern Air Lines has started its first daylight coach operation New Yorkover a year ago and now also operates over Eastern in the Colonial merger. three a day-two nonstop and one via Jacksonville and Tampa. Both EAL &

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NAL operate DC-4s on daylight coach

- ► International Air Transport Assn. reports record airline revenues this July law and CAB regulations and hence and August. Interline clearances were about \$21 million each month-up over 40% from a year ago. Total the first eight months this year at \$142 million
 - ► International Civil Aviation Organization plans to move its Far East and Pacific office from Melbourne to Bangkok, closer to the center of that area's operations.
 - ways, will speed company independence from subsidy, CAB says. The new Mo-hawk route also includes Pittsfield,
 - ▶ National Airlines would be a vital link between Canada, U.S., and South
 - Shipbuilding division.
 - ► Northwest Airlines' October load
 - ► Pan American World Airways is replacing its Stratocruisers in South America with DC-6Bs. The Boeings will go to PanAm's longer-range, lower-altitude
 - DC-6s with Pratt & Whitney CB-16 engines increase cruise speed 15 mph., making its Miami-Buenos Aires service "the fastest ever flown by any airline."
 - ► Scandinavian Airlines System plans Nov. 19 departure of its first trans-Arctic DC-6B delivery flight from Santa Monica to Copenhagen via Edmonton and Thule. This flight "will be the first of two exploratory flights blazing the trail for a regular commercial schedule which SAS hopes to inaugurate soon. This shortcut would "revolutionize" U.S. West Coast travel to Europe, the company claims.

America if the President okays CAB decision of the Balboa service case for Miami nonstop, three flights daily. Na- Latin American interchange service and tional Airlines started daylight coach if CAB continues to favor National

- ► National Production Authority Aircraft division has been consolidated into the NPA Aircraft, Ordnance and
- factor of about 66% compares with 70% in September and 73% and 74% respectively a year ago. . . . Reports average domestic trip is now 700 mi., compared with 641 mi, last year, 640 in 1950, 576 in 1949, and under 400 miles 25 years ago. Average international NWA trip is now 1,749 miles.
- Pacific routes.
- ▶ Panagra reports its newly modified

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AVIATION WEEK, November 17, 1952

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P-5835, Aviation Week 520 N. Michigan Ave., Chicago 11, Ill.

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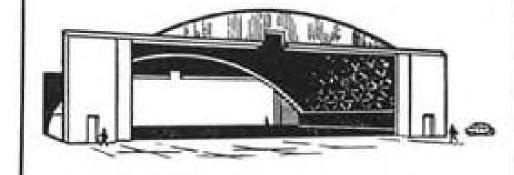
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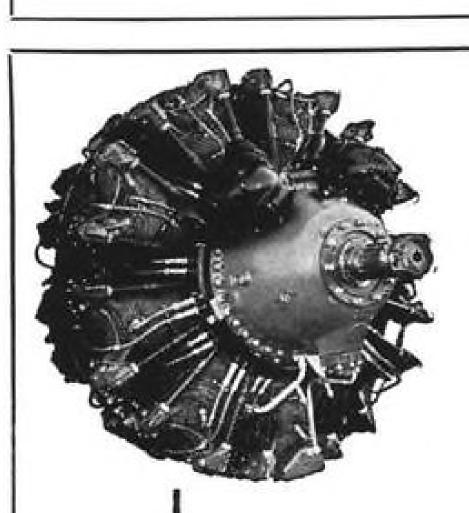
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11	14601-1F-B1	Eclipse	Gyro Indicator
71	828TY13Z2	Weston	Oil Temp Indicator
40	119862	Weston	Carb, Air Temp Indicator
10	15401-1	Eclipse	Amplifier (PB10)w/ED3 MOUNT
66	10078-1AG	Eclipse	Gyro Indicator
62	CQ-9	Eclipse	Clutch Switch (PB10)
57	MF45-3911-20Z	Vickers	Hydraulic Pump (3000PSI)
327	PF4-713-20BCE	Vickers	Hydraulic Pump
75	1416-12E	Eclipse	Starter
142	28008	Airesearch	Jack (Cowl FLAP)
45	AN4103-2	Clifford	Brass (Valve #U4785) Oil Cooler
120	MF9-713-15A	Vickers	Hydraulic Pump
550	TFD 8600	Thompson	Fuel Booster Pump
125	D7818	Adel	Anti-icer Pump
250	AN4014	Erie Meter	Wobble (D-3) Pump
1000	AN5780-2	G,E.	Wheel & Flap Position Indicator
400	AN5780-2	Weston	Wheel & Flap Position Indicator
115	P4CAQA	Parker	Primer
70 450	AN3213-1	Scintilla	Ignition Switch
90	A-9 (94-32226) JH950-R	Nasco	Ignition Switch
53	AN6203-3	Jack & Heinz	Starter Motor
140	K14949E	Bendix Marguette	Accumulator 10 -1500 P.S.I.
188	EYLC-2334	Barber-Colman	Windshield Wiper Kit Control
11	12086-1C	Eclipse	Amplifier
250	558-1A	Eclipse	Oil Separator
100	716-3A	Eclipse	Generator (NEA-3A)
89	318	Edwards	Horn
230	921-B	Stewart-Warner	Heater (200000 BTU)
97	6041H-146A	Cutler Hammer	Relay (B-12)
22	0655-D	Aro	Oxygen Regulator
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130	8288	Follower Ass'v
814	35814	Blower Ass'y
53	48362	Shaft
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56	48392	Sump
390	48461	Gear
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113	84487	Housing
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26170-1)	42	AN9511) SF5RN-12 (manufacturer's part No. 10-	Bendix Scintilla Magneto	
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LETTERS

'The Coach Robbery'

Capt. Robson, in his recent article, "The Great Coach Robbery," has aptly diagnosed a moral, if not legal, illness of some airlines who are using equipment exigencies as an excuse for confusing coach and first-class services.

On June 2, 1952, while en route between Seattle and Detroit, I was obliged to accept transportation on a 60-passenger DC-4 coach-type plane in lieu of a Stratocruiser because the latter's flight was postponed indefinitely at Minneapolis due to alleged mechanical trouble. Since the substitute flight was labeled first class in the airline's schedule, I asked the stewardess why a coach-type plane with "high-density seating" was being used. She informed me that all of this airline's DC-4s had been converted to coach-type seating. I asked her what distinguished a coach flight from a first-class flight. She replied, that meals were served only on first-class flights.

counted three unoccupied seats on the flight between Minneapolis and Detroit; thereby making the number of "first-class" passengers 57. Small noisy fans were employed in an attempt to augment the deficient ventilation.

As might be expected, in a crowded airplane on a warm day flying directly beneath cumulus clouds, many passengers became acutely airsick. The unpleasant odors caused by the effects of air sickness, crowding and inadequate ventilation did little to make the \$9.26 "complimentary" meal a

pleasant experience. I should like to stress the point that meals served aloft are the sole difference between first-class and coach service on this airline. The airline alleges that meals served aloft are without cost, yet the first-class fare between Minneapolis and Detroit is \$9.26 more than the coach fare. I believe that most people would resent paving \$9.26 for a "complimentary" meal while riding in a

As Captain Robson has written, "no matter what the excuse, this can only be termed gypping the public."

coach-type plane under coach service con-

FRED A. ELLIS, M. D. 1017 Minor Ave. Seattle 4, Wash.

Farnborough Crash

I would like to correct a misstatement in Aviation Week for Sept. 15, in the story signed with the initials R.B.H. and headed "The Crash" on page 15. The author says "As soon as the bodies were removed and the excitement subsided Neville Duke continued the show.

In fact, the Display was continued with only a few seconds more delay than was needed to send an aerodrome van along the runway to make sure that no debris of the D.H.110 had fallen on it. The Hunter was already waiting to take off when the accident happened and did so immediately the aerodrome van had reached the end of

the runway and had telephoned Flying Con-trol "All Clear."

As for the "excitement," the calm and steadiness of the crowd, even in the immediate vicinity of the casualty area, was most remarkable. British people do not easily get excited.

E. C. Bowyer, Director Society of British Aircraft Constructors, Ltd. 32 Savile Row London W-1, England

From Whirlajet

We have received our Oct. 6 AVIATION WEEK in which we found the article written by William J. Coughlin anent our company. We feel that Mr. Coughlin did a most capable job on this article.

JACK H. ZILLMAN, President Whirlajet, Inc. 21043 S. Wilmington Ave. Long Beach 10, Calif.

Praise

All of us at California Central Airlines read with great interest the letter written to Mr. Christian by Southern Pacific regarding comparison of fares. The consensus is that his reply was a classic.

As you are well aware, this company prides itself on the fact that we offer firstclass service right on down the line although we operate on a purely air coach fare structure. We are sure that other air carriers constantly aim toward that passenger service objective.

> HAL PEYER, Director of Public Relations California Central Airlines Lockheed Air Terminal Burbank, Calif.

WE ARE OVERWHELMED AT CONSIDERA-TION GIVEN OUR CONFERENCE BY AVIATION WEEK AND PARTICULARLY THE IGNITION ANALYZER ITSELF. IT IS A FINE REPORT OF THE PROCEEDINGS. I WISH I HAD KNOWN GEORGE CHRISTIAN WAS DOING THIS. WOULD HAVE SAVED MYSELF TROUBLE OF PREPARING FORMAL MINUTES. THESE HAVE BEEN COMPLETED AND ARE TO BE PRINTED NEXT WEEK.

ROBERT BOYER, JR., Senior Sales Engineer Scintilla Magneto Div. Bendix Aviation Corp. Sidney, N. Y.

. . . we are all appreciative here of the attention which Phil Klass gave to the IATA Communications Symposium. It was an excellent boil-down of a very large amount of material into a comparatively short space, and I do not think that anything at all vital was lost in the process. . . .

S. RALPH COHEN, Public Relations Officer International Air Transport Assn. International Aviation Building Montreal 3, Canada

WHAT'S NEW

Telling the Market

Facilities and products of Stillman Rubber Co., makers of custom precision parts and specialists in rubberto-metal bonding capable of handling transfer, injection and compression molding, are described in eight-page brochure available by writing firm at 5811 Marilyn Ave., Culver City, Calif.

Five major causes of manhour losses through inefficient materials handling and the four basic plant operations involved are covered in colorful booklet, How to Catch Manhour Thieves, issued by Towmotor Corp., 1226 E. 152 St., Cleveland 10, Ohio.

Volatile corrosion inhibitors are detailed in two technical bulletins, VT-1 and GB-2, which answer questions most frequently asked. Write Industrial Packaging division of Berlin & Jones, Inc., 601 W. 26 St., N. Y. 1.

Locating Common Faults in X-Ray Generators is an 11x14-in. chart developed to aid plant engineers and lab technicians in trouble-shooting generator problems and giving correction procedures. Write C. J. Woods, Research & Control Instruments division, North American Philips Co., Inc., 750 So. Fulton Ave., Mt. Vernon, N. Y.

Model 84 small hole grinder, which can be converted to external grinding, is described in Catalog 84A available from Rivett Lathe & Grinder, Inc., Brighton 35, Boston, Mass.

Gas-fired and electric Super Cyclone furnaces for annealing, normalizing, tempering, nitriding and special heating are detailed in Bulletin 131 issued by Lindberg Engineering Co., 2450 W. Hubbard St., Chicago 12, Ill.

Complete line of Landis precision cylindrical grinding machines, with application and size of each machine, is detailed in general catalog available from Landis Tool Co., Waynesboro, Pa.

Publications Received

- Development of the Guided Missile, by Kenneth W. Gatland, published by Illife & Sons, Ltd.; available from the Philosophical Library, Inc., 15 E. 40 St., New York 16, N. Y., 1952, price 10s. 6d. The substance of this book was originally published as a series of articles in Flight magazine. The author has gathered together all the available facts on the evolution of guided missiles and describes their possible future development; illustrations, tables.
- Stuka Pilot, by Hans Ulrich Rudel, published by Euphorion Press, 302 Vauxhall Bridge Road, Victoria, S. W. 1, 1952, price 12s. 6d. Account of Rudel's life in the German Air Force in World War II, mainly in the East.

AVIATION WEEK, November 17, 1952

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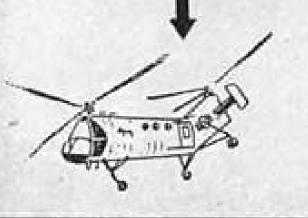
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EDITORIAL

The Complexity Problem III

By Wing Commander A. U. Houle, DFC
(The Second of Two Installments)

▶ Steering and Brakes—Two good examples of sound design are provided by nosewheel steering and anti-skid brakes. Nosewheel steering need only save five to ten gallons of fuel normally required for taxiing in order to offset all the additional weight of the steering equipment. The ease and speed of getting into position seem to make it well worth while; and further, in the event of brake failure, the pilot can still maneuver to avoid hitting obstacles. Non-skid brakes add little to the weight, but they cut down materially on the landing-run and resultant wear of tires. Aerodrome lengths and type of surface are restricting the ability of jet aircraft to operate closely behind an advancing army. Non-skid brakes will add to the fighter's adaptability.

► A Place for the Piston-Engine—The subject of Army support leads us to the consideration of another aspect of aircraft design, namely, the use of slower and more economical

Wing Commander Houle is Chief Project Engineer at the Central Experimental & Proving Establishment of the Royal Canadian Air Force, near Ottawa. His personal views, presented in these two installments, are based on experience since 1940 in the RAF and RCAF as combat pilot, squadron leader, and project engineer.



reciprocating-engine aircraft for strafing and fighter-bombing. Have we allowed our enthusiasm for our new toy, the jet, to blind us to the advantages of aircraft such as the Spitfire or Mustang for this type of work?

It is fatal, in a real war against a well-equipped enemy, to try to strafe at a height of more than 50 ft., and it is quite impossible to do a good job of spotting a target, changing course on it, and hitting it, at speeds over 200 knots.

The speed of the jet makes it unsuitable for strafing, and its initial cost and fuel consumption make it most expensive. Though operations of this kind are unquestionably more dangerous (as far as ground fire is concerned) when carried out at low speeds, let us not forget the number of extra passes or sorties which have to be made at higher speeds in order to knock out an equal number of well-dispersed targets. ► Structural Strength—At the risk of being called a heretic, I would suggest that our structural strength requirements be examined and possibly relaxed. We are now designing fighters with a limit load factor of more than seven and an ultimate of 11G. The advent of the anti-G suit has had a tendency to push the figures up and up, because a pilot can now stand more. But the added weight penalty has made it difficult for the present-day fighter to get above 40,000 ft.-and it takes a lot longer. At such altitudes it is impossible to pull more than 2G without falling out of the sky. This being so, why on earth do we not design to a normal load factor of 4 or 5 and an ultimate of 6 or 7½G?

▶ Pressurized Cockpits—During the second World War, air-

90

craft cockpits were pressurized to allow pilots to reach the altitudes necessary to shoot down the enemy's reconnaissance aircraft. Have we gone on blindly from there? The weight penalty for structure and blower is high and the vulnerable area is excessive: It is also difficult, because of the leak-rate to maintain sufficient pressure at high altitudes.

An expenditure of a few million dollars at the most should be sufficient to develop a suit for the pilot which would be a combined air-conditioned pressure-suit and anti-G suit. The pilot would still be pressurized for high-altitude bailout and have protection from the cold for his fall.

Without pressure suits, a bullet-hole or the failure of a canopy seal limits the physiological ceiling for the pilot of a high-speed aircraft to 44,000 ft., because the cockpit pressure falls far below ambient pressure for the altitude at which the aircraft is flying.

▶ Other Considerations—In concluding my complaints, let me reiterate my conviction that in attempting to solve our problems we are too often becoming exuberant over peacetime stop-gaps that will penalize us in the event of war.

It sounds good to say that we have aircraft with the greatest rate of roll—some 270 deg. per second, with our next objective 540 deg. per second. The requirement for a high rate of roll is a figment of an unrealistic imagination, and it plays little part in any type of aerial fighting. Aircraft now in production actually have too high rate of roll for even the best of pilots to maintain sufficient orientation.

And have we, by putting a crash helmet on the pilot, really solved the problem of preventing him from conking his head?—Or have we at the same time provided him with blinkers such as were formerly used to prevent horses from looking backwards? In the next war it will be just as necessary for a pilot to see beyond his tail as it was in the last.

Again, during the last war the engineers decided to put weights in the Spitfire control system because some goof tried to show how strong he was, reefed back on the stick, and tore the wings off. The extra weight hampered the pilot and seriously slowed down maneuvers in the looping plane; and although there was an order against it, the weights were tossed away. How long can a country go on winning wars in spite of all this sort of thinking?

▶ The Ideal Fighter—The ideal fighter would have unlimited altitude, speed, rate of climb, range, armament, comfort, strength, safety, and minimum takeoff and landing run, fuel consumption, size, weight, and cost. Unfortunately, the requirements conflict with each other, and it is much easier to criticize than to arrive at the ultimate compromise.

We can't, however, get even close to it if we blind ourselves to the fact that compromises have to be made. Personnel who are in the service today may not fight the next war, but it is their duty to pass on the best possible tools and knowledge to the men who will fight it for them.

Every department concerned with the design of an aircraft wants perfection for his particular baby. Therefore someone must be appointed as umpire. Without such an umpire, we shall have complicated and weighty fighters. Too many safety features can become dangerous. Every suggested component of a fighter must be examined supercritically, and rejected unless absolutely essential. It should be easy to reduce the weight of a fighter, while maintaining the same load and ammunition, from 14,000 lb. to 12,000 lb. The rate of climb will be increased approximately 35% by the 2,000 lb. saved—and 95% for 4,000 lb. Furthermore, while the wing loading will remain the same, every other aspect of performance will be improved.

Surely this is worth striving for.

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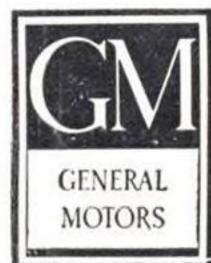
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