AIRCRAFT YEAR BOOK

1929

HARRISON BRAND, JR.

AIRCRAFT YEAR BOOK, 1929

"Others, whose names will long be remembered, had done much to solve the problem, but it remained for the able, persistent and modest brothers from Dayton to demonstrate completely the possibility of a machine raising itself by its own power and carrying a man in sustained flight.

"Human flight with wings, which had intrigued the imagination since the beginning of time, became a practical reality on the day that the airplane of Wilbur and Orville Wright rose from the windswept dunes of the Atlantic Coast. The elder brother lives with us only in memory, but Orville Wright, who piloted the first plane is still actively interested in that science.

"With genius, indomitable perseverance, and a will to overcome obstacles, the Wrights, mindful of what had gone before, applied themselves to the solution of the problem. They experimented at Kitty Hawk for three seasons; and in the fourth, on December 17th, 1903, success crowned their efforts."

—The President of the United States, Calvin Coolidge, addressing International Civil Aeronautics Conference, Washington, D. C., Dec. 12th, 1928.


Chamber of Commerce
Orville Wright

AIRCRAFT YEAR BOOK

1929

Published By

AERONAUTICAL CHAMBER OF COMMERCE OF AMERICA, INC.

NEW YORK CITY

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

FOREWORD

IN editing and preparing data for the eleventh successive *Aircraft Year Book,* acknowledgment is gratefully made to the officials and officers of the Government service through whose sympathetic and prompt assistance the collection and compilation of complete data has been made possible.

We also desire to express our appreciation of the loyal support and coöperation of the members of the Aeronautical Chamber of Commerce of America, Inc., and our sincere thanks to the executive staff of the New York Office and the Washington Bureau, to whom should be credited not only the publication of this book, but also the successful continuance of the work of the organization.

SAMUEL STEWART BRADLEY.

February 15, 1929.

CHAPTER I

AVIATION QUALIFIES AS A MAJOR INDUSTRY

THE year 1928—reviewed in this, the eleventh successive edition of the *Aircraft Year Book*—witnessed an amazing transformation of aeronautics in the United States. Flying became a recognized public service. The end of the year—the twenty-fifth anniversary of human flight—found it well to the fore among other means of transportation. American aviation, including not only flying but also manufacture of equipment and the development of airports and airways, was beginning to assume the proportions of a major industry.

If the twelve months recorded here appear to be for the most part a chronology of phenomenal expansion in all branches of the art, we must bear in mind that expansion has been in the past the very element which aviation needed most.

Expansion in practical form had to wait for popularity. Public confidence brought popularity to aviation in 1927, and it was soon translated into active participation on the part of the people generally. In 1928 the public commenced taking a personal interest in every phase of aeronautics.

The air transport lines extended their service in every direction. They flew twice the mileage of the preceding year. They carried three times the quantity of mail and more than four times the number of passengers. Traffic increased month by month. While a daily average of five tons of mail was flown during 1928, it averaged more than seven tons in December.

Aerial service operations which in the past had been handled largely by individuals and small companies showed substantial expansion. Local aerial taxi concerns were merged. They in turn joined the larger operating groups, taking in whole regions covering several States. Those groups acquired modern machines and other equipment, opened flying schools to train their own personnel and commenced operating short line transport services between cities, thus forming a network of feeder lines to the trunk line systems.

The number of privately owned airplanes operated by corporations on company business or by individuals for personal transport or pleasure in 1928 increased from hundreds to thousands. The number of persons licensed to become aviators increased from 1,500 to more than 11,000.

Aircraft Display in the Coliseum, Chicago, First International Aeronautical Exposition, under auspices of Aeronautical Chamber of Commerce.

At the same time there were approximately 4,500 airplanes in commercial use throughout the United States. Not only was the flying machine being put to more varied uses in this country than in any other, but a greater number were actually in use. Some of the European lines carried more persons during the year than did the American operators; but aerial passenger traffic here was growing at such a rapid rate that it promised soon to exceed that of the heavily subsidized lines of Europe.

Again, while the airplane factories abroad were practically maintained by contracts from their respective governments, the American plants were becoming self-supporting. A number of them had never produced anything but commercial machines. The engine-builders, whose products made possible the development of planes, had previously depended largely upon the Government for production orders, but in 1928 they found the situation reversed. They were filling more orders for commercial than for military engines, and they had expanded plant facilities to provide for commercial requirements. More buildings were erected and more employees added to all departments of the factories.

A Photograph of New York, by Fairchild Aerial Surveys, Inc.

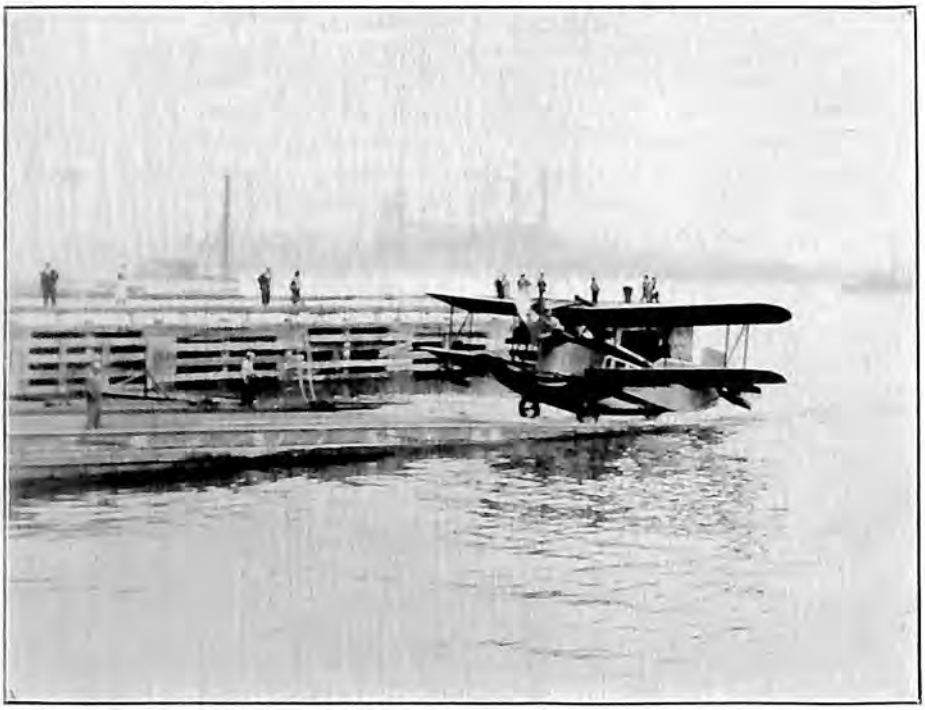
Companies were merged that they might market their products to greater advantage; new companies were formed. Many corporations long established in other industries created new divisions for the manufacture of aircraft or aeronautical accessories, until at the end of 1928 a large percentage of the big industrial organizations were participating in aviation.

The expansion took other forms. The number of cities providing airports increased from a hundred to approximately a thousand. Flying clubs were organized extensively. Aviation was adopted as a subject in the curriculae of the public schools. Flying meets, air races and aeronautical expositions increased in number and secured greater public patronage than ever before.

The way had been paved for all that development. In the United States aeronautics was built on a firm foundation, not by direct subsidies from the Government, but by more constructive forms of support, mainly coöperation, which strengthened and seasoned the industry by challenging its pluck and energy and arousing its ingenuity.

Most important has been the work of Congress, which by sane and expert legislation provided a wise Governmental policy calcu-

(Top) Boeing mail plane, Pratt & Whitney *Hornet,* at Salt Lake City. (Bottom) Mail and express go aboard National Air Transport plane at Chicago.



Loening cabin amphibian coming up on floating runway at 31st Street and East River, New York.

lated to insure steady development. By means of the Five-Year Procurement Program, the Army and Navy have been placed in a position to provide the air services with modern equipment designed and built by Americans. Under the wise provisions of that Act, the industry is able to maintain expert staffs with the resulting improvement of planes, engines and accessories. That progress not only is providing better military equipment; it is producing better commercial planes at lower costs of production.

Under the authority of Congress, the Post Office Department had been able to develop the air mail service and to prove its reliability and practical value in business and social intercourse. The experience gained during the period of the Department's operation of the air mail was invaluable. Equally valuable was the Government's application of its traditional policy of non-participation in business enterprises and also its policy of reserving to American capital and American machines all of its franchises and contracts for carrying the mail. It was because of the Government's experience and its support of those sound policies that private initiative

was able to attract the capital necessary to improve and popularize the air mail, thus assuring the development of air transport on a practical businesslike basis.

Under the Civil Aeronautics Act of 1926 the Aeronautics Branch of the Department of Commerce, through its splendid administration of the air law, the creation of flying routes and maintenance of airways, has been of the utmost value to commercial aviation, exercising the proper kind of control and at the same time guiding and strengthening its continuous development on a permanent basis.

At the end of 1928 all the above promised soon to make aviation everybody's business.

Night view of Hangar No. 1 at Oakland Airport.

CHAPTER II

THE TREND IN AIR TRANSPORT

WHILE expansion marked every phase of American aviation in 1928, nowhere was it more apparent, more constructive in character and more enduring than in the field of organized air transport. The operation of aircraft on regularly scheduled routes became a recognized public service supported by a substantial portion of the financial structure of the nation, and by active elements in the older forms of transportation.

In 1926 air transport was an experiment. In 1927 it began to emerge from the experimental state, largely through the efforts of a few individuals who spent their time and money in a successful effort to prove that flying the mails could be made profitable to both operator and patron. The beginning of 1928 found them with fair prospects for expansion of this service, providing that they could surmount certain difficulties.

Some of the operators required faster planes to meet competition. Others needed machines of greater pay load capacity that they might handle the traffic profitably at imminent competitive rates. All realized that their challenge for speed and service, not only to one another, but to the established means of land and water transport, carried with it the necessity for providing constantly improved facilities.

Invariably they had to enlarge their service shops, develop their communication systems, augment their forces of skilled workmen, add experts to their staffs of executives in each department, and, briefly, expand their entire organizations in every direction while at the same time reducing the overhead.

Methods which had been adequate for experimental air lines no longer sufficed when an operator laid claim to an established and well-organized service. It was to be either expansion or contraction because competing companies were bound to take away the business unless the older operators proved equal to the growing demand for a continuously improved service, faster, more regular and, in most cases, less expensive. The result was a rapid transformation of the operating end of the industry.

More planes were put into service during the year. The number of companies increased. New companies began operations. More miles were added to established air routes. Traffic grew at a steady

(Top) Western Air Express over the Coast Range Mts. (Bottom) Home terminal of Western Air Express at Vail Field, Los Angeles.

and satisfactory pace. The figures summarizing the number of passengers, pounds of mail and express carried by the various companies became larger month by month during the year, until in December they showed for the mail contractors alone a threefold increase over 1927.

Equally important, the structure of the organizations engaged in air transport underwent a radical change. In the past the operators had been either companies or individuals. Early in the year there developed a tendency toward mergers of lines into systems, and during the last three months of 1928 there was ample evidence that the majority of the lines were being welded together by groups identified with many branches of the aircraft industry. The transition from individual experimentation to corporation effort, and from corporation effort to group control formed the highlights of operations in 1928.

It was that change in the financial structure of air transport which won for it complete recognition as an indispensable public service. By expansion in operation and finally reorganization into systems, adequately financed and ably managed, it became virtually an integral part of the vast transportation system of the country.

That the development during the year should take this trend was inevitable, and it may be attributed primarily to three reasons. One was the growth in public demand not only expressed by increased traffic over the air routes, but by other developments. In response to the obvious need the Federal Government continued to provide the various indirect aids to commercial air navigation, laying out more airways, nightlighting the routes and providing other facilities for safe flying.

Influenced by the competition of other cities eager to become established as aviation centers, many municipalities speeded up the development of airports, providing better facilities for the air lines entering their environs. With that came more patronage and a desire on the part of the public to have available the best service that air transport could supply. The operators were thus impelled to expand and improve their facilities.

The growing popularity furnished another cause for expansion. Realizing that aviation had won public confidence important railroad interests seriously undertook the fostering of air transport schedules for air-rail connections throughout the country, whereby passengers might travel part way on the roads and fly the rest of their journey. In that manner air transport became definitely allied to the most important carrying utility in this country.

The third reason for the extensive development of big systems

is found in the availability of capital. Without the financial support required to put their plans into operation the leaders who participated in the reorganization of the companies during the year would not have been able to launch their programs. But the ever-growing popularity of aviation had already influenced capital. For several years important banking houses had been conducting extensive research as evidenced by their requests to the Aeronautical Chamber of Commerce for accurate data. With their responsible officers once assured that aviation had become popular they promptly entered the field. The interest of the more important

Pan-American Airways station at Miami, Fla.

banks distributed in large cities throughout the country attracted smaller institutions, and within a few months approximately a hundred banks had become identified with air transport projects in one form or another.

The identification of conservative financial institutions in air transport immediately fortified the hitherto rather timid interest of private investors. The popularity of the investment trust and its apparent success in other fields made practicable the organization of several such companies dealing solely with aviation securities, such as Aeronautical Industries, Inc. and National Aviation, Inc., pioneers among investment trusts in aviation. During the year a number of other aeronautical investment trusts and holding companies were organized.

Prosperous conditions through the United States were reflected in the financial market and the unparalleled extent of trading as well as permanent investing in all lines of business had its influence on aircraft securities.

To what extent the rapid rise in the market value of aircraft stocks may be attributed to general speculation in 1928 it would be difficult to say. The influence was there, however, for aviation undoubtedly captured public imagination, and it effected the new financing to a certain degree; for aviation stocks became popular with both the investor and the speculator.

At the end of the year when some of the companies showed appreciable earnings for the calendar period the public felt that its faith had been justified. The result was that financing was a simple matter; and upon reorganization those companies under control of the established financial groups found an abundance of capital.

At the same time there were many reasons why the group system should appeal to the public. For one thing, people have become familiar with it. They have seen the railroads, the utilities, the telephone, gas, electric light and power companies, merged into big organizations either under control of holding companies or dominated by individuals interested in a number of kindred concerns. Those who invest their money in utility enterprises have profited by the group system; so have the consumers, with better service and reasonable rates. Indeed, the group system is indispensable to our modern way of doing business.

Those familiar with the operation of the group system understand readily some of the advantages to be gained by combining a number of companies, thus standardizing service, reducing costs, and permitting lowered charges to the user.

The operation of an air line involves a tremendous amount of experimental work. The operator must be constantly on the alert for auxiliary equipment that will make his service more dependable. He must have the best equipment. He may buy a new plane today and tomorrow find that for his purposes it requires certain alterations, a different engine, landing gear or a relocation of the load space. Invariably this requires a change in design. But the operator can determine the needed changes only after he has used a machine and tested it in practical flying. Many of the operators have adopted the policy of controlling the sources of their equipment. By that they hope to reduce initial costs and cut down the expense of research. The cost of procuring and developing new equipment can be controlled best if confined within one organization.

Many also believe that long delays in delivery of new equip-

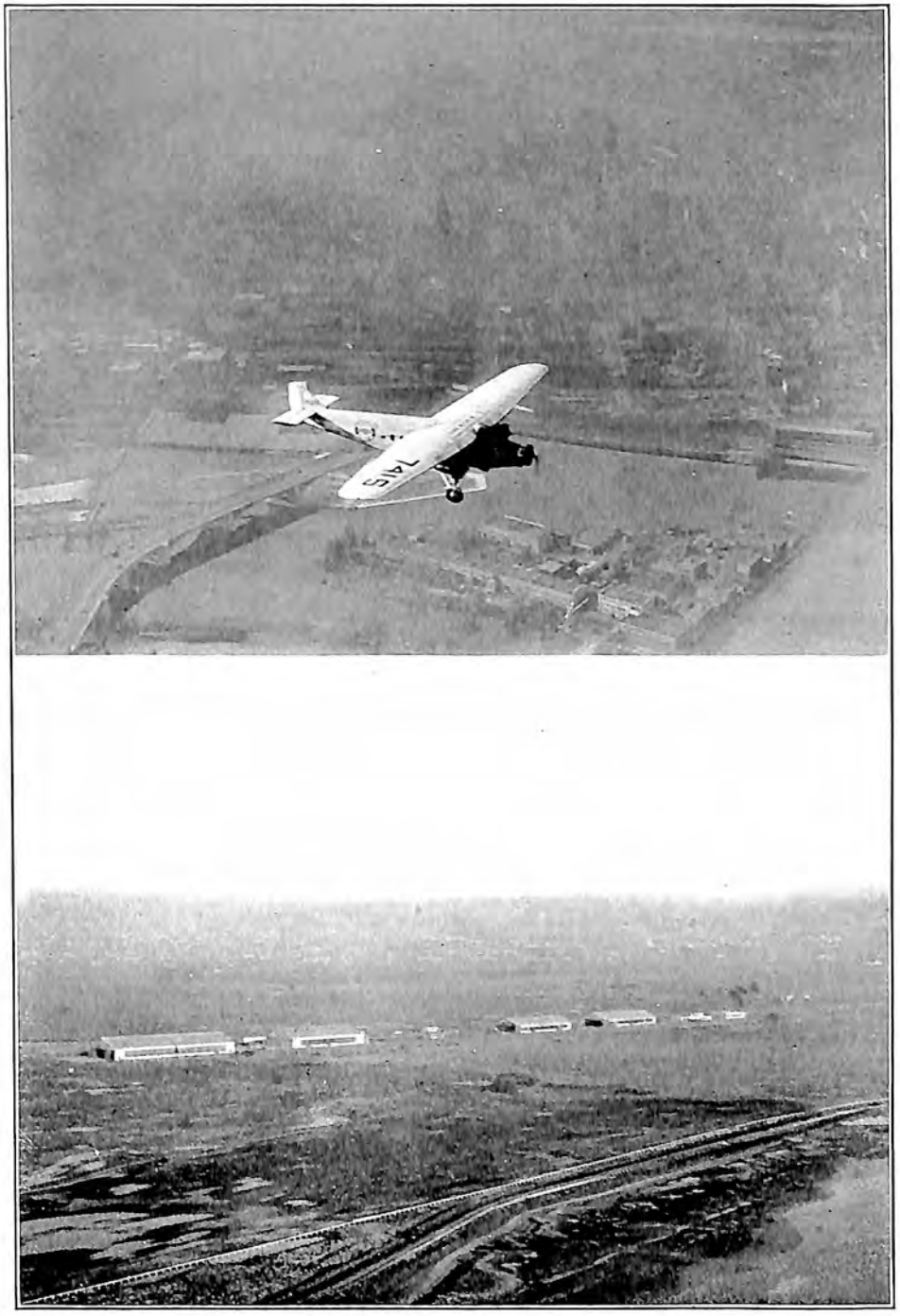
ment can be avoided by controlling its design and manufacture. Others have adopted the policy of training their own personnel, holding that months are required to break in a new employee, whether he be pilot or a mechanic, whereas if he receives his training under the company which will employ him, that delay can be reduced to a minimum. This had led many of the big operating groups to acquire control of flying schools. It has encouraged the merging of many local flying or aerial taxi services, the same executive staff being employed for both school and taxi service.

The merging of engineering, design, production, training, local service and trunk line operation—all under a single group or company—featured the expansion of the aircraft industry in 1928.

Another sound economic reason for consolidation of air transport companies has been the desire of the operators to expand their services and lengthen the systems by absorbing established lines rather than by engaging in destructive competition. In this they have followed the course of the railroads. They have seen how both the railroads and the public benefited by linking small lines until they became vast systems. They have noted the manner in which electric power and light, gas and telephone companies have developed into great systems, exercising virtual monopolies in their territory. They have watched these systems grow in popularity while at the same time the service was improved, overhead expense reduced and rates and profits adjusted accordingly.

Still another reason for the mergers and consolidations under the control of holding companies and syndicates may be found in the opportunity offered for expansion by means of feeder lines radiating from the main trunk line systems. Direct handling of traffic without transferring to rival carriers has been used as an argument to favor the consolidation of the railroads. The reason given is that it reduces expense and thereby serves to keep down rates. Fewer employees at the terminal, one staff handling the traffic instead of separate staffs of rival companies, with a single headquarters executive organization directing operations over the entire system, is another reason. The purchase of equipment and raw materials can be facilitated and the prices curtailed when acquired in large quantities. Thus the big system can reduce its overhead where the small competitor cannot.

Convinced that the time was at hand for establishing air transport on a sound basis where it would be in as favorable a position as other consolidated surface systems, several of the experienced operators during the year participated in the organization of holding companies. Others, while maintaining their corporate identity,



(Top) Northwest Airways transport over Twin Cities. (Bottom) Oakland, Cal., Airport.

joined with financial groups controlling many units of the industry. At the end of the year there were five big groups in the United States. They were reorganizing and expanding their lines. While a number of individual operating companies remained, by far the greater part of the airway mileage in the United States was controlled by the groups which had been formed in recent months.

As far back as 1919, the railroads regarded aviation with sympathetic interest. Possibly the first of the great rail systems to officially endorse aviation was the Pennsylvania, whose attitude has been attributed to the fact that its president, Gen. W. W. Atterbury, while in charge of rail transportation with the American Expeditionary Forces in France, visualized the practical commercial future of flight.

The late A. H. Smith, President of the New York Central, wrote in the Aircraft Year Book for 1923:

"In traveling on the Twentieth Century Limited, which the New York Central believes is the finest train in the world, and observing from the window a seaplane flying up the Hudson at a speed at least half again as fast as the Century, or a mail plane bound overland for Chicago, making two miles and a half to the Century's one, I cannot close my mind, as did the stage-coach owners in the late thirties, to the fact that here is a new form of transportation which, sooner or later, may become of substantial service for other than war purposes.

"How will commercial aircraft be regarded by the railways? My judgment is that when the railways find that aircraft offer an expeditious high-speed service which can be used to relieve the railways of certain portions of traffic requiring excessive or abnormal speed, then there must naturally develop a mutually advantageous coördination. How long this will require depends upon the demonstration of utility by aircraft."

Today finds the Pennsylvania Railroad participating in the financing and operation of Transcontinental Air Transport, while the New York Central has, unofficially, linked its rail service direct with the air service of the Universal Aviation Corporation and, it is understood, maintains the same sympathetic attitude toward Boeing Air Transport, whose present eastern terminal is Chicago.

Although the Pennsylvania and New York Central thus early evinced their interest, it so happened that three western roads—the Great Northern, Northern Pacific, and Chicago, Milwaukee, St. Paul & Pacific, in the order named—were actually the first roads to start regular physical co-ordinated service with an air line. Northwest Airways on Sept. 1, 1928, established a joint service with those

railroads which was later extended to include the Pennsylvania and the Baltimore & Ohio.

Somewhat earlier in 1928, the Robertson Aircraft Corp. division of Universal, announced an arrangement with the Illinois Central whereby, on payment of a joint tariff, passengers could travel between St. Louis and Chicago one way by rail and the other by air.

Late in 1928 Pan-American Airways entered into a joint air-rail traffic arrangement with the Atlantic Coast Line and the Seaboard Air Line.

As previously noted, however, the first railroad to invest money in air transport was the Pennsylvania Railroad Company, which in 1928 took a substantial interest in the Transcontinental Air Transport, Inc., organized to operate a train and plane service between New York, Los Angeles and San Francisco. The entry of the Pennsylvania Railroad was best explained by General Atterbury in these words:

> "The idea of using airplanes for commercial transportation of passengers is not new to the Pennsylvania Railroad management. We have been studying air transport for a number of years and with particularly close interest and attention in view of the impetus which commercial aviation has received since the close of the World War. During the last five years several of our best equipped officers have been definitely assigned to watch the progress and development of air transport in America, with a view to the possible use of airplanes in connection with our train operations, or in a separate transportation service.
>
> "Many of our patrons using Broad Street Station, in Philadelphia, have noticed at the head of the grand staircase, immediately over the information desk in the main waiting room, the bas relief by Karl Bitter, famous Austrian sculptor, entitled 'The Progress of Transportation.'
>
> "The panel depicts the evolution of transport from the days of the ox-cart and chariot down to the modern locomotive and steamship. Its most significant feature is the figure of a young child which leads the procession, carrying in its arms a model of an airship. This indicates that even as early as 1895, when Mr. Bitter executed the panel, the Pennsylvania Railroad was air-minded.
>
> "Our studies in air transportation have, of course, been greatly influenced by the really marvelous development of the air mail lines in the United States, and the operation of regularly scheduled and dependable passenger-carrying air lines over the continent of Europe.
>
> "The idea of operating a joint rail-air service was the natural and logical outcome of our studies in air transportation.

We wanted to develop a service in which passengers could have confidence and which could be regularly and dependably operated in all seasons and under every condition of weather. We wanted nothing experimental or visionary. The combination of the railroad train and airplane, with all night journeys made by train, seemed to afford the ideal service under present conditions.

"The Transcontinental Air Transport, Inc., was formed to bring to fruition these ideas and to place in actual operation a service such as we had visualized. As has already been announced, this new company, in which the Pennsylvania Railroad is financially interested, will establish next spring a coördinated rail-air route between New York and Pacific Coast cities. The new service will be operated on a regularly established schedule, carrying passengers between New York and the Pacific Coast in two days, approximately half the time of the present all-rail journey."

Aside from Transcontinental Air Transport, Inc., in which the Pennsylvania Railroad Company and the finance group headed by C. M. Keys are interested, he and his associates operate the Curtiss Aeroplane & Motor Company, Curtiss Flying Service, Curtiss Assets Corporation, Curtiss-Robertson Airplane Manufacturing Company, Curtiss Aero Export Company, Aviation Exploration Company, Curtiss-Caproni Corporation, National Air Transport, North American Aviation, Inc. (an investment trust), Sperry Gyroscope Company, and Curtiss-Reid Airplane Company of Montreal.

Closely affiliated with the Keys group are the Sikorsky Aviation Corporation, Cessna Airplane Company and the Douglas Company, through commercial sales arrangements with the Curtiss Flying Service. The various interests operated by the group represent a total capitalization of $58,362,450.

Closely associated with Mr. Keys are Howard E. Coffin, vice-president and director of the Hudson Motor Car Co.; J. Cheever Cowdin, vice-president of Blair & Co., Inc.; Leonard Kennedy, vice-president of Curtiss Aeroplane & Motor Co., Inc.; J. A. B. Smith, secretary-treasurer of Curtiss Aeroplane & Motor Co., Inc.; Chester W. Cuthell, of Cuthell, Hotchkiss & Mills; Paul Henderson, vice-president of National Air Transport; C. Roy Keys, vice-president of Curtiss Aeroplane & Motor Co.; James C. Willson, of James C. Willson & Co.; and D. M. Sheaffer, chief of passenger transportation of the Pennsylvania Railroad Company.

Other associates are O. J. Anderson, of Oliver J. Anderson & Co., St. Louis; Walter S. Bucklin, president and director of the American British & Continental Corp.; R. D. Chapin, chairman of

Right end of Karl Bitter's bas relief in Broad Street Station, Pennsylvania Railroad, Philadelphia.

board of Hudson Motor Car Co.; Philip Dalton, of Coffin & Burr, Boston; Charles R. Blyth, of Blyth, Witter & Co.; Robert K. Cassatt, of Cassatt & Co.; Hamilton F. Corbett, director of the First National Bank, Portland, Ore.; Donald W. Douglas, president of Douglas Aircraft Co., Inc.; V. M. Drury, of Drury & Co.; Thomas N. Dysart, of Knight, Dysart & Gamble; Herbert Fleishhacker, president and director of the Anglo & London-Paris National Bank; John C. Grier, Jr., president and director of Guardian Detroit Co.;

John D. Hertz, chairman of the board and president of Chicago Yellow Cab Co., Inc.; C. O. Kalman, of Kalman & Co.; R. R. McCormick, president and editor of The Chicago Tribune; William B. Mayo, chief engineer of the Ford Motor Company; W. L. Munro, president of the American Window Glass Machine Co.; Roland Lord O'Brian, of O'Brian, Potter & Stafford; E. A. Pierce, of E. A. Pierce & Co.; Charles Reed, of F. B. Keech & Co.; James A. Richardson, of James Richardson & Sons, Ltd.; Herbert Bayard Swope; J. A. Talbot, president and director of the Richfield Oil Company; B. A. Tompkins, president of Bankers Company of New York; Eli T. Watson, of Watson, Williams & Co., New Orleans; Garrettson Dulin, of Hunter, Dulin & Co.; Thomas B. Eastland, of Bond & Goodwin & Tucker, Inc.; George deB. Greene, of E. H. Rollins & Sons; Parmely Herrick, president and director of The Herrick Co.; Thomas Hitchcock, Jr.; C. Townsend Ludington, vice-president of National Air Transport, Inc.; Walter S. Marvin, of Hemphill, Noyes & Co.; John J. Mitchell, Jr., director of Douglas Aircraft Company, Inc.; Grayson M. P. Murphy, of G. M. P. Murphy & Co.; Frank Phillips, president and director of Phillips Petroleum Co.; George F. Rand, president and director of Marine Trust Co., of Buffalo; Earle Hay Reynolds, president of National Air Transport, Inc.; Morton L. Schwartz; Harold E. Talbot, Jr., director of Transcontinental Air Transport, Inc.; Eugene E. Thompson, of Crane, Parris & Co., Washington, D. C.; William H. Vanderbilt, director of Rochester Gas & Electric Co.; Elisha Walker, president of Blair & Co., Inc.; and William Jenks Wright, of Janney & Co.

Paralleling the foregoing group, and in many ways closely cooperating with it, is another headed by Richard F. Hoyt, of Hayden, Stone & Company. Mr. Hoyt and his associates have extended their activities through the entire range of aviation—production, operation and finance.

At several points, the Hoyt and Keys interests are in close sympathy, perhaps the outstanding example being the National Aviation Corporation, the executive committee of which Mr. Hoyt is chairman. This financing organization—dominant in its field—includes in its directorate Messrs. Keys, Coffin, Cowdin, Cuthell, Dysart, Henderson, Kennedy, Murphy, Reynolds and Willson, and also the following: Carle C. Conway, president and director, Continental Can Co., Inc.; Sherman M. Fairchild, president and director, Fairchild Aviation Corp.; E. O. McDonnell, partner, G. M. P. Murphy & Co.; John J. Mitchell, Jr., of the Illinois Merchants Trust Co.; David Sarnoff, vice-president and director, Radio Corporation of

America; George W. Davison, president and trustee, Central Union Trust Co., of New York; Charles L. Lawrance, president and director, Wright Aeronautical Corporation; Walter S. Marvin, partner, Hemphill, Noyes & Co.; H. E. Talbot, Jr., director, National Air Transport, Inc.

A second point of common contact between the above mentioned great groups is the Aviation Credit Corporation, of which Mr. Hoyt also is chairman. The Aviation Credit Corporation is an offshoot of the Commercial Credit Corp. and is designed especially to finance the sales of aircraft, motors and accessories on a time basis. Officers include William B. Robertson, vice-president, and J. A. B. Smith, secretary and treasurer. Among the directors are: J. P. Butler, president, Canal Bank & Trust Co., New Orleans; James C. Fenhagen, partner, Robert Garrett & Sons, Baltimore; A. E. Duncan, chairman, Commercial Credit Co. of Baltimore; Allan Forbes, president, State Street Trust Co., Boston; Arthur W. Loasby, president, The Equitable Trust Co. of New York; William B. Mayo, chief engineer, Ford Motor Company; George F. Rand, president and director, Marine Trust Co., Buffalo; Frank H. Russell, vice-president, Curtiss Aeroplane & Motor Co., Inc.; Charles L. Lawrance, president, Wright Aeronautical Corp.; Albert P. Loening, vice-president and director, Keystone Aircraft Corp.; George M. Pynchon, Jr., partner, Pynchon & Co.; Walter W. Smith, president, First National Bank of St. Louis.

The aviation enterprises in which Mr. Hoyt and his associates are directly interested, in addition to the above, include: The Aviation Corporation of the Americas, Keystone Aircraft Corporation, Moth Aircraft Corporation, New York Air Terminals, Inc., Travel Air Company, and Wright Aeronautical Corporation.

On the directorates of the above companies are some of the best known names in aviation and general finance, including: Robert W. Atkins, R. B. Bevier, S. Sloan Colt, Lyman Delano, G. B. Grosvenor, John A. Hambleton, W. Averell Harriman, Robert Lehman, Grover Loening, George Mixter, J. T. Trippe, William H. Vanderbilt, C. V. Whitney, Edgar N. Gott, C. T. Ludington, Albert P. Loening, M. M. Warren, Walter H. Beech, J. H. Turner, Frederick B. Adams, James B. Clews, Harvey D. Gibson, Charles Hayden, Charles L. Lawrance and Earl E. T. Smith.

Another important consolidation of interests was that which brought together a group of capitalists and bankers in the control of the Fokker Aircraft Corporation of America and Western Air Express, the latter operating between San Francisco and Los Angeles,

(Top) Boeing mail plane, *Hornet* powered, in flight over the Rockies. (Bottom) Boeing passenger transport, tri-motored *Wasp*, on San Francisco-Chicago route.

Los Angeles and Salt Lake City and Cheyenne and Colorado Springs, with the announced intention of extending eastward in 1929 from Los Angeles to Kansas City.

One of the biggest mergers was that which produced United Aircraft and Transport Corporation, incorporated late in 1928. It is a holding company formed primarily to provide for future financing and to determine basic policy for the various subsidiary companies. The company owns all of the capital stock of Boeing Airplane Company, Boeing Air Transport, Inc., The Chance Vought Corporation, Hamilton Aero Manufacturing Company, Hamilton Metalplane Company and the Pratt & Whitney Aircraft Company, and more than 70 per cent of the common stock of the Pacific Air Transport Company.

All of the principal aeronautical activities are contained within the group, including the design and manufacture of planes, engines and propellers and transport of mail, express and passengers. The business of the several companies is well distributed between commercial, naval and army types.

All of the subsidiary companies have been among the leaders of their respective fields and all companies are of long standing with a history of successful operation. The present personnel and management of the subsidiary companies will continue in active charge of their individual companies. It is the policy of the United Aircraft and Transport Corporation to maintain the identity of all of its subsidiaries and to govern inter-company transactions so as to foster a broad competitive policy in all of the fields covered by its subsidiaries.

United Aircraft and Transport Corporation was organized under the direction of the National City Company, marking the latter's first participation in the aeronautical field.

The Board of Directors and officers of the corporation are: William E. Boeing, chairman of the board; Charles W. Deeds, secretary and treasurer; Edward A. Deeds, chairman of the Board, Niles-Bement-Pond Company; Thomas F. Hamilton, president, Hamilton Aero. Mfg. Co.; Philip G. Johnson, vice-president; Charles F. Kettering, vice-president, General Motors Corporation; Kenneth R. Kingsbury, president, Standard Oil Company of California; Charles K. Knickerbocker, vice-president, Griffin Wheel Company; William B. Mayo, chief engineer, Ford Motor Co.; George J. Mead, vice-president, the Pratt & Whitney Aircraft Company; Guerney E. Newlin, of Newlin & Ashburn, Los Angeles; Frederick B. Rentschler, president; Gordon S. Rentschler, assistant to the president, The National City Bank of New York; Joseph P.

Transcontinental Air Transport plane on New York-Los Angeles air-rail route.

Ripley, vice-president, The National City Company; Orval W. Tupper, assistant secretary; Chance Vought, vice-president.

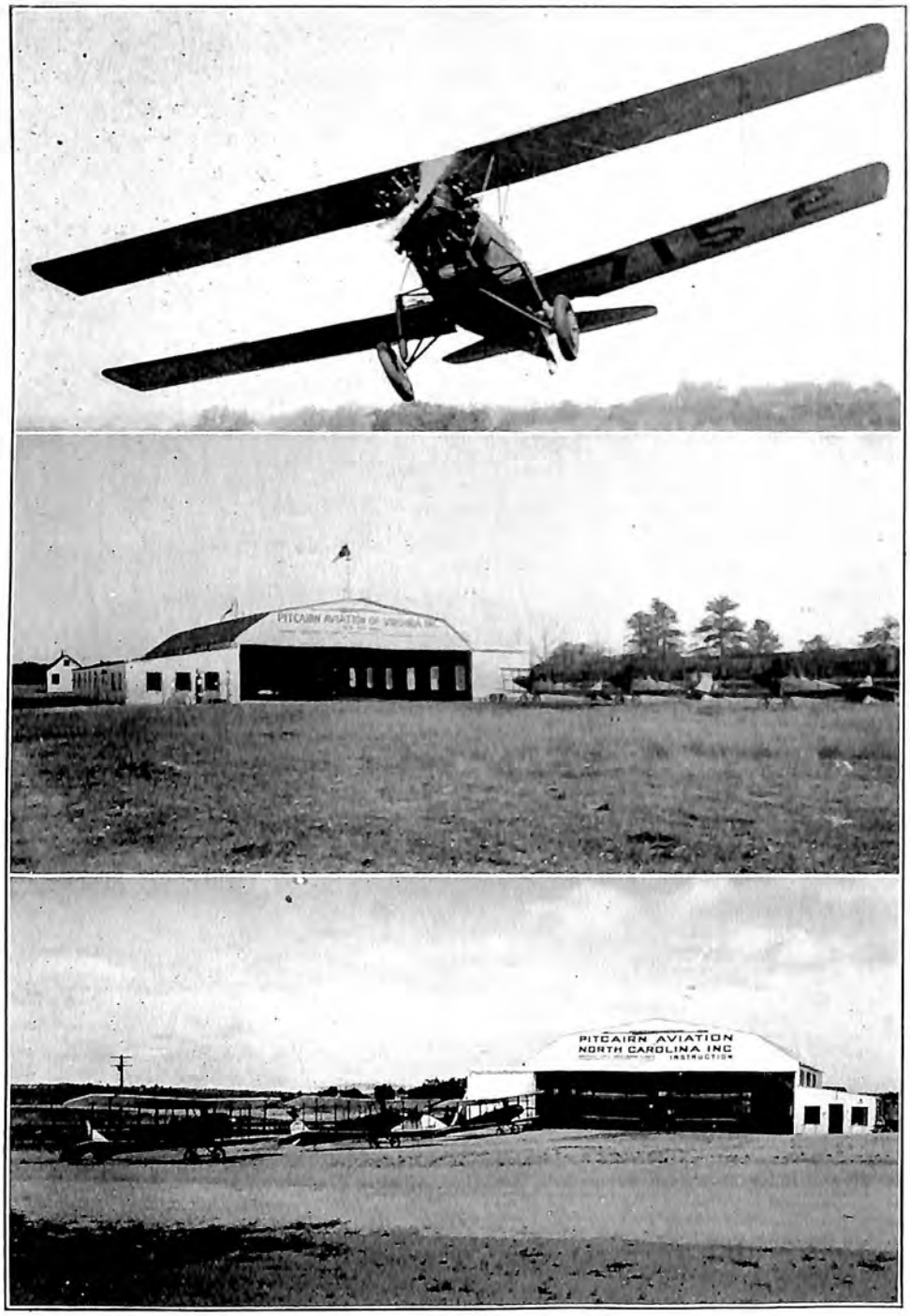
One of the largest consolidations of the year was that of Universal Aviation Corporation, to operate passenger, mail and merchandise planes over scheduled routes aggregating more than 4,000 miles. Among the existing lines in the merger were those of Universal Air Lines, Inc., operating between Cleveland, Chicago and the Twin Cities; the Robertson Aircraft Corp., operating mail and passenger routes between Chicago, St. Louis, Omaha and Kansas City; and Northern Air Lines, passenger and express routes from Minneapolis to Duluth and Minneapolis to Fargo, N. D. Other companies in that consolidation included the Universal Air Line System Terminal Co., Mid-plane Sales and Transit Co., Northern Airplane Co., Air Transportation, Inc., Egyptian Airways, Inc., and Robertson Flying School, Inc.

The new organization planned to extend operations throughout

the Northwest, Midwest and Southwest and double the mileage of its air lines in 1929. Arrangements were made with the New York Central Railroad for an exchange of passengers at Cleveland, O., flying passengers west of Cleveland and taking them from the New York Central lines between Cleveland and New York. That schedule was designed to shorten by fifteen hours the traveling time between New York and the Twin Cities. Arrangements were made with the American Railway Express Company, the Greyhound Bus Lines and the Western Air Express to sell transportation on Universal Air Lines. In addition the company planned the immediate establishment of flying schools in several cities, selling agencies for airplanes and further, had a program to provide all other kinds of aviation service, including aerial taxis, sightseeing, aerial photography and surveys.

The five groups mentioned in the foregoing paragraphs at the end of the year had extensive expansion programs still under way, both in the manufacture of airplanes and accessories and in all kinds of operations. Represented on their boards were many of the largest financial institutions and investment houses. They were ably financed and organized with highly trained corps of experts in aviation and transportation. With the individual operating companies also expanding the new year promised even more rapid development than that of 1928.

Official Air Mail Pilot's Insignia. Designed by Col. L. H. Brittin, of Northwest Airways.



(Top) Pitcairn *Super-Mailwing.* (Center) Pitcairn hangar at Richmond, Va. (Bottom) Pitcairn service station at a North Carolina airport.

CHAPTER III

AIR TRANSPORT OPERATIONS

AT the end of 1928, while the world was celebrating the twenty-fifth anniversary of human flight, there were 15,128 miles of airways in the United States, two-thirds of that mileage lighted and otherwise equipped for night flying. Over those routes 32 air line companies were operating on regular daily schedules, some of them both night and day, with traffic increasing at a steady and profitable rate.

Twenty-two companies were operating 33 air mail lines under contract with the Post Office Department. Four new lines were to be in operation early in 1929. Mail planes were flying a total average of 27,848 miles every twenty-four hours.

A number of the mail contractors were also carrying passengers or express, or both. Nine others having no mail contracts in 1928 had confined their scheduled flying to passengers or express. Without exception all the air lines were in process of expansion.

Several companies had been either merged or absorbed during the year. Others had been reorganized with vastly increased capitalization to permit extension of their service. And new ventures in air transport were under way, the promoters having been attracted by the amazing developments in that field during the last twelve months.

In 1926 there had been only 19 operators, the majority of them small individual enterprises. In 1927 the number had grown to 24, and the smaller operators were maturing into fairly well organized air line companies, while the larger organizations were beginning to show profits with a steady increase in traffic. In 1928 the air lines with an aggregate of 294 single and multi-engine transports in service flew a total of 10,472,024 miles against 5,242,839 miles in 1927.

That doubled mileage was accompanied by a threefold increase in air mail poundage and more than four times the number of passengers on regularly scheduled service. In 1927 the air lines of the United States carried 1,222,843 pounds of mail. In 1928 they carried 3,632,059 pounds. In 1927 12,594 passengers were flown from one place to another on scheduled, regularly operated service. In 1928 they numbered 52,934.

Reports from all the operators having contracts with the American Railway Express indicate a healthy growth in business during

the year; and yet the volume of business reported for 1928 remained approximately the same as that for the preceding twelve months, about two thousand tons. That is explained by the fact that the majority of operators did not begin to carry express until late in the year, while in 1927 most of the air express was parcel freight carried for business houses and corporations which in 1928 acquired their own private machines for that purpose.

Just as reduction of air mail postage on August 1—from 10 cents to 5 cents for the first ounce—had the immediate effect of filling mail planes with capacity loads, so were many factors calculated to increase the volume of express.

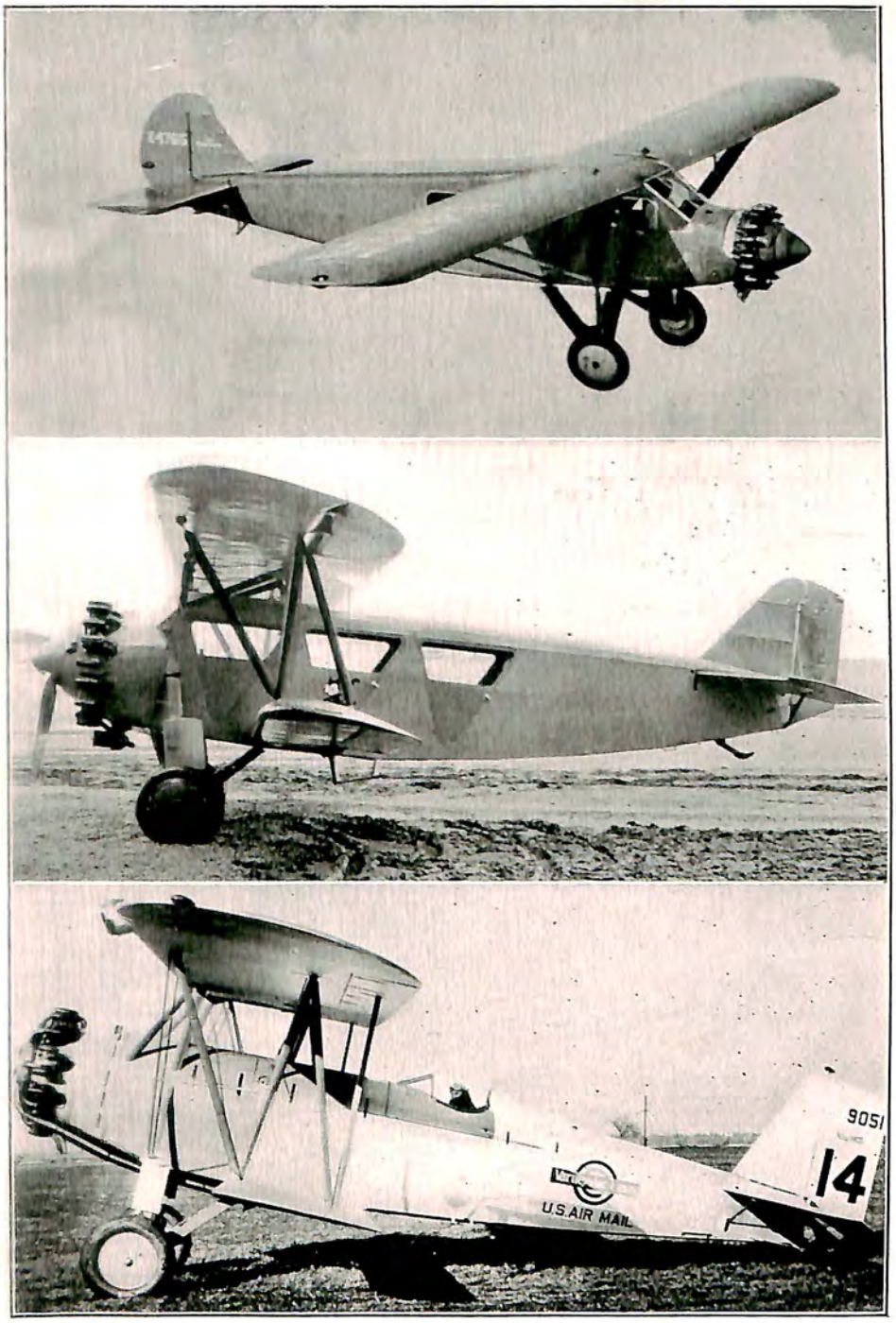
Late in the year feeder lines were being developed to connect with the long haul systems. Regularity of service was constantly attracting public attention. Lack of accidents on the air transport routes was convincing the shipper that his valuable parcels might be safely flown. With the exception of the Ford Motor Company, which had operated its own flying express service for several years, practically all the parcel freight was flown during the last quarter of 1928. That promised rapid development during the ensuing months.

Evidence that the operators were no longer conducting an experiment in a new kind of transportation came at intervals throughout 1928 with one line after another expanding its service, placing new machines on its routes and seeking additional patronage. New passenger lines either launched or extended to other cities in 1928 numbered 23, and added 6,451 miles. Additional mail routes, either new or extended during the year, numbered 16 with 5,928 miles. Nine express lines were started, with a total of 2,151 additional miles for the year.

It will be noted that not all the new lines were over new airways. In many instances a number of companies were operating over the same route at the end of the year. The foregoing figures, therefore, refer to service mileage and have no bearing on the extension of airways. While complete statistics of transport operations will be found in the Appendix, numerous facts about the individual air lines are worthy of further note.

Air Transport Companies

Boeing Air Transport operated the contract air mail route (C.A.M.) Number 18, between Chicago and New York. Equipment included 28 Boeing planes powered with Pratt & Whitney *Wasp* or *Hornet* engines. The total number of employees was 120, including 35 pilots. During the year Boeing Air Transport carried 837,211 pounds of mail, 149,068 pounds of express and 1,863 passengers,



(Top) Travel Air cabin monoplane. (Center) Knoll cabin biplane. (Bottom) Stearman *Speed Mail,* flagship of Varney Air Lines.

without a serious accident in 2,178,365 miles of cross-country flying, part of it over the Rocky Mountains. New and larger Boeing passenger and mail planes were to be placed in operation early in 1929.

Paul R. Braniff, Inc., operated from the Municipal Airport at Oklahoma City, Okla., using two Travel Air monoplanes, two Stinson monoplanes and one Ryan monoplane, all powered with Wright *Whirlwind* engines. Employing 16 persons, including 6 pilots, Braniff started operations in June, 1928, and at the end of the year had carried 3,000 passengers on regularly scheduled service between Oklahoma City and Tulsa, without serious accident. The Braniff line was to be extended to Wichita Falls and Dallas, Tex., in February, 1929.

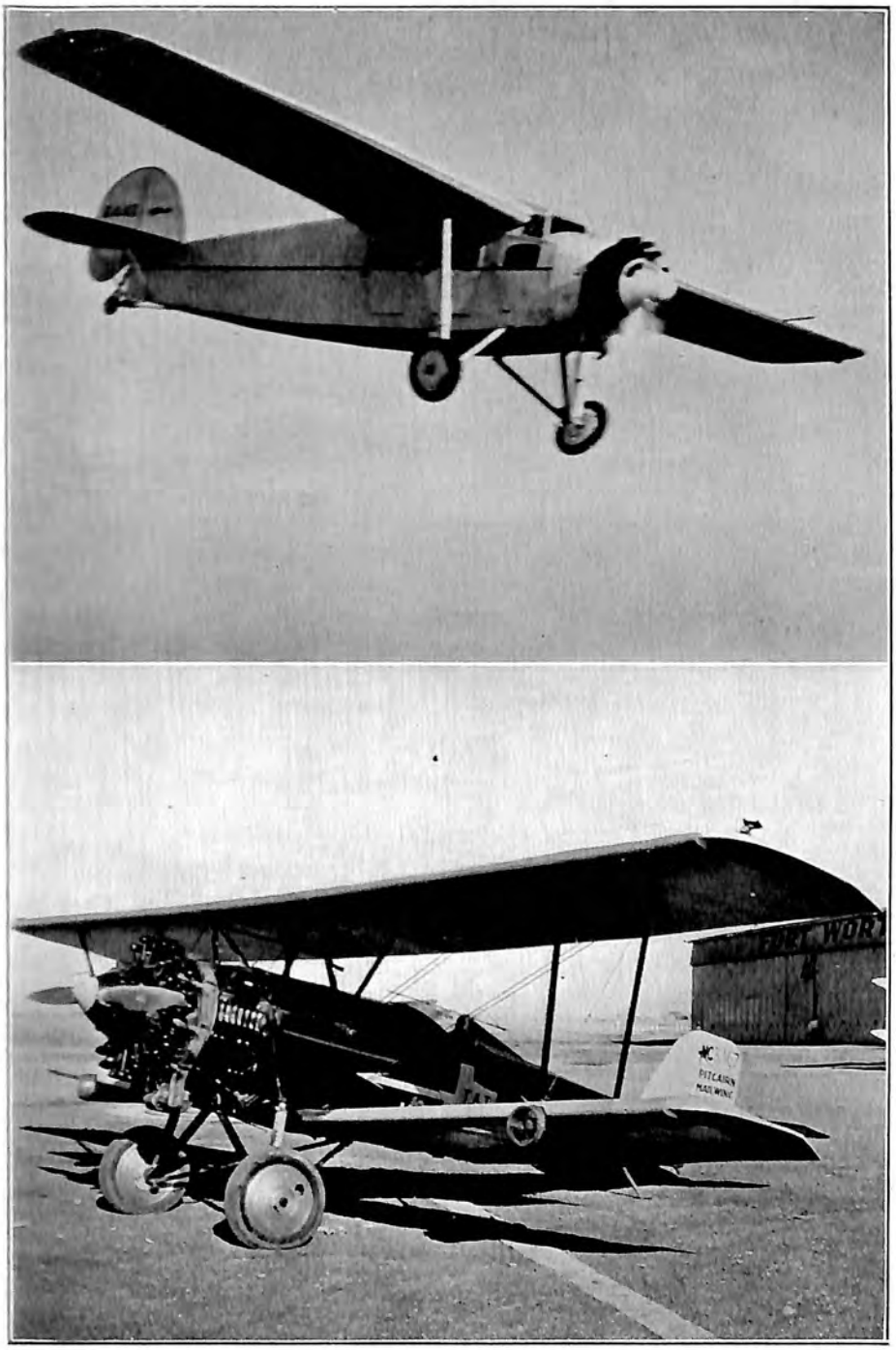
Clifford Ball, Inc., operated 5 airplanes on C.A.M. route 11 between Pittsburgh and Cleveland. The planes were three Fairchild, one Ryan and one Travel Air, all powered with Wright *Whirlwind* engines. Passenger fare was $20 between the two terminals. In 1928 the line carried 725 passengers, 3,600 pounds of express and 54,852 pounds of mail, with 84,850 miles of flying. The 16 employees included 4 pilots.

Capitol Airways, Inc., operated a passenger and parcel freight service between Indianapolis, Detroit, Chicago and Louisville, Ky. Four Ryans, *Whirlwind* powered, three Alexander *Eaglerocks*, Curtiss OX-5 engines, and one Swallow, OX-5 powered, were used. With 12 employees, including 6 pilots, the line started operations in October, 1928, and at the end of the year had carried 800 passengers and 300 pounds of express, with 40,000 miles of flying.

Colonial Air Transport Inc., operated C.A.M. route 1 between New York and Boston, also carrying passengers and mail. Equipment included three Pitcairns and two Fairchilds, all *Whirlwind* powered. With 26 employees, including 4 pilots, Colonial in 1928 carried 121 passengers, 1,950 pounds of express and 47,453 pounds of mail, with 115,638 miles of flying.

Colonial Western Airways, Inc., operated C.A.M.-20 between Albany, N. Y., and Cleveland, in 1928 carrying 45,309 pounds of mail, 243 passengers and 282 pounds of parcel freight, with 184,308 miles of flying. Employees totaled 37, among them 9 pilots. Equipment included 4 Fairchilds, 4 Pitcairns and 1 Ford tri-motored, all *Whirlwind* powered.

Canadian Colonial Airways, Inc., operated Foreign Air Mail (F.A.M.) Route Number 1 between New York and Montreal, beginning Oct. 1, 1928. Four Fairchilds and 2 Pitcairns were placed in service, with 29 employees, including 5 pilots. In three months the



(Top) Cessna 6-passenger monoplane with Wright *Whirlwind*. (Bottom) Texas Air Transport's Pitcairn *Mailwing, Whirlwind* powered.

line carried 280 passengers, 120 pounds of parcel freight and 32,103 pounds of mail.

The Embry-Riddle Co. operating C.A.M. route 24 between Cincinnati and Chicago, carried 35,667 pounds of mail, 2,014 pounds of express and 270 passengers, with 35,665 miles of flying. One Fairchild and 4 Waco-tens were used in mail transport; a Fairchild, 2 Monocoupes, 1 Waco and 1 Ryan were flown in passenger work. The company combined its scheduled transport with aerial service operations, employing 50 persons, including 6 pilots.

Gulf Air Lines, Inc., started operations in May, 1928, with C.A.M.-23 between New Orleans and Atlanta, Ga. With 5 Fokkers, *Wasp* powered, 1 Fokker, *Whirlwind*, 1 Pitcairn *Mailwing* and a Travel Air, both *Whirlwind* powered, Gulf Air Lines carried 349 passengers and 23,325 pounds of mail with 196,680 miles of flying. Passengers were flown at night between Atlanta and Birmingham, Ala. In January, 1929, the line was to begin operating C.A.M.-29 between New Orleans and Houston, Texas. Employees numbered 17, including 6 pilots.

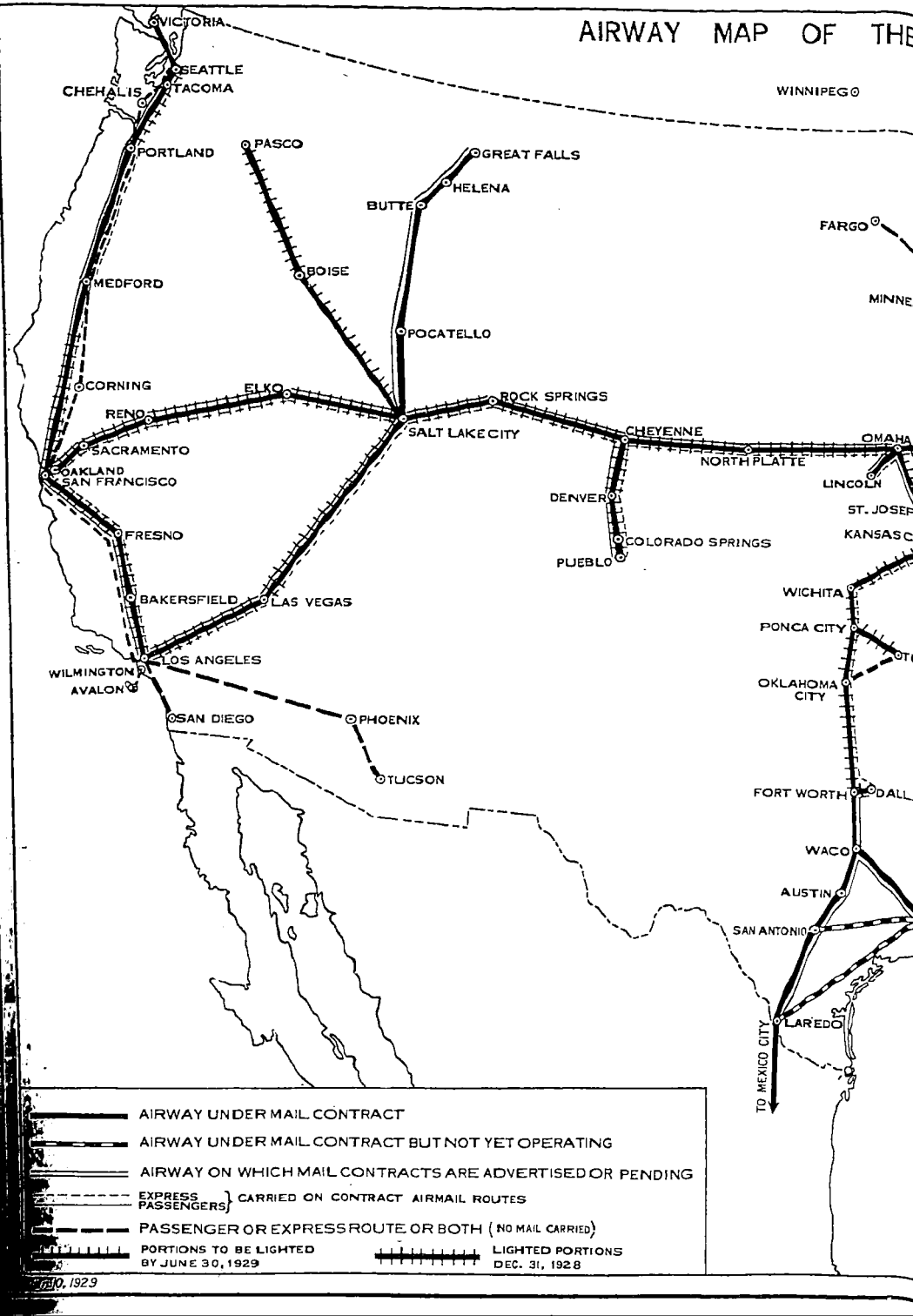
Interstate Airlines, Inc., started operating C.A.M.-30 between Chicago and Atlanta in November, 1928. Seven Fairchilds, 3 Stearmans, 1 Travel Air and a Waco formed the fleet of 12 planes. Employees numbered 41, with 9 pilots. In the eight weeks up to Dec. 31 the line carried 473 passengers and 1,076 pounds of mail, with 81,024 miles of flying.

Maddux Airlines operated out of Los Angeles with a fleet of 17 passenger planes, including 13 Fords, 2 Lockheed Vegas and 2 Travel Airs. The four divisions of the service covered routes between Los Angeles and San Francisco, between Los Angeles and San Diego and to cities in both the Imperial and San Joaquin valleys. In 1928 Maddux planes flew 386,736 miles and carried 9,443 passengers.

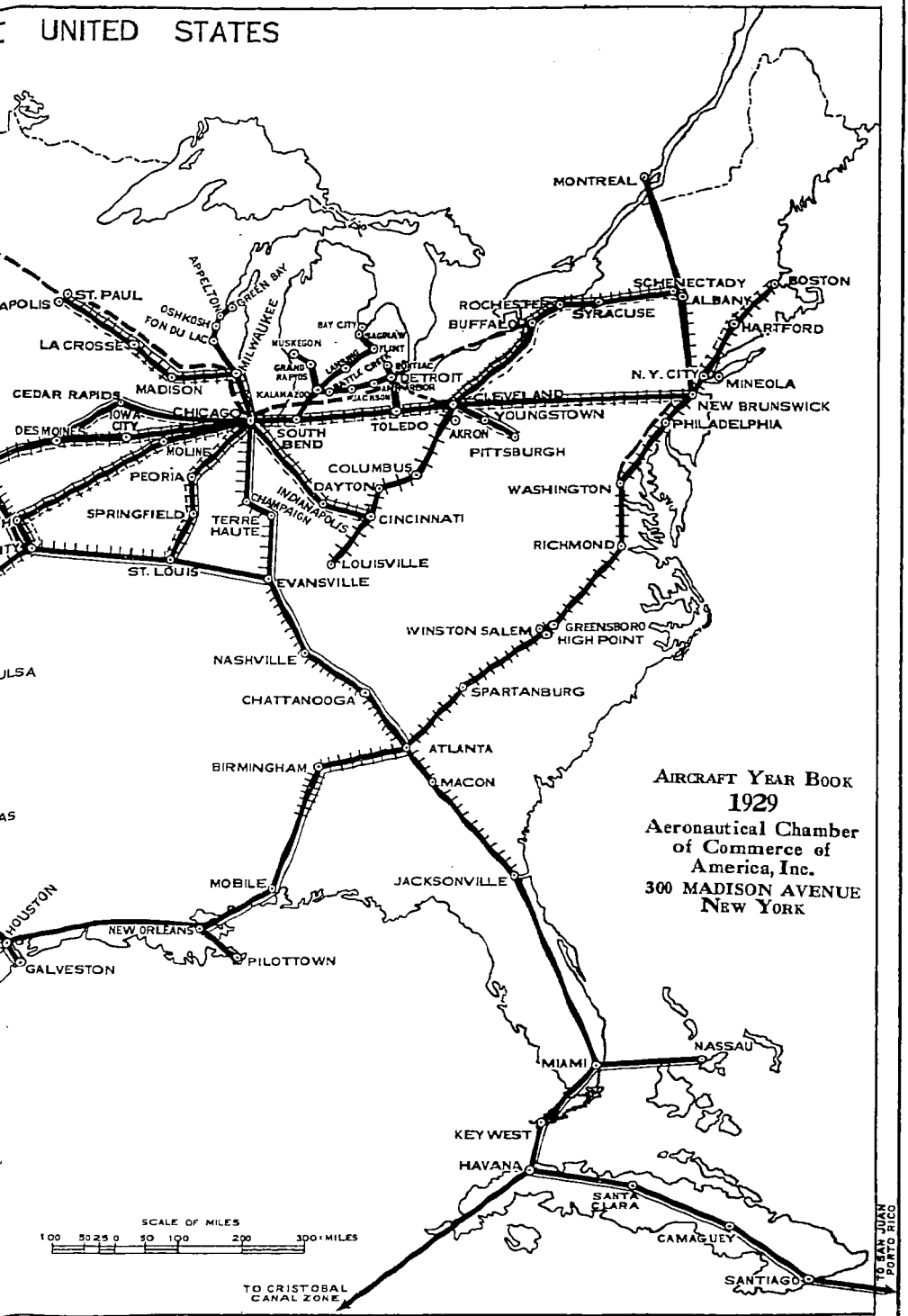
Midwest Airways, Inc., started operations Nov. 12, 1928, with 2 Ryan Broughams, *Whirlwind* powered, carrying passengers between Waterloo and Des Moines, Ia. Seventy-six passengers had been carried at the end of the year, with 7,030 miles of flying.

Mutual Aircraft Corporation operated a day and night passenger service between Los Angeles and San Francisco, using 4 Ryan Broughams and employing 5 pilots. In 1928 Mutual carried 2,350 passengers and 132,645 pounds of express.

Northwest Airways, Inc., on Sept. 1, 1928, established the first coördinated air-rail service; the railroads associated in that pioneering enterprise being the Great Northern, Northern Pacific, Chicago, Milwaukee, St. Paul & Pacific, the Pennsylvania and the Baltimore & Ohio. Northwest Airways operates between the Twin


AIRWAY MAP OF THE
VICTORIA
SEATTLE
TACOMA
CHEHALIS
WINNIPEG
PORTLAND
PASCO
GREAT FALLS
HELENA
BUTTE
FARGO
BOISE
MEDFORD
POCATELLO
CORNING
ELKO
ROCK SPRINGS
RENO
SALT LAKE CITY
CHEYENNE
OMAHA
SACRAMENTO
NORTH PLATTE
OAKLAND
SAN FRANCISCO
LINCOLN
DENVER
FRESNO
COLORADO SPRINGS
PUEBLO
KANSAS C
WICHITA
BAKERSFIELD
LAS VEGAS
PONCA CITY
LOS ANGELES
WILMINGTON
AVALON
OKLAHOMA CITY
SAN DIEGO
PHOENIX
TUCSON
FORT WORTH
WACO
AUSTIN
SAN ANTONIO
LAREDO
TO MEXICO CITY
AIRWAY UNDER MAIL CONTRACT
AIRWAY UNDER MAIL CONTRACT BUT NOT YET OPERATING
AIRWAY ON WHICH MAIL CONTRACTS ARE ADVERTISED OR PENDING
EXPRESS
PASSENGERS
CARRIED ON CONTRACT AIRMAIL ROUTES
PASSENGER OR EXPRESS ROUTE OR BOTH (NO MAIL CARRIED)
PORTIONS TO BE LIGHTED BY JUNE 30, 1929
LIGHTED PORTIONS DEC. 31, 1928

JO. 1929


UNITED STATES
MONTREAL
ROCHESTER
BUFFALO
SYRACUSE
SCHENECTADY
ALBANY
BOSTON
HARTFORD
N. Y. CITY
MINEOLA
NEW BRUNSWICK
PHILADELPHIA
CLEVELAND
YOUNGSTOWN
AKRON
PITTSBURGH
TOLEDO
DETROIT
BAY CITY
SAGINAW
FLINT
MUSKEGON
GRAND RAPIDS
LANSING
BATTLE CREEK
PONTIAC
ANN ARBOR
JACKSON
KALAMAZOO
APPLETON
GREEN BAY
MILWAUKEE
OSHKOSH
FON DU LAC
LA CROSSE
ST. PAUL
APOLIS
MADISON
CEDAR RAPIDS
CHICAGO
IOWA CITY
DES MOINES
MOLINE
SOUTH BEND
PEORIA
COLUMBUS
DAYTON
INDIANAPOLIS
CHAMPAIGN
SPRINGFIELD
TERRE HAUTE
CINCINNATI
LOUISVILLE
ST. LOUIS
EVANSVILLE
WASHINGTON
RICHMOND
WINSTON SALEM
GREENSBORO
HIGH POINT
NASHVILLE
CHATTANOOGA
SPARTANBURG
ATLANTA
BIRMINGHAM
MACON
MOBILE
JACKSONVILLE
NEW ORLEANS
PILOTTOWN
GALVESTON
NASSAU
MIAMI
KEY WEST
HAVANA
SANTA CLARA
CAMAGUEY
SANTIAGO
TO SAN JUAN PORTO RICO
TO CRISTOBAL CANAL ZONE
SCALE OF MILES
100 50 25 0 50 100 200 300 MILES
AIRCRAFT YEAR BOOK
1929
Aeronautical Chamber of Commerce of America, Inc.
300 MADISON AVENUE
NEW YORK

Cities and Chicago, approximately 350 miles. Tickets are on sale at the railroad offices. Passengers transfer from rail to air at Minneapolis, St. Paul and Chicago. The air service uses 2 Ford trimotored *Wasp* powered ships, covering the distance in 3 hours and 16 minutes eastbound and 3 hours 30 minutes westbound.

Northwest Airways operates two other lines, one with 2 Hamilton all-metal planes flying passengers and express between the Twin Cities and Chicago by way of La Crosse, Madison and Milwaukee. The other using Stinson planes carries passengers between Milwaukee and Green Bay, Wis., by way of Fond du Lac, Oshkosh and Appleton.

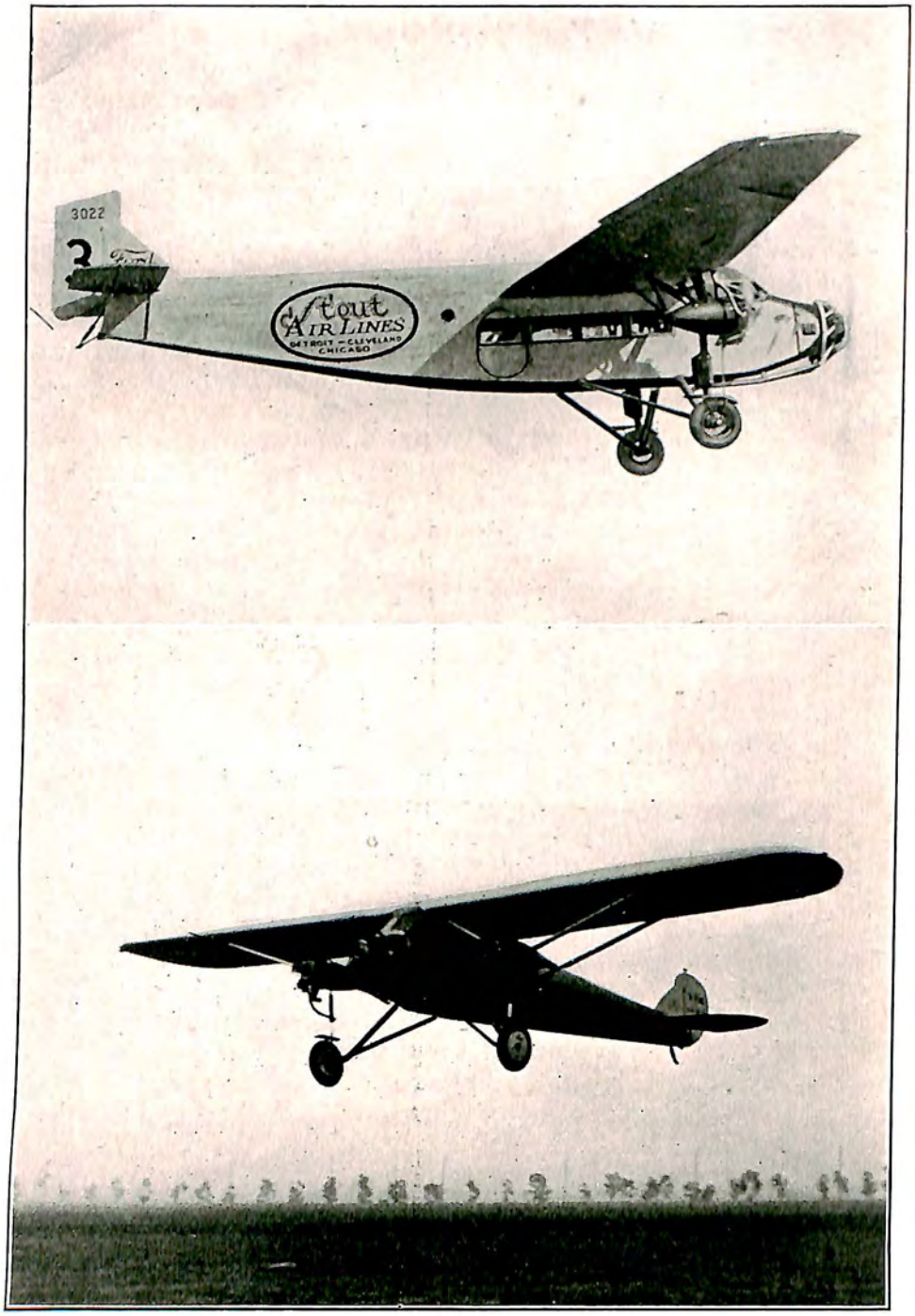
All three of the Northwest Airways lines carry passengers, mail and express. In 1928 its C.A.M.-9 service between Chicago and the Twin Cities flew 57,104 pounds of mail, and with the other lines carried 6,145 passengers and 2,664 pounds of express.

National Air Transport, Inc., operating C.A.M. routes 3 and 17, New York-Chicago and Chicago-Dallas respectively, had a fleet of 30 planes and as many pilots in 1928, carried 977,964 pounds of mail, 70,122 pounds of express and 1,256 persons, though the passenger service was discontinued on Oct. 1 owing to the heavy increase in the volume of mail.

On Feb. 1, 1928, N. A. T. shifted from a day to a night schedule on the Chicago-Dallas route, thereby saving a business day in the dispatch of mail and express between the Southwest and points on the transcontinental airway east and west of Chicago. A new daylight service was also started between Chicago and Kansas City, Mo. On June 4, N. A. T. mail and express planes started flying between Toledo and Detroit making connections with Chicago-New York overnight plane schedules. The next month N. A. T. started mail and express service between Ponca City and Tulsa, Okla. With that additional service N. A. T. increased its scheduled 24-hours mileage from 4,818 at the end of 1927 to 6,000 miles on Dec. 31, 1928. During the year N. A. T. planes were in the air 23,581 hours, 45.7 per cent of that time flying at night. They flew 2,248,069 miles.

New planes acquired in 1928 included 8 Curtiss *Falcon* mail ships for the Southwestern Division. They averaged a speed of 144 miles an hour. N. A. T. planned to add to its New York-Chicago route in 1929 a fast passenger service with planes carrying more than a ton of paying load.

National Parks Airways operated C.A.M.-26 between Salt Lake City and Great Falls, Mont., using 3 Fokkers and 2 Stearmans. From the start of operations on Aug. 1, 1928, until the end of



(Top) Stout passenger transport. (Bottom) Kreutzer *Aircoach.*

the year the line carried 752 passengers and 18,752 pounds of mail.

Pacific Air Transport, part of the Boeing System, but in 1928 operating as a separate unit, used 6 Boeing planes and during the year carried 117,658 pounds of mail over the C.A.M.-8 route between Seattle and Los Angeles, with 20,319 pounds of express and 1,484 passengers in a total of 703,542 miles of flying.

Pitcairn Aviation, Inc., began operations over C.A.M.-19, between New York and Atlanta on May 1, 1928, with 8 Pitcairn *Mailwing* planes. Air mail poundage increased rapidly, and 8 new Pitcairn *Super-Mailwings* were added to the fleet. In eight months of operations Pitcairn carried 85,153 pounds of mail between New York and Atlanta and on Dec. 1 had started operating the Atlanta-Miami route, C.A.M.-25. The Pitcairn mail pilots flew a total of 369,417 miles, completing 94 per cent of their schedule.

Pan-American Airways, Inc., operating F.A.M.-4 between Key West, Fla., and Havana, Cuba, on Sept. 1 moved its northern terminal to Miami. During the year it carried 345,725 pounds of mail and 1,184 passengers, with 118,868 miles of flying. Four planes were employed in the service. On Nov. 9 Pan-American Airways started a mail and passenger service between Miami and Nassau, Bahamas.

Robertson Aircraft Corporation operated between St. Louis and Chicago and St. Louis and Kansas City. Its C.A.M.-2 line between St. Louis and Chicago transported 56,300 pounds of mail in 1928. The Robertson passenger planes carried 2,492 persons on the two routes. Late in the year the company was consolidated with the Universal Air Lines System.

Standard Airlines, Inc., operating between Los Angeles, Phoenix and Tucson, Ariz., with 4 planes carried 1,003 passengers and 2,000 pounds of express in 154,000 miles of flying during the year. Air-rail connections were made with the Texas & Pacific railroad by which passengers between Los Angeles and New York might make the trip in 70 hours instead of the all-rail time of 81 hours. To carry out that program Standard Airlines proposed early in 1929 to extend its service to El Paso, Tex.

Stout Air Services, Inc., with four Ford-Stout tri-engined all-metal monoplanes and one Fairchild monoplane operated its passenger service between Detroit and Cleveland, Detroit and Chicago. During the year 5,640 passengers were transported between terminals, with 161,775 miles of flying.

Texas Air Transport, Inc., operating C.A.M. routes 21 and 22, Dallas-Galveston and Dallas-Laredo, carried 61,491 pounds of mail

in 1928, and with 7 planes in service flew 363,584 miles. The company planned to open eight new passenger lines in 1929.

Thompson Aeronautical Corporation, of Cleveland, operated C.A.M.-27 route between Bay City, Pontiac, Muskegon and Chicago. Beginning in July, 1928, its planes carried 70,254 pounds of mail with 147,597 miles of flying.

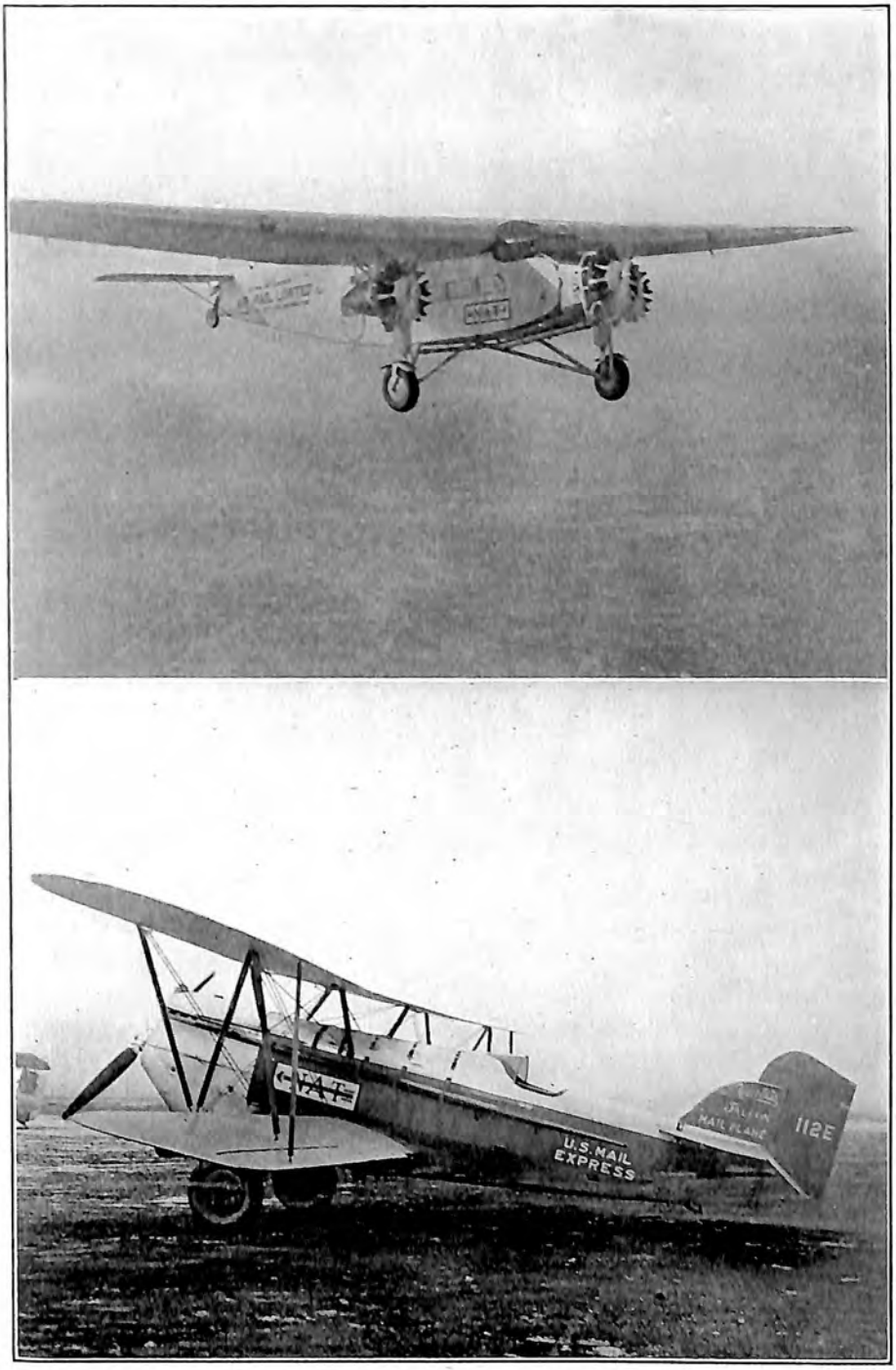
Transcontinental Air Transport, Inc., was formed in May, 1928, as a Delaware corporation. The principals included groups of men associated with the Curtiss Aeroplane & Motor Company, the Wright Aeronautical Corporation, both manufacturers of aeronautical equipment, Blair & Company, bankers, New York City; the Pennsylvania Railroad, the National Air Transport, Inc., and also an important group of bankers and business men in St. Louis, headed by H. B. Knight and Harold M. Bixby. These groups and other individuals and groups associated with them provided for the underwriting of T. A. T. for $5,000,000 capital.

The following are directors: Harold M. Bixby, Henry Breckinridge, Howard E. Coffin, J. Cheever Cowdin, Chester W. Cuthell, Thomas Dysart, Thomas B. Eastland, J. L. Eysmans, Fred Harvey, Paul Henderson, Richard T. Hoyt, Leonard Kennedy, C. M. Keys, Harry B. Knight, Charles L. Lawrance, Walter Marvin, William B. Mayo, Earle H. Reynolds, Daniel M. Sheaffer, James C. Willson, William H. Vanderbilt. The officers are: C. M. Keys, president; Paul Henderson, vice-president; Henry G. Hotchkiss, secretary, and J. A. B. Smith, treasurer. The executive offices are in New York.

The directors provided for a technical committee, to which all questions of a technical nature are referred before decisions are made. This committee includes Col. Charles A. Lindbergh, chairman, C. S. Jones (Casey Jones), William B. Mayo, chief engineer of the Ford Motor Company and Major Thomas G. Lamphier, until recently commander of the First Pursuit Squadron.

Transcontinental Air Transport was organized for the purpose of establishing an air-rail service between New York, Los Angeles and San Francisco. The first several months' activity were spent in a detailed survey by the technical committee to determine a flying route. Then T. A. T. decided that its initial service should be in coöperation with the Pennsylvania and the Santa Fe railroads, with passengers traveling by train at night and by plane during the day.

The rail portion of the service was to be between New York and Columbus and between Waynoka, Okla., and Clovis, N. M. The air service between Columbus and Waynoka, Okla., was to have intermediate stops at Indianapolis, St. Louis, Kansas City, Mo., and



(Top) National Air Transport air mail plane on New York-Chicago route.
(Bottom) Curtiss *Falcon* mail plane used by National Air Transport.

Wichita, Kan. Between Clovis, N. M., and Los Angeles and San Francisco, intermediate stops were to be located at Albuquerque, N. M., Winslow and Kingman, Ariz.

During the latter months of 1928 the activities of the company were principally those of making plans for the construction of proper landing fields, radio and weather stations, passenger stations, hangars and other technical equipment. By the end of the year all construction was under way. Operations were to start in May, 1929. Ten specially equipped Ford transports were to be used in the service at first.

Universal Air Lines, Inc., on Sept. 15, 1928, started a day and night passenger service between Cleveland and Chicago. With 5 planes and 25 employees, including 5 pilots, it carried 425 persons in 28,800 miles of flying during the last three and a half months of the year. On Dec. 31 Universal absorbed Northern Air Lines and Robertson Aircraft, the new organization becoming Universal Air Lines System. Northern Air Lines had started operations Aug. 16, 1928, flying passengers between Chicago and the Twin Cities. Operations of Robertson Aircraft have been previously noted in this chapter.

Varney Air Lines operated C.A.M.-5 route between Salt Lake City and Pasco, Wash., and carried 112,838 pounds of mail, with 393,280 miles flown in 1928. Nine airplanes were used, 5 Stearmans and 4 Swallows, all *Whirlwind* powered. Employees numbered 27, including 7 pilots.

Western Air Express in 1928 operated C.A.M.-4 and 12 between Salt Lake City and Los Angeles and between Cheyenne and Pueblo, Col. With passenger, mail and express planes its fleet numbered 25, including 9 Fokkers, 7 Douglas, 4 Stearmans, 1 Lockheed, 1 Sikorsky Amphibian and 3 H52L flying boats. The number of employees was 143, including 18 pilots. During the year Western Air Express carried 374,628 pounds of mail, 97,025 pounds of express and 6,014 passengers on its regular routes, with 622,755 miles of flying on schedule.

Continental Air Lines began operations late in the year between Louisville, Ky., and Cleveland, C.A.M.-16 route. With 4 planes Continental carried 21,354 pounds of mail in 121,000 miles of flying between Aug. 1 and Dec. 31, 1928.

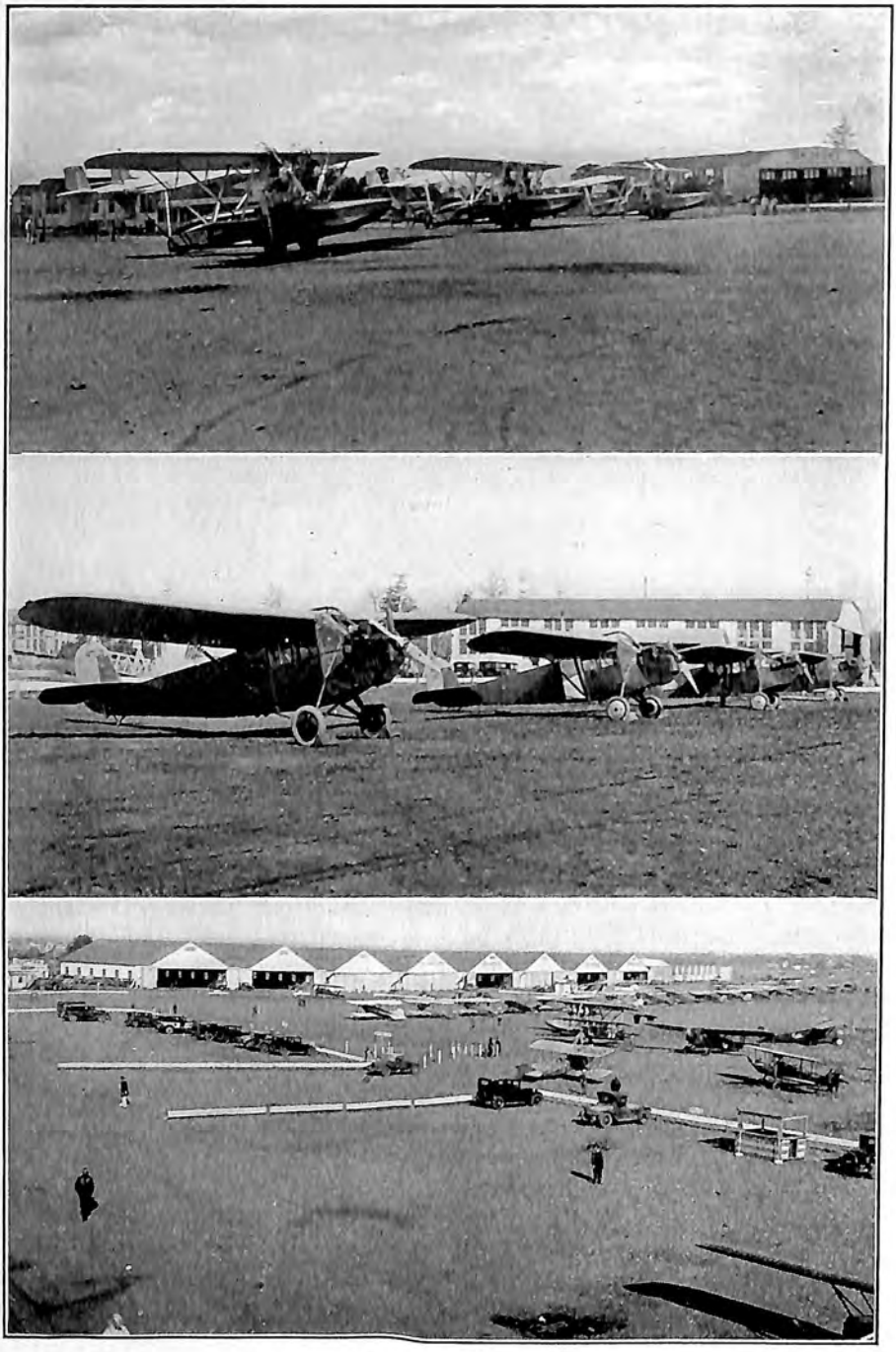
West Coast Air Transport Co. operated a daily passenger service between Seattle, Portland and San Francisco. Eight tri-motored cabin planes were used. They carried 4,946 persons in 1928, with 210,604 miles of flying.

Besides the two foreign mail lines, one to Montreal and the other

Ford tri-motored plane carrying 14 passengers over Pittsburgh, Pa.

to Havana, two short routes were operated under F.A.M. contracts to expedite mail between ocean liners and the shore. One was F.A.M.-2 between Seattle and Victoria, B. C. More than 58,817 pounds of mail were flown over that route in 1928, the other, between New Orleans and Pilottown at the mouth of the Mississippi, accounted for 80,706 pounds of mail.

New foreign mail routes projected and which were to be in operation early in 1929 include one from Brownsville, Texas, to Vera Cruz or Mexico City, and another from Cristobal, Canal Zone, via Buenaventura and Tumaco, Colombia, Guayaquil, Ecuador, Lima, Peru, to Santiago, Chile.



(Top) Sikorsky amphibians. (Center) Fairchild cabin monoplanes. (Bottom) Curtiss Flying Service fleet at Curtiss Field, Garden City, N. Y.

CHAPTER IV

AERIAL SERVICE

A SURVEY of aerial service operations—meaning all activities which may not be properly classified as scheduled transport or private flying—was made by the Aeronautical Chamber of Commerce for the calendar year 1928.

It reveals that while aerial service organizations have been decreasing numerically, they have been growing rapidly in all other ways. They have developed better facilities, found more profitable employment for their machines and a steadily growing number of patrons. The summary of reports for three years shows that in 1928 less than half the former number of organizations, with only two-thirds of the equipment, carried more persons into the air and accomplished more miles of flying than during the preceding year.

Aerial Service Summary

	1926	*1927*	*1928*
Operators Reporting	420	357	168
Planes in Service	969	768	489
Miles Flown	7,656,492	8,341,517	8,411,889
Passengers Carried	380,201	476,724	526,203

California, the reports indicate, had twice the aerial service of any other State. Fifty-six planes employed solely in aerial taxi, sightseeing, photography, and other work not conducted on regular schedules, took up 74,727 persons and flew a total of 1,386,718 miles. Illinois was second, with 48 planes carrying 39,182 passengers and flying 684,957 miles. Michigan was third, with 26 airplanes, 20,890 passengers and 399,434 miles of flying.

Almost without exception those operators remaining in business at the end of 1928 had expanded their organizations and had invested substantial blocks of new capital in new airplanes, enlarged buildings and other service facilities. In no instance did an operator report a loss or decrease in revenues. A majority reported increases ranging from 50 to 300 per cent over 1927.

Two-thirds of the operators were conducting flying schools with students numbering from 25 in the smallest communities to 300 in the larger cities. A number of the operators had merged their interests and were doing business under new names. Others

(Top) Hamilton Cabin Metalplane, Pratt and Whitney *Wasp*. (Bottom) Ireland Amphibian, Wright *Whirlwind*.

had recently become units in reorganized companies with programs for expansion throughout the country. Many had become specialists; instead of doing an aerial hacking business ready at all times for any kind of emergency work, they were confining operations to photography, local sightseeing or the chartering of machines for special parties. While admitting that this reduced gross revenues, they explained that the net returns were much larger.

An instance of expansion was the reorganization of the Curtiss Flying Service, which in the past had confined operations to its field at Garden City, N. Y. It was reorganized in 1928 to permit doing business on a national scale. It launched a program of expansion calculated to establish Curtiss Flying Service in 25 large cities in the United States. At the end of the year several fields were in operation.

Marked increases were reported in all phases of its work. The total flying mileage advanced from 320,000 in 1927 to 560,000 in 1928, and hours flown from 4,169 to 7,567. The number of passengers increased from 10,000 to more than 17,000, and the number of students enrolled in the school, from 225 to 304. Of these 189 soloed. The total income for the year reflected the increased activity. It was more than $300,000, a gain of approximately 24 per cent over that of 1927.

The company's total flying time of 7,567 hours was divided as follows:

Instruction	3,642 hours
Passenger Flights	895 hours
Photography	293 hours
Cross Country	1,592 hours
Student Solo	670 hours
Testing and Miscellaneous	475 hours

A fleet of 22 planes of various types was used in the work. In order to have planes always available the Curtiss Flying Service maintained a staff of 11 pilots and a ground crew of about 50 men.

One of the unusual flights during the year was that made by William Winston, manager of Curtiss Field. With a party of news reel photographers he flew to Greeneley Island where the *Bremen* was stranded. Leaving Garden City in a Fairchild cabin monoplane, Winston made the trip in two stages, stopping enroute at Murray Bay, Ontario. On the way he encountered bad weather and was forced to fly blindly. However, he succeeded in locating and landing on Greeneley Island, and in bringing back the photographers and their pictures without mishap.

Other flights were made to distant parts of the United States,

including Los Angeles, Seattle, and Miami. One of several trips to Miami was made in less than 12 hours. Doctors, bankers, reporters and business executives were transported swiftly and without delay to their destinations when other means of transportation proved inadequate.

In addition to providing emergency cross-country transportation, activities of the Curtiss Flying Service included carrying passengers on short sight-seeing flights, crop dusting, aerial photography and mapping, and elementary and advanced flight instruction. Over 15,000 passengers were taken on short trips in the vicinity of Curtiss Field. One orchard dusting operation was conducted in Maine and another one on Long Island. Hundreds of square miles of territory were mapped from the air, some from altitudes of 16,000 and 18,000 feet. When the *Graf Zeppelin* arrived in America 15 Curtiss Flying Service planes carrying reporters and photographers were sent out at one time to meet her. Flight-testing operations were also conducted for the Curtiss Aeroplane & Motor Company.

The program of expansion for Curtiss Flying Service contemplates for its branches in each city fast emergency transportation, complete courses of flight instruction, airplane sales and service. Each unit is to be equipped with new ships for student training and cross-country flying. Storage facilities for transient airplanes will be made available and a complete stock of airplane and engine parts will be maintained. A force of trained mechanics will also be available for repairs and overhauls.

Pitcairn Aviation, Inc., besides operating scheduled air mail routes, expanded its activities in 1928 to include five separate aerial service corporations; at Willow Grove, Pa., Richmond, Va., Greensboro, N. C., Spartanburg, S. C., and Atlanta, Ga.

As evidence of what might be accomplished by a highly organized service operating the most modern equipment Pitcairn Aviation during the year carried 15,124 passengers and trained 344 student aviators. Having available 25 planes especially for that work it was possible for Pitcairn to maintain a thoroughly efficient repair and overhaul schedule which assured a perfect record of safe flying for the year.

The Embry-Riddle Company, operating at Lunken Airport, Cincinnati, O., was another of the many concerns which might be cited as examples of the transformation of aerial service. That organization turned out 200 aviators in 1928 and carried 6,300 passengers on a variety of missions. With Fairchild Aerial Surveys the Embry-Riddle planes flew on a photographic survey of the Cum-

(Top) Ryan *Brougham.* (Center) Velie *Monocoupe.* (Bottom) Fokker *Universal.* All three equipped with Edo floats.

berland River Valley. That work resulted in 3,570 square miles of mapping to be used by the War Department in its flood control program.

Gray Goose Air Lines operating at the Chicago airport accomplished 107,480 miles of sightseeing flying in 1928, and carried 8,932 passengers. Yellow Air Lines, of Spokane, Wash., was organizing its short line service to the coast. Spokane is 12 hours from the coast by train; by air it is 3½ hours. Travelers, either eastbound or westbound, can save a business day by flying between Spokane and the western terminals.

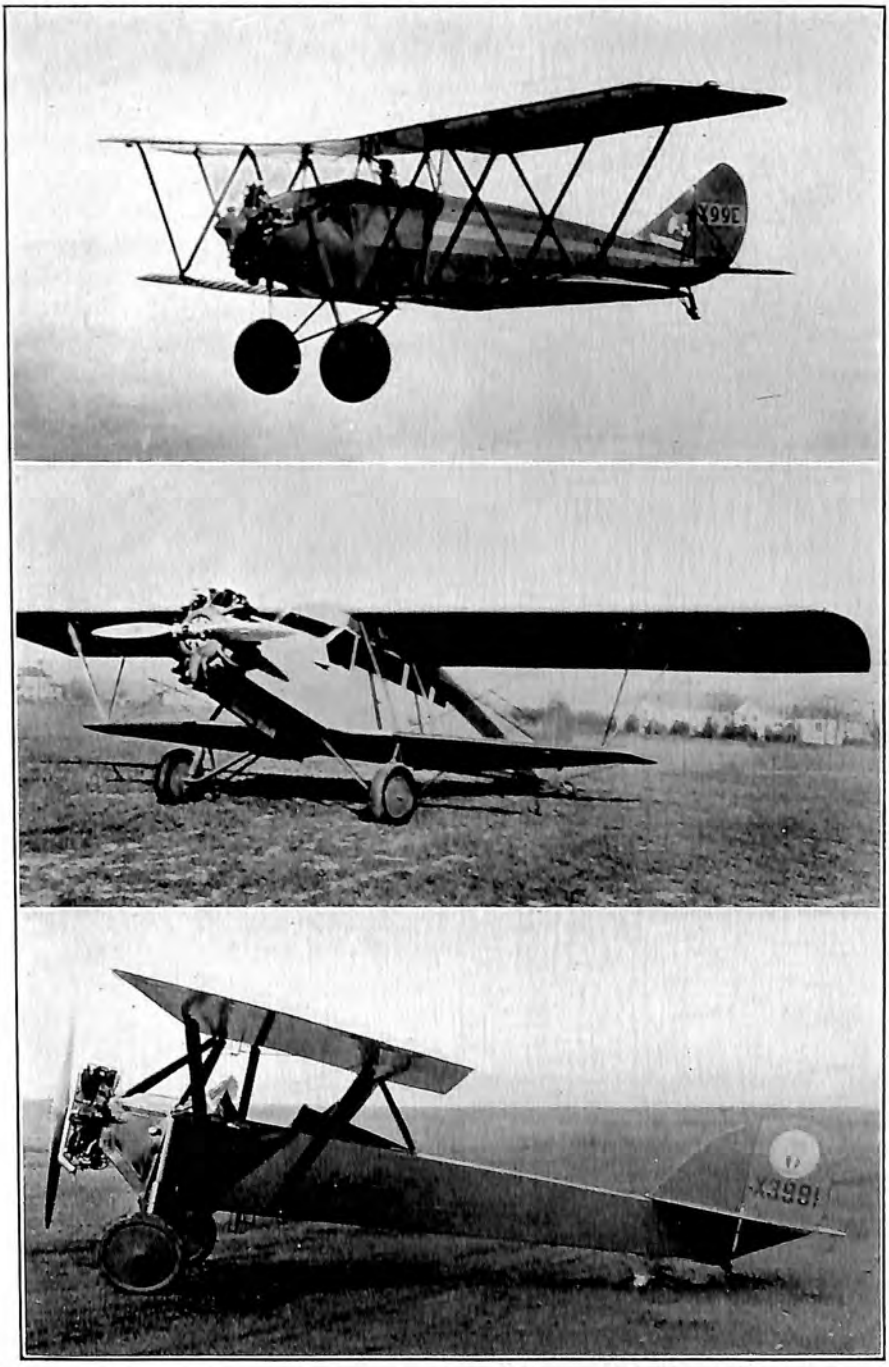
Late in the year it became apparent that a number of the aerial service operators were developing feeder lines to the trunkline air transport systems. Flying on a daily schedule between cities 50 to 200 miles apart these aerial bus lines carried passengers and express into the junctions on the long routes. Rates for passengers ranged between 10 and 50 cents a mile; while sightseeing flights cost anywhere from $2.50 to $25, depending upon the locality and the extent of the trip.

Rates for aerial service were not generally reduced during the year; and this was explained by the fact that the operators had acquired new and relatively expensive equipment and were writing it off as rapidly as possible. This was sound business though it marked a departure from the old "hay-wire days" of barnstorming, gipsy flying and shoe-string operations.

One and two-man organizations once purchased cast-off war machines and engines at bargain prices and flew them without much thought of repairs. Even in 1928 the larger, more ably managed and adequately financed operators, when absorbing the small concerns often found them without an accounting system, occasionally without bank accounts, and invariably at an utter loss to place a fair price on their business, simply because they did not know their operating costs and had no means of determining the depreciation.

Still there were scores of companies employing an average of 10 persons, including pilots, which in 1928 flew thousands of miles on missions peculiar to aerial service and which only the airplane could carry out with success. They equipped their private fields for night flying and answered calls every hour of the twenty-four.

Important documents were delivered to ships at sea and on the Great Lakes. Hunting parties were flown into remote places in the Northwest. Fishing parties were taken into the high Sierras. Passengers on disabled ships were taken off. Bandits were pur-



(Top) American Eagle sport biplane. (Center) Buhl *Airsedan, Whirlwind.* (Bottom) Elias *Aircoupe.*

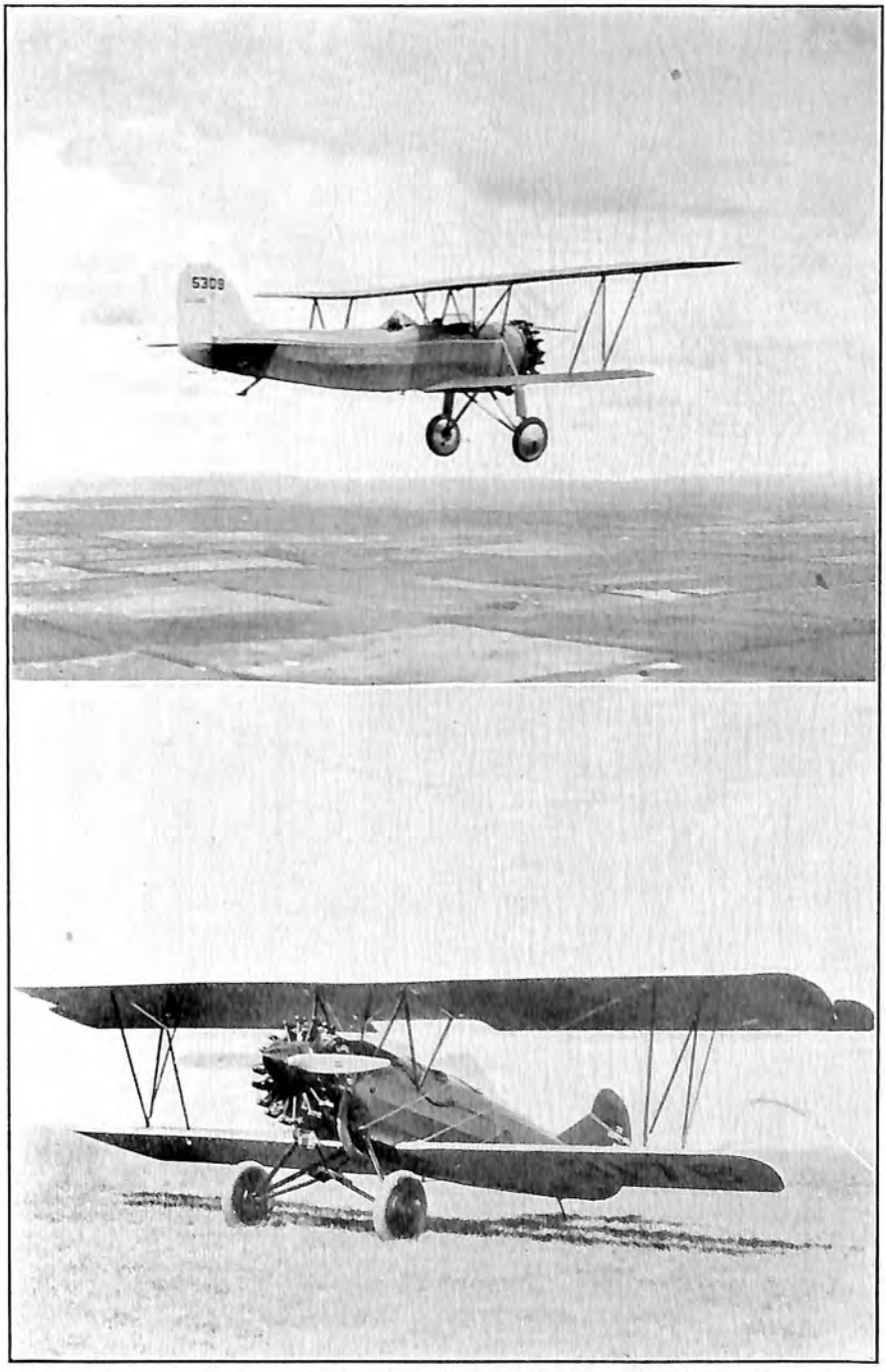
sued in the air, and caught. Seed was planted from airplanes. Crops were sprayed and dusted.

Newspapers were delivered to outlying towns when heavy snow halted surface transport. Doctors were carried across country to patients and patients were taken to hospitals. Aerial photographs were made of hundreds of important events and others, taken on the ground, were distributed by plane that they might be published while possessing news value. Prisoners were taken to jail by plane to avoid crowds and possible rescue. More than a thousand big concerns employed planes for aerial advertising. One company alone transported more than two tons of emergency freight, all small parcels, at irregular intervals—tools needed for urgent repairs, instruments required in costly operations where time-saving was essential, special parts, clothing, perishable foods, flowers, seeds and medicines. Bootleggers catered to customers hundreds of miles distant. Border patrols were flown by State and Federal officers. County sheriffs and State police went up in the air, literally, on many occasions, and posses seeking lost persons or fugitives hired aerial service to study the terrain from above and report suspicious circumstances in swamps and other nearly inaccessible places.

Because the operators were equipping their service with new, larger, speedier and more efficient machines there were fewer accidents than in other years and public confidence was won for aerial service whereas in the past it had been reserved for the exceptionally few operators of known responsibility and the regular air transport lines.

The flying service branch of National Air Transport in 1928 carried 10,279 passengers off the airports along the route between New York and Chicago. Paul R. Braniff, Inc., with three planes took up 2,000 passengers at Oklahoma City. The Thompson Aeronautical Corporation, of Cleveland, with four planes carried hundreds of sightseeing passengers. R. S. Fogg at Concord, N. H., flew 70,000 miles and carried 3,000 passengers during the year. Fogg was one of the first aviators to fly to Greeneley Island during the *Bremen* episode.

Another reason for the falling off in the number of aerial service operators is found in the growing popularity of private flying. Business houses, sportsmen and others having continuous use for planes were once the best customers of aerial service. In 1928 they bought their own machines, and either hired pilots or learned to do the piloting themselves. So the operator found himself becoming more of a dealer in planes and the proprietor of a school. With him aerial hacking dropped into third place.



(Top) Stearman Sport, *Whirlwind.* (Bottom) Travel Air, *Whirlwind.*

(Top) Curtiss *Falcon* mail plane built for National Air Transport. (Center) One of the Interstate Airlines Fairchild passenger planes. (Bottom) R. S. Fogg's Sport *Waco, Whirlwind* powered, equipped with skis, at Concord, N. H.

One Ohio operator sold 47 planes to private owners in 1928. Another in Illinois sold 70 machines. The sale of spare parts and engines provided an ever-widening source of income. The old time—and it was less than 8 years ago—gipsy pilot housing his "Jenny" in a shed or tent became only a memory in 1928.

Progress in Aerial Photography

Because of the many remarkable developments in aircraft during 1928, aerial photography was somewhat overshadowed. Nevertheless, Fairchild Aerial Camera Corporation and Fairchild Aerial Surveys, Inc., made substantial progress in all branches of the business. A decided improvement both in photographic quality and in map accuracy was noted, costs were reduced and the demand for aerial oblique views and photographic maps spread until practically every large industry was using aerial photography for some important purpose.

One cause of improvement lay in the popularity of the high-wing cabin monoplane which has been found admirably suited to that work. The availability of this type of ship has shown results in better field work on the part of aerial photographers.

One of the main difficulties in the past was motion in the pictures. That has been largely eliminated because the operator is now able to keep his camera almost entirely out of the slipstream. Also the photographer working in comparative comfort is able to concentrate on his job. The stability of the ship has enabled him to secure pictures with much less tilt, which reflects not only in the accuracy of the finished map but also in the reduced cost. Photographic mapping with monoplanes, designed to give the pilot exceptionally good visibility, has resulted in much straighter flight lines, better overlap, quicker deliveries and a less expensive product.

Another important factor has been the new type precise altimeters. For several years the Fairchild company studied every type of altimeter. During the last few months of 1928 Fairchild was using altimeters so precise that in many instances fairly accurate photographic maps could be made without going through the expensive laboratory process of scale correction.

In 1928, the Fairchild company made further improvements in camera shutters and also developed a new method of focusing the camera. These two features combined have insured sharper negatives which also are of more uniform density.

The Eastman Kodak Company contributed to the advance of this branch of photography by putting out a new type of film. The emulsion of this latest film can be preserved for several months, a

decided advantage over that used in the past, which often was unsatisfactory after being in storage longer than a few weeks.

The Fairchild company perfected a new chemical formula for developing aerial negatives. That now adopted permits staining the negatives heavily. With it photographs may be taken during periods when the light is not very strong, as for instance early in the morning or late in the afternoon. Not only does this lengthen

Yosemite Valley, California, from an airplane.

the working day, but it also permits photographing certain buildings and territories which, because of their peculiar location, cannot be photographed from the proper viewpoint excepting at periods when the light would ordinarily not be strong enough to secure a good negative.

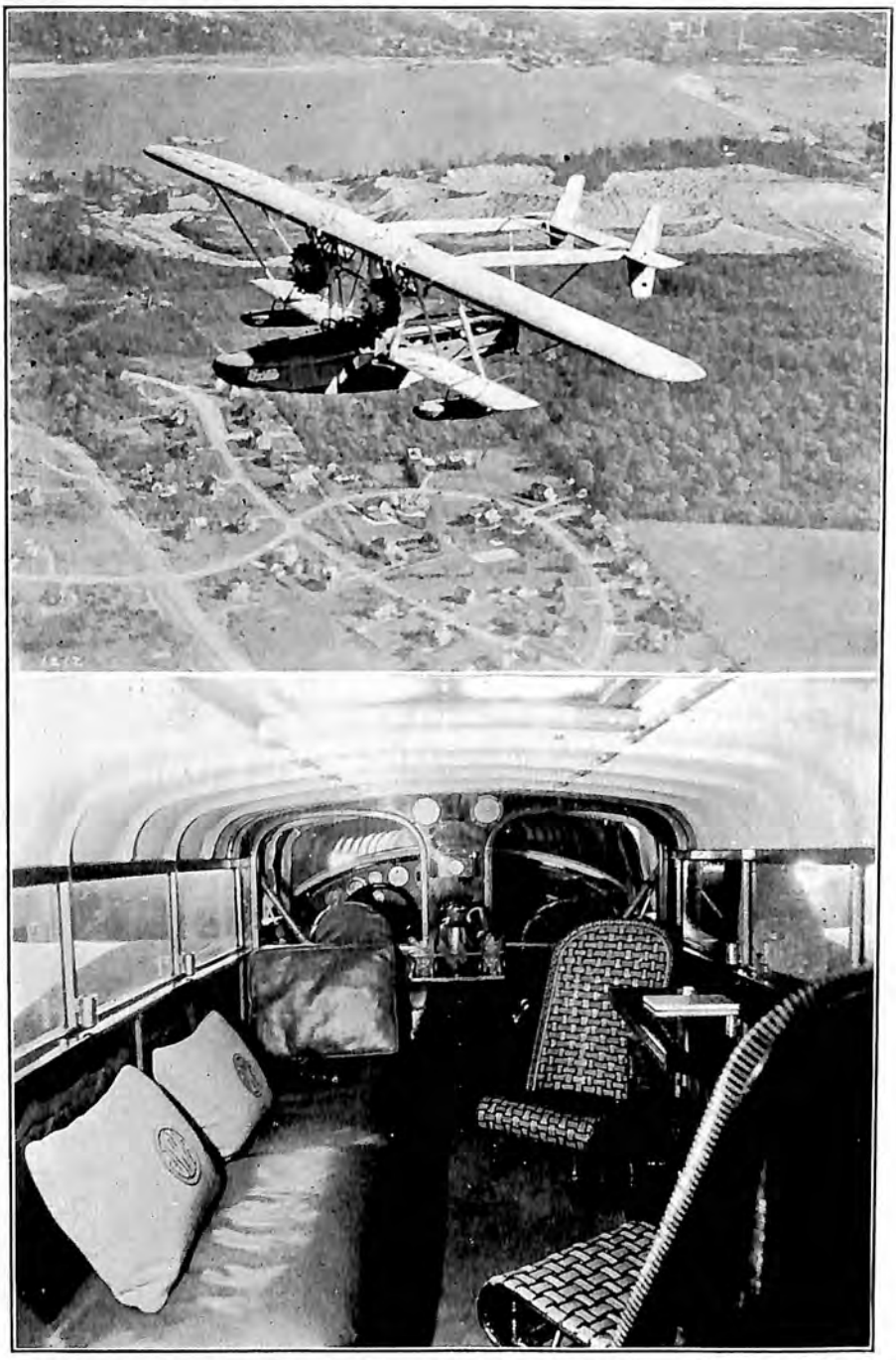
Tests were also made in controlling the expansion and contraction of photographic paper. It was found that by buying paper in quantities and running experiments to determine the amount of

The Capitol at Washington.—*Photograph by Fairchild Aerial Surveys, Inc.*

variation of that particular lot of paper that much more accurate allowances could be made for error.

During the year, multi-lens cameras became available commercially. Only a small start was made in the strictly commercial application of that form of aerial surveying, but as it will permit the photographing of large areas for as little as 5 dollars a square mile, it promises much. It opens a field for reconnaisance maps in all remote territories; for example, the thinly inhabited sections of the United States, vast areas in Mexico and Central America.

Besides Fairchild Aerial Surveys other companies engaged in extensive aerial photographic work in 1928 included Hamilton Maxwell, Inc., of New York. Mosaic maps were made of sections throughout the country.



(Top) Sikorsky Amphibian, twin *Wasp* engines. (Bottom) Interior of Sikorsky Amphibian.

CHAPTER V

PRIVATE FLYING

INCREASE in public airports, improved planes and engines, better service and repair facilities in every State and the growing popularity of aircraft both for sport and as the quickest means of reaching a destination were responsible for the unprecedented developments in private flying during 1928.

At the end of the year the Aeronautics Branch of the Department of Commerce listed 4,844 planes either licensed or with licenses pending. Of that number approximately 3,000 were privately owned, either by individuals or corporations using them on company business.

They did not include the private machines—believed to be relatively few—owned by those who chose to confine all their flights within the boundaries of their own States rather than take out Federal licenses permitting interstate flying.

Lindbergh Travels Only in the Air

Col. Charles A. Lindbergh was America's most conspicuous user of the airplane in 1928. He flew a total of 65,000 miles during the year, spent about 800 hours of that period in the air and carried with him as companions and passengers 1,500 men, women and children. Since his epochal non-stop flight from New York to Paris in May, 1927, he had never used a train to reach his destination.

He landed in St. Louis, Mo., on Feb. 13, 1928, after a good-will flight beginning Dec. 13, 1927, at Washington, D. C., thence non-stop to Mexico City, to Guatemala, Belize, San Salvador, Nicaragua, Costa Rica, Colon, Panama, Colombia, Venezuela, Virgin Islands, Porto Rico, Santo Domingo, Haiti and Havana, Cuba. He flew his famous plane the *Spirit of St. Louis*. That trip alone gave him 9,060 miles of flying.

Lindbergh flew across the continent ten times in 18 months after the Paris flight. He kept business appointments in St. Louis, Chicago and St. Paul within a single day. He hunted in Mexico, toured the Rocky Mountains, visited associates in a score of cities and managed to find time to attend the official opening of many airports. He often flew miles out of his course to look over a special bit of scenery.

Lindbergh in his traveling clothes.

Arriving in New York from Washington one day in April he learned that serum then in New York might save the life of Floyd Bennett, stricken with pneumonia in Quebec, Canada. That day Lindbergh flew to Quebec with the serum. Not long afterward he explored the Grand Canyon from the air, dropping down into the gorge, 4,000 feet below the top of the walls. Meanwhile he was inspecting the proposed route for Transcontinental Air Transport, the air-rail service to be started between New York and Los Angeles in 1929.

Private flying received considerable impetus during the year in the formation of several country flying clubs near many of the larger cities. One of the major projects was the organization in October, 1928, of the Long Island Aviation Country Club, at Westbury, L. I. The officers were Charles L. Lawrance, president; Edward O. McDonnell, vice-president; and Chance Vought, secretary and treasurer. The board of managers included Reginald Langhorne Brooks, William Hale Harkness, Henry P. Davison,

William B. Leeds 2d, Oliver O'Donnell, George M. Pynchon, Jr., and James B. Taylor, Jr.

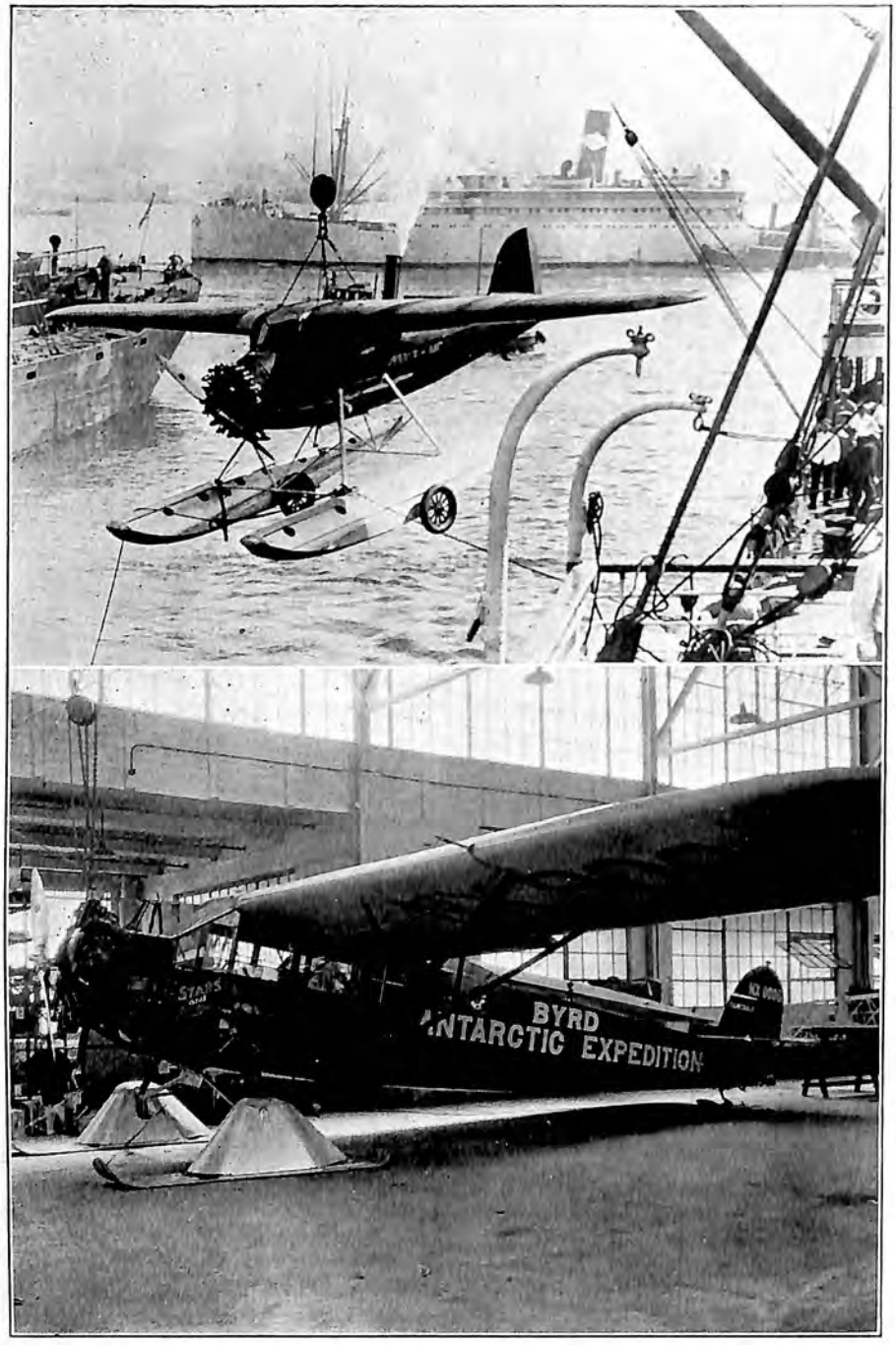
A national organization was formed for the purpose of fostering similar clubs in other cities, all related under the parent body known as Aviation Country Clubs, Inc. Other clubs were to be started in New Jersey, Westchester County, N. Y., and at Newport, R. I.

With the usual country club facilities a flying field and hangars for the planes of members and guests were to be established. A fleet of club machines was to be acquired and made available to members. Flying was to be taught by a club pilot-instructor.

Meanwhile, a number of country clubs throughout the country were beginning to take up flying, buy planes and hire pilots to create aviators among the members.

In 1928 thousands of persons learned that they might own a machine and fly it at relatively the same expense as that involved

Installing skis on Ford transport for Byrd Antarctic Expedition.



(Top) Lockheed Vega, *Whirlwind,* starts for the Antarctic with Wilkins Expedition. (Bottom) Fairchild plane, *Wasp,* equipped with Aerial Service skis for Byrd Antarctic Expedition.

in operating a good motor car. Light planes could be purchased for the price of a good car. Operating and maintenance costs were lower.

Manufacturers, encouraged by sales and future orders, prepared to supply a constantly growing market in 1929. They based their conclusions on reports of distributors.

Salesmen were buying planes that they might cover territory more quickly. The number of doctors using airplanes about as often as their car for professional calls was increasing steadily. Business men, weary of congested motor highways on the outskirts of the larger communities were becoming flying commuters. In districts with mountains or bad roads to make motoring tedious and difficult people were beginning to buy machines that they might fly from one place to another, by bee-line traveling instead of wasting hours, or days, detouring around natural obstacles. Timber companies, ranchers and planters were becoming good customers of the airplane dealers in several States.

More than a score of New York business men own flying boats and amphibians, and at least 200 others living in the vicinity of New York maintain their own planes for pleasure flights.

California, however, leads other States in private flying. New York ranks second, Illinois third and Michigan fourth. Texas is fifth because of the number of oil companies which maintain their own air service. Generally the Mississippi Valley has more private flying than any other section because of the flat country and relatively long distances between important centers.

The most striking instance of airplane operations confined to company business is found in the annual report of the Ford Motor Company's airline division. Throughout the year the company operated its own planes between the Ford Airport at Dearborn, Mich., and Chicago, Cleveland and Buffalo.

The Ford planes carried materials, tools, light parts and mail between important units of the company in the three cities. In 1928 they made 565 flights between Dearborn and Chicago, 304 between Dearborn and Cleveland and 444 between Dearborn and Buffalo.

All told, the three machines employed in the service flew 278,943 miles with only 39 forced landings—29 caused by weather and 10 by mechanical trouble.

Company freight carried in the planes aggregated 1,663,120 pounds. United States mail sent out by the company and flown in the freight planes amounted to 10,923 pounds. The planes put in 3,198 flying hours; and roughly, saved thrice that length of

time, which otherwise would have been lost, had the freight and mail traveled on the surface.

The Standard Oil Company of Indiana was another industrial corporation to report wide use of aircraft. The directors used a tri-motored plane while traveling on inspection trips, flying 84,000 miles in about 12 months. They made a trip from Chicago to Denver in 11 hours, from Chicago to St. Louis, to Kansas City, to North Platte and to Casper, Wyo., in 12 hours and 20 minutes.

Late in the year they made an inspection tour of the Texas oil fields, covering 2,900 miles in 33 hours flying time and completed in four and a half days a trip which ordinarily would have required nearly two weeks. Fifty to 80 per cent of the directorate flew at one time. The planes of the company flew 76,491 miles and carried 5,988 passengers in a year and a half.

The Richfield Oil Company of California set out to develop a market for its aviation fuels and lubricants, and commenced using planes for transportation and demonstration purposes. In 1928 the company operated throughout the Pacific Coast States and the Southwest, equipping airports with fueling systems and supply stations. In order to cover the territory it acquired three airplanes, a Fokker, a Stearman and a Waco. The Fokker was used for transporting company officials and was also placed at the disposal of the governors of California, Oregon and Washington for the entertainment of distinguished guests.

During the year the Richfield Company launched a program to erect 39 beacons in the Pacific Coast States. The three planes of the company flew more than 107,000 miles during the year.

The B. F. Goodrich Rubber Company uses planes in sales promotion work. The Chicago Daily News and the Des Moines Register-Tribune and a number of other newspapers have their own planes for speeding reporters and photographers to the scene of a story. The Parker Pen Company and the Celotex Company have planes for the transportation of executives. The Dominion Explorers, Ltd., use their own planes in transportation work. The A-C Spark Plug Company sends out rush orders in its plane and the salesmen often make hurried trips by air.

Among other business and industrial companies owning airplanes for routine work are the following:

The Allen Company of Chicago; Anhaeuser-Busch Company of St. Louis; Becker Roofing Company of Chicago; Central Electric Company of Fort Wayne, Ind.; E. B. Cole, Inc., of Peoria, Ill.; Continental Motor Company, Curtis Candy Company of Chicago; Firestone Tire and Rubber Company; Jello Company; Naturaline

Company of America; Pittsburgh Plate Glass Company; Remington-Rand Company; Royal Typewriter Company; Skelly Oil Company; Standard Oil Company of New Jersey; Standard Oil Company of California; Union Gas and Electric Company of Cincinnati; Union Trust Company of Detroit; Walgreen Drug Stores of Chicago; W. H. Company (chain of hosiery stores) of Tulsa, Okla.; Texas Company (oil) of New York; Eugene Dynner (realty) of New York; United Cigar Stores of New York; Marmon Motor Car Company, of New York; National Lead Battery Company; Wadhams Oil Company of Milwaukee, Wis.; Cleveland Pneumatic Tool Company; Roper Gas Range Company of Rockford, Ill.; National Association of Real Estate Boards of Culver City, Cal.; Elliott Core Drilling Company of Los Angeles; Reid, Murdoch & Company (groceries) of Chicago; Shaffer Oil & Refining Company of Chicago; A. W. Shaw Company (Magazine of Business) of Chicago; and Duplex Printing Press Company of Battle Creek, Mich.

Airplane anchorage on estate of Col. E. A. Deeds, at Dayton, O.

(Top) Advance Sport *Waco* planes, *Whirlwind* powered. Center) Aeromarine Klemm, Salmson engine, monoplane. (Bottom) Kreider-Reisner, Warner *Scarab*.

CHAPTER VI

MANUFACTURERS
AIRPLANES—ENGINES—ACCESSORIES

AMERICAN manufacturers built approximately 5,000 airplanes and 3,500 aircraft engines in 1928. They included 3,781 commercial and 1,219 military planes, 2,087 engines for commercial and 1,413 for military aircraft. The commercial airplane production was 140 per cent larger than in 1927, when 1,565 machines were built.

Reports covering 53 companies are embraced in the production figures for 1928. Of that number four companies were producing both airplanes and engines, 41 were making airplanes only and eight were confining their activities to engine-building. The output of the 53 plants represented all but a fraction, within 300 at the most, of the total airplane and engine production.

There were, perhaps, as many more plants which might be identified as airplane factories, but at the end of the year they either had built only one or two experimental planes or were perfecting plans for production. The *Aircraft Year Book* figures for 1927 show that only 30 plants reported production during that year. The additional 23 plants in 1928 represented nearly a twofold increase in American producing companies during the twelve months.

At the same time nearly all of the older companies expanded their manufacturing facilities from 25 to more than 100 per cent; and that must also be taken into account in any consideration of the growth of American production facilities in 1928.

Commercial production really covers only a seven-years period. In 1921 not a single strictly commercial machine was built, and the military output, then the sole source of income to the industry, reached the low level of 302 planes. The total value of aircraft and motors produced during that year was $5,000,000.

The retail market value of commercial planes and motors built in 1928 was in excess of $27,000,000, to which should be added $8,000,000 for the manufacture of spares and for experimental work. Military production and experimentation, it is estimated, accounts for $35,000,000 more, bringing the total for the industry in 1928 to more than $75,000,000.

Analysis of the commercial aircraft figures in 1928 reveals several interesting trends. Biplanes outnumbered monoplanes two to

one, there being 2,422 of the former and 1,079 of the latter. Of the biplanes the great majority were small open cockpit types, while a majority of the monoplanes were closed cabin machines. Of the multi-engined planes, there were 12 monoplanes built to each biplane produced.

The following are the comparisons of the 53 plants as reported:

Production of Commercial Aircraft, 1928

	Monoplanes	*Biplanes*
Open cockpit	171	2,348
Closed cockpit	850	69
Multi-engined transports	58	5
Total	1,079	2,422
Total retail value of above (less motors)	$8,738,683	$7,541,615

	Miscellaneous
Seaplanes	5
Flying boats	6
Amphibians	30
Total	41
Total retail value of above (less motors)	$914,000

Total monoplanes, biplanes and miscellaneous....3,542
Total retail value (less motors)....$17,194,298

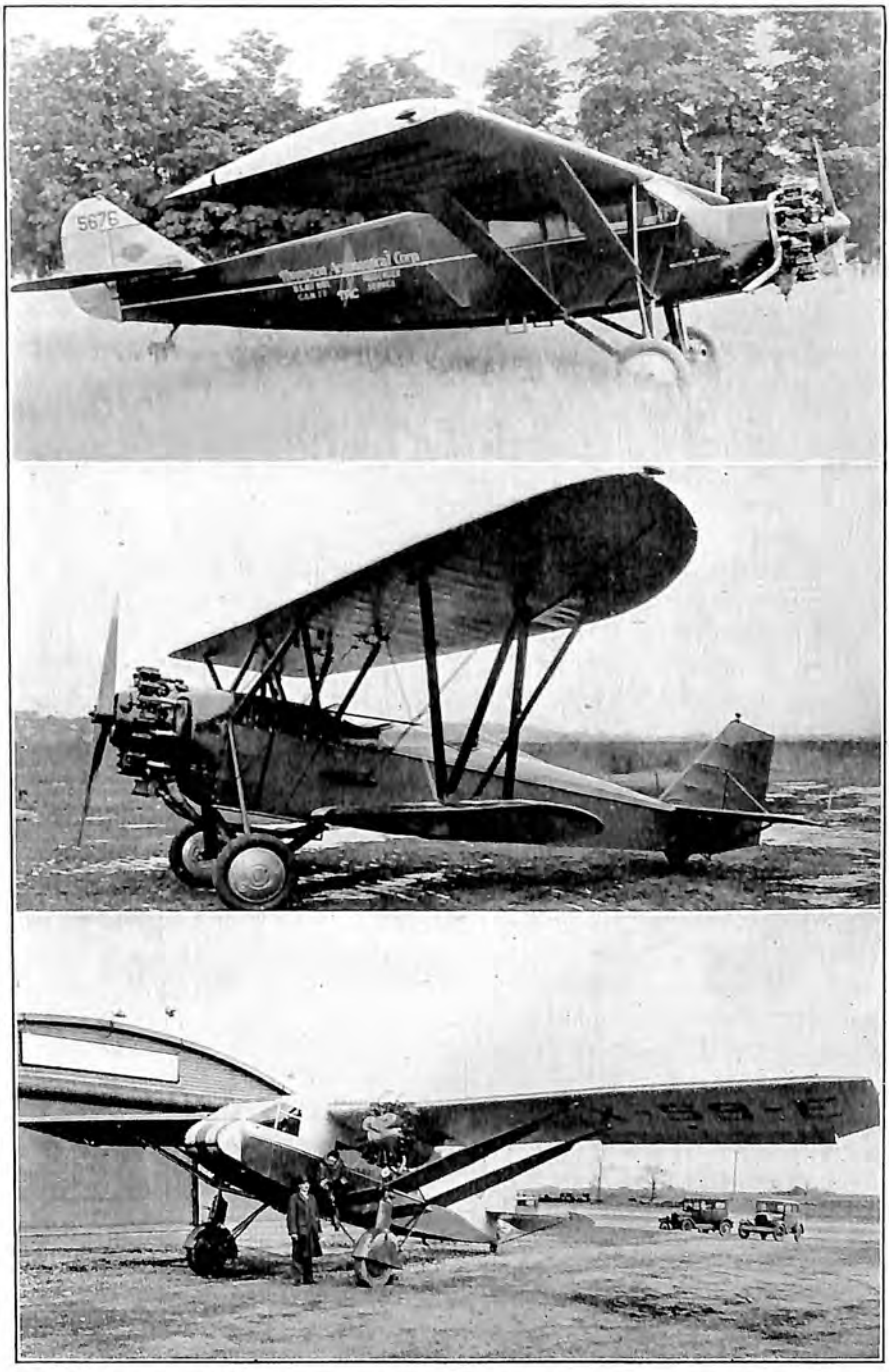
The 12 companies reported as making engines in 1928 cover the field. They show a commercial production of 1,850 having a retail value of $8,936,725.

That production was divided by rated horsepower, as follows:

Less than 50 horsepower, 32 engines.
50 to 100 horsepower, 237 engines.
100 to 200 horsepower, 182 engines.
200 to 300 horsepower, 924 engines.
300 horsepower and more, 475 engines.

At the close of the year the trend was toward the extremely powerful types for transport service and the lighter motors for sport and training planes. Experimentation with heavy oil-burning air-cooled types was notable. Possibly 100 motors, not included in the above total, were built for experimental purposes. Scattered production, it is believed, added nearly 150 more.

What appeared to some as a disturbing feature of the 1928 production was the sharp decline in military manufacture. Altogether, 1,219 airplanes were built by nine plants for the Navy Bureau of Aeronautics and the Army Air Corps. Four plants built 1,413 military engines. Steadily diminishing preponderance of military orders was noted during the closing months of the year.



(Top) Stinson *Detroiter* in mail service of Thompson Aeronautical Corp. (Center) New Standard, Wright *Whirlwind,* biplane. (Bottom) General Airplanes Corp., *Whirlwind,* cabin monoplane.

From the foregoing reports 53 plants produced in 1928 a grand total of 4,761 aircraft and 3,263 motors, which may conservatively be increased to 5,000 planes and 3,500 engines for the entire industry.

Will the aircraft industry be concentrated in one locality, as is the case with the motor car, or even in one section of the country, as is the case in some other industries? The answer appears to be in the negative. Aircraft manufacture during the World War developed largely on the Atlantic seaboard, with extensions shortly afterward to the Pacific coast. In the experimental commercial years (1922-1927) a certain phenomenal production developed in cities of the Middle West where natural conditions were favorable or local capital sympathetic.

In 1928 two powerful factors operated to change the aircraft map—consolidations and municipal rivalry. Production schedules were being merged and factories relocated, East to West, and West to East, according to the various theories of distribution. That trend is still in progress, affecting, however, mainly the larger or potentially more powerful units.

The grouping of private capital is, to a definite degree, being offset by the ambition of cities to be known as aviation centers. Scores of municipalities, through their Chambers of Commerce or newly formed aviation boards, are making attractive offers of land or money grants to obtain an aircraft or engine factory, or to establish an air line. This accounts, probably more than any other factor, for the increase in the number of new aviation manufacturing enterprises in 1928. Among the cities competing for recognition as centers of aircraft production or operation are: Boston, Bridgeport, New York, Baltimore, Miami, Scranton, Pittsburgh, Rochester, Buffalo, Cleveland, Chicago, Detroit, Milwaukee, Minneapolis and St. Paul, St. Louis, Kansas City, Wichita, Dallas, Houston, Los Angeles, Seattle and San Diego.

In the Chamber's estimate for production, as released in November, 1928, three cities, New York, Wichita and Detroit, were cited as contending for the honor of being known as "The Air Capital of the United States." So far as actual production is concerned, based upon the 53 reports cited, Wichita led with 927 planes, which was the total also for the entire State of Kansas. New York State was second with 875 units, but first with an estimated gross airplane production value of $7,500,000 as against $3,000,000 for Wichita. New York's production, however, was scattered among three or four points.

In the rank of aircraft manufacturing states, Ohio came third, showing a production of 816 planes; Missouri fourth, with 736;

(Top) Curtiss P-3A *Hawk* taking off. (Center) Curtiss *Falcon* observation plane, powered with Curtiss *Chieftain*. (Bottom) Curtiss *Falcon* seaplane, Curtiss *D-12* engine.

Colorado fifth, with 341; Illinois sixth, with 248; Michigan seventh, with 181 and California eighth, with 140. In estimated gross value of production only, after New York, the leader, Missouri was second with $3,500,000, Kansas and Michigan tying for third place, with $3,000,000 each; Ohio fourth, with $2,500,000; California fifth, with $1,500,000; Colorado sixth, with $750,000, and Illinois seventh, with $500,000.

In engine production, New Jersey and Connecticut were predominant, with Michigan second, New York third and California fourth.

Growth of the Chamber

Expansion of the industry in 1928 was reflected in the growth of its representative organization, the Aeronautical Chamber of Commerce of America, Inc. During the last six months of the year the membership was doubled and the total list included half a hundred manufacturers, a score of trunkline system air transport operators and hundreds of industrial enterprises engaged in affiliated branches of the industry. The membership was distributed in thirty different States.

In order to give the members located in widely separated cities more direct participation, the Chamber established the seven following geographical divisions: Eastern; South Eastern; North Central; Great Lakes; South Central; South Western, and North Western, each with a Divisional Vice-President in charge.

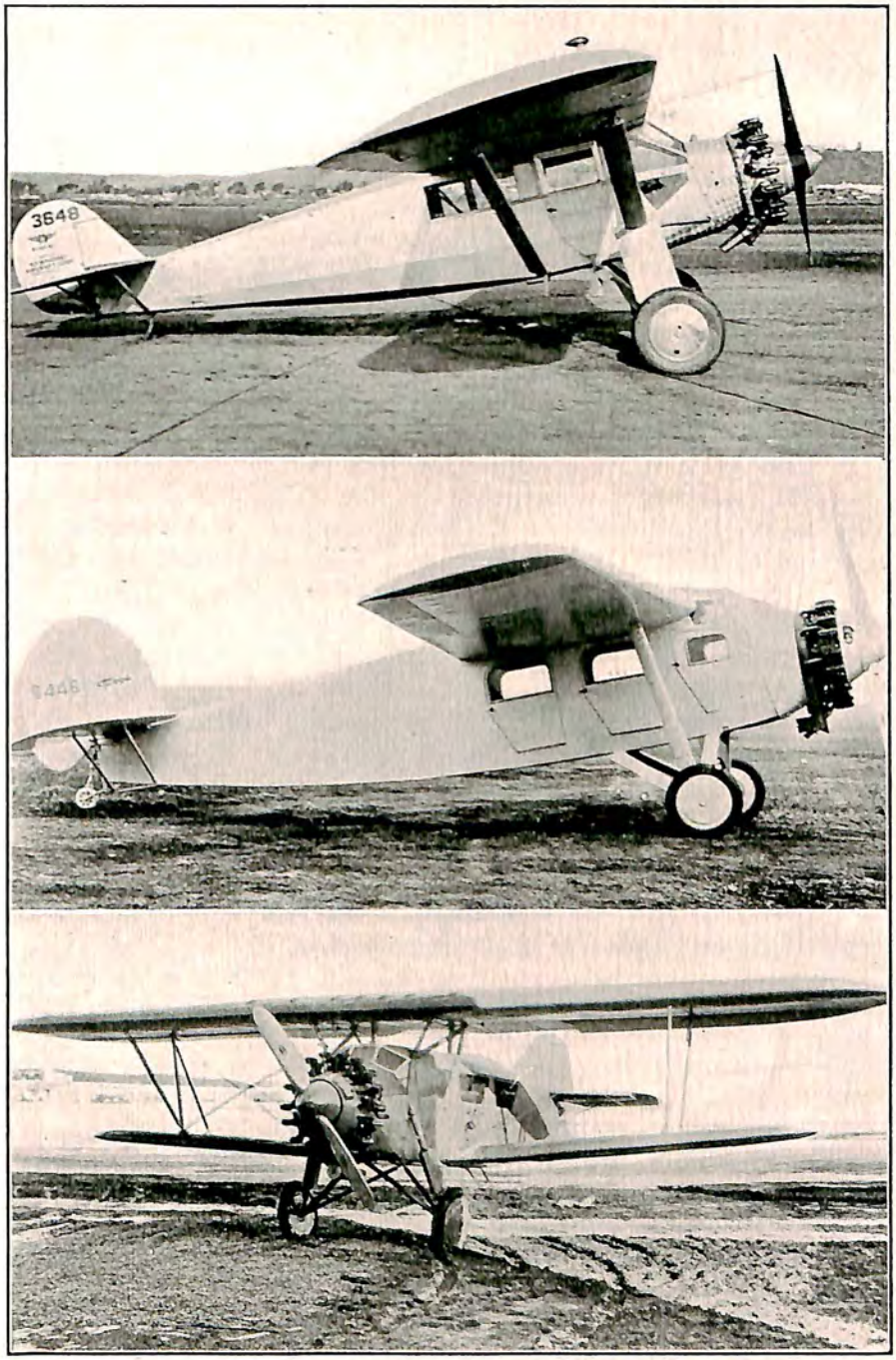
The Chamber was also organized topically, as well as geographically, to include these sections: Commercial Airplane Manufacturers; Motor Manufacturers; Transport Operators; Airships; Airports; Flying Schools; Material, Equipment and Supplies; Jobbers and Dealers; Fuel and Lubricants; Publishers; Aerial Service; Photography and Survey.

These general committees were established: Show; Insurance; Arbitration; Technical Standards; Aeronautical Education and Government Relations.

The Commercial Airplane Manufacturers Section, which had existed as a special committee before the establishment of the various sections on July 31, held five national conferences during the latter part of the year, two in Wichita, one in Los Angeles, one in Detroit and one in Chicago. Committees were appointed to handle specific problems. Results of their work included:

The adoption of a standard form of sales agreement between the airplane manufacturer and the distributor.

Standardization of performance testing to eliminate misunder-



(Top) Mahoney-Ryan *Brougham.* (Center) Cessna six-passenger monoplane. (Bottom) Knoll biplane. All Wright *Whirlwind* engines.

standings relative to the various claims made by manufacturers on the performance ability of their products.

Compilation of a list of satisfactory sources of supply for purchasing agents.

Establishment of a Legal and Legislative Research Department.

In addition to those definite accomplishments, the Commercial Airplane Manufacturers Section undertook to provide a shipping tariff analysis and the development of uniform accounting methods.

The Air Transport Operations Section, which comprises all of the major trunk air transport systems, employed the machinery of the Chamber as an active agency in bringing about an agreement on the allocation of bands for radio communication. Conferences were held in Washington and Government radio authorities, air transport operators, representatives of the Federal Radio Commission, together with officials of the Department of Commerce, the War and Navy Departments, attended. The conference resulted in a definite agreement of cooperation in radio communication on the part of the trunk air transport systems, agreement on specifications for the guidance of the equipment manufacturers and a united recommendation to the Federal Radio Commission for the allocation of specific bands for use by the trunk air transport operators.

A significant phase of the airport section activity was the cooperation between a sub-committee of the section and the National Board of Fire Underwriters in preparation of a suggested code for the reduction of fire hazards at airports.

The Flying School Section was the result of conferences between the Commercial Airplane Manufacturers Section and officials of the Department of Commerce, following which a Flying School Committee was appointed by the Chamber. This committee, during the Chicago Show, resolved itself into the Flying School Section of the Chamber, which after careful study of the flying school situation announced six definite requirements for flying schools, which must be met before they win a place on the Chamber's accredited list. These requirements were approved by the Department of Commrce and the committee began working out with the Department a practical plan for rating flying schools that apply for such recognition.

The Fuel and Lubricants Section, organized during the Chicago Show, created widespread interest throughout the petroleum industry. The annual report of the Chamber explains "establishment of this section is a typical illustration of the spontaneous acceptance by the industry of the departmental idea." Motor manufacturers were requested to outline their problems involving fuel and lubricants so that the gas and oil producers and refiners might, as a sec-

tion, cooperate with motor manufacturers in correcting conditions as they arise.

Although airship construction in 1928 was limited to a few firms, the magnitude of the work under way and its governmental and internal ramifications prompted the airship manufacturers to form their own section and to appoint a committee to guide the Chamber in its conduct of matters affecting the manufacture and operation of lighter-than-air craft.

Airplane Manufacturers

Acme Aircraft Corporation, of Rockford, Ill., was organized late in the year and produced a 2-place high wing open monoplane for training purposes. It had folding wings and was designed to take engines up to 120 horsepower.

The Advance Aircraft Company, of Troy, Ohio, increased its manufacturing space approximately 30 per cent during the year and continued production of Waco airplanes for student instruction, passenger carrying, commercial taxi work, air mail and individual owners. Officials of the company found the most significant feature of the year in the rapidly increasing number of sales to private owners. In districts where in 1926 only 12 per cent of the sales were made to private owners they climbed to more than 45 per cent in 1928. The tapered wing sport model was a new Waco produced during the year. It won the transcontinental race between New York and Los Angeles in September and also took the sweepstakes prize for best time between the cities.

Aerial Service Corporation, of Hammondsport, N. Y., during the year produced the "Mercury Kitten," a cabin monoplane, Velie powered, and a primary training monoplane with a Warner engine. That company also placed on the market the Mercury combination wheel-ski gear, of duralumin construction and capable of being fitted to any plane.

Aeromarine Klemm Corporation, of Keyport, N. J., produced a number of low wing monoplanes for sport and training purposes, the machine being an adaptation of the Klemm model which originated in Germany.

Alexander Aircraft Co., of Colorado Springs, Colo., in 1928 increased its production facilities from those permitting three planes a day to one an hour. The number of employees was enlarged by 40 per cent. Distribution facilities were also added. The company acquired 50 per cent more distributors and dealers during the year. Motor car dealers were added to the sales organization. Company officials spent some time abroad investigating the export market and found South America promising an excellent market. Sales in 1928

were increased by more than a million dollars. Planes were exported to Canada, Alaska and Australia. The company developed the "Eaglerock Bullet," a 4-place cabin monoplane of the low wing full cantilever type.

The Alliance Aircraft Corporation built a new plant at Alliance, Ohio, during the year and produced an experimental biplane. The company also owns its own airport.

American Aeronautical Corporation, New York, was organized in 1928 to produce the Savoia-Marchetti S-55, S-56, and S-62, Italian planes, and purposed to build a factory on Long Island in 1929.

American Eagle Aircraft Corporation, of Kansas City, Mo., expanded its line of planes from 1 to 4 types in 1928, including a 3-place open cockpit commercial biplane, a 2-place folding wing sport biplane, a 4-passenger cabin monoplane and a 6-passenger twin motor cabin monoplane. The factory space and number of employees were more than doubled. Many distributors were added to the sales organization. Officials of the company found flying becoming popular in many sections of the country which 12 months before did not appear at all promising.

The Bird Wing Commercial Aircraft Co., of St. Joseph, Mo., developed 3 types of biplanes and planned to build 5 planes a month in 1929.

Boeing Airplane Co., of Seattle, Wash., during 1928, carried out an extensive program in the building of experimental and production types of aircraft for both military and commercial use.

The XP-7, a standard PW-9, with a Curtiss V-1570 engine installed, was built for a service test. A fleet of F3B-1's, a shipboard fighting plane, was delivered to the Navy Department. The last one on the contract was equipped with the automatic wing slot, so designed that it could be locked in the closed position. All planes were equipped with the Boeing type emergency flotation gear, which is now standard equipment on all Navy airplanes. The F4B-1, a high performance, single seater, fighter, was built and demonstrated to both the Army and Navy, and placed in production for both services. For the Navy, the standard emergency flotation gear and deck arresting gear were provided.

In the commercial field, the Boeing Airplane Company produced several planes of different types. Nineteen of the 24 Model 40-A mail planes delivered to Boeing Air Transport, Inc., in 1927 were modified to 40-B mail planes, with the Pratt & Whitney "Hornet" taking the place of the lighter "Wasp" engine.

Construction was begun on a fleet of Model 95 mail planes, designed exclusively for the transportation of mail and express.

(Top) Bellanca monoplane. (Center) Alexander *Eaglerock*. (Bottom) Fokker *Universal*.

The newly-developed steel and duralumin type of fuselage is utilized and is designed with four cargo compartments, three for mail, and a specially-designed express compartment back of the pilot. It is powered with a Pratt & Whitney "Hornet" engine. Ten of these mail planes were scheduled for delivery to the Boeing Air Transport, Inc. early in 1929.

Four Model 80, 3-engine transports, powered with "Wasp" engines, fully equipped with modern conveniences, including hot and cold running water, provisions for a buffet service, etc., were completed and delivered to the Boeing Air Transport, Inc. during the summer of 1928. Model 80-A, a refinement of the transport Model 80, was under construction at the end of the year. It is designed to seat 18 passengers.

Several B-1E flying boats were constructed. The machine has a luxurious enclosed cabin seating five passengers and a pilot, and is powered with a "Wasp" engine.

Another type of commercial airplane, Model 81-A, a three place open cockpit, sport and training biplane was being developed.

Buhl Aircraft Co., of Marysville, Mich., continued production of the 5-place "Airsedan" and during the year also produced the 3-place Sport "Airsedan" and the 8-place "Senior Airsedan." All of the planes are closed cabin models of the sesquiplane type for use in commercial and private flying.

Butler Aircraft Corporation, of Kansas City, Mo., produced two experimental types with "Whirlwind" engines, one a 4-place cabin, and the other a 3-place open machine, both designed by Waverly Stearman.

Cessna Airplane Company, of Wichita, Kan., doubled its distribution facilities during the year and sold machines for mail transport, private and photographic flying. The company planned to produce a 6-place plane in 1929.

Command-Aire Incorporated, of Little Rock, Ark., more than doubled its factory space and number of employees, adding additional distributors for its 3-place open biplane of the training ship class. The feature of the Command-Aire experimental work during the year was the slotted aileron, designed to provide stall speed control and balance. The company planned to double production in 1929.

Consolidated Aircraft Corporation, of Buffalo, N. Y., doubled its factory floor space in 1928, added 25 per cent to the number of employees and produced the Consolidated "Husky Junior," a training and sport, 2-place biplane. Consolidated also built the Navy's largest patrol boat, the XPY-1.

Development of large flying boats has received considerable attention in Europe of late, and the Consolidated's work promises to attract much interest in the commercial field here. The XPY-1, if built for air transport purposes, could carry 32 passengers.

Cunningham-Hall Aircraft Corporation, of Rochester, N. Y., was organized late in 1928. It planned to produce in 1929, 6-place cabin all-metal and 4-place cabin planes. This company brings into the industry James Cunningham, Son & Co., for ninety years identified with vehicles, producing the famous Cunningham coaches and at present the Cunningham automobiles. It also brings back into the industry William F. Thomas, founder of Thomas Bros. Aeroplane Company and until 1921 vice-president of the Thomas-Morse Aircraft Corporation. He is chief engineer of the new company.

Curtiss Aeroplane & Motor Co., of Garden City, and Buffalo, N. Y., in 1928 continued its refinement and production of military aircraft and the experimental development of new types for military purposes, and entered the commercial field as manufacturers of planes and engines. Three types of commercial planes were produced, the "Robin," the "Falcon" mail plane, and the "Fledgling" training plane.

The "Robin" is produced by an affiliated company, Curtiss-Robertson, of St. Louis, and is designed for private owners as a semi-cantilever cabin monoplane for a pilot and two passengers, and is powered with either the watercooled 90 horsepower Curtiss "OX-5" engine, or the aircooled 170 horsepower Curtiss "Challenger" engine. An interesting innovation is the use of one piece stamped metal ribs in both the wings and control surfaces.

The Curtiss "Falcon" mail plane, a single bay biplane, is a modification of the military "Falcon" in extensive use by the Army, Navy and Marine Corps. Several of these planes powered with the "Liberty" engine, were produced for National Air Transport, and with their high cruising speed of approximately 120 m.p.h. enabled that company to shorten the running time between its terminals.

The Curtiss "Fledgling" training plane was originaly designed to enter a Navy competition for training planes in which it took first place from a field of fourteen competitors; and while adopted by the Navy as its standard training ship it is built for commercial purposes as well.

It is a 2-bay biplane for a pilot and a student, and, with the Curtiss "Challenger" engine, has been selected by the Curtiss Flying Service as standard equipment for its nation-wide chain of flying schools. It is convertible as either a landplane or seaplane.

The "Fledgling" as a Navy training plane is equipped with the

Wright "Whirlwind" engine, and while essentially the same as its commercial sister ship is especially adapted to the requirements of advanced training, including fixed and flexible gunnery, radio spotting and bombing.

In addition to the "Fledgling," the Curtiss Company designed and built another type for the Navy, the XF8C-2. This is a two-seater fighter, the first ever built for the Navy, and in appearance and performance, particularly with respect to maneuverability at altitude, resembles the single-seater fighter. Its climb is fully equal to that of the single-seater, and its top speed only slightly less. It is a single bay biplane, powered with the Pratt & Whitney "Wasp" engine, with the upper wing sharply raked to give directional stability in landing, and is especially designed to operate from the decks of aircraft carriers.

For the Army, Curtiss added to the "Hawk" series the P3A, an adaptation of the standard pursuit ship to the aircooled "Wasp" engine. It was produced in quantity during the year. Designs for two more "Hawks," the P1C and the P6, were also prepared.

Besides creating new types of aircraft and engines, the Curtiss organization was actively engaged in the production of new designs, and in the solution of a wide range of problems in aeronautical research.

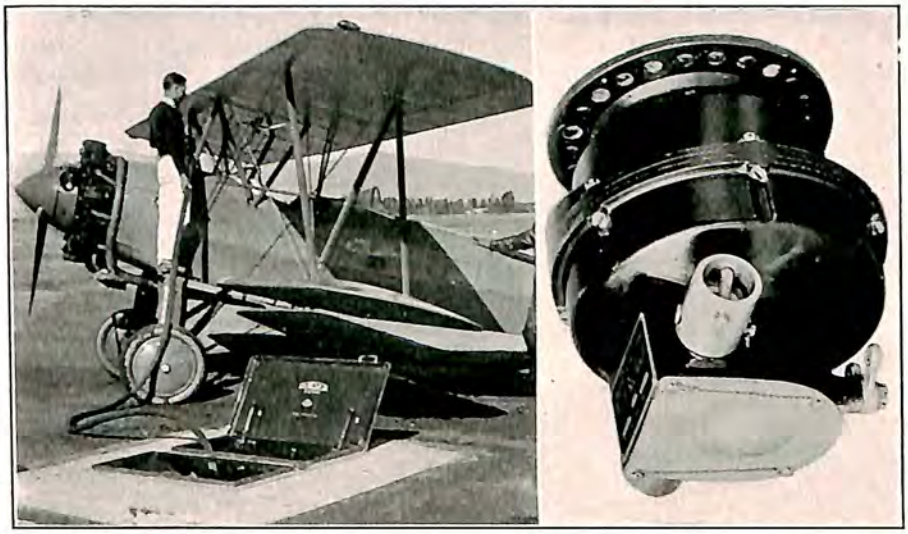
The Davis Aircraft Corporation of Richmond, Ind., planned to produce new types of commercial machines in 1929.

Driggs Aircraft Corporation, of Lansing, Mich., expanded plant facilities and produced a new machine, the "Skylark."

G. Elias & Bro., Inc., of Buffalo, developed three types of airplanes during the year, a mail and express plane, the "Aircoupe" and the "Airmobile," and planned to enter production in 1929. The company also made plans for a new plant to be located at the Buffalo airport.

Fairchild Aviation Corporation of New York, was organized to hold the stock and manage subsidiary corporations in both the manufacturing and operating fields of the industry. The subsidiaries are Fairchild Aerial Camera Corporation, Fairchild Aerial Surveys, Inc., Fairchild Airplane Manufacturing Corporation, Fairchild Flying Corporation, and, in Canada, Fairchild Aviation, Ltd., and, in Mexico, Compañia Mexicana de Aviación.

The Fairchild Airplane Manufacturing Corporation increased production of cabin monoplanes fourfold over the preceding year. The Fairchild-41 is a 4-passenger high wing cabin monoplane powered with a Wright "Whirlwind" engine, equipped with folding-wings and luxuriously appointed for comfort and convenience. It



(Left) Richfield Oil Company underground fueling pit at Metropolitan Airport, Los Angeles. (Right) Eclipse Hand Inertia Starter.

is distinguished by high performance, complete equipment, and sturdy construction. The Fairchild-71 is a general utility transport, carrying seven passengers and powered with a Pratt & Whitney "Wasp" engine. It is also equipped with folding wings. The Fairchild-21 is a 2-place low wing monoplane designed primarily for training and student flying.

Fairchild plant facilities were developed at Farmingdale, Long Island, N. Y., in 1928, including an airport and a large factory building with dope shop, heat-treating plant and metallurgical laboratory. The company planned to build 1,150 airplanes in 1929. It was also developing the foreign market, officials and executives making surveys in South America.

The experimental engineering department of the Fairchild corporation worked throughout the year toward the development of a silencer which would muffle the engine exhaust. After months of experimentation and study a device was perfected to a degree warranting its use on a current model. Accordingly, the Fairchild-41 and the Fairchild-71 were equipped with exhaust silencers.

A new type landing light, to be built into the leading edge of a monoplane wing was also developed by Fairchild engineers. A combination ski and pontoon was also produced and installed on Fairchild equipment.

The Fokker Aircraft Corporation of America in October, 1928,

entered into close affiliation with several of the most important air transport operators, including the Western Air Express and a group of California capitalists headed by James A. Talbot, president of the Richfield Oil Company, and Harris M. Hanshue, president of the Western Air Express, Inc. This organization also established close connection with the Universal Aviation Corporation, which acquired stock in the Fokker Corporation.

A financial interest was also acquired by a group headed by Major John A. Hambleton of Baltimore, who are active in the Aviation Corporation of the Americas, of which Pan-American Airways is an operating subsidiary.

Fokker factory space was increased in 1928 to include the enlarged factory at Teterboro, N. J., a leased building at Passaic, N. J., and a new plant at Glendale, W. Va. A new factory was to be built in Los Angeles in 1929. The number of employees increased from 266 in 1927 to 906 in 1928.

During the year the Fokker Corporation produced several new types, including the "Super-Universal," "Wasp" powered, the "F-10," a 14-passenger monoplane with three "Wasps," and an 8-passenger metal-hull amphibian.

General Airplanes Corporation, of Buffalo, produced the "Aristocrat," a 3-place open biplane, and the "Surveyor," a twin "Whirlwind" photographic plane, and was developing other machines. General built a special plane for the Byrd Antarctic Expedition.

The Great Lakes Aircraft Corporation was organized late in 1928 to take over the physical properties and designs of the Glenn L. Martin Company, of Cleveland. Production of planes was to start early in 1929.

Hall-Aluminum Aircraft Corporation, of Buffalo, expanded plant facilities in 1928 and began construction of two aluminum alloy airplanes for the Navy Bureau of Aeronautics, also producing experimental amphibian floats.

The Hamilton Metalplane Co. acquired additional space for assembly and test work at the Milwaukee county airport and produced types "H-45" and "H-47," all-metal planes which were sold for transport of passengers and mail.

The Huntington Aircraft Corporation, of Bridgeport, Conn., was organized to produce a two-place cabin monoplane. Howard Huntington, a pioneer in aeronautics, is head of the corporation.

Ireland Aircraft, Inc., of New York, doubled the number of its employees during the year and developed a new cabin amphibian. The Ireland machines are distributed through Curtiss Flying Service.

Keystone Aircraft Corporation late in the year was merged with

Consolidated Navy Patrol Boat XPY-1.

the Loening Aeronautical Engineering Corporation. The Keystone plant at Bristol, Pa., and the Loening plant in New York were retained. Distributors were appointed to market the Keystone "Patrician" and the Loening Amphibian "Air Yacht."

Loening amphibians were delivered to both the Army and the Navy air forces in quantity during 1928. The commercial Loening was first exhibited at the aircraft show in Detroit, and several machines were purchased by air transport lines and individuals. The "Air Yacht," Wright "Cyclone" powered, seats 8 persons. The company planned to produce a small 4-place sport amphibian in 1929.

The Keystone "Patrician" was the largest passenger plane built during the year, carrying 18 persons besides two pilots and having a wing spread of 90 feet. It weighs 15,000 pounds fully loaded, is powered with three engines and has a flying range of about six hours.

The Knoll Aircraft Corporation, of Wichita, Kan., was organized in October, 1928, and produced its KN-1 type. A new trimotored "Wasp" powered transport plane to carry 22 passengers and a crew of four was to be built in 1929.

Kreider-Reisner Aircraft Co., Inc., of Hagerstown, Md., expanded production facilities in 1928 and put out three models.

Joseph Kreutzer Corporation, of Los Angeles, developed a trimotored "Air Coach" and was putting out 8 planes a month at the end of the year. Production facilities were to be increased to permit construction of one plane a day.

Lockheed Aircraft Company, of Los Angeles, increased the number of employees from 23 to 150 and expanded factory space from 6,375 to 43,000 square feet. The "Wasp" powered "Air Express" monoplane produced in 1928 was being marketed in numbers at the end of the year.

Mahoney-Ryan Aircraft Corporation, of Anglum, Mo., confined production to the 5-place "Whirlwind" powered Ryan "Brougham." An experimental low wing monoplane with a single lift section tail surface and lacking both stabilizer and rudder fin promised to warrant production in 1929.

Mono Aircraft, of Moline, Ill., a branch of the Velie Motors Corporation, produced two closed high wing types, the 2-place "Monocoupe" and the 4-place "Monocoach."

New Standard Aircraft Corporation, of Paterson, N. J., developed a 5-place open cockpit plane, Model GD-24, with its fuselage structure entirely of open dural sections riveted together. The machine was designed for use as a passenger or mail plane, operating from either land or water.

Nicholas-Beazley Airplane Co., of Marshall, Mo., in addition to a general expansion of their aircraft supply business, developed a new monoplane in 1928.

Parks Aircraft, Inc., of St. Louis, Mo., was organized during the year to manufacture a line of airplanes, including two open 3-place biplanes, the P-1 with OX-5, the P-2 with any 150 h.p. engine, and the P-3, a cabin monoplane.

Pitcairn Aircraft, Inc., in its factory at Bryn Athyn, Pa., manufactured five types of machines, the "Fleetwing," "Mailwing," "Sport Mailwing," "Super Mailwing" and the "Super Sport Mailwing."

The rapid growth of air mail poundage on all of the routes throughout the country created a very urgent need for a machine having the high performance and maneuverability of the Pitcairn "Mailwing," but capable of carrying approximately twice the cubic mail capacity. Pitcairn "Mailwings" had already become standard equipment on several air mail lines and the need for the new ship resulted in the production of the "Super-Mailwing," type PA-6, having a mail compartment of 40 cubic feet and a pay load capacity of 500 pounds while retaining the high top speed (over 130 m.p.h.), the low landing speed (45 m.p.h.) and the controllability and maneuverability of the former "Mailwing" type.

Sikorsky Aviation Corporation, of College Point, Long Island, N. Y., completed development of its S-38 amphibian and placed that type in production in 1928. The S-38 is powered with two Pratt & Whitney "Wasp" engines and provides quarters for 10 or 12 persons, including the crew.

The Simplex Aircraft Corp., of Defiance, O., developed a 2-place open monoplane, and was planning increased production of that and other types in 1929.

Spartan Aircraft Company, of Tulsa, Okla., built a new factory in 1928 and during the twelve months increased the number of employees from 25 to 100. Planes were sold to superintendents of oil companies and drilling contractors for rapid transportation and to a number of private owners for pleasure flying.

The Stearman Aircraft Company, of Wichita, Kan., tripled its factory space in 1928 and increased the number of employees from 50 to 190. The "Speed Mail," "Cyclone" powered, was designed to carry 1,000 pounds of paying load and the plant was in production on that type at the end of the year. The "Speed Mail" was developed from the C-3B sport commercial plane. A new type, the Stearman "Coach" was to be produced in 1929.

The Stinson Aircraft Corporation in 1928 made plans for a new factory to be built at Wayne, Mich. An average of 200 persons were employed at the plant in Northville, Mich., with facilities for turning out 10 planes a week. The 6-passenger "Detroiter" and 4-passenger "Junior" were produced in quantity during the year, and a number sold to business organizations. Others were sold abroad.

Swallow Airplane Co., of Wichita, Kan., produced its 3-place open biplane in quantity during the year.

Swift Aircraft Corporation, of Wichita, Kan., produced a 2-place training biplane in 1928 and planned to put out an open sport biplane in 1929.

Szekely Aircraft Corporation, of Holland, Mich., enlarged factory space in 1928 and produced the single-place "Flying Dutchman," a monoplane designed for sport flying. A 2-place monoplane was to be produced in 1929.

Thaden Metal Aircraft Corporation, of San Francisco, developed an 8-place all-metal cabin monoplane, with fuselage built on the stressed-skin monocoque principle, using corrugated duralumin. The next Thaden development was a 4-place cabin metal machine. Both types were to be produced in quantity in 1929.

Thomas-Morse Aircraft Corporation, of Ithaca, N. Y., at the end of the year was producing a number of all-metal observation planes for the Army Air Corps. They were to incorporate refinements determined by tests of the Army XO-19 plane, the metal construction following the practice found satisfactory in service tests carried on for two years.

Travel Air Company, of Wichita, Kan., in 1928 doubled plant facilities and the number of employees was increased from 130 to 260. More than 500 planes were built. New types produced during the year included the 6-place cabin monoplane and open cock-

pit biplanes for Warner, Axelson or Curtiss "Challenger" engines. New designs included Type 6000 cabin monoplane for "Whirlwind" or "Wasp" engines.

Chance Vought Corporation, of Long Island City, New York, one of the oldest and largest producers of aircraft in the country, showed a large increase in sales and shipments during 1928, total shipments amounting to approximately $3,000,000, an increase of 200 per cent over 1927. The major portion of the Vought production was for the U. S. Navy. Several planes were built for the Argentine Navy and contracts negotiated with other South American governments.

Quantity production was concentrated on the "Corsair" model of the O2U-1 and O2U-2 types, each powered with a Pratt & Whitney "Wasp" engine, the latter type being a development of the original "Corsair." This Model O2U-2 is quickly convertible to either landplane, seaplane, or high-performance amphibian. Four world records made by the "Corsair" early in 1927 were still standing at the end of 1928.

The "Corsair" in 1928 was equipped with the slotted wing, that installation being the first made on an American military airplane. Tests indicated that the device would largely eliminate the spin. It was said that the plane could be brought out of a tight spin in a half-turn with the slots opened. The use of the slots also permitted the plane to land more slowly.

During the year a new 2-seater fighter, the F2U-1, was developed by Vought engineers, and this model, with the O2U-2, was to comprise the major production of the Vought plant in 1929. Research and development work on a new Naval pursuit plane and new type commercial plane also were in progress at the end of the year.

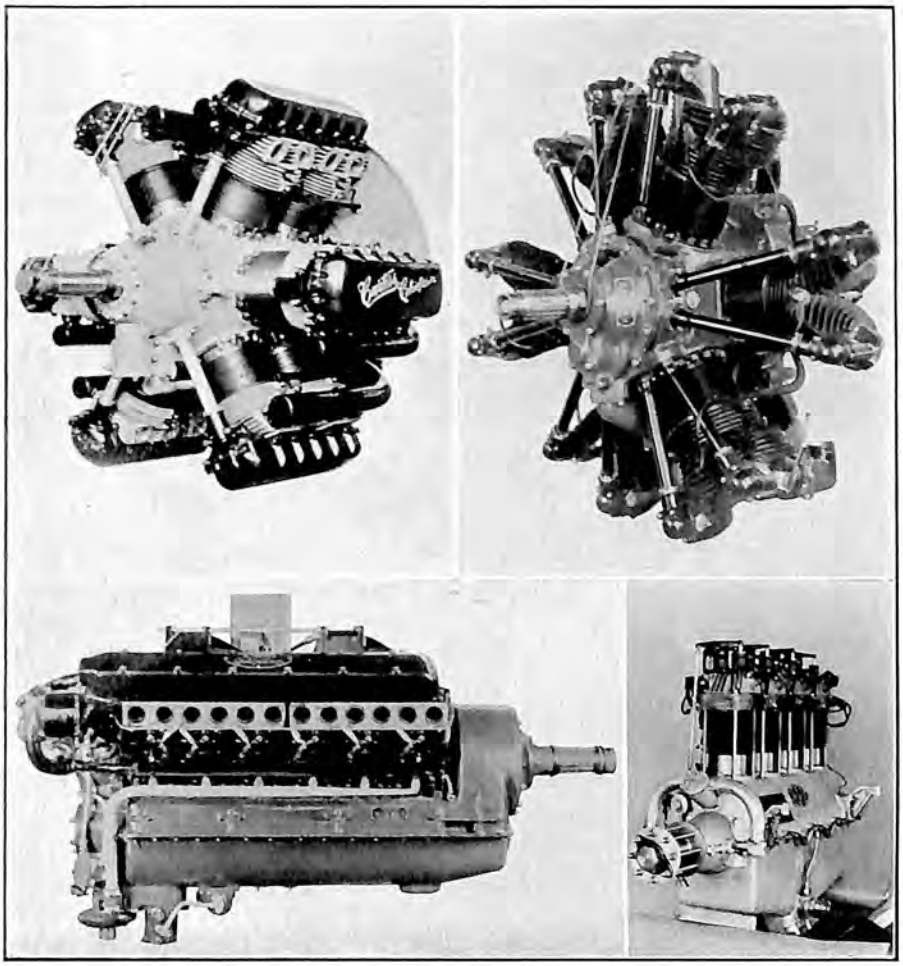
Whittelsey Mfg. Co., Inc., of Bridgeport, Conn., acquired the American rights of the Avro Avian and was preparing to produce that type in 1929.

Engine Manufacturers

Among the new companies entering the aircraft motor field in 1928 was the American Cirrus Engines, Inc., organized in November with its plant located at Belleville, N. J. Production was started on the Cirrus 4-in-line aircooled engine.

The Aeronautical Products Corporation, of Naugatuck, Conn., developed the "Scorpion," a 4-in-line aircooled airplane motor and was preparing to increase production in 1929.

Curtiss Aeroplane & Motor Co., Inc., in 1928 added another engine to its aircooled line which was started with the 600 h.p. "Chief-



Aircraft engines: (Top Left) Curtiss *Chieftain.* (Top Right) Curtiss *Challenger.* (Bottom Left) Curtiss *Conqueror.* (Bottom Right) American *Cirrus.*

tain." The new engine was the "Challenger," a 6-cylinder radial type developing 170 h.p. at 1800 r.p.m.

The "Challenger" features a 2-throw crankshaft with consequently staggered cylinders, and combines smoothness of operation at all speeds with advantageously low frontal area. The Curtiss company was to build the "Challenger" in quantity during 1929, and to that end had under construction at Buffalo a large plant to be devoted entirely to manufacture of engines. The new plant, with about 490,000 square feet of floor space, was to double Curtiss production facilities.

The Curtiss company also continued the production of the "Chieftain," the "Conqueror," and the D-12, all in extensive use by the Army and Navy air services.

The "Chieftain" represents perhaps the widest departure from conventional design of any aircooled engine built in the United States. It is of the hexagon type, and has two banks of six cylinders arranged directly one behind the other on a 2-throw crankshaft with overhead gear driven cams. Though developing 600 h.p. at 2100 r.p.m., it has a lower over-all diameter than any 400 h.p. radial aircooled engine in service in 1928.

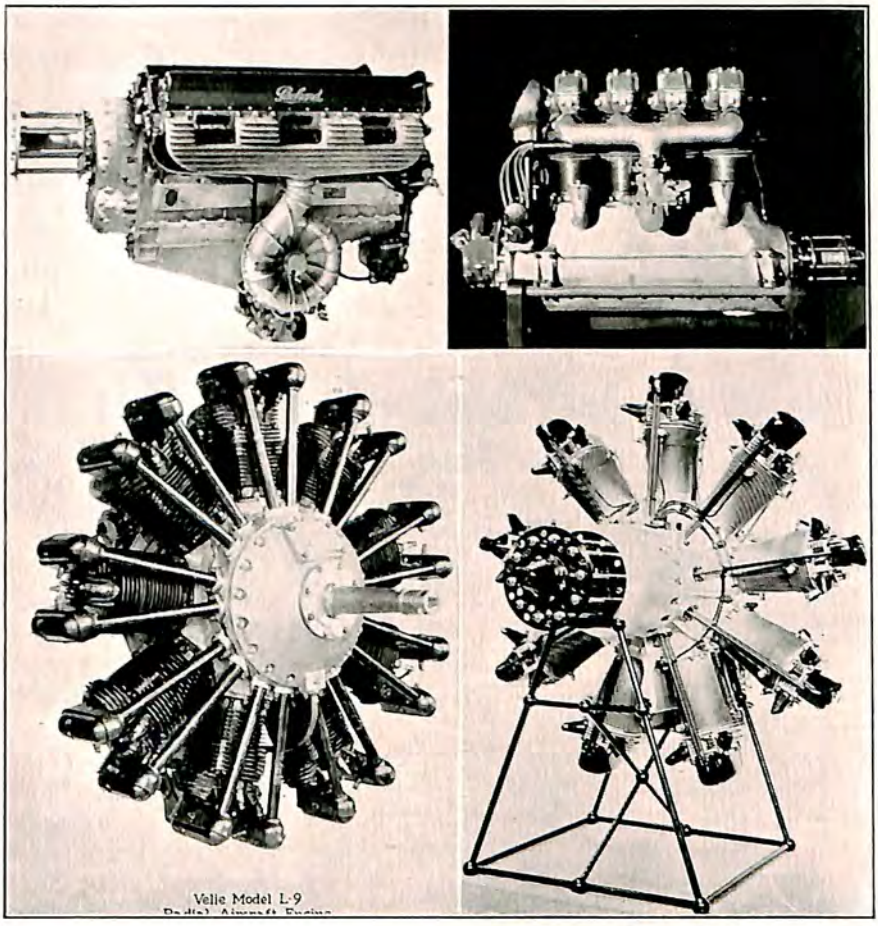
The Curtiss "D-12," a twelve cylinder vee-type watercooled engine, developing 435 h.p. at 2300 r.p.m., has gained wide prominence from its extensive use in high performance military aircraft. A modification of this model, known as the "D-12F," is equipped with a side type supercharger to give increased performance at high altitudes, and has been installed in the Curtiss P-5 "Super-Hawks" built for the Army Air Corps.

The Curtiss "Conqueror" engine is manufactured in two models, the V-1570, a direct-drive type, delivering 625 h.p. at 2400 r.p.m., and the GV-1570 producing 600 h.p. at 2400 r.p.m. Both are 12 cylinder, vee-type, watercooled engines, having the same basic design and dimensions as the less powerful D-12. The geared "Conquerors" have been selected as the power plant of the "Condor," the high performance bomber which Curtiss is producing for the Army Air Corps, and the direct-drive model is used in various other types of military and commercial aircraft.

The Curtiss company also continued the production and refinement of the celebrated Curtiss-Reed duralumin propeller, a single piece airscrew manufactured in two types, the "D" type, twisted from a flat slab of rolled metal, and the "R" type forged from a solid ingot, both in extensive use in the United States. The "D" type is designed for engines of up to 200 h.p. and the "R" type for engines of 200 h.p. and more.

Refinements were projected during the year in the manufacture of the "R" type propeller designed to bring about further improvements in its dynamic, aerodynamic, and static qualities. The company also perfected the design for a propeller with three detachable blades for use on large transport ships, and was to place it in production in 1929.

The Aircraft Holding Corporation, of Culver City, Calif., in 1928 worked in the field of the 2-stroke valveless super-charged motor, designed to reduce power plant cost, weight and head resistance. The company planned to produce such engines in 1929.



Aircraft engines: (Top Left) Packard 4A-2500 with supercharger. (Top Right) Aeronautical Products Corp. *Scorpion.* (Bottom Left) Velie L-9. (Bottom Right) Bliss *Jupiter,* geared.

The Axelson Machine Company, of Los Angeles, during the year produced a 7-cylinder, 150 h.p. radial engine for commercial planes. The Axelson engine has several exclusive features, among them the compensating rocker box, the unique design of which is the result of tests under actual flying conditions at maximum speeds. The special feature is a pivoted rocker stud capable of compensating any change and length of push rods, therefore equalizing valve lifts at all times. The rocker arm contacting with the valve stem and push rod is of the roller type which reduces friction to a minimum. The amount of travel of the roller while in contact is only 27/1000.

These rollers also have a tendency to reduce the side thrust on the valve stem, thereby giving maximum life to the valve stem and valve guides.

The E. W. Bliss Company of Brooklyn, N. Y., one of the oldest manufacturers of heavy machinery and known as the makers of the Bliss-Leavitt torpedo, entered the aircraft engine field in 1928, acquiring American rights to manufacture the "Jupiter" engine, product of the Bristol Aeroplane Co. of England.

Features of the Bliss "Jupiter" include the valve compensating gear, which maintains valve clearance throughout the whole temperature range of "Jupiter" engines, and the special exhaust manifold which is an annular ring in the front of the engine, and which, besides collecting and silencing the gases, forms a stream line front to the entrance.

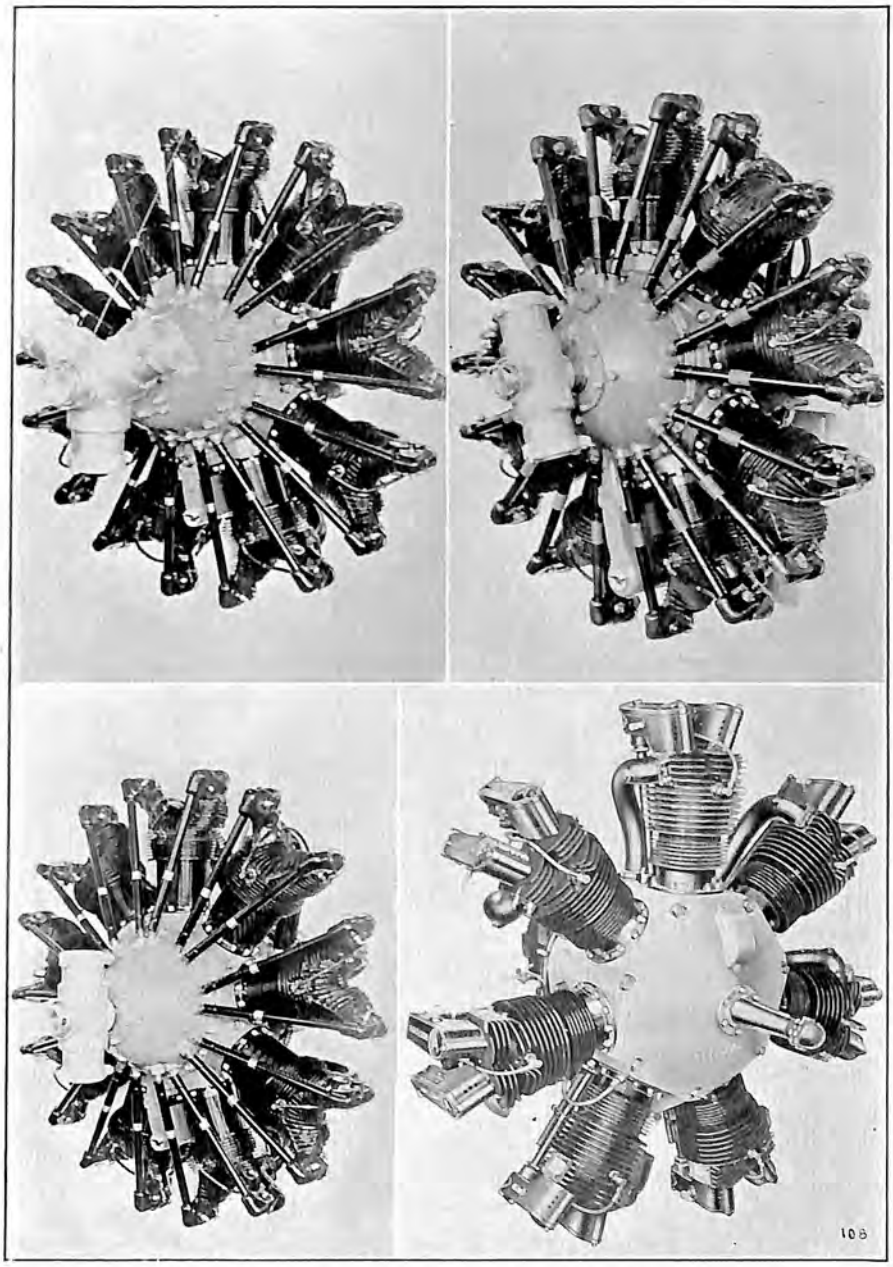
Other features of the "Jupiter" is its forged duralumin crank case and the utilization of a split crank shaft and solid big end rod. Another point is the 4-valve head, developed by the need, in large horsepower engines, to utilize multiple valves, both for efficiency and reliability. The "Jupiter" engine also has a very large diameter ring, allowing short and light engine mounting. The diameter of this ring is such that the engine can be placed in or removed from a plane without disturbing the accessories mounted on the rear.

The Bliss "Jupiter" has the spiral intake and the Triplex carburetor. Spiral form of gas intake on the "Jupiter" solves the problem of the equal distribution of intake gases in a 9-cylinder radial engine without requiring the use of extra moving parts. A 3-way spiral is built into the rear half of the crank case. Each of the passages in this spiral are fed by an individual carburetor and in turn each passage feeds three different centers equally spaced around the engine, practically a set of three perfectly balancd 3-cylinder engines super-imposed.

The Bliss company scheduled for production besides the "Jupiter," the Bristol "Titan" 5-cylinder and the Bristol "Neptune" 7-cylinder engines, 225 h.p. and 325 h.p. respectively. All of the parts for these engines are interchangeable with those of the "Jupiter."

Continental Motors Corporation took up aircraft engine development in 1928 and produced a 7-cylinder aircooled radial engine of four and five-eighths bore and stroke, with a rating of 150 h.p. at 1850 r.p.m. Continental Motors planned to develop new types in 1929.

The Siemens & Halske company of Germany established a sales



Aircraft engines: (Top Left) Pratt & Whitney reduction geared *Hornet.* (Top Right) Pratt & Whitney series C *Wasp.* (Bottom Left) Pratt & Whitney direct drive *Hornet.* (Bottom Right) Axelson engine.

and service station in the United States for its Siemens engine, under the direction of K. G. Frank, of New York.

The Kimball Aircraft Corporation of Naugatuck, Conn., in 1928 conducted experimental work and tests on its "Beetle" 7-cylinder radial engine. A distinctive feature is the use of an F-type cylinder head.

Kinner Airplane & Motor Corporation, of Glendale, Cal., put up a new factory in 1928, doubling the floor space and increasing the number of employees from 25 to 150. Production was confined to the Kinner K-5, 5-cylinder, aircooled radial, 4-cycle engine of 100 h.p., a development of the former Kinner motor which had Approved Type Certificate No. 3.

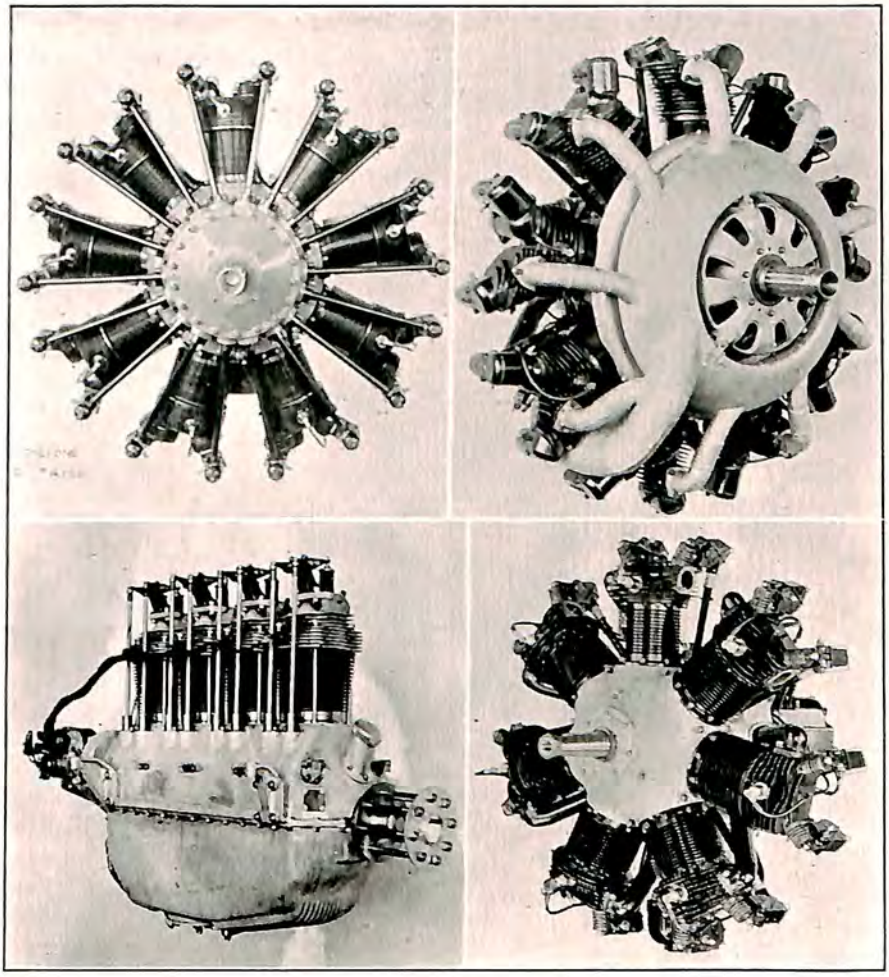
The Packard Motor Car Company, of Detroit, in 1928 continued production of its 600 h.p. and 800 h.p. aircraft engines and built a Packard-2500 engine equipped with twin superchargers of the centrifugal type and developing 1,000 h.p. That engine was delivered to the Army Air Corps for test. Another Packard-2500 was produced, with high compression and without superchargers, developing 1,100 h.p.

During the year Packard also produced a Diesel type aircraft engine, the first motor of the kind to be flown. Packard test pilots and engineers used it on a number of field flights, and it was undergoing endurance tests at the end of the year. The Packard Diesel is in the form of a 9-cylinder aircooled radial of about 200 horsepower, and uses fuel oil under the injection principle.

The Pratt & Whitney Aircraft Company, of Hartford, Conn., one of the largest manufacturers of aircooled airplane engines in the world, produced its "Wasp" and "Hornet" engines in 1928. They were installed in 45 different types of planes, military and commercial, and were used, in whole or in part, by more than 25 mail and transport operators.

The "Wasp" 9-cylinder radial engine originally rated at 410 h.p. at 1900 r.p.m., was developed into a Series B, and at the end of 1928 into the Series C, both of which later types are rated at 450 h.p. at 2100 r.p.m. for military rating. The "Wasp" is the Navy standard engine for single and 2-seat fighter and observation planes, and since its adoption has brought six world records to the Navy. The Army Air Corps is using a number of these engines, particularly in the single-seat fighters. Service test in the pursuit type is being conducted with the new Boeing fighter.

The "Hornet," a larger engine, was developed for the heavier weight-carrying planes. The first of the type, known as Series A, is rated at 525 h.p. at 1900 r.p.m. and has been supplied both



Aircraft engines: (Top Left) Wright *Cyclone.* (Top Right) Wright *Whirlwind Nine.* (Bottom Left) Wright *Gipsy.* (Bottom Right) Warner *Scarab.*

with direct drive and two to one reduction gearing. The Navy has used this engine for observation, bombing and patrol planes. "Hornets" installed in this latter type brought six more world records to the Navy, making a total of twelve world records established for Pratt & Whitney engines. The Army Air Corps used "Hornets" in large twin-engined bombing planes.

The Series B "Hornet" successfully completed its development tests during 1928, preparatory to production as the second engine of the type in 1929. The displacement of the Series B has been considerably increased, although the weight is only negligibly greater

than the older type. The Series B "Hornet" is rated at 575 h.p. at 1950 r.p.m. for the direct drive type, and 550 h.p. at 1950 r.p.m. for the geared type. The Series B "Hornet" becomes the most powerful single row aircooled radial in the world, based upon its standard service ratings.

Besides being produced in this country in large quantities, the "Wasp" and "Hornet" are manufactured in Europe under license by the Bavarian Motor Works, and are assembled in Canada by the Canadian Pratt & Whitney Aircraft Company, Ltd., at Longueil, near Montreal, Quebec.

Velie Motors Corporation, of Moline, Ill., produced two types of radial aircooled engines, the 5-cylinder M-5, 62 h.p. at 2000 r.p.m., and the L-9, a 9-cylinder type developing 180 h.p. at 1900 r.p.m.

The Wright Aeronautical Corporation of Paterson, N. J., another of the largest engine companies, expanded its plant facilities sixfold in 1928 and increased the number of employees from 1028 to 2215. Wright engines placed in production included the 150 h.p. "Whirlwind-5," 225 h.p. "Whirlwind-7," 300 h.p. "Whirlwind-9" and 525 h.p. "Cyclone." The new "Whirlwind" series were lighter in dry weight than the older J-5 model, the "Whirlwind-5" weighing 370 pounds and "Whirlwind-7" 425, compared to the 200 h.p. J-5 which weighs 508 pounds dry. Prices for 1929 showed a marked reduction from those in 1928.

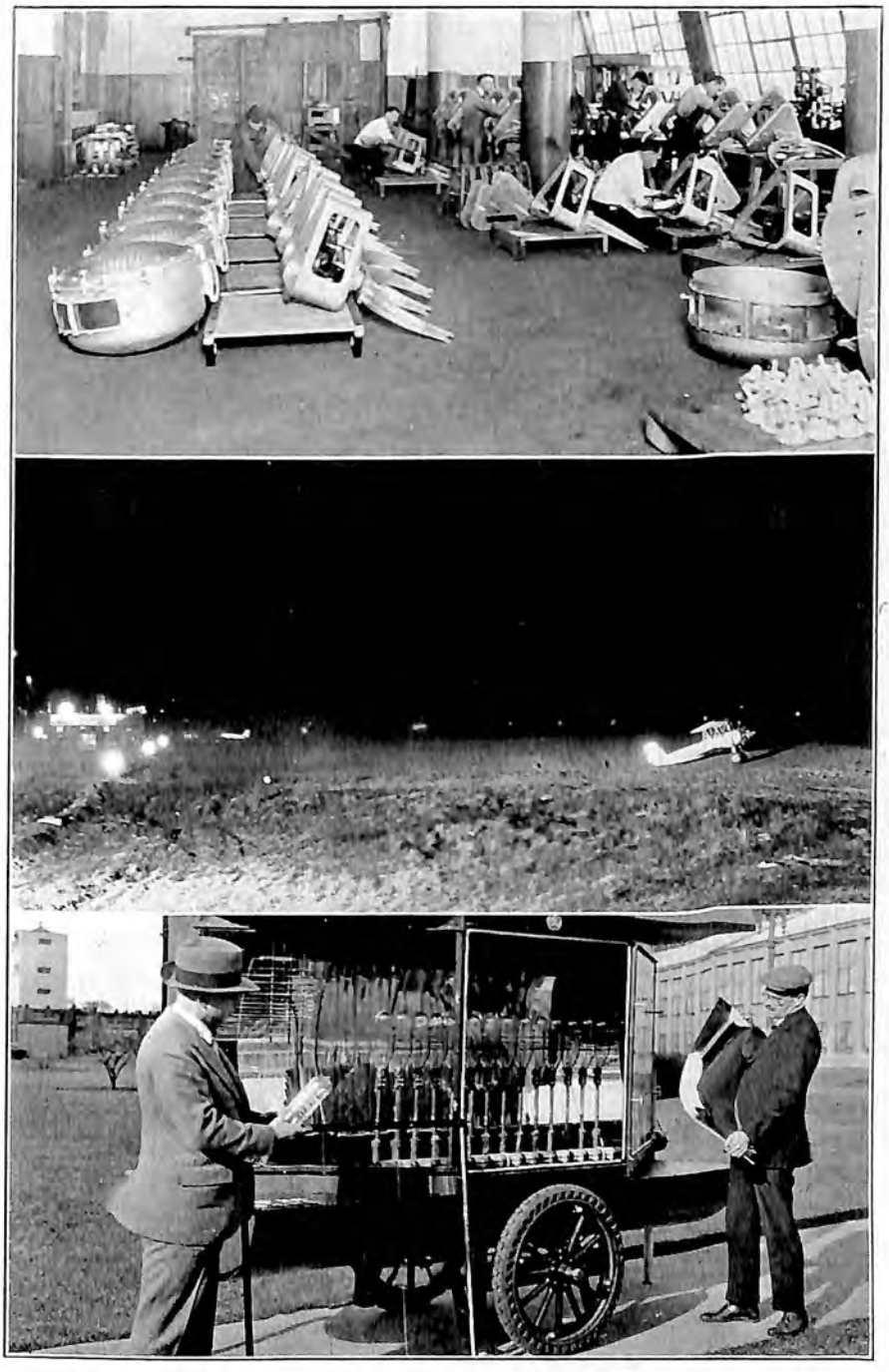
Wright also entered the light motor field with its new "Gipsy" engine, manufactured under American rights acquired from the de Havilland Company of England. The "Gipsy" is a 4-cylinder vertical aircooled engine developing 90 h.p. at 1900 r.p.m. and 100 h.p. at 2100 r.p.m. The cylinders are arranged in line like an ordinary motor car engine.

Foreign licenses to make and sell Wright engines were issued in 1928 to Canadian Wright, Ltd., of Montreal, Mitsui & Co., Ltd., of Tokio, Société Française Hispano-Suiza of Paris; Skoda Works, Ltd., of Pilsen, Czechoslovakia, and the Polish Government at Warsaw.

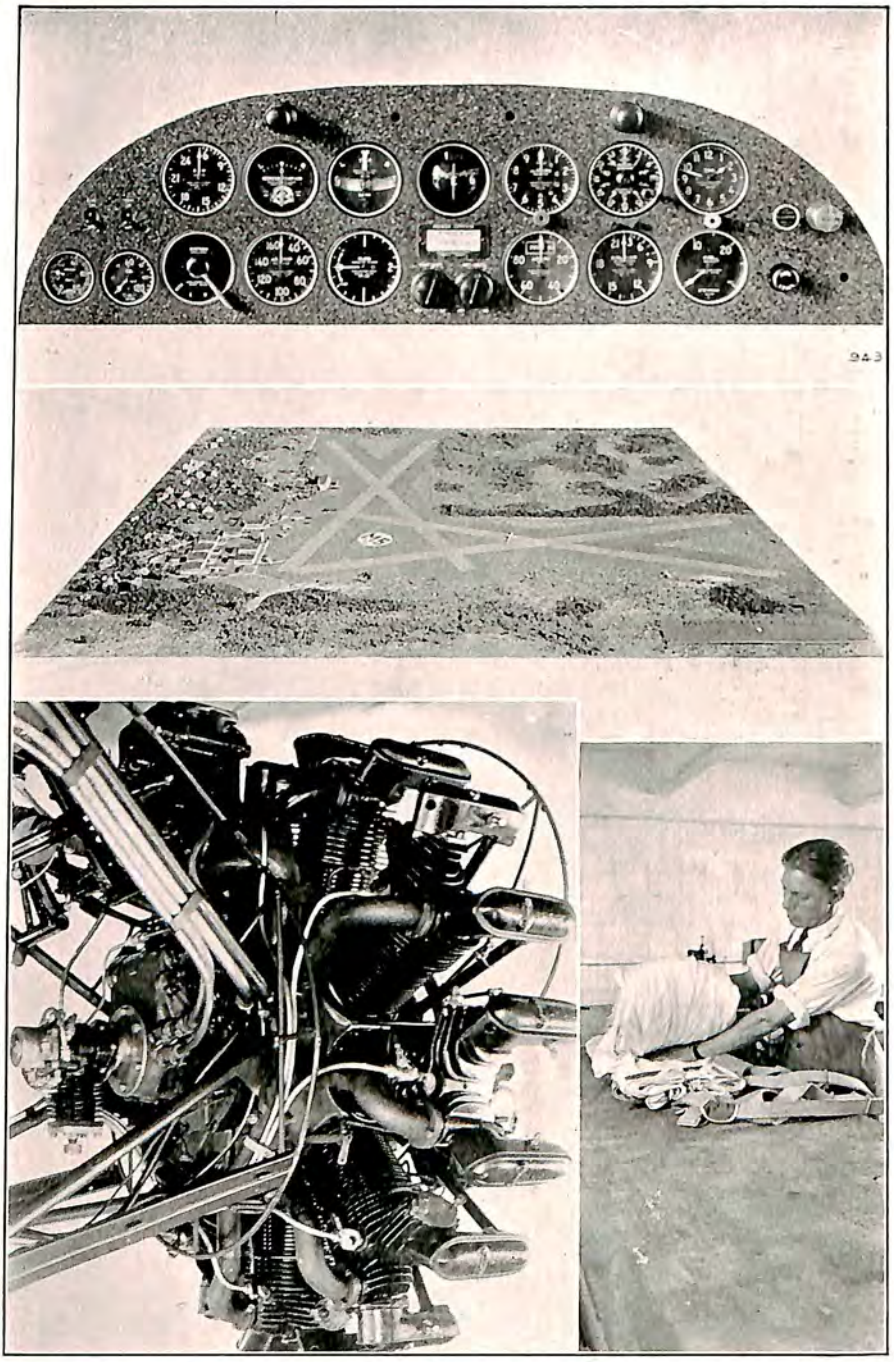
During the year Wright engines were sold for training, bombing and pursuit planes in both the Army and Navy air services and for commercial planes on a large number of air transport routes, for surveying and exploring machines, sightseeing planes and private aircraft.

Expansion in Accessory Fields

Because scores of different kinds of materials and hundreds of separate parts must be invented, designed and built before an air-



(Top) Making beacons at plant of Sperry Gyroscope Co. (Center) General Electric floodlight illumination at Boise, Idaho. (Bottom) General Electric Novalux field-lighting projector.



(Top) Pioneer Instrument Board. (Center) American Airports Corp. model of Mid-South Airport, N. C. (Lower Left) Heywood starter. (Lower Right) Folding Russell Lobe parachute.

plane or engine becomes a finished product, the accessory branches of the aircraft industry in 1928 were greatly expanded to meet the new demand. There were many instances where companies devoting only a small part of their effort to producing parts for aircraft felt impelled to reorganize those branches and make them equal in importance with their older divisions, such as those purveying to the motor car, the radio, electric and other industries. Increases in the number of planes during the year and production schedules for a still greater output in 1929 encouraged them to enlarge factory space, augment their forces of skilled workmen and develop their research and laboratory facilities in order to meet competition and improve their products.

Air Associates, Inc., of New York, distributing agents for important models of airplanes, engines and parts, established a complete consolidated air ticket bureau in their show room at 535 Fifth Avenue, New York City. Working capital was quadrupled. Supply and service branches were opened in Chicago and Newark.

The Airport Development & Construction Company of Philadelphia was organized late in the year to provide expert technical advice and consultation in every phase of airport work. Officers of the company include C. Townsend Ludington, E. N. Gott and J. Brooks B. Parker. T. E. Denton, the president, was formerly an executive of the Philadelphia Rapid Transit Company.

The American Airports Corporation of New York and its affiliated company, American Airports Corporation of New England, were engaged for airport development and management or both in 33 cities.

The directors of American Airports Corporation are: Stedman S. Hanks, president; Guy George Gabrielson, treasurer; Jerome C. Hunsaker, vice-president of Goodyear-Zeppelin Corporation; Gen. J. Leslie Kincaid, president of American Hotels Corporation; Wm. B. Mayo, chief engineer of Ford Motor Company; George Mixter, vice-president, Division of Aeronautics of Stone & Webster, Inc.; Gen. John F. O'Ryan, president of Colonial Airways System; Franklin Remington, chairman of board of The Foundation Company; and James W. Wadsworth. The directors of American Airports Corporation of New England are: Williard E. Freeland of Freeland & Warren, Inc.; Stedman S. Hanks; John S. Lawrence of Lawrence & Company; George Mixter; and Robert A. Warren of Freeland & Warren, Inc.

The American Gas Accumulator Company during the year increased its factory floor space 20 per cent and developed a new type of acetylene airway routing beacon. American Neon Light

Corporation increased its factory space and shop force and made experimental installations of Neon beacons for airport use. The Austin Company erected a number of modern hangars at important airports throughout the country.

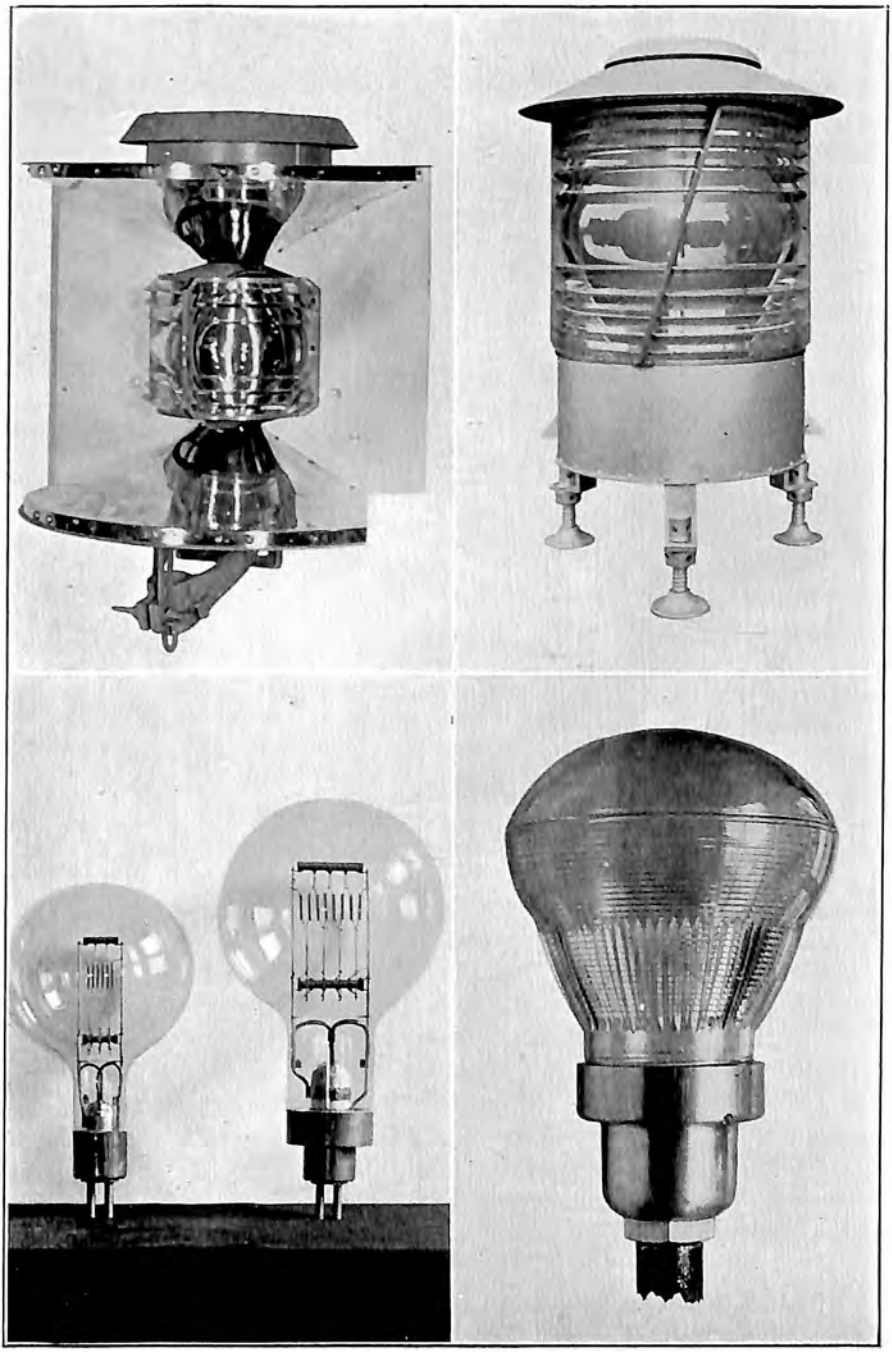
The Balsa Wood Company developed the use of its Lata Balsa Wood in attaining streamlining. The material was credited with having increased the lift and speed of the Ryan Brougham from five to eight miles an hour. Bendix Brake Company placed in production a full line of disc wheels incorporating brakes within the streamlining of the disc. Berry Brothers placed their forces on over-time and double shift to handle the growing demand for aircraft varnishes and other finishes which were shipped in carload lots and stocked in Wichita and Seattle. Black and Bigelow, Inc., of New York, air transport engineers, had charge of construction work at the Long Island Aviation Country Club and designed several other airports, including that at Camden, N. J.

Other companies engaged in airport development work included the Bonforte Airport Engineering Corp., of New York; Murphy & Chapman, of New York; Saginaw Airport Co., of Saginaw, Mich.; and B. Russell Shaw Co., Inc., of St. Louis.

The Consolidated Instrument Company of America expanded facilities to include plants in Baltimore, Mt. Vernon, N. Y., Philadelphia and New York City, and were preparing to produce complete instrument boards. The Crawford Airplane Supply Company announced at the end of the year that it carried a stock of supplies, life belts, fuel pumps, etc., in excess of $250,000. The Eclipse Machine Company added to its line a light weight hand inertia starter and a single cylinder motor, weighing 28 pounds, to drive a directly connected generator, the combination making a complete portable aircraft power plant for radio transmission.

The Edo Aircraft Corporation increased the factory floor space at its College Point, L. I., plant by 90 per cent and developed a complete line of standardized all-metal float installations which at the end of the year were found in 19 different types of American planes. The Electric Storage Battery Company of Philadelphia increased the number of sizes in its line of batteries with smaller sizes for lighting loads and radio. Batteries were also developed for the new radio beacon receiving sets.

E. I. duPont de Nemours & Company, and subsidiaries, increased their facilities for making airplane dopes, fabrikoid and pyralin sheeting. The industrial finishes division prepared to offer a finishing system for every part of an airplane and a complete line of finishing materials. The fabrikoid division of the duPont



(Top Left) B.B.T. Corporation beacon. (Top Right) B.B.T. intermediate land floodlight. (Bottom Left) Westinghouse 5000-watt, 115-volt G-64 bulb lamp and 10,000-watt, 115-volt G-80 bulb lamp. (Bottom Right) Westinghouse marker light.

Company developed several special color combinations for airplane use. Nemours airplane fabrics were made in new light weight materials, developed for interior trim of cabin ships.

The duPont Viscoloid Company manufactured pyralin gasoline tank gauges, running lights, dial faces for instruments and sheeting for windows. The outstanding advantage of pyralin for these purposes is that it is a substitute for glass and is unbreakable.

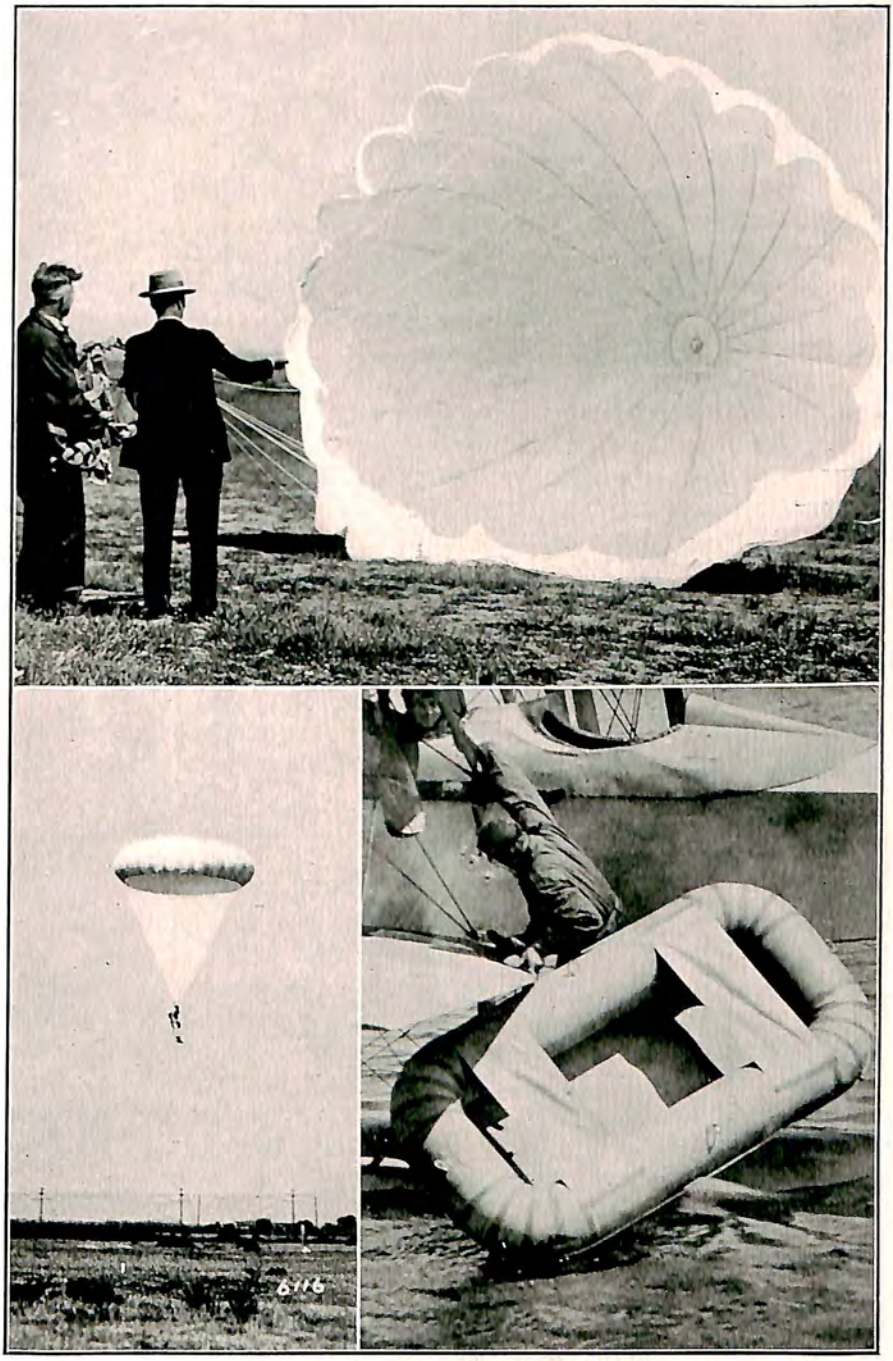
The Ex-Cell-O Tool & Manufacturing Company of Detroit increased production facilities 100 per cent during 1928 and at the end of the year made plant additions providing another 100 per cent increase. That was the ninth year that the company had been making aircraft engine parts, starting with one customer, Packard, and expanding to include nearly all of the motor builders in the country.

The General Electric Company produced a new type of airport floodlight, in which circular lenses and mirrors, ordinarily used in searchlights and floodlights, are entirely absent. It contains 14 high-power incandescent lamps, giving a total of approximately three million beam candlepower. The lamps are arranged in a row in front of a half dozen cylindrical mirrors that spread the light over the field without permitting it to rise high enough to interfere with the vision of the pilots landing directly into the beam of the powerful floodlight.

At a distance of a mile from the floodlight there is a sufficient illumination so that a newspaper can be read; and at 2,500 feet, the average maximum airport distance, the illumination is sufficient so that landing pilots can quickly and accurately determine the nature of the surface.

B. B. T. Corp. of America, with main offices in Philadelphia, made many improvements on its lighting equipment during the year.

The B. F. Goodrich Rubber Company expanded its facilities to produce additional accessories, including the new size airplane cases required under the standard set by the Society of Automotive Engineers. The companies purveying tires and other rubber equipment for airplanes included Firestone Tire & Rubber Co., United States Rubber Company, Goodyear Tire & Rubber Company, the Russell Mfg. Co., of New York, and the Goodrich Rubber Co. The Hartol Refining Corporation conducted important tests with lubricating oil. Stewart Hartshorn Company expanded facilities 50 per cent, enlarged its factory space 33 per cent and increased the number of employees by 25 per cent. The Haskelite Company developed its new Plymetl with aluminum duralumin faces, and also produced both insulated Haskelite and Plymetl. The



(Top) Testing an Irvin parachute. (Bottom Left) Landing with Russell parachute. (Right) Launching an Airships Incorporated Airaft.

most spectacular use of the insulated panels was made in the Army *Question Mark* which early in January, 1929, broke the sustained flight record, remaining up more than six days. The floor was made of balsa-insulated Haskelite and this was largely responsible for the crew's ability to "outlast" the engines.

The Heywood Starter Corporation, led by the demand for lighter starters, began work in that field. Factory space in Detroit was expanded 100 per cent and the number of employees greatly increased.

Interflash Signal Corporation, New York, in addition to their general automatic flashing signal equipment, at the end of the year was engaged in the manufacture and development of aviation beacons. The company has gone into extensive production of aviation automatic flashing beacon lights, especially airways course lights for night flying, introducing a new development of double pilot and adjustable light sources.

Kendall Refining Company airplanes, in 1928 visited the principal airports, and representatives of the company established distribution facilities for Kendall Penzbest motor oils. Other companies developing the market in aviation fuels and lubricants included Standard Oil of New York; the Texas Company; Texas Pacific Coal & Oil Co.; Gulf Refining Company, of Pittsburgh; Standard Oil Co. of New Jersey; Standard Oil Co. of Indiana; Tide Water Oil Sales Corp., of New York; Vacuum Oil Company, of New York; Wolverine Lubricants Co., of New York, and the Richfield Oil Company, of California. Walter Kidde & Company developed the Lux flotation equipment for landplanes. It consists of two rubber bags, a container of Lux gas under pressure and release mechanism. The rubber bags when inflated act as pontoons and add enough buoyancy to a land plane to hold it above the surface. Under ordinary flying conditions the rubber bags are stored, deflated, in compartments on both sides of the fuselage. If trouble occurs, a pull in the release mechanism opens the bag compartment, permitting the bags to fall out, and also inflates them by discharging the Lux gas into the bags.

The MacWhyte Company patented their new safe lock terminal for tie rods and put it into production. A feature of the lock nut is that it can be tightened without limit and yet will not damage terminal or tie rod. The Moto Meter Company in 1928 developed an ice warning indicator, designed to inform the pilot of formation of ice on the airplane. The National Steel Products Company continued its development work on metal fittings for both military and commercial planes.

The Packard Electric Company set up an engineering department devoted to the solution of airplane wiring and radio shielding problems, and commenced marketing a complete line of shielded cable. Perry-Austin Manufacturing Company reported that they were expanding facilities for the production of airplane dopes.

The Pioneer Instrument Company, Brooklyn, N. Y., prominent manufacturers of aircraft instruments, in 1928 standardized their entire line. A new and smaller size was adopted, permitting more compact grouping and better arrangement of instruments on a panel. An outstanding development was the Titterington Micrometer Compensator which was adopted for all Pioneer compasses including the Earth Inductor Compass. This Compensator, which eliminates the loose magnets formerly used, incorporates a magnet which can be adjusted to any strength from zero to its maximum in either direction by the turning of an adjustment screw. A new flush mounting magnet compass was also introduced.

Rand McNally & Company developed and placed on the market a large, detailed map of the United States, designed for airports and aviation executives. It is 10 feet 2 inches by 6 feet 6 inches on a scale of 25 miles to the inch. Its projection (conic, based on two standard parallels) makes it possible to measure distances in any direction directly from the map with a negligible error. The map shows towns of over 1,000 population, States, counties and rivers. It is accompanied by a complete index. Concentric circles at 100-mile (4-inch) intervals around the point at which the map is used make possible the rapid computing of distances, flying times and rates. Another Rand McNally contribution was the edition of state pocket air maps of dependable accuracy for the entire United States.

The H. H. Robertson Company in 1928 supplied its protected metal roofing and siding sheet for hangars at Minneapolis, Oakland, Chicago, and Miami. The Rome Wire Company supplied its Trenchlay non-metallic and special boundary light cable at a number of airports. The Russell Parachute Company during the year designed a new method of placing the shroud lines within the pack, thereby eliminating the possibility of fouling. The Irving Airchute Co., of Buffalo, also expanded its facilities to accommodate the growing demand for "Irvin" parachutes.

The Scintilla Magneto Company made considerable progress in 1928 toward satisfactory radio shielding for magnetos, developed a new replacement unit for the OX-5 engine and perfected its type SC magneto, effecting a weight saving of 15 to 20 pounds, chiefly through the use of the company's improved magnet steel of high

cobalt content. Splitdorf Electric Co., of Newark, also planned to take care of the growing demand for magnetos.

The Sperry Gyroscope Company supplied to the Department of Commerce and to the privately operated institutions a large number of incandescent airport and airway beacons, and equipped many airports with Sperry high intensity floodlights units.

The Stromberg Motor Devices Company designed, tested and put into production a series of single barrel aircraft carburetors, designated as the NA-R models, to meet the carburetion requirements of aircooled engines. These range in size from 1½ to 3 inches, and incorporate a number of new features not previously used in American carburetors, the most outstanding of which are the use of a pump for smooth and rapid acceleration, an economizer for obtaining maximum economy at cruising speeds regardless of the richness of the mixture at full throttle, and a needle valve type of mixture control. The standard Stromberg plane tube air bled type of metering system has been retained in all designs. A number of new carburetors to meet special military and commercial requirements were developed for experimental and service use.

The Summerill Tubing Company expanded its aircraft accessory manufacturing facilities 100 per cent in 1928 and also increased production to that extent. Beginning operations on July 15th the Supreme Propeller Company of Wichita, Kan., formerly the Stone Propeller Company of Dayton, within six months increased production from three a day to ten a day. Other companies producing propellers included Hamilton Aero Mfg. Co., of Milwaukee; Reed Propeller Co., of New York, and Standard Steel Propeller Co., of Pittsburgh.

The Westinghouse Electric Manufacturing Company expanded its facilities to meet the demand for airport lighting equipment. The Westinghouse Lamp Company developed its airplane headlight lamp with projector to be placed on the underside of the fuselage for emergency landings in otherwise unlighted fields.

The companies making spark plugs included Champion Spark Plug Co., of Toledo, Ohio; A C Spark Plug Co., of Flint, Mich., and The B.G. Corporation, of New York.

Among the important concerns contributing to the success of American aviation the following should be noted. Clarence Whitman & Sons, Inc., of New York, long established in the textile trade, specialized in airplane fabrics. Aerovane Utilities Corporation, of New York, brought out a complete and important line of airport markers. The Celluloid Corporation, Newark, N. J., through special research and study, was able to supply the industry with more satis-

factory celluloid products. F. R. Cruikshank & Co., of New York, entered the field of aviation insurance during the year. U. S. Aviation Underwriters, Inc., specialized in all forms of aviation underwriting. The Travelers Insurance Company, of Hartford, Conn., one of the first to offer aviation protection, expanded the facilities of its special department to take care of the business developed by its effective coverage of the industry.

The Elgin National Watch Co. expanded its aircraft instrument division and added new equipment to its extensive line known to the trade as "Avigo" instruments. Follmer Clogg & Company, of Lancaster, Pa., also expanded their manufacturing facilities during the year and found a growing market for their "Positive Opener" parachute. Wellington Sears & Co., of New York, were among the important manufacturers with a constantly expanding market for airplane fabrics.

The increased demand for airplanes was reflected in the expansion of facilities throughout the industry. The Binks Spray Equipment Co., of Chicago, developed a large market for its paint spraying equipment. The Leece-Neville Co., of Cleveland, greatly increased their line of voltage regulated generators for all types of airplanes. The Naturaline Co. of America, Tulsa, Okla., reported increased sales for its aviation fuels. The Linde Air Products Company, manufacturers of oxygen, acetylene and carbide welding and cutting apparatus, found the aircraft industry using more of its products month by month.

The Johnson Aeroplane & Supply Company, of Dayton, one of the oldest in aviation, expanded their facilities and enlarged their stocks of materials and equipment for manufacturers, operators, schools and airports. The Aero Supply Mfg. Company, of College Point, N. Y., long established in their special field, developed new markets throughout the country for their extensive line of airplane accessories, parts and supplies. Brewster & Co., Inc., of Long Island City, N. Y., one of the first of the large manufacturers in other fields to enter aviation, expanded its aeronautical department to accommodate the increased demand for pontoons, flying boat hulls and other parts. The Kelsey-Hayes Wheel Corporation, of Detroit, was another important concern to report a rapidly growing market for its complete line of airplane wire wheels. The Aircraft Products Corporation of America, Detroit, besides other important equipment popular throughout the industry, specialized in the manufacture of Oildraulic Shock Struts. The Cleveland Pneumatic Tool Company found a ready market for its line of airplane parts, including its specialty Aerol Struts.

The Crouse-Hinds Co., of Syracuse, N. Y., increased facilities to supply its rapidly growing market with complete lighting equipment for airports and airways. The National Carbide Sales Corp., of New York, besides its large general business, specialized in airport lighting equipment.

The Garrison Fire Detecting System, Inc., of New York, became extensively interested in the industry and supplied automatic fire alarm equipment for airport hangars and other buildings. Van Schaack Bros. Chemical Works, Chicago, added to its well established business a department producing high grade airplane dopes. Titanine, Inc., of Union, N. J., a pioneer in its field, continued to expand facilities for making its well-known line of dopes, paints and finishes for airplanes.

E. S. Twining & Co., of New York, in the textile field, found a steadily increasing market for its popular "Flightex Fabric" for aircraft. The Thurston Cutting Corporation, of New York, another large textile company purveying to aviation, specialized in production of "Dartmouth Tex," high grade cloths and tapes for aircraft.

A. G. Spalding & Bros., of New York, internationally famous throughout the sporting world, reported vastly increased sales of flying suits, helmets, gloves and other equipment for flyers.

Voice of the Sky, Inc., of New York, continued the development of its "plane speaker," a large amplifier carried in a plane and transmitting to the public on the surface advertising messages, music and the like. The S. S. White Dental Mfg. Co., of New York, another concern credited with having contributed much to aviation through one of its special departments, continued to supply the industry with flexible shafting and accessories for tachometer driving.

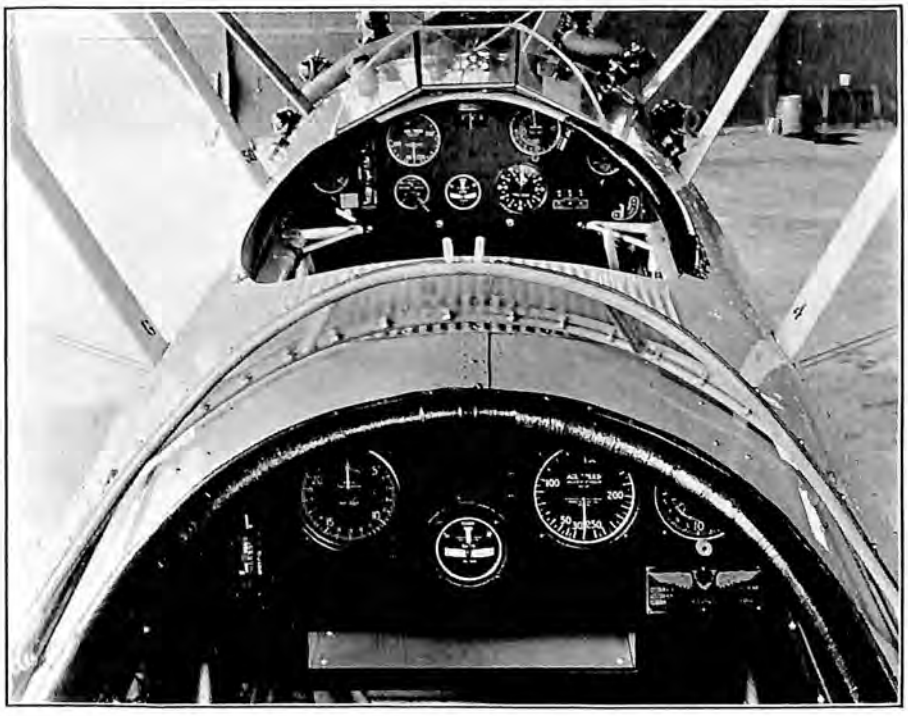
The number of important machine tool and supply manufacturers making special airplane parts was another indication of the industry's growth.

John A. Roebling's Sons Co., of Trenton, N. J., continued to supply large quantities of aircraft wire and cable. The Taylor Instrument Companies, of Rochester, N. Y., maintained a special technical branch for the development of aircraft instruments. Thompson Products, Inc., of Cleveland, large manufacturers of valves and motor fittings, produced increased quantities of engine parts. The Wood & Spencer Co., of Cleveland, supplied many engine builders with connecting rods and other fittings. The Wyman-Gordon Company, of Worcester, Mass., one of the largest manufacturers of drop forgings, made crankshafts and other forgings for a large number of engine builders. The Aluminum Co. of America found a rapidly expanding field for its duralumin and allied products. Alu-

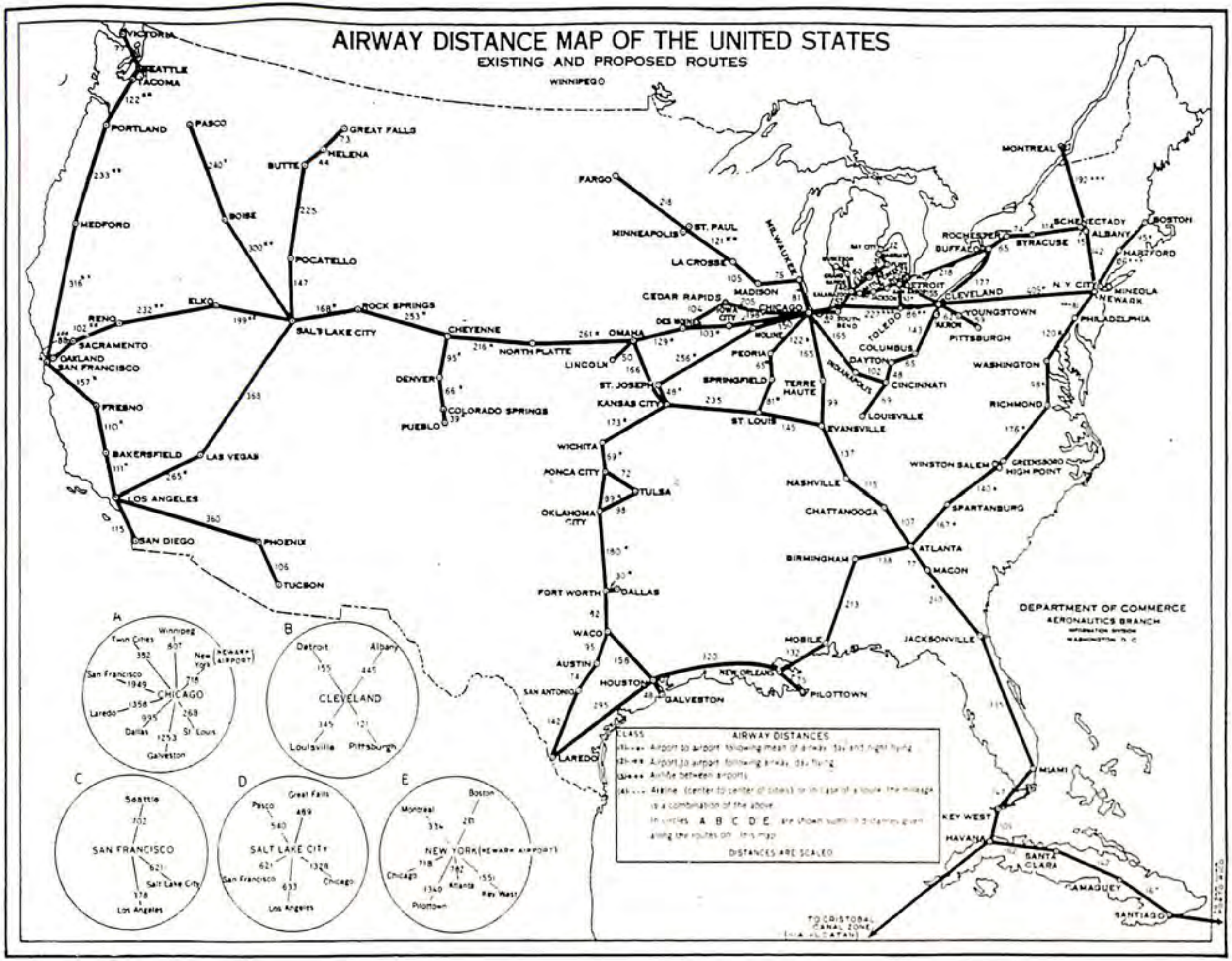
minum Industries, Inc., of Cincinnati, was another important company supplying aluminum materials in quantity. S. K. F. Industries, of New York, produced for many of the leading engines the noted "Scayef" self-aligning ball and roller bearings and other materials.

The Park Drop Forge Co., of Cleveland, one of the larger concerns in its field, expanded its market for crankshafts, camshafts, rod and gears. The Bohn Aluminum & Brass Corp., of Detroit, one of the most prominent manufacturers of motor equipment and parts in the country, also expanded facilities to accommodate the growing demand. The Norma Hoffman Bearings Co., of Stamford, Conn., makers of the well-known "Precision" ball and roller bearings, was another company with a rapidly developing market. The J. G. Brill Company, of Philadelphia, nationally known car manufacturers, directed its attention to the increasing opportunities for sales expansion through the aircraft industry.

The Carpenter Steel Company, of Reading, Pa., was one of the most important producers of specialized material used in aircraft. The U. S. Hammered Piston Ring Co., of Irvington, N. J., expanded facilities to provide for increased output of engine rings.



Vought *Corsair* equipped with Pioneer Instrument boards.


AIRWAY DISTANCE MAP OF THE UNITED STATES
EXISTING AND PROPOSED ROUTES
WINNIPEGO
DEPARTMENT OF COMMERCE
AERONAUTICS BRANCH
AIRWAY DISTANCES
DISTANCES ARE SCALED
VICTORIA
SEATTLE
TACOMA
PORTLAND
MEDFORD
RENO
SACRAMENTO
OAKLAND
SAN FRANCISCO
FRESNO
BAKERSFIELD
LOS ANGELES
SAN DIEGO
PASCO
BOISE
GREAT FALLS
HELENA
BUTTE
POCATELLO
ELKO
SALT LAKE CITY
LAS VEGAS
PHOENIX
TUCSON
ROCK SPRINGS
CHEYENNE
NORTH PLATTE
DENVER
COLORADO SPRINGS
PUEBLO
FARGO
ST. PAUL
MINNEAPOLIS
LA CROSSE
MADISON
MILWAUKEE
CEDAR RAPIDS
DES MOINES
IOWA CITY
CHICAGO
OMAHA
LINCOLN
ST. JOSEPH
KANSAS CITY
MOLINE
PEORIA
SPRINGFIELD
TERRE HAUTE
ST. LOUIS
EVANSVILLE
INDIANAPOLIS
LOUISVILLE
SOUTH BEND
TOLEDO
DETROIT
CLEVELAND
AKRON
YOUNGSTOWN
PITTSBURGH
COLUMBUS
DAYTON
CINCINNATI
BUFFALO
ROCHESTER
SYRACUSE
SCHENECTADY
ALBANY
MONTREAL
BOSTON
HARTFORD
N. Y. CITY
MINEOLA
NEWARK
PHILADELPHIA
WASHINGTON
RICHMOND
WINSTON SALEM
GREENSBORO
HIGH POINT
SPARTANBURG
ATLANTA
MACON
JACKSONVILLE
MIAMI
KEY WEST
HAVANA
SANTA CLARA
CAMAGUEY
SANTIAGO
NASHVILLE
CHATTANOOGA
BIRMINGHAM
MOBILE
NEW ORLEANS
PILOTTOWN
WICHITA
PONCA CITY
TULSA
OKLAHOMA CITY
FORT WORTH
DALLAS
WACO
AUSTIN
SAN ANTONIO
HOUSTON
GALVESTON
LAREDO
TO CRISTOBAL CANAL ZONE
A
CHICAGO
B
CLEVELAND
C
SAN FRANCISCO
D
SALT LAKE CITY
E
NEW YORK (NEWARK AIRPORT)

CHAPTER VII

AIRPORTS AND AIRWAYS

ON Dec. 31, 1928, there were 48 airways in the United States. They had a combined length of 20,000 miles and linked together in one nation-wide network of flying routes 368 cities which at the end of the year possessed municipal airports in various stages of development.

Along 19 of the main routes 7,566 of their total length of 9,135 miles had been lighted and otherwise made available for night flying. The equipment installed by the Aeronautics Branch of the Department of Commerce, charged with maintaining the airways system of the nation, included the lighting of 197 intermediate fields, 1,269 rotating or flashing beacon lights, with upper air observers, weather reporting and distributing stations, radio telegraph, radio telephone and land telephone communication and radio beacon direction installations.

At the same time the Department of Commerce had under contract 2,001 miles of lighting, with 49 intermediate fields and 244 beacon lights. And 2,000 miles more of beacon lights were to be installed or contracted for during the first six months of 1929.

The principal result of that program when completed was to provide an all-lighted transcontinental airway between New York and San Francisco, thereby making possible both day and night service all the way between the Atlantic and the Pacific. Until the route between Salt Lake City and San Francisco had been lighted night flying was possible only between New York and Salt Lake. With night service throughout the transcontinental route regularly scheduled air transport could be accomplished between the coasts in two nights and a day.

Adhering to the principle that commercial flying must be a 24 hours a day matter in order to compete successfully with surface transportation, the Government, the industry and business leaders generally prevailed upon municipalities to equip their fields for night operations. While the airport program was well under way at the beginning of 1928 very little lighting had been done, and it remained for the 12 months that followed to bring about the desired development.

The Government agencies were selecting routes offering the best flying conditions between designated airports, at the same time

providing them with intermediate fields approximately 30 miles apart, route markers and landing field markers for day flying, and all the equipment for safe navigation at night.

Municipalities in turn commenced installing airport beacons, red obstruction lights, green range lights on the safe approaches, lighted wind indicators, floodlighted hangars and other buildings. The degree of completion with which airports were thus equipped determined their rating under the provisions of the Air Commerce Act. The Department of Commerce was to begin rating airports early in 1929.

While there were only 365 municipal airports in operation in 1928 other landing fields brought the total number to 1,324. They included 368 commercial and private fields, 312 auxiliary fields, the 197 Department of Commerce intermediate fields, 64 Army, 16 Navy, one Department of Agriculture and one Interior Department field.

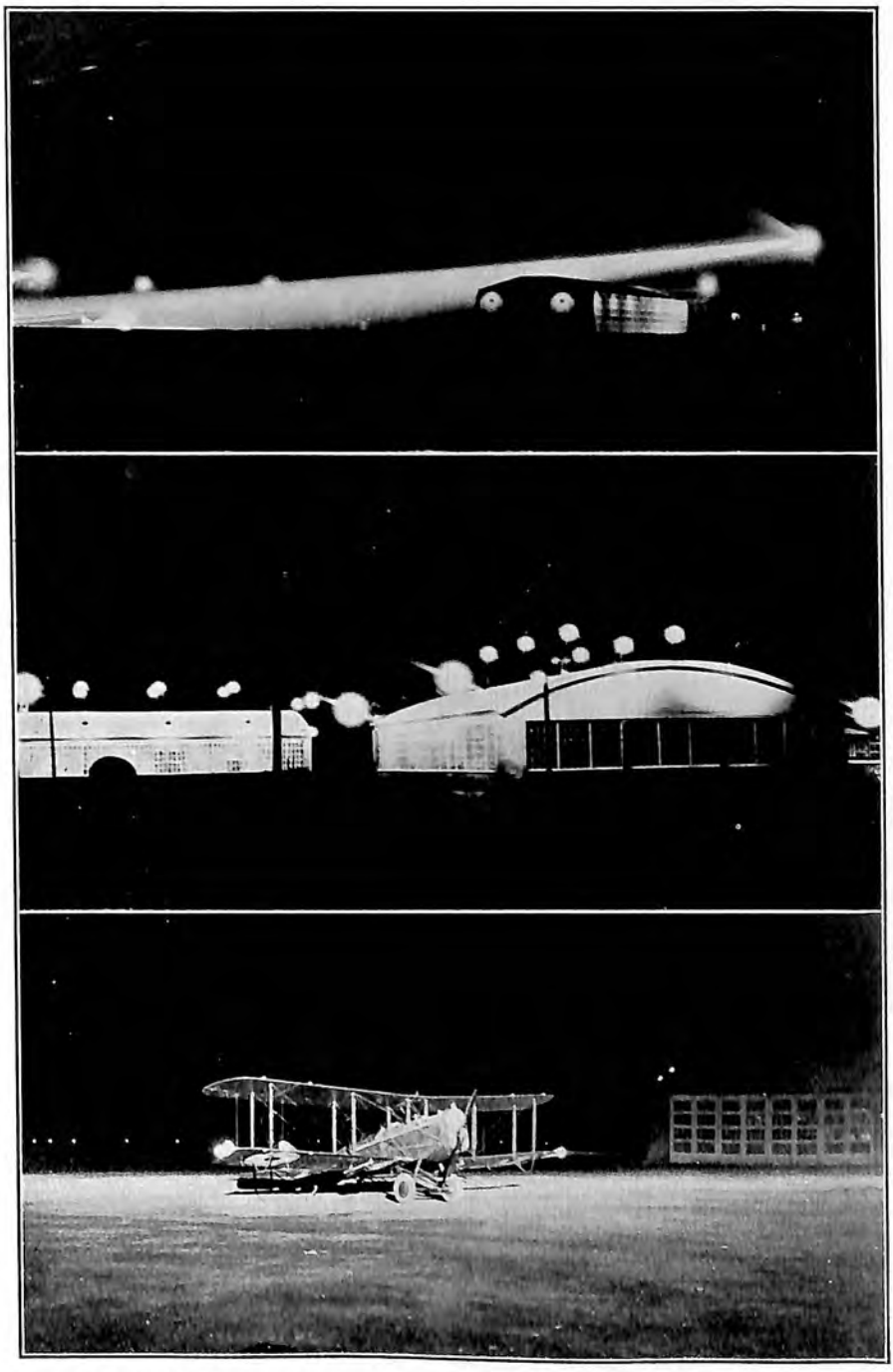
California led all other States with 143 fields; Texas had 101; Pennsylvania, 83; Ohio, 62; Illinois, 60; Oklahoma, 46; New York, 43; and Iowa, 38. With those in other States they comprised the 1,324 fields which at the end of the year either had airport facilities or which had been marked and reserved for landing fields without facilities. At the same time there were 894 other projects for fields, the majority of them municipal; while the Department of Commerce had listed no less than 4,000 places in the United States where landings might be made.

That the public in accepting aviation as something to be used in a practical every day manner is prepared to bear the financial cost involved in providing adequate landing facilities, was evidenced at the November elections when many bond issues for airports were voted upon and passed.

A few cases were taken into the Courts to determine the status of an airport, whether it is properly a public necessity or should be classified as of benefit to a special class and therefore barred from support with tax funds. In each case the bond issue was sustained. The decree of the Missouri State Supreme Court expressed the common legal opinion, stating in part:

"An airport is analagous to a harbor, and if the ownership and maintenance of docks falls within the scope of municipal government, it would seem that airports must necessarily do so."

An idea of the money invested in municipal airport development may be had by noting the expenditures at 12 of the principal flying centers. St. Louis is spending $2,000,000, mostly for land. The land value of the Chicago Municipal Airport is $1,850,000;



(Top) Searchlight spotting mail plane. (Center) Cleveland airport at night. (Bottom) Night mail plane with landing lights.

at Oakland, Cal., $1,500,000; Cleveland, $1,220,000; Boston, $1,075,000; San Francisco, $1,000,000; Buffalo, $650,000; St. Paul, $550,000; St. Joseph, Mo., $200,000; Fort Worth, $175,000; Philadelphia, $160,000, and Hartford, Conn., $155,000.

Lighting and other equipment at Buffalo cost $205,000; and late in 1928 the estimated cost for expansion to accommodate the traffic was an additional $500,000. Chicago spent $115,000 on equipment and began planning for another airport on the lake shore to cost $10,000,000. Without exception the municipalities were confronted with the possibility of soon having to enlarge and improve their facilities. The Oakland airport was the only public field in the United States at the end of the year which had been brought anywhere near to the completion stage. But at least 100 others were making considerable progress, notably the Los Angeles, San Francisco, St. Louis, Kansas City, Atlanta and Newark airports.

Newark Airport was to become the New York terminal field for the air transport lines, and at the start of operations was fairly well equipped for night flying. New York also commenced its development of Barren Island in 1928.

Other agencies participating in the improvement of airways during the year included the Daniel Guggenheim Fund for the Promotion of Aeronautics which organized a campaign to procure adequate roof markings in all communities. In this the Fund had the coöperation of the Post Office Department, which directed all postmasters to take part in the movement. Complete statistics concerning airports and airways will be found in the Appendix.

Aids to Navigation

Under the Air Commerce Act the Weather Bureau is the responsible agency for collecting and disseminating weather information. The Airways Division of the Department of Commerce operates in connection with the Weather Bureau in disseminating weather information along airways. The bureau maintains personnel at the principal airports to analyze and interpret reports. The Airways Division now maintains 28 radio stations for the exchange of weather information and dispatch of airplanes, this service being supplemented by telephone and teletype communications.

Great progress was made during the year in the development of radio communications to aircraft. On the transcontinental airway, two stations were in operation experimentally under the Airways Division for several months, and 12 additional radio-telephone transmitters were installed at Cleveland, Bryan, Chicago, Omaha,

North Platte, Cheyenne, Rock Springs, Salt Lake City, Elko, Reno and Oakland. At the close of 1928, these radio stations had been completed and a new system of control of airways operation initiated.

The radio telephone transmitters are of 2,000-watt capacity, broadcasting voice on 900 meters, with a reliable range of 125 miles. Apparatus for 15 additional stations was to be delivered soon, and other stations established along other night flying routes. A radio-beacon and communication station was being set up at Key West for the Pan-American Airways.

A new system of weather and communications service was devised by the Weather Bureau and Department of Commerce to develop the greatest utility from the new radio telephone facilities and it was proposed to introduce this system on the transcontinental airway, using the stations then under construction. This system promises the degree of safety required by air transportation on a basis that permits unlimited traffic. Timely and accurate weather and landing conditions were to be made available to any airplane, airport, landing field or individual that cared to tune in.

The eastern division of the transcontinental airway (between New York and Chicago) was the first to be operated under the new system. The control center was located at Cleveland, from which point the Weather Bureau, National Air Transport Company and Airways Division manage the operation of the service. The American Telephone and Telegraph Company had arranged to install an automatic telegraph typewriter system under an agree-

ment with the Airways Division for instantaneous communication between the radio stations, landing fields along the route, the Weather Bureau and operations manager's office. By this system a message written on a typewriter at any point in the circuit between Newark, N. J., and Cleveland could be transmitted instantaneously and written on a tape at all other points in the circuit. The radio operator at the Department of Commerce radio stations was to broadcast the messages by radio telephone.

The weather service, forming the basis of this new system, is founded on the regular reports gathered by the Weather Bureau throughout the United States each morning and evening, supplemented by a secondary net of weather reports gathered at intervals of three hours from critical points in the vicinity of the airway route and further supplemented by hourly reports of weather and landing field conditions from intermediate landing fields located 50 miles apart along the airway. The Weather Bureau representative analyzes the weather data and prepares a short range forecast of weather conditions, predicting the track, movement and severity of storms, and all other vital information required for the safety of flying.

Aircraft Radio

The Radiomarine Corporation of America is a subsidiary of the Radio Corporation of America. It is engaged in that oldest branch of radio service, communication with ships at sea, and it was believed by the officials of the Radio Corporation of America that the organization built up and experience gained through many years of marine radio communication and work with radio direction finders on ships should be utilized in working out the problems connected with one of the more recent applications of radio—communication with and navigation of aircraft. Accordingly the aircraft radio activities of the Radio Corporation of America were transferred to the Radiomarine Corporation of America during the summer of 1928.

In coöperation with the engineers of the Radio Corporation of America and its associated manufacturing companies, General Electric and Westinghouse, a program of active development and manufacture of radio communication and navigation devices suitable for aircraft is being carried out. This work has included investigations to determine the amount of power needed for communication between aircraft and ground and the wave lengths most suitable for such service. Much of this work was carried out during 1928 in coöperation with the Pan-American Airways,

Bell Laboratories airplane used for experimental radio telephone work.

which permitted the use of its facilities in flight testing apparatus and working out methods of applying radio to navigation of aircraft.

Of the equipment developed there is now being manufactured a combination telephone and telegraph transmitter with an output of 100 watts which can be furnished for operation in the wave band of 600-950 meters or on any of the waves which the Federal Radio Commission recently allocated for the use of aircraft in the 50-200 meter band. This transmitter is so designed that suitable space in which to install it can usually be easily found, and the weight has been kept at a minimum for a transmitter of this power.

Transmitters of smaller power (approximately 10 watts) have been developed and tested as well as a larger transmitter of about 300 watts. As a result of this experience it is believed that 100 watts output may be considered the maximum power necessary for communication from aircraft to ground, as applied to the average transport plane, and that in many cases much less power will be sufficient.

Receiving sets have been developed, tested and are being manu-

factured for use in navigating planes by means of the radio range beacons provided by the Department of Commerce. This receiver operates on a vertical pole antenna only six feet high, projecting out of the top of the fuselage. The receiver and its antenna may be located in any convenient part of the plane, since provision is made for remote control, including adjustment of wave length. It has a wave length range of 600-1,100 meters so that it is suitable for receiving the radio range beacons, the Department of Commerce telephone stations which broadcast weather reports, and also, if desired, the marine radio shore stations with which planes flying over the water may communicate. Since the antenna used is only six feet in length, this receiver is necessarily designed to have a tremendous gain, three of the tubes used being of the screen grid type. Other receivers suitable for communication on the shorter waves have also been developed and are being manufactured.

The Bell Telephone Laboratories and Western Electric Company, subsidiaries of the American Telephone and Telegraph Co., in 1928 also made progress in aircraft radio communications.

A special radio receiver was developed for use in airplanes for receiving the weather and beacon signals now being provided by the Department of Commerce radio stations on the airways. This receiver is extremely sensitive and capable of furnishing ample strength of signals at distances of from 100 to 200 miles from these stations. It weighs about 12 pounds, with dimensions of approximately 4¼ by 8¾ by 13 inches. No batteries are required for operation of the receiver, both filament and plate supply being furnished by a small wind driven generator weighing about 6 pounds.

In addition to that special receiver, a complete two-way radio telephone system was under development at the end of the year, including apparatus for both ground and plane use.

Besides the development of that apparatus the Bell Telephone Laboratories made a systematic study, under flying conditions, with an equipment mounted in their own plane of the transmission of speech by radio between the plane and their own ground stations. The results of the work indicated which frequencies are desirable for this service, which ranges may be expected, and the special requirements which the apparatus must meet.

CHAPTER VIII

EDUCATION

IN 1928 there were a number of highlights in aeronautical education which proved to be a very broad field, including not only those institutions offering academic and practical training but other agencies influencing the trend of popular thought.

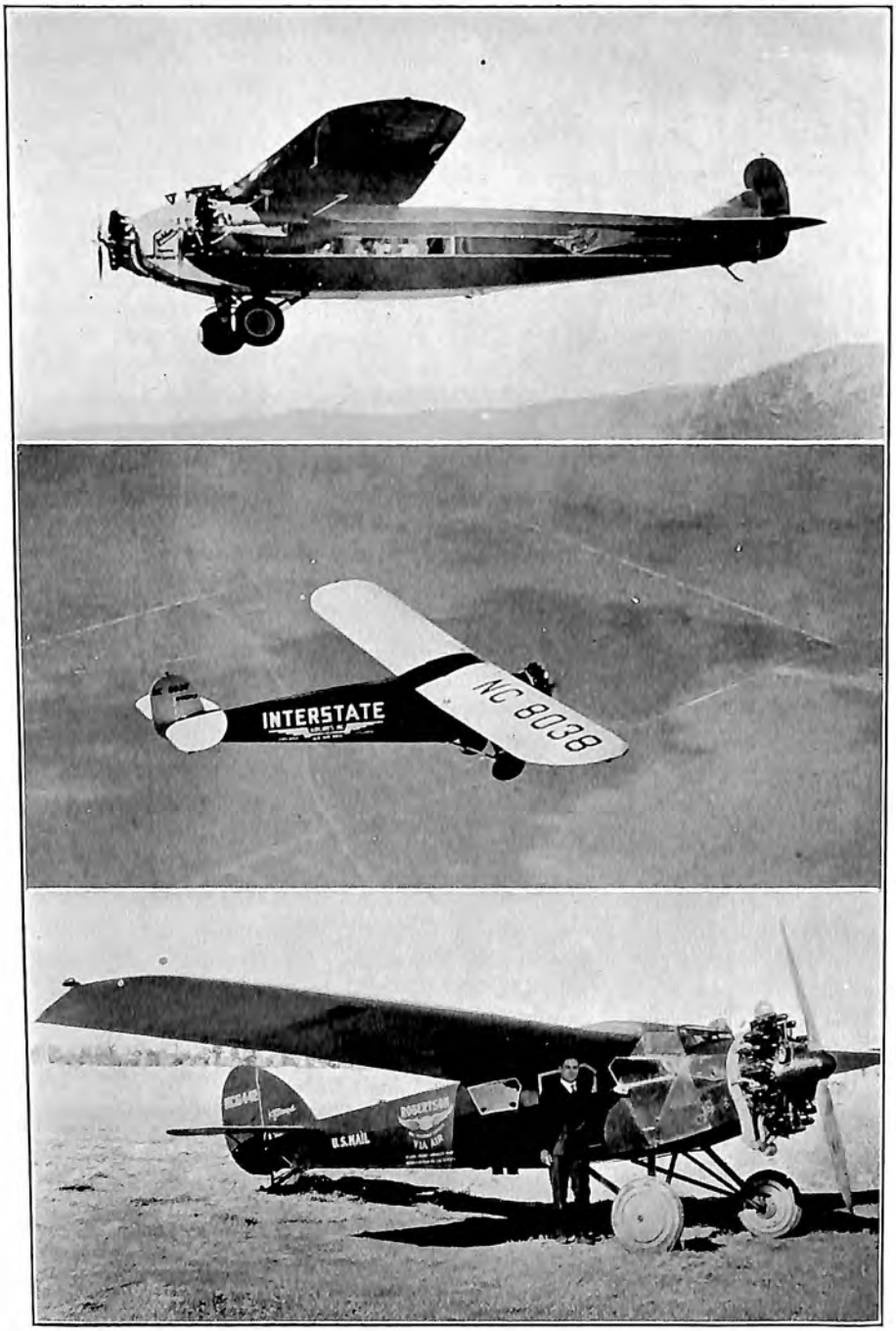
The newspapers remained, as they inevitably must remain, the most powerful and constructive medium for disseminating general information of current events. Throughout the country awakened public interest in aviation was reflected in the amount of space which the great newspapers devoted to the subject. Instead of the few paragraphs or at best a column which seemed ample a few years ago, whole pages were reserved regularly for news of flying and flying machines. By virtue of the printed word and editorial influence, the newspapers during the year demonstrated their power to create definite and lasting impressions.

Possibly the motion picture news films played an equally important part. All the companies in 1928 began to include some kind of flying topic in every weekly or bi-weekly release. Because the news films are viewed by more than a third of the population every week they have become extremely important. While the newspapers chronicle the contemporaneous history of aviation development, the motion picture illustrates it in graphic and fascinating form.

The important part taken by motion pictures in popularizing aeronautics was recognized on Sept. 24, 1928, when American aviation, through the Aernoautical Chamber of Commerce, gave a testimonial dinner to the motion picture industry in New York. It was the first time that one industry had so honored another.

More than a thousand prominent persons, Government officials and leaders in both industries heard speeches praising the motion picture for its constructive influence on aviation. A film depicting the Atlantic flight and the good-will tour of Col. Charles A. Lindbergh was a feature of the evening.

In the words of Lester D. Gardner, President of the Aeronautical Chamber, and toastmaster: "For many years the aeronautical industry has been conscious of the benefits derived from the motion picture industry, but only with the filming of Lindbergh's Atlantic flight, and subsequent tours, have these benefits become concretely apparent. Familiarity with flying, as depicted in pictures, has estab-



(Top) Fokker transport of the Richfield Oil Co. (Center) Interstate Airlines plane entering Chicago. (Bottom) Cessna cabin monoplane, *Whirlwind* powered.

lished aircraft, not only as the most speedy, but as a thoroughly reliable and safe means of transportation."

And Will H. Hays, responding for the Motion Picture Producers of America, explained: "When Colonel Lindbergh flew across the Atlantic, six newsreel companies made no less than 318 subject shots showing the take-off, first in San Diego and then on Long Island; the arrival in Paris, receptions abroad and at home, and the subsequent good-will hops. More than 42,000 feet of positive film were shown in the making of which 477,000 feet of negative film were exposed. No person in history has ever been accorded equal film footage and it is doubtful if any individual or event has been made known to so many people throughout the world."

Mr. Hays then presented on behalf of the Motion Picture Producers of America six sets of the Lindbergh film which the Aeronautical Chamber in turn gave, one to Colonel Lindbergh, one to the Secretary of State for the historical archives in Washington, one each to the Governments of Great Britain, France and Belgium. Assistant Secretary of State, William R. Castle, Jr., accepted the film on behalf of the State Department.

Later an American mission appointed by the Chamber and including Lester D. Gardner, William B. Stout and George W. Lewis, Director of Research for the National Advisory Committee for Aeronautics, officially presented the films to the Governments of Great Britain, France and Belgium.

The generally enthusiastic interest of all the people was further evidenced during the year by the rapid increase in the number of aviation periodicals and the big sales of books on aeronautical subjects. The advertising literature of the large corporations interested either in flying or in important units of the aircraft industry was another indication that aviation had achieved a high degree of popularity; for wherever possible company advertising and sales propaganda were tied in with matters pertaining to the air.

For the first time in the history of transportation the railroads commenced advertising air transport. Steamship lines advertised airplane connections. Travel agencies conducted aerial tours. Thousands of persons were flown in specially chartered planes as a direct result of that kind of advertising.

A broad survey of the lecture field during the twelve months reviewed here indicates that aeronautical lectures increased tenfold over the previous year. International Rotary, Kiwanis, Lions, Exchange and other business clubs featured their periodic luncheons with addresses by aviation experts; and reports show that the subject invariably was the most popular on the program. Chambers of

Commerce and Boards of Trade which were among the first civic groups to accept aviation, not only fostered local educational campaigns, but expressed the popular sentiment in more concrete form by launching municipal airport projects. The fact that the greater number of airport bond issues were passed at the November elections is ample testimony of the influence which the combined efforts of the various agencies had exercised on the public mind.

Aviation in Colleges and Schools

In no other field of utilitarian activity have so many elements combined to educate the younger generation. The number of col-

Measuring distances on Rand McNally Standard Aviation Map.

leges and universities which were giving or preparing to give aeronautical engineering courses was increased substantially in 1928. Five institutions were giving complete courses under grants of money made by The Daniel Guggenheim Fund for the Promotion of Aeronautics.

One, the California Institute of Technology, at Pasadena, had enrolled eight students for the first year that the aeronautical department was functioning. Another, the University of Michigan, at the end of the year had nearly 200 students in aeronautics, including 170 undergraduates in the course leading to the degree of Bachelor of Science in Aeronautical Engineering, a dozen graduates and sev-

eral special students. Twenty-five students had received degrees in June.

The Massachusetts Institute of Technology had 186 students in aeronautics. Of that number 134 were undergraduates and the graduate students were taking degree courses. Twenty-two students were graduated in June, 1928. Stanford University in California was another great institution giving aeronautics courses, with degrees. The University of Washington was the fifth to establish such degree courses under the grants of the Guggenheim Fund.

Among other important institutions to grant degrees was the University of Detroit with 343 students in aeronautics, seven of whom were to receive engineering degrees in June, 1929. The University of Minnesota reported 95 students taking the professional course in aeronautical engineering, with 45 others in other aviation courses.

The Daniel Guggenheim School of Aeronautics of New York University had 229 students in all classes preparing for degrees in aeronautical engineering. Seven who had specialized in aeronautics received degrees in mechanical engineering in 1928 and six took the degree of aeronautical engineer. During the year the faculty, recognizing the importance of air transport, organized this division of the aeronautical work into two options, aeronautical engineering and air transport. The University of Wichita, Kan., had 26 students in aeronautics at the end of the year, five to receive degrees in 1930.

Other schools giving aeronautic courses without, however, conferring special aeronautical engineering degrees, include: Armour Institute of Technology, Chicago, with 25 graduates in 1928 who had taken aeronautics;

University of California, with 51 students in 1928 completing the general course in aerodynamics;

Carnegie Institute of Technology, Pittsburgh, with 27 students taking all the aeronautics courses;

Kansas State Agricultural College, Manhattan, Kan., with five students of airplane design and aerodynamics;

University of Kansas, Lawrence, Kan., with 16 students in aeronautical engineering;

University of Nebraska, Lincoln, Neb., with eight graduates in aeronautics in 1928 and twelve students specializing at the end of the year;

Purdue University, Lafayette, Ind., with 23 of the 90 mechanical engineering graduates in June, 1928, having completed the aeronautical engineering course. Thirty per cent of the seniors in

mechanical engineering were specializing in aeronautics at the end of the year.

Renssellaer Polytechnic Institute, Troy, N. Y., was giving all mechanical engineering students a course in aeronautics;

The University of Cincinnati was preparing courses in aeronautics at the end of the year.

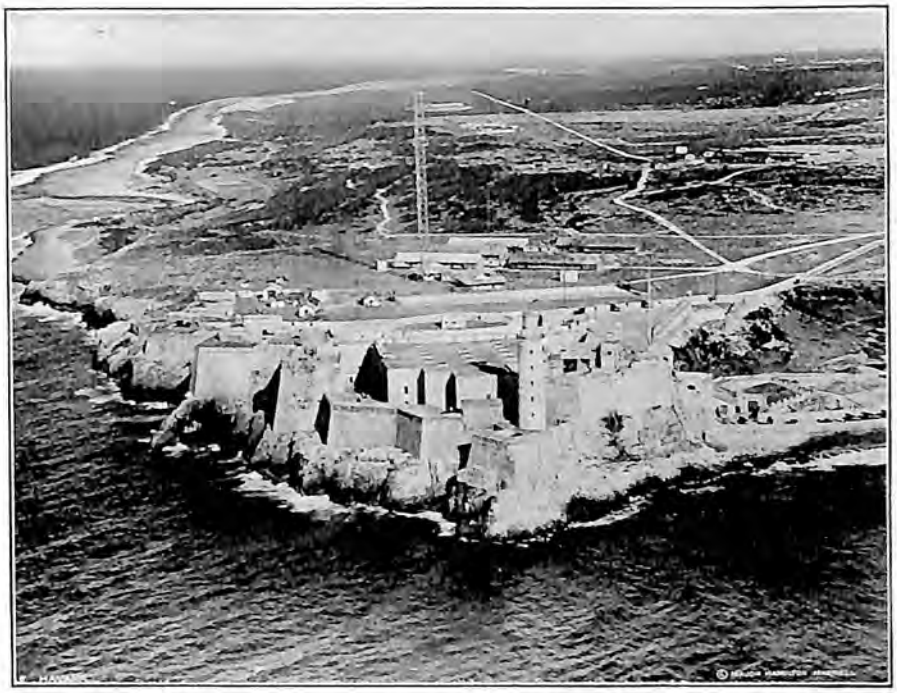
One of the most remarkable developments in aviation is found among the high schools and grades throughout the United States. The subject of flying became uppermost in the minds of the pupils following the Lindbergh flight to Paris in 1927. During 1928 it took definite form; in response to virtually unanimous opinion in many localities boards of education began establishing aviation courses in the public schools. At the end of the year aeronautics had been accepted generally as a subject for general study in all grades, and a majority of schools were teaching it in one form or another.

Notable among the junior technical institutions teaching aviation is the Galt Joint Union High School and Technical Junior College, at Galt, Cal. It gives a complete course and has become a model for other technical high schools throughout the country. A pilot's course is also given, 50 new students being admitted every year. Student instruction in 1928 aggregated 40,000 hours of flying.

In relation to the public schools the work of the Guggenheim Fund Committee on Elementary and Secondary Aeronautical Education was of outstanding importance.

The Committee was organized late in 1927, in a measure the result of many requests which came to the Guggenheim Fund from teachers and principals of public schools seeking information which could be used to satisfy the rapidly growing curiosity of boys and girls concerning aviation. The Committee in December, 1928, included about 80 men and women prominent in educational circles. Roland H. Spaulding, specialist in aeronautical education at the School of Education, New York University, was in active charge of the work; with Dr. John W. Withers, Dean of the school, chairman of the Committee.

At first a survey of the public school systems of the United States was made to determine what, if anything, was being done in aeronautical education. This study, including all returns received up to Dec. 31, revealed that 206 public schools of elementary, junior and senior high school grade were giving instruction in aeronautics of one type or another. Thirty were found to be teaching aeronautical subjects which had been added to the curriculum. The instruction ranged from an isolated course on airplane engines to a full four-year curriculum which included many related courses,



Morro Castle, Havana.—*Photograph by Hamilton Maxwell, Inc.*

together with 200 hours dual-control instruction in piloting an airplane.

A detailed study of these schools is now being made by the Committee. Many school systems having no aviation instruction have asked for information with a view to starting courses in 1929.

One of the aims of the Committee is to train teachers for aviation instruction in schools of elementary and secondary grade. To that end a course was organized for the 1928 summer session of the School of Education at New York University. Fifty-two school superintendents, principals, and teachers representing 15 different States enrolled in the course which was conducted as a discussion seminar. Lectures were given before that group by men prominent in aeronautical activities. The object of the course was an attempt to determine: 1, the place, if any, of aeronautics in the public school curriculum with special reference to aeronautics as a career; 2, the best procedures for the introduction of aeronautical material into the usual subjects of the curriculum such as science, history, geography, etc.; 3, the relation of aeronautics to extra-curriculum activities; and 4, the value of work already being done in the field of

aeronautics in the public schools. The course met with such an enthusiastic response that the Committee decided to repeat it during the school year of 1928-1929, and also again during the 1929 session of Summer School. The Committee's program of activities for 1929 includes preparation of courses suitable for use in junior and senior high schools, aerodynamics, theory of flight, model building and history of aeronautics; establishing the Committee as an effective clearing house for information concerning significant and suggestive work in aeronautical education; to supply as far as possible direct personal assistance, when desired, to superintendents in organizing the work in their school systems; and training of teachers and others for work in aeronautics in schools.

The executive group includes:

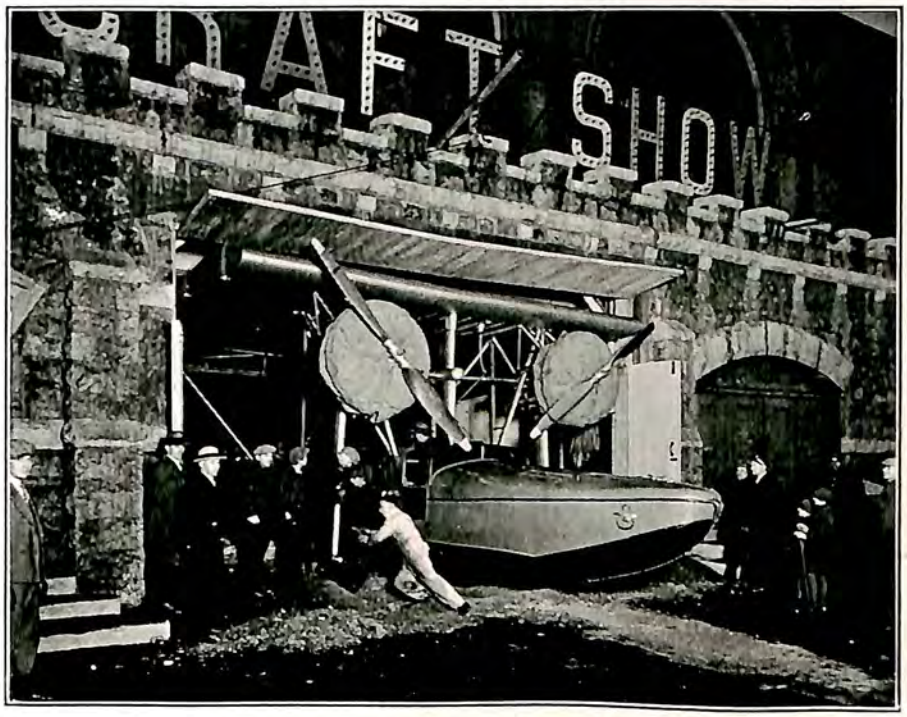
John W. Withers, *Chairman*, Dean, School of Education, New York University; Milton E. Loomis, *Secretary*, Assistant Dean, School of Education, New York University; Harry F. Guggenheim; Philip W. L. Cox, Professor of Education, New York University; C. S. Jones, President, Curtiss Flying Service, Inc.; Robert A. Kissack, Professor of Education, New York University; Alexander Klemin, Professor of Aeronautical Engineering, New York University; Emory S. Land, U. S. N., Vice-president of the Guggenheim Fund; Mrs. Evangeline Lindbergh, instructor, Cass Technical High School, Detroit, Michigan; J. W. Miller, Secretary of Guggenheim Fund; E. George Payne, Assistant Dean, School of Education, New York University; Ralph E. Pickett, Professor of Education, New York University; Roland H. Spaulding, Specialist in Aeronautical Education, New York University; and J. C. Wright, Director, Federal Board for Vocational Education.

Each member of the advisory committee is the superintendent of schools in his community. The members are:

Frank W. Ballou, Washington, D. C.; J. R. Barton, Oklahoma City, Okla.; Nicholas Bauer, New Orleans, La.; James C. Bay, Easton, Pa.; F. H. Beede, New Haven, Conn.; J. H. Beveridge, Omaha, Neb.; W. J. Bickett, Trenton, N. J.; William J. Bogan, Chicago, Ill.; E. C. Broome, Philadelphia, Pa.; W. J. S. Bryan, St. Louis, Mo.; Jeremiah E. Burke, Boston, Mass.; Leslie A. Butler, Grand Rapids, Mich.; Ira T. Chapman, Elizabeth, N. J.; G. N. Child, Salt Lake City, Utah; Frank Cody, Detroit, Mich.; Thomas R. Cole, Seattle, Wash.; Randall J. Condon, Cincinnati, Ohio; N. R. Crozier, Dallas, Tex.; William M. Davidson, Pittsburgh, Pa.; John C. Diehl, Erie, Pa.; Mrs. Susan M. Dorsey, Los Angeles, Cal.; C. B. Glenn, Birmingham, Ala.; J. M. Gwinn, San Francisco, Cal.; B. C. Hall, Little Rock, Ark.; E. C. Hartwell, Buffalo, N. Y.; S. O. Hartwell, St. Paul, Minn.; A. H. Hill, Richmond, Va.; Lamont F. Hodge, Yonkers, N. Y.; R. G. Jones, Cleveland, Ohio; R. H. Latham, Winston-Salem, N. C.; John H. Logan, Newark, N. J.; George E. McCord, Akron, Ohio; Joseph F. Noonan, Mahanoy City, Pa.; James A. Nugent, Jersey City, N. J.; William J. O'Shea, New York City, N. Y.; M. E. Pearson, Kansas City, Kan.; Frank G. Pickell, Montclair, N. J.; M. C. Potter, Milwaukee, Wis.; Rhys Powell, Scranton, Pa.; O. C. Pratt, Spokane, Wash.; C. R. Reed, Bridgeport, Conn.; A. B. Rhett, Charleston, S. C.; Charles A. Rice, Portland, Ore.; C. E. Rose, Tucson, Ariz.; Z. E. Scott, Springfield, Mass.; Arthur O. Smith, Union City, N. J.; Paul C. Stetson, Dayton, Ohio; J. W. Studebaker, Des Moines, Iowa; Landis Tanger, Reading, Pa.; A. L. Threlkeld, Denver, Colo.; David A. Ward, Wilmington, Del.; L. C. Ward, Fort Wayne, Ind.; H. C. Weber, Nashville, Tenn.; W. F. Webster, Minneapolis, Minn.; H. S. Weet, Rochester, N. Y.; David E. Weglein, Baltimore, Md.; John R. Wilson, Paterson, N. J.; H. B. Wilson, Berkeley, Cal.; Isaac C. Winslow, Providence, R. I.; Clarence L. Wright, Huntington, W. Va.; and Walter S. Young, Worcester, Mass.

One of the problems arising during the year was that relating to the training of commercial pilots. So many schools had been forced to expand their organizations to accommodate the phenomenal increase in the number of students in 1928 that they could not always be depended upon to give thorough and adequate training.

Prof. Spaulding is Chairman of the Educational Section of the Aeronautical Chamber of Commerce.



Chicago Coliseum receiving giant plane for the Exposition.

Standards for Flying Schools

The Aeronautical Chamber of Commerce through its Flying School Section, which grew out of a temporary committee, appointed at the request of the Aeronautics Branch of the Department of Commerce, late in the year established definite standards by which flying schools may be judged.

Action invited by the Chamber is purely voluntary, for it is realized that the Chamber cannot, of course, require schools to coöperate. The committee feels that the best way to approach the problem is to encourage the schools to improve themselves.

The Flying School Section was formed at a meeting held during the International Aeronautical Exposition in Chicago. Previous to that a temporary committee had requested the Chamber to distribute a questionnaire among the various schools in the United States advertising themselves as giving either ground or flying instruction. Responses confirmed the conviction that the flying school situation required the constructive attention of the industry as a whole.

The Chicago meeting was attended by approximately 30 repre-

Passengers alighting from Keystone *Patrician.*

sentatives of the flying school division of the industry. Data revealed by the questionnaires formed the basis for general discussion, after which it was recommended that a permanent flying school Section be established within the Chamber to carry out the recommendations of the conference.

The Section, which embraces one representative from each of the six geographical divisions of the Chamber, two members at large and a chairman, after a careful study of the problems, decided upon the following six minimum requirements which must be met before a flying school can win a place on the Chamber's accredited list:

(1) *Course of Instruction.*—The minimum flying course to receive recognition must qualify a student for a private pilot's license from the Department of Commerce. Ground courses must include subjects required by the Department of Commerce in qualifying a pilot for a transport license.

(2) *Licensed Instructors.*—All flying instructors must hold transport pilot licenses from the Department of Commerce.

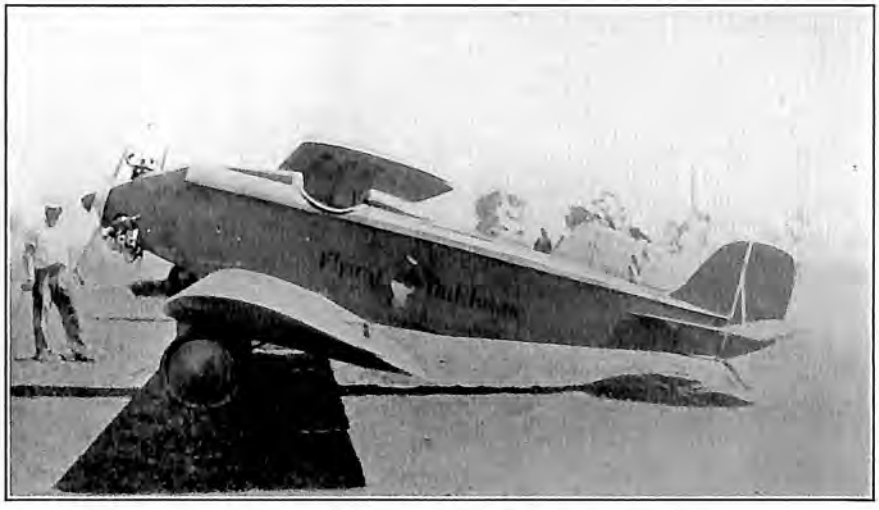
(3) *Licensed Airplanes.*—All airplanes used in school instruction shall be licensed by the Department of Commerce.

(4) *Fields and Traffic.*—Training fields should have runways into the prevailing winds 1500 feet by 500 feet, with a 10 to 1 ratio to clear all obstructions. Student activity should be discouraged at fields where operations are confined to narrow prepared runways. The maximum amount of traffic safely permissible on a training field is 10 ships per 100 acres of available landing area. Where a school is located on a field from which there are transport operations, and should such operations be sufficiently frequent to warrant, student activity should be apportioned a definite part of the field. The ideal condition is to have training fields remote from transport fields.

(5) *Advertising.*—All advertising or promotional literature must be based strictly upon the facts about the school itself; upon ascertainable facts about aviation generally, with especial regard to prospect for employment or business opportunity. All accredited schools must pledge themselves to do their utmost in carrying out the spirit of the above.

(6) *Daily Inspection.*—Daily inspection of the equipment must be enforced.

The Aeronautical Chamber of Commerce in coöperation with the Department of Commerce early in 1929 began devising a practical method of inspecting and accrediting flying schools.



Szekely *Flying Dutchman,* Szekely SR-3 engine.

(Top) Fairchild seaplane in New Guinea. (Center) Fairchild low wing monoplane, *Genet* engine. (Bottom) Fairchild cabin monoplane, *Wasp* powered.

CHAPTER IX

GOVERNMENTAL CIVIL AVIATION

FEDERAL air regulation by enforcing standard safety requirements for interstate flying so stimulated public confidence in 1928 that a large part of the expansion in commercial aviation must be attributed to the creditable manner in which the Aeronautics Branch of the Department of Commerce has administered the law.

The Aeronautics Branch at the end of the year had issued 3,212 licenses for American airplanes, those licenses granting certificates of air-worthiness and thereby permitting their operation from state to state. Licenses had been granted to 4,940 active pilots. Approximately 11,000 permits had also been issued to student pilots.

A total of 101 different types of airplanes had been granted approved type certificates. Thirty other machines had received individual approval in cases where an Approved Type Certificate was not required. Fifteen different types of aircraft engines had received Approved Type Certificates and 14 others approval for license without certificate. Six types of airplane propellers had received the Approved Type Certificate. A complete list will be found in the Appendix.

In order that the work of the Aeronautics Branch may proceed and effectively accomplish its duties it has been divided into divisions and sections as follows:

The Air Regulations Division as originally formed was obliged to initiate and assume responsibility for its activities which were entirely without precedent. Its duties were designed primarily to aid the industry and protect the public by regulating air navigation. The Chief of the Regulations Division is responsible to the Director of Aeronautics for the general administration of the Division, and for organizing, supervising and coördinating the work of the following Sections of which it is composed:

The Inspection Section is charged with the inspection of aircraft for airworthiness, the examination and rating of various classifications of pilots and mechanics, as well as investigating and reporting on accidents and violations of the Air Traffic Rules.

For the purpose of field inspection, the United States is divided into eleven inspection districts with a supervising inspector in each, and if available, as many additional inspectors as the district requires. These supervisors and inspectors, 50 in all, are young men of

unusual qualifications. They must be pilots above the average and good mechanics with expert knowledge of the maintenance and repair of aircraft.

Specifically, the inspectors give written and oral examinations to both pilots and mechanics, and in the case of the former, flight test them by riding in a dual controlled airplane to determine the candidate's flying ability. Airplanes are inspected by the personnel of the Section to determine their airworthiness, and they are recommended either for approval or disapproval for license.

The engineer-inspector group carries on the flight testing of "new production" airplanes for which engineering data has been furnished, and the factory group assumes responsibility of inspecting factories for materials, construction and fabrication methods. In January, 1928, there were twelve inspectors; twelve months later fifty. In view of the fact that airplanes are inspected yearly and that civil pilots may, at the discretion of the Department, be re-examined every six months, the volume of work pyramids rapidly.

The flying public is gradually being brought to realize that the burden rests with the owners to see that airplanes, pilots and mechanics are licensed and that, for this purpose contact should be made with the nearest inspector at the proper time rather than wait for the inspector to do the locating. This has resulted in the stationing of inspectors at certain airports throughout the country where the industry knows they are available at all times; and for others a fixed itinerary is arranged to assure an inspector's presence at a given place at a predetermined time and date.

The Licensing Section is responsible for licensing and keeping complete record of all aircraft, pilots and mechanics, license renewals, transfers of title and the issuance of export certificates. In July, 1927, the Licensing Section had barely begun to function. The personnel was entirely inadequate, the work was new and without precedent as a guide to its work. Aircraft operators, owners, pilots and mechanics were beginning to appreciate the necessity and advantage of licenses. This resulted in a rapid increase in applications. By the end of the first month the volume of work had doubled and by the end of the third month trebled.

Simultaneously the public became increasingly air-minded. There came a demand for aircraft far in excess of the supply. It aroused the industry to feverish activity. The activities resulting from this stimulation had not reached their peak at the end of 1928, and the Licensing Section had received a flood of applications exceeding all expectations.

An entirely new and simplified system of aircraft licensing which

is now being put into operation should materially simplify matters for both the industry and the Department.

The Engineering Section determines that all plans for aircraft as submitted are of proper design. The specifications, stress analyses, structural designs and drawings submitted for each type of aircraft for which approval is requested must be examined in detail. This requires the attention of aeronautical engineers familiar with all the technical problems of analysis and design and at the same time capable of passing upon all the details and methods of construction.

In acting on a manufacturer's application for an Approved Type Certificate, the Engineering Section examines the design and technical data and receives from the Inspection Section a report on weight and flight tests, and factory inspection. After this is satisfactorily concluded, an Approved Type Certificate is issued for the aircraft in question. All aircraft granted Approved Type Certificates are eligible for license and use in interstate commerce if manufactured in exact accordance with the approved specifications, drawings and construction methods. Periodic inspections of all production assure that such is being done. Engines used in licensed aircraft must also be approved by this Section. Those engines which have not been subjected to acceptance tests by the Army or Navy must pass a Department of Commerce test conducted by the Bureau of Standards. Propellers are in the same category and must be approved by the Section before being used in licensed aircraft.

The Medical Section, through 600 especially qualified physicians, examines pilots and students for physical and mental fitness before licensing, and checks by periodical examination the condition of those already licensed. The total number of physical examinations received to date is approximately 25,000. A list of examiners will be found in the Appendix.

Through the above sections the Regulations Division carries out the Government policy to assist civil aeronautics by bringing about a combination of those elements considered essential to the progress of aviation, airworthy aircraft, adequately equipped and efficiently maintained, flown by competent pilots in conformity with the Air Traffic Rules.

While the Federal air law was regulating the various phases of interstate flying the problem of providing adequate and reasonable laws for air traffic confined within State boundaries became more pressing in 1928; if possible, more of a problem.

Many of the States had their own air law. Yet State officials and the industry were not content, chiefly because such laws were either inadequate or confusing, or both.

Twenty States had no aeronautical legislation. They included Alabama, Arizona, Georgia, Illinois, Indiana, Iowa, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Mexico, North Carolina, Ohio, Oklahoma, Rhode Island, South Carolina, Texas, Washington and West Virginia. They had no air law; yet the need for it was becoming more apparent with the rapid development of private flying.

State officials, members of the Bar and the industry are agreed that legal control over aviation is just as much of an essential within a State as within the United States. The problem is one of determining the proper kind of legislation. Obviously it should not conflict with the Federal law; nor should it diverge from the principles of the established air law in other States.

Proposed Model State Laws

A Committee of the American Bar Association was appointed to work out some method and plan whereby the law of the States could be made uniform. It coöperated with a Committee of the National Conference of Commissioners on Uniform State Laws. The two committees drafted a proposed Uniform State Air Licensing Act. It will be submitted to the American Bar Association at its annual meeting in Memphis, Tenn., Oct. 23, 1929.

The views of the committees in drafting the proposed model law are set forth by Chester W. Cuthell, Esq., Chairman of the Committee on Aeronautical Law of the American Bar Association, in a letter to the Aeronautical Chamber of Commerce, as follows:

> "We have in mind that most of the flying that needs inspection and licensing is entirely intrastate in character. The Federal law takes care of the interstate flying adequately, but under the scheme of organization of the United States the Federal Government cannot deal with intrastate matters. This is so elementary to the lawyers that argument on it we consider unnecessary.
>
> "The Department of Commerce very properly desires uniformity, but until the States surrender all of the rights of control over intrastate trade, I do not believe that any legislation will be held constitutional that is drawn on the theory that Federal licenses can be required of planes and pilots who do not operate across State lines.
>
> "The proposed bill permits the holder of a Federal license to fly anywhere and it goes as far as a State statute should to provide for uniform regulations.
>
> "We believe that the States should set up very effective machinery for the regular inspection of all planes that are doing a local business so that the public may have an added assurance

of safety We believe that the bill we propose goes as far as the circumstances will permit.

"We do not believe that bills drawn on the other theory will have any greater chance of being passed by all the State legislatures than bills providing for the Federal licensing of all the automobiles in the country, whether engaged in intrastate commerce or not, or bills providing for uniform incorporation or divorce or any other subjects which have always been dealt with by the separate States."

Department of Commerce Suggestions

Meanwhile the Department of Commerce received so many requests for suggestions as to proposed State legislation that it issued a bulletin (Aeronautics Bulletin No. 18, Aug. 1, 1928) reviewing the characteristics of various State Acts and setting forth in detail three suggested drafts of laws designed to meet the different requirements of individual States and at the same time the very desirable feature of uniformity. The Bulletin explains the three drafts in these terms:

"No. 1. This draft is premised upon legislation recently enacted by the State of New York, with changes which are designed to remove certain ambiguities. It requires a Federal license for all pilots and all aircraft operating within the State. It would not necessitate any additional personnel or any increase in cost to the State. Local police authorities could handle violations thereof in the same manner now provided for motor vehicles. Transgressions thereunder would be for violation of the State law requiring Federal license rather than a violation of the Federal Act.

"No. 2. This draft is suggested as an amendment to the State penal code and accomplishes the same result as outlined above. It has been suggested that this draft may conflict with some of the State constitutions; therefore consideration should be given this question before enactment is undertaken. It is recommended for its brevity and conciseness and is without equivocation.

"No. 3. This draft is modeled after one prepared by a committee of the American Bar Association and requires either a State or Federal license. Such legislation would necessitate setting up a State inspection system with its attendant costs and complications. The draft, however, does not contemplate the actual issuance of licenses by the State. Rather it is intended that the State and Federal license requirements will be identical, in which case the applicant would prefer the latter bcause of its broader privileges. This draft does not definitely assure uniformity to the same extent as the preceding ones. It would permit a

given State to depart from the Federal requirements, with its consequent confusion to the industry, thus defeating the purpose of uniform State legislation. If, due to some State constitutional provision, this draft is the best type of legislation that can be enacted, it is highly desirable that extreme caution be exercised in promulgating requirements for State licenses in order that they may conform to the Federal requirements.

"Legislation throughout the United States requiring only Federal licenses would be of real benefit to manufacturers, operators and pilots, who would then know that compliance with the Federal regulations would also be compliance with State regulations; also there would then be uniform throughout the country one set of aeronautical standards, obviating a multiplicity of licenses and conflicting regulations with their attendant costs to the States."

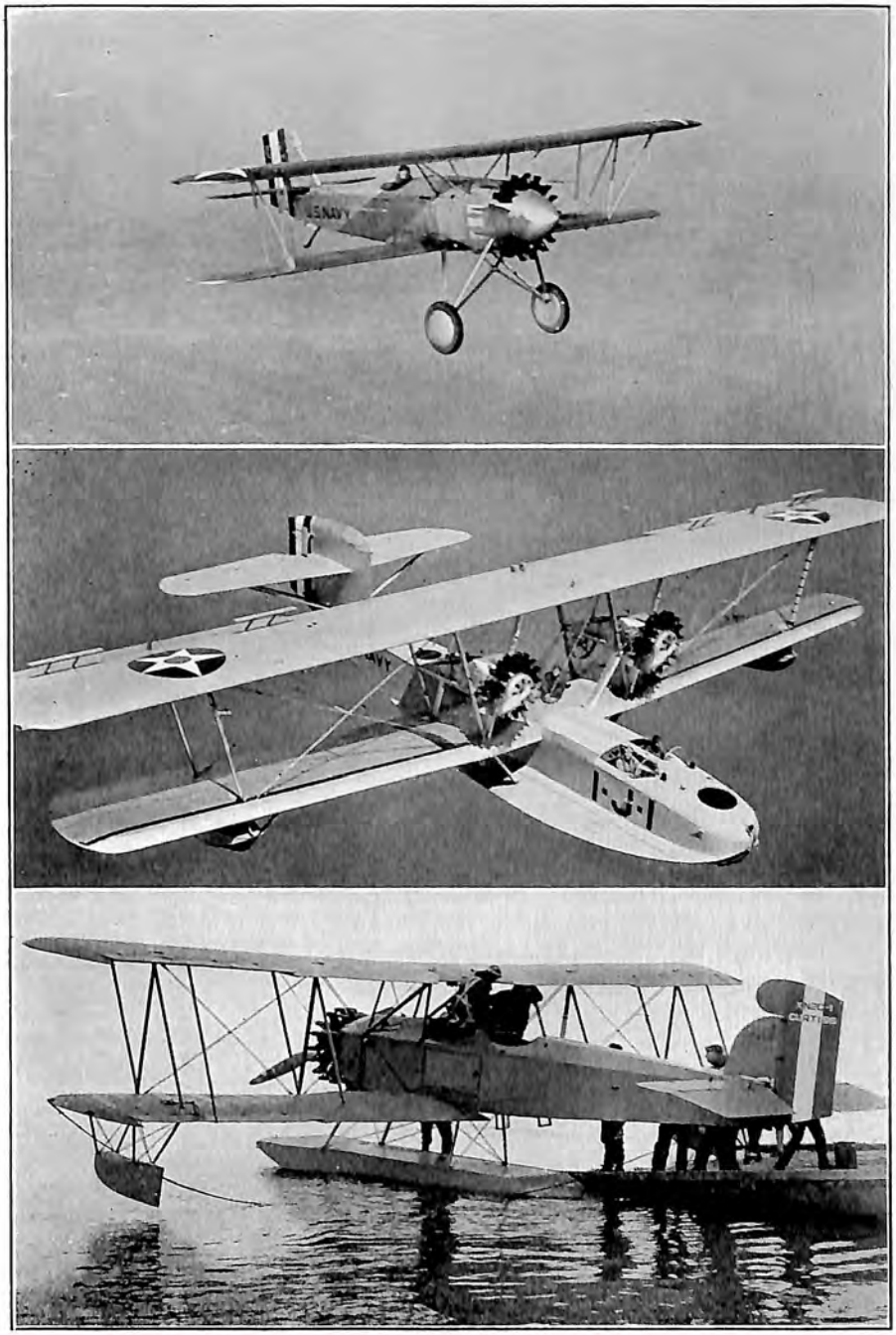
It will be seen by the foregoing that the legal profession, the aeronautical industry and the officials of the Federal and State Governments have progressed far in the direction of unification. Having eliminated a number of impracticable ideas in former years, they devised various constructive measures in 1928, with the promise that the ensuing twelve months would develop generally acceptable forms of legislation.

National Advisory Committee for Aeronautics

The rapid growth of aeronautics was reflected in greatly increased demands on the National Advisory Committee for Aeronautics in 1928. The number of requests from the Army and Navy and the industry for the solution of research problems in connection with the safety and economy of aircraft was greater than ever before. The number of important investigations conducted by the Committee was steadily increasing at the end of the year.

In 1928 the Committee issued 26 Technical Reports and 32 Technical Notes describing the results of research and technical investigations, and in addition, 26 Aircraft Circulars, and translations or reprints of 50 valuable foreign technical articles as Technical Memorandums.

In accordance with the policy adopted in 1926 of holding annual conferences between the National Advisory Committee and representatives of the aeronautical industry, the Third Annual Aircraft Engineering Research Conference was held at the Langley Memorial Aeronautical Laboratory, Langley Field, Hampton, Va., on May 15, 1928. Aircraft manufacturers and operators, aeronautical trade journals and educational institutions teaching aeronautical engineering were represented. Dr. Joseph S. Ames, Chairman of



(Top) Curtiss *Sea Hawk* shipboard fighter with *Wasp* engine. (Center) Navy PN-12 patrol boat, twin Pratt & Whitney *Hornets,* which established six world records. (Bottom) Curtiss *Fledgling* training seaplane, Wright *Whirlwind.*

the National Advisory Committee for Aeronautics, presided. The chief purpose of the conference was discussion of the problems of commercial aviation, and 30 problems were presented, chiefly by the industry.

The research work conducted by the Committee during the year included the study of such important problems as the aerodynamic loads on airplanes and airships, airplane controllability and maneuverability, spinning characteristics of airplanes, loads on seaplane floats, ice formation on aircraft, the efficiency of airplane propellers, the cowling and cooling of aircooled engines, interference effects between wing and fuselage, the development of wing sections, oil engine development and supercharger development.

The Patents and Design Board

The Aeronautical Patents and Design Board was created by the Army Air Corps Act, approved July 2, 1926. Its members are the Assistant Secretaries for Aeronautics in the Departments of War, Navy and Commerce. The Act creating the Board provided that upon recommendation of the National Advisory Committee for Aeronautics the Board should determine questions as to the use and value to the Government of aeronautical inventions submitted to the Government.

By Act of Congress approved March 3, 1927, the Act of July 2, 1926, was amended, limiting the Board to consideration of such cases as were favorably recommended to it by the National Advisory Committee. This relieved the Board of the burden of considering cases which were unfavorably recommended by the National Advisory Committee and made the Committee responsible for the final disapproval of a large majority of the devices submitted.

In 1928 the National Advisory Committee received about 1,000 new designs, of which approximately 200 were submitted for the consideration of the Patents and Design Board. Of those 200, the Committee submitted to the Board reports and recommendations in 179 cases. The remaining 800 designs were disposed of by the Committee.

United States Coast Guard

The work accomplished by the airplanes of the United States Coast Guard in 1928 proved conclusively that airplanes provide the most economical and efficient methods of performing many of the duties peculiar to that service. In some cases the airplane is the only adequate means. In areas where there are many small islands

Tank cars for helium. Each car has 200,000 cu. ft. capacity under pressure of 2,000 lbs. to the square inch.

as off the coasts of Maine, Rhode Island and Florida, the smuggler of drugs, aliens or other contraband has no fear of surface vessels. Only aircraft promise immediate discovery and examination.

The five airplanes operated by the Coast Guard have been exceedingly valuable in scouting vast areas off shore. They have covered 8,000 square miles in an hour, searching for disabled vessels, missing fishermen and suspected ships. For that search work the airplane is at least twenty times as effective as the most efficient surface craft. The maximum area that surface vessels can search is about 400 square miles an hour.

During the first three months of 1928 the five Coast Guard planes responded to 31 calls for assistance in the search for lost, stolen, or overdue vessels, located three derelicts that were dangerous to navigation and made two unassisted seizures of vessels attempting to smuggle contraband into the United States. On two occasions along the Florida coast contraband was found close to shore below the surface of the water and was later turned over to Customs officials.

Indicative of the varied and many duties performed by the planes is the report of OL-5 No. 1: "October 12, 1928. Received information by telephone that a boat was on fire five miles east of Bass Rocks, Mass. Started engine, launched plane, took off and arrived at burning boat thirteen minutes later."

The three Loening Amphibian planes with inverted Liberty en-

gines and two Vought planes with Wright *Whirlwind* engines were purchased in 1926 and were still in service at the end of 1928.

Since the establishment of the two Coast Guard Air Stations in 1926, the ability of the planes to carry out extensive searches has fostered "airmindedness" in the personnel, reflected in the large number of applications for pilot training and requests for assignment of airplanes to various areas to assist in the performance of service duties.

During the calendar year 1928, the five planes of the Coast Guard made 446 flights:

Average distance patrolled offshore, 100 miles;
Maximum distance patrolled offshore, 330 miles;
Total time in air 989 hours, 10 minutes;
Miles cruised, 83,083;
Area covered on patrol and search 3,213,240 square miles;
Number of forced landings, calendar year 1927, none;
Number of forced landings, calendar year 1928, one;
Injuries to personnel, calendar year 1927, none;
Injuries to personnel, calendar year 1928, none.

The Helium Board

The Helium Board in 1928 continued to act as coördinating and advisory body to the several executive departments with reference to helium matters. The members of the Board were: Army, Major H. W. Hann and Lt. Col. C. deF. Chandler (ret.); Navy, Cmdr. S. M. Kraus (Alternate, Cmdr. G. Fulton); Bureau of Mines, R. A. Cattell; Audit, W. J. Barry.

The actual control and production of helium is under the Helium Division of the Bureau of Mines, and the technical staff in charge of this work is: R. A. Cattell, chief engineer; C. F. Cook, supervising engineer; C. W. Seibel, supervising chemical engineer; Andrew Stewart, senior chemist; H. S. Kennedy, engineer in charge natural gas investigations; F. A. Vestal, engineer in charge Amarillo Plant, and W. M. Deaton, chemist in charge of the Amarillo Cryogenic Laboratory.

During the year the Government acquired rights in the gas acreage at Soncy, near Amarillo, Texas. The helium having been practically exhausted at Fort Worth, that plant was discontinued, and production started in the Amarillo plant, which was constructed during the year in anticipation of the exhaustion of the Petrolia Fields from which source the Fort Worth plant operated. In addition to the supply of helium for the new Amarillo plant, which comes from the gas lands near Amarillo, Texas, the Government has

a helium reserve, designated as Helium Reserve No. 1, in Emory County, Utah.

There was produced during 1928 a total of 6,687,834 cubic feet of helium at an average cost of $41.00 a thousand cubic feet, or approximately $1.00 a thousand cheaper than in 1927. All of that production was either used or held in reserve by the Army and Navy.

The Aeronautical Board

The Aeronautical Board continued during 1928 its very important mission of preventing duplication of effort in the Air Corps of the Army and the Bureau of Aeronautics of the Navy, and succeeded in securing a more complete coördination in the aeronautical work of those two branches.

The board is specifically charged with the following: 1. Plans to prevent competition in the procurement of material when the chiefs of the two services have been unable to come to an agreement concerning procurement. 2. Before arranging to purchase aircraft each service ascertains whether aircraft of the type desired can be obtained from the other service. 3. Joint plans for procurement of material in time of war are submitted to the Army and Navy Munitions Board. 4. The personnel of the Board shall be: for the Army—The Chief of Air Corps; the Chief of the Training and Operations Division; one member of the War Plans Division, General Staff, as designated by the Chief of Staff of the Army. For the Navy—The Chief of the Bureau of Aeronautics; the Chief of Planning Division; one member of the War Plans Division, Office of Chief of Naval Operations, to be designated by the Chief of Naval Operations.

Board of Surveys and Maps

The Board of Surveys and Maps coördinates all map-making and surveying activities of the Government and settles all questions at issue between executive departments relating to surveys and maps in so far as their decisions do not conflict with existing laws. Meetings are held at stated intervals, to which representatives of the map-using public are invited for conference and advice. The board has established a map information office in the Interior Department Building. This office endeavors to keep on file data relating to maps and general geographic information for any part of the world. No maps are distributed; simply information regarding them is furnished.

In 1928 the Board approved a report of the Committee on Photographic Surveying relative to progress in photographic sur-

veying since 1926. The subjects discussed in the report relate to the application of aerial photography to mapping, which includes types of surveys adaptable to aerial photography, types of aerial photographs adaptable to surveying, and methods of using aerial photographs in map compilation; photo-topography, in which various methods are discussed; and under miscellaneous subjects, the indexing and filing of photographs, the trend of recent improvements, the use of stereoscopes, and public and private facilities for carrying on photographic surveys. A joint report by the committees on technical standards and aerial navigation maps relative to standard symbols for air navigation maps was adopted also by the board.

Beacon on the New York-Chicago airway in the Allegheny Mountains, Pennsylvania.

CHAPTER X

MILITARY AND NAVAL AVIATION

AVIATORS in all the branches of the defensive establishment of the United States accomplished 33,680,940 miles of flying in 1928. That was a third more than during the preceding year.

The Army Air Corps on Dec. 31, 1928, had 957 pilots, 104 officers taking pilot training and 3,545 aviators in the Reserve Air Corps. It had in active service, 1,111 airplanes, besides lighter-than-air-equipment. Army flying during the year aggregated 19,546,450 miles.

The Navy Bureau of Aeronautics on Dec. 31, 1928, had 712 pilots, including 469 officers commissioned in the Navy, 57 Marine Corps officers, 23 Navy warrant officers, 2 Marine Corps warrant officers, 150 enlisted men in the Navy and 25 enlisted men in the Marine Corps. Student pilots were 197 in number. Including 99 Marine Corps planes the Navy had a total of 783 machines, besides lighter-than-air equipment. Navy flying in 1928 totaled 14,135,490 miles.

As in former years, the military and naval aviators had more flying mileage than all of the commercial and private pilots in the United States. But their lead was nowhere that of the past. In 1927 the service mileage had been about double the civilian. In 1928 it was less than 7 per cent larger.

Remarkable as it was, the flying time put in by the services exceeded the other by such a narrow margin that it served more than anything else to indicate the rapid growth of commercial aviation. But even that did not minimize the importance of military and naval aeronautics and the part the services must continue to take in future development.

The service pilots are constantly trying out new machines and other devices. Theirs, admittedly, is the most hazardous kind of flying; they are not only training for the dangerous science of war, they are also developing new equipment.

The present success of American aircraft engines, new designs of planes, improved instruments and other auxiliaries must be attributed to the effort put forth by the Army and Navy in coöperation with the industry during recent years.

The high standard always demanded in service equipment long ago trained manufacturers to follow the practice in commercial

construction, with the result that structural defects as well as defects in design are rare in American aircraft.

The Work of the Air Corps of the Army

In the words of Major General James E. Fechet, Chief of the Army Air Corps, "Progress in military aviation and its effect on commercial aviation in 1928 were as rapid as in any preceding year."

The increased flying mileage was occasioned by a variety of tactical missions, including photographic projects for the Government bureaus, patrols over public lands, experimental service flights, bombing tests and continuous trials of instruments and other auxiliary equipment.

Army pilots flew at the opening exercises of 201 airports in 1928. In the course of maneuvers at the different service schools of the Army the pilots of 74 planes put in a total of 296,000 miles of flying, with all types of service planes, and without accident.

Progress in aerial photography was recorded by remarkable flights to great altitudes or at night when photographs were made under artificial lighting conditions.

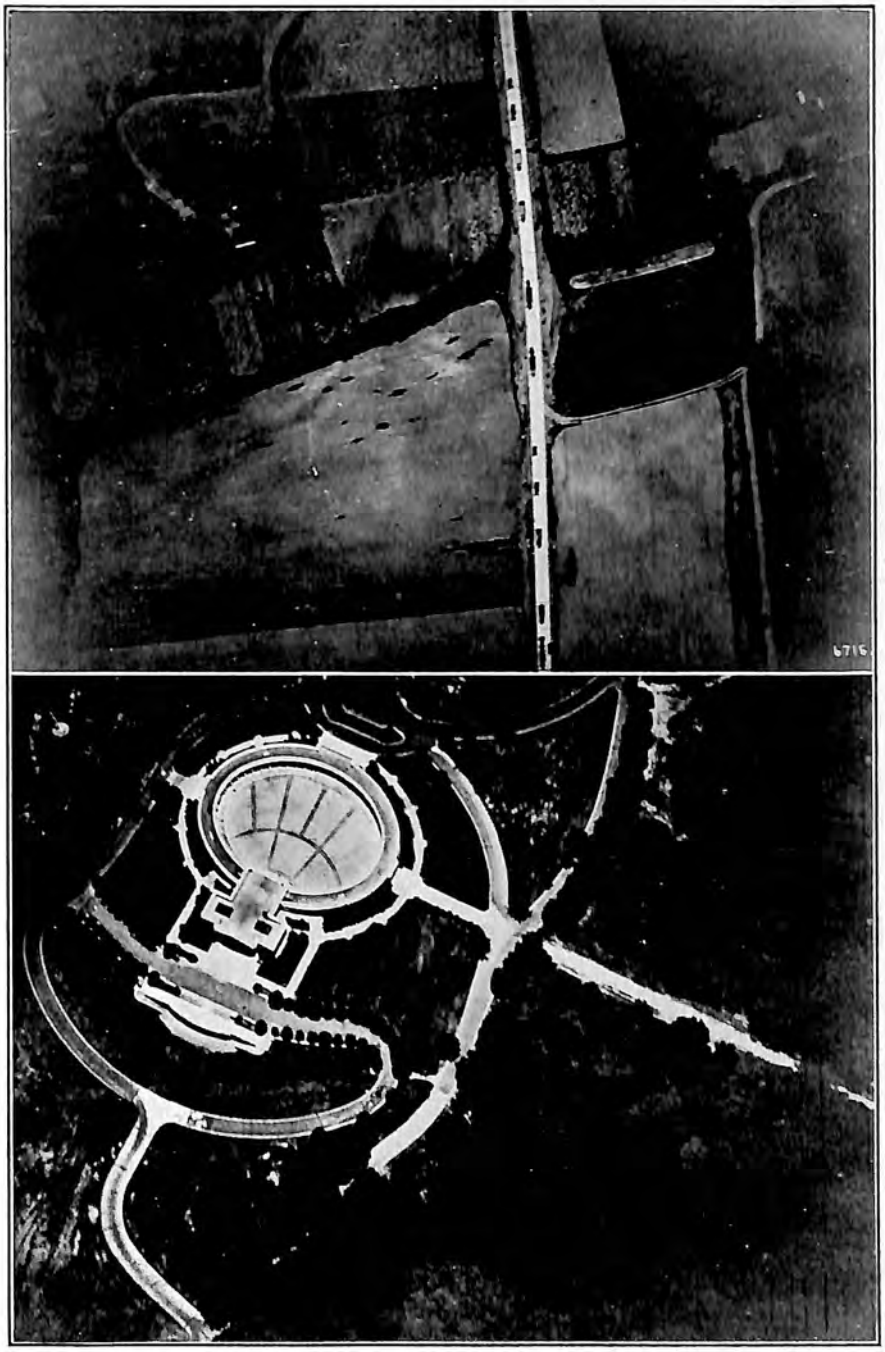
A flight which demonstrated the high efficiency of the Army pursuit plane was that of two PW-9 ships from the Panama Canal Zone to Washington, D. C., in 36 hours, with ten stops. It was the longest flight ever undertaken by the Air Corps using single-seater planes.

Several successful experiments were conducted during the year with lighter-than-air craft, tending to demonstrate the highly advantageous manner in which airships may be utilized in the field of commercial aviation. An Army TC airship landed on the deck of a steamer about three miles from shore and transferred mail without halting the surface vessel. A similar type airship flew directly over a fast-traveling passenger train, dipped down to the top of the express car, and one of its occupants handed a bag of mail to the railway mail clerk.

In the Air Corps at the end of the year the Curtiss P-1 and Boeing PW-9, Curtiss D-12 powered planes, were standard pursuit types. A few supercharged D-12-F engines were used in P-1 planes for high altitude work.

The pursuit plane of today has a high speed of 180 miles an hour, a cruising radius of 635 miles, gas for 4 hours flying, 50 cal. machine guns and can climb about 30,000 feet.

The Curtiss A-3 observation type was standard attack equipment at the end of the year.



Night photography from army planes. (Top) A road. (Bottom) Arlington Amphitheater illuminated by flares dropped just before exposure was made.

Tests were being made with six different bombardment types. Two cargo types were adopted for service use, the Fokker tri-engined monoplane and the Douglas C-1.

Four observation types had been standardized, two Curtiss, a Loening Amphibian and a Douglas.

A new exhaust driven supercharger, the Form F-2, was developed for 600 h.p. engines.

War-time planes were practically out of service at the end of the year, and the "Liberty" engine, a war product and then a notable achievement in engineering, had become obsolete. The "Liberty" was to be barred from new equipment ordered after July 1, 1929.

A large reserve of competent personnel received flying training at the Air Corps flying schools in 1928, and some progress was made toward securing commissioned officers in the Regular Army as authorized under the five-year program. Five Air Corps squadrons, previously on inactive status, were reconstituted.

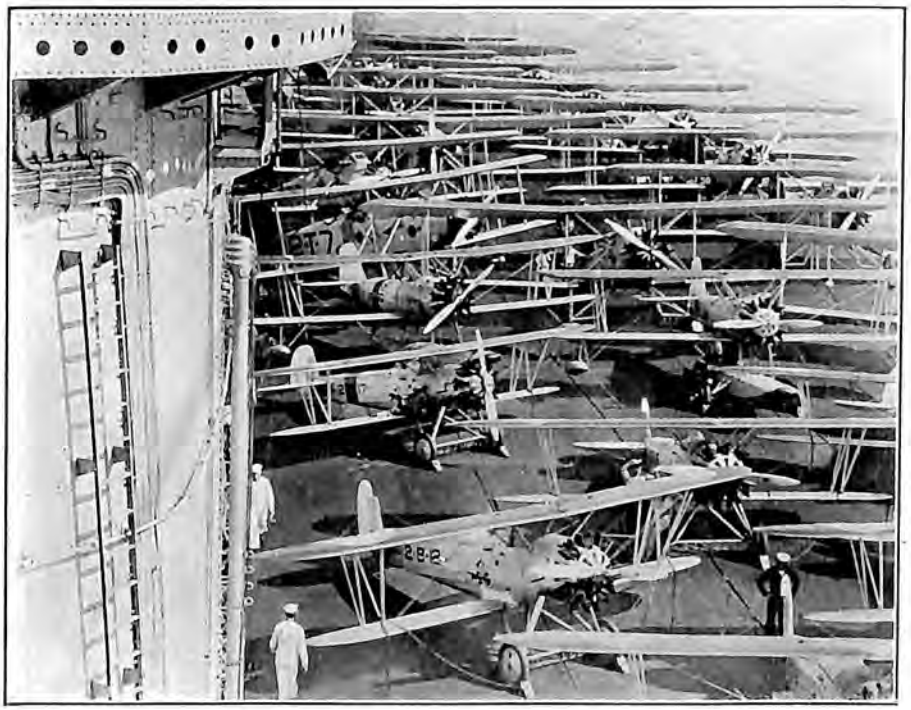
The Air Corps units of the National Guard were rapidly developing into tactical units in 1928 rather than primary training squadrons. During the year 261 pilots of the National Guard, 15 observers, 347 officers and 1,689 enlisted men operated 120 airplanes in 23,991 hours of flying. Practically all squadrons were equipped with the quota of four standard observation and four advanced training planes. Thirteen of the 18 squadrons put in a total of 3,734 flying hours at field training camps during the summer. The average flying time for each National Guard pilot was 91 hours 55 minutes. At the end of the year the National Guard observation planes were being fitted with standard Army equipment, including radio, and all but one squadron had an established airport, either municipal or Federal, from which it was operating.

The five-year program of the Air Corps prescribes an air strength of 1,800 planes, 1,650 flying officers, 500 reserve officers on active duty, 500 cadets in training and 15,000 enlisted men, by the end of 1932.

The War Department appropriation for 1930 will provide 275 new planes for the Air Corps and 22 for the National Guard, making a total of 297. This total will be made up of 14 attack planes, 67 bombardment planes, 146 observation planes and 70 pursuit planes. No training planes are provided, as the Army has 13 such planes over the present requirements of the five-year program.

The promotion of officers was a pressing question in the Air Corps at the end of the year. Junior officers were performing duties out of all proportion to their rank and with discouraging prospects

(Top) Keystone Army observation plane. (Bottom) Keystone Army LB-7 light bombardment plane.



Navy fighting planes on carrier *Saratoga*.

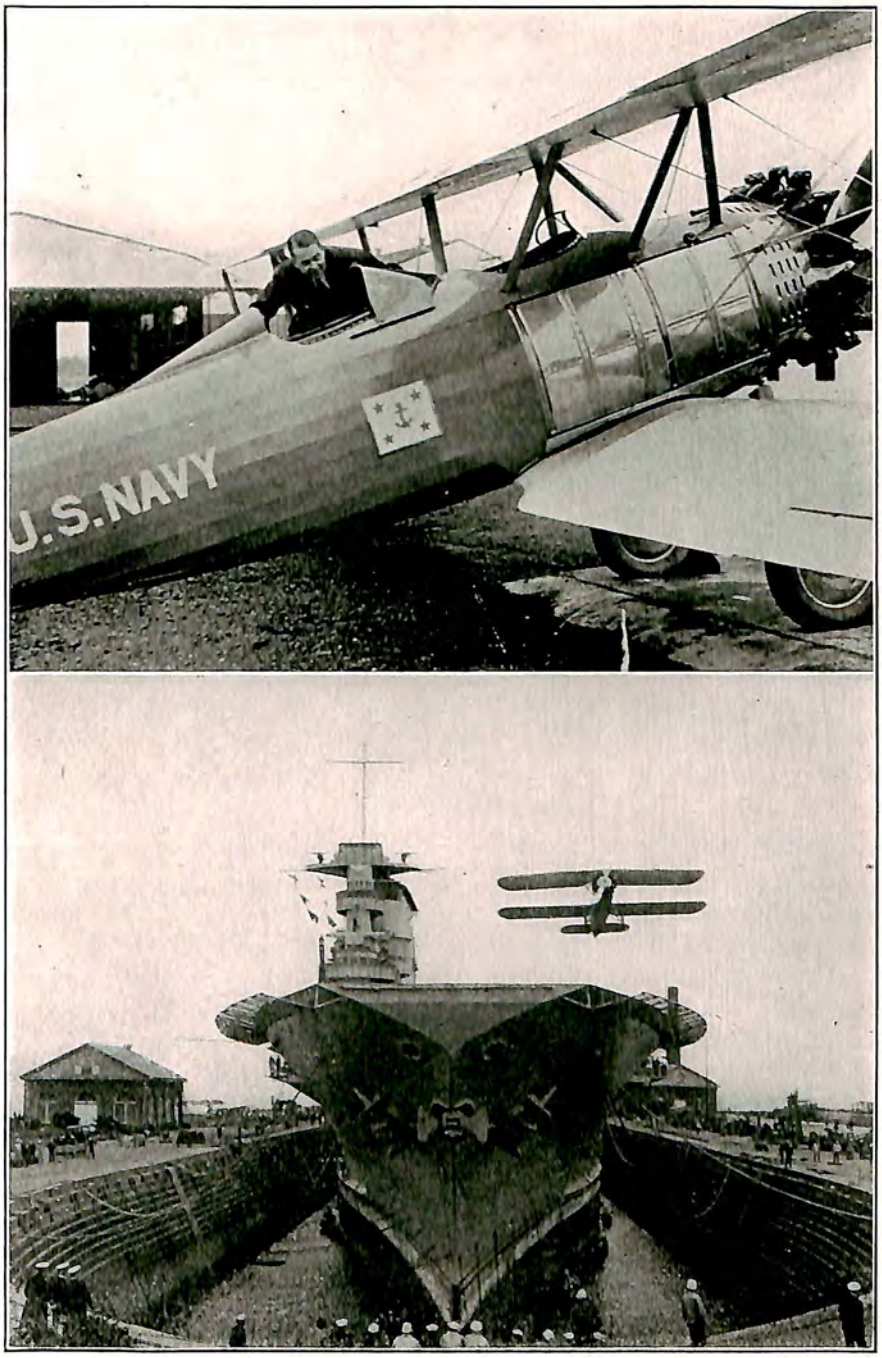
of promotion. Many valuable officers had left the service because of better opportunities for advancement in civil life. A bill introduced in Congress provided for immediate promotion of Air Corps officers below the rank of Major. All others would be under the same promotion regulations as other divisions of the Army.

Complete statistics relative to appropriations, personnel, equipment, etc., of the Air Corps will be found in the Appendix.

Work of the Bureau of Aeronautics of the Navy

The greatest achievement of Naval aviation in 1928 was the solution of problems relative to Fleet aviation. As explained by Rear Admiral William A. Moffett, Chief of the Bureau of Aeronautics, "At the end of the year the fleets had been provided with modern airplanes of all types and all squadrons were, or soon would be, at full authorized strength by delivery of planes under existing contracts."

That very satisfactory situation was attributed to the five-year program, the energetic work of the officers and the manufacturers. Progress was shown in all phases of naval aviation.



(Top) Asst. Secretary of Navy for Aeronautics, Edward P. Warner and his official plane, a Vought *Corsair,* with Pratt & Whitney *Wasp* engine. (Bottom) Vought *Corsair* taking off from deck of the *Saratoga.*

Fighting planes ready to fly off deck of carrier, *Lexington,* at maneuvers with the Fleet.

Naval aviators accomplished 8,559,180 miles of flying at airdromes, 3,796,560 miles at sea with the fleets, and cross country or over water, 1,779,750 miles.

The airplane carriers "Lexington" and "Saratoga" were placed on active service early in 1928, and from the beginning functioned in such manner as to indicate their vital importance. Whole squadrons were flown off their decks in one-two-three order, and the Navy Department late in the year felt warranted in asking Congress to provide for another carrier of approximately 13,800 tons. The United States was then 56,300 tons below its allowance for carriers under the Washington treaty.

Approximately 225 planes were being operated from the ships. Bombing, torpedo, scouting, observation and fighting planes were carried aboard the "Lexington," "Saratoga" and the "Langley." Fighting and observation planes were operating from catapults on the battleships, and each light cruiser carried two observation planes.

Improved landing gear on the carriers and the installation of flotation gear on all planes with the Fleet were important developments of the year. New types of amphibians were under develop-

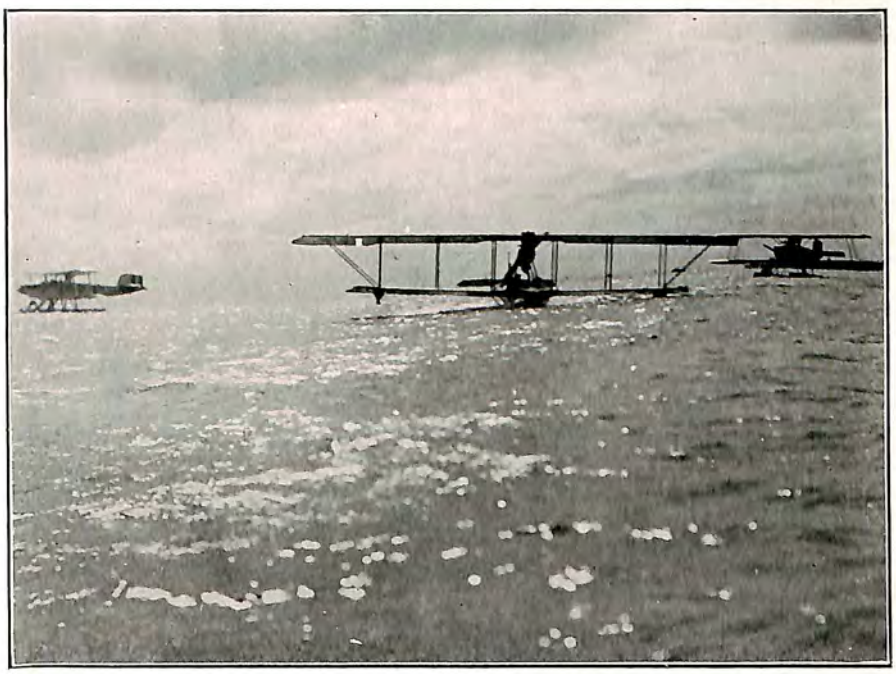
ment, among them the Vought. The Navy also acquired the largest flying boat in the United States, the Consolidated Aircraft Corporation's patrol boat XPY-1, which was designed to meet the Navy's need for a long distance patrol plane.

Like the Air Corps the Bureau of Aeronautics in 1928 adopted as standard several types which had been developed during the preceding year. Flying boats were acquired as part of the program to keep abreast of other nations in that development. The Bureau also committed itself to the use of aircooled engines.

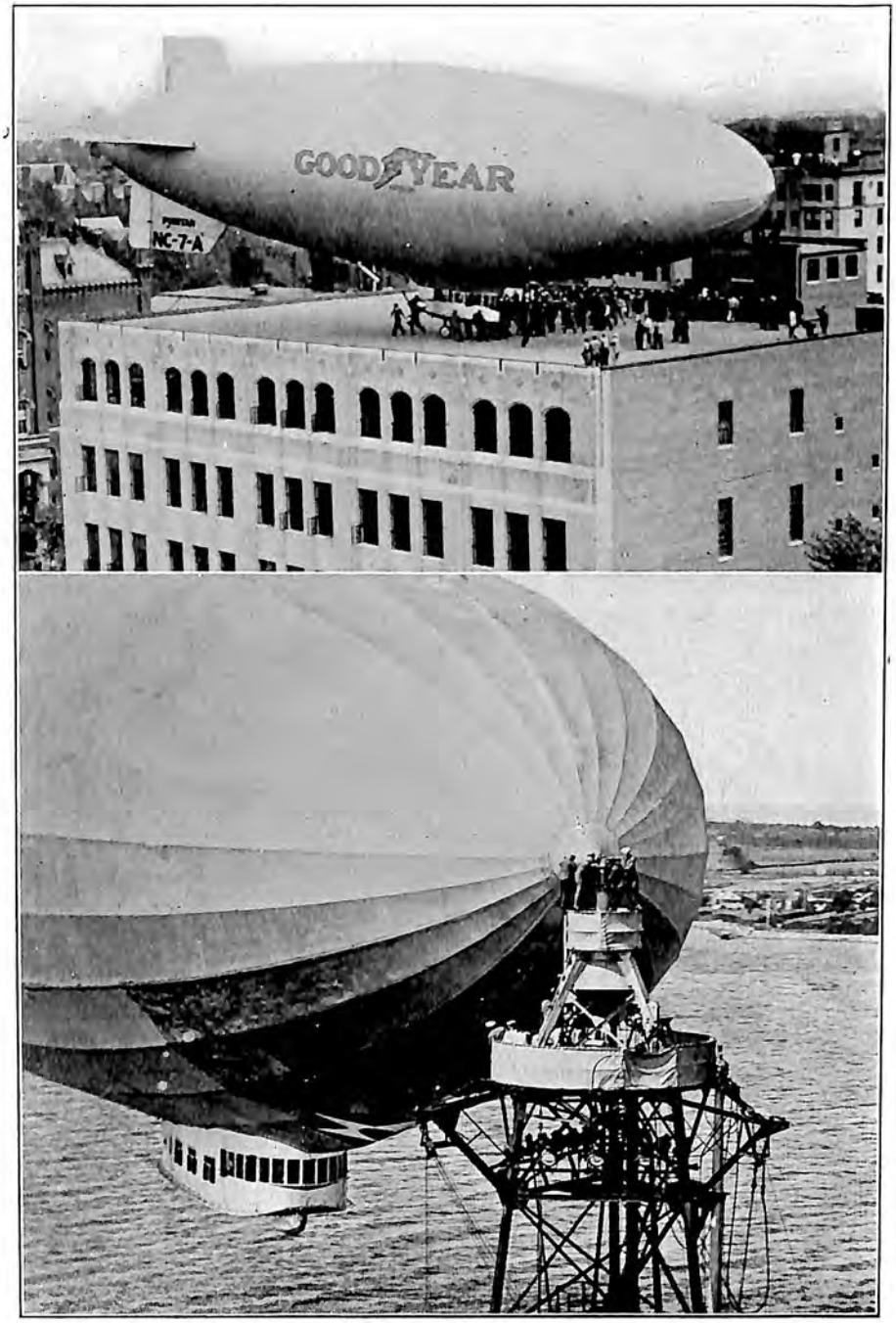
The efficiency of modern equipment and training was demonstrated by the Marine Corps flying contingent in Nicaragua. During successive campaigns against rebels and bandits the Marine Corps personnel repeatedly flew into the fighting zone on innumerable missions, including reconnaissance, communications and rescue work.

Activities of the Navy in the field of lighter-than-air are described at length in another chapter. At the Lakehurst, N. J., Naval Air Station, airships were operated from a stub mast and other experiments conducted which were of importance.

Complete statistics relative to appropriations, equipment, etc., of the Bureau of Aeronautics will be found in the Appendix.



Navy planes in Biscayne Bay, Miami, Fla.



(Top) Goodyear *Puritan* landing on roof of an office building. (Bottom) *Los Angeles* moored to mast of tender *Patoka.*

CHAPTER XI

AIRSHIP DEVELOPMENT

AERONAUTICAL expansion during the year was accompanied by important developments in the field of lighter-than-air. The German airship *Graf Zeppelin* was completed, and in October made her round trip flight to the United States. The Bureau of Aeronautics, U. S. Navy Department, continued to operate the *Los Angeles* which during the twelve months was in the air 600 hours, covering about 28,000 miles. Two Naval non-rigid airships were flown 300 hours each, while free balloon flights augmented the time put in by Navy personnel in training operations. During the year the Bureau of Aeronautics ordered from the Goodyear-Zeppelin Corporation, Akron, O., two giant rigid airships of 6,500,000 cu. ft. gas capacity each, designed to be the largest and most modern airships in the world.

The *Graf Zeppelin* on her American flight was commanded by Dr. Hugo Eckener, with Capt. Ernst A. Lehmann as first officer. On her westward flight, beginning Oct. 11, she carried 20 passengers and a crew of 40 officers and men, with several tons of mail. Strong headwinds and storms held her back and caused her officers to change the course, so that the *Graf Zeppelin* actually cruised 6,000 miles during her 111½ hours flight from Friedrichshafen, Germany, to the Naval Air Station at Lakehurst, N. J.

The bad weather was encountered before the *Graf Zeppelin* left the European continent. Dr. Eckener and his veteran staff of navigating officers then pointed the ship's nose southward, turning out over the Atlantic off the coast of Africa and setting a course over the Madeira Islands group. Another storm came up and damaged the covering on a tail fin. It was necessary to halt all motors for 12 hours while emergency repairs were made. The flight was then continued at half speed to Lakehurst.

In spite of those delays an average speed of 56.6 miles an hour was maintained for the flight and the airship arrived at the Naval Air Station with sufficient fuel to remain aloft an additional 55 hours if necessary.

Setting out on the return flight October 29, with 25 passengers and the same crew of 40, the *Graf Zeppelin* accomplished the journey in 71 hours and 12 minutes, a new record for airships, although

storms again made it advisable to change the ship's course several times on the northern route.

The *Graf Zeppelin* was the first airship to employ blau gas for fuel in addition to gasoline, it's motors being designed to consume both by means of a simple carburetor adjustment. Approximately 1,200,000 cu. ft. of blau gas were used in refueling the airship for the return trip, supplied by the Bureau of Aeronautics. Repairs to the damaged fin were also made under the direction of Naval officers at Lakehurst.

Lieut.-Cmdr. Charles E. Rosendahl, Commander of the *Los Angeles,* made the westward flight on the *Graf Zeppelin* standing watch as a regular ship's officer, and on the return flight to Europe, Cmdr. M. R. Pierce, Lieut. Charles E. Bauch and Lieut. T. G. Settle were observers.

Though their preliminary tests and long experience had indicated that a 5,000,000 cu. ft. hydrogen ship was the smallest craft practical for the proposed service, the German Zeppelin officials in building the *Graf Zeppelin* had been handicapped by the size of the only available construction shed. The capacity and outside dimensions of the *Graf Zeppelin* were therefore dictated by those limitations. She had a gas capacity of 3,710,000 cu. ft. of hydrogen, was 770 ft. long, 100 ft. in diameter, and her five Maybach engines gave her a top speed of 78 miles per hour.

At that speed her cruising radius was about 5,360 miles, though throttled down to 70 her range was increased to 7,030 miles. In fundamental design the *Graf Zeppelin* was similar to her immediate predecessor, the *Los Angeles,* which was delivered to the Navy in 1924, and four years later was still in first-class condition.

Los Angeles Flies to Panama

Starting from Lakehurst, N. J., on February 12, 1928, the *Los Angeles* made a non-stop flight to Panama, 2,178 miles in 40 hours. She was commanded by Lieut.-Cmdr. Charles E. Rosendahl and carried a crew of 40 officers and men. Of that trip the New York Times, on March 1, 1928, commented editorially:

"The Navy Department has never regarded the *Los Angeles* as an auxiliary of the Fleet. Assistant Secretary Warner, delighted with her smooth and uneventful voyage to Panama, was careful to say that it was 'splendid evidence of the commercial and naval usefulness of airships and the desirability of energetic development here.' One likes to think of the *Los Angeles* steadily coursing through the sky at the maximum speed of the Empire State Express as a ship of commerce. The uses of larger dirigibles for war would

Los Angeles, Graf Zeppelin and two Naval blimps in the Lakehurst, N. J., hangar.

be limited by the superiority in speed of bombing airplanes. But it would be hard to set a limit to the value of lighter-than-air ships for the carriage of passengers and cargoes.

"In her cruise to Porto Rico and return, 4,000 miles, in May, 1925, and in her still longer voyage to Panama and back, the *Los Angeles* has demonstrated the worth of dirigibles for commercial uses. She was the second ship of her kind to cross the Atlantic from Europe, and since her acquisition by the United States she has been sailed many thousands of miles without a serious accident. On the whole, she has behaved well in storm and fog. In the use of helium for inflation she has been made practically safe from explosion and fire. She has done admirable trial work for commerce in the hands of officers and men of the Navy. The day of regular air travel across the Atlantic seems to be approaching."

Experiments with Airships

Landing on the top of a building; picking up supplies from a moving truck; transporting a relief crew to salvage a wrecked airplane; landing on the deck of a steamer out at sea; conducting

a search over Chesapeake Bay for lost flyers, and removing two men from a small boat by means of a rope ladder lowered from above were among the many experimental missions performed by small non-rigid airships assigned to the 19th Airship Company, Army Air Corps, at Langley Field, Va.

Those two airships, both of the TC type, were in commission every day for 12 months. With a record of 183 hours and 35 minutes for the month of September and a total time of 1,167 ship hours for the entire period, the 19th Airship Company broke all previous records for lighter-than-air training at Langley Field.

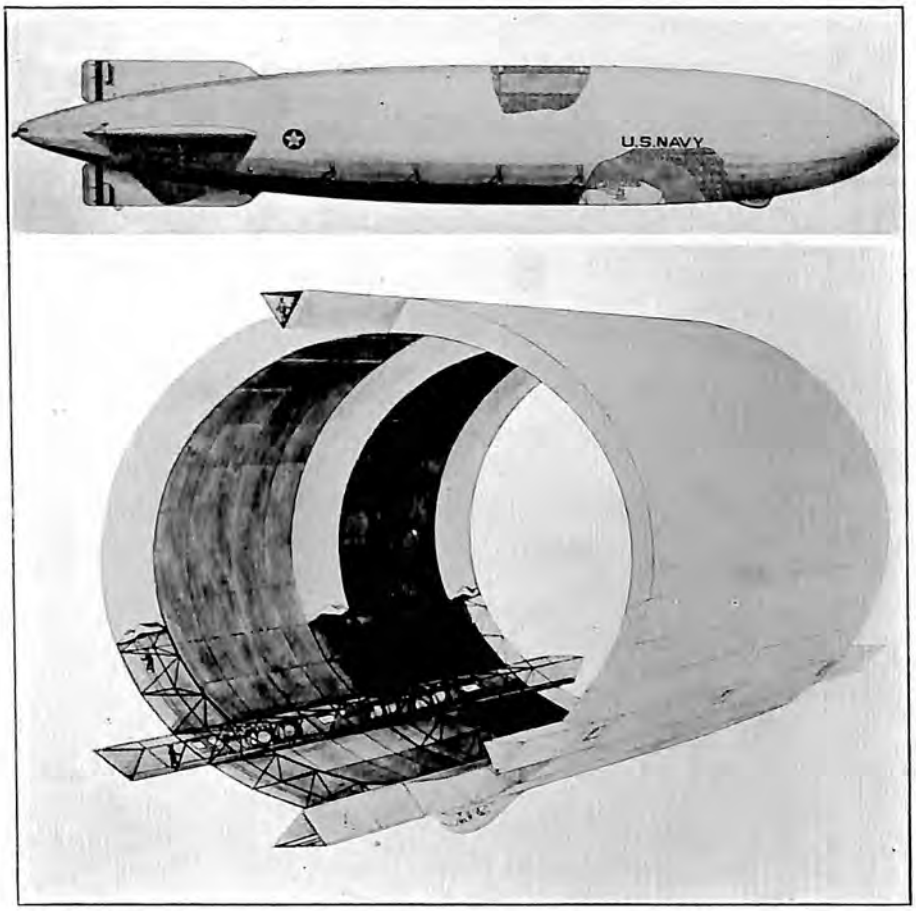
The landing on the top of the Newport News High School building was an outstanding experiment. There were three great handicaps to be overcome—the small landing space available; obstructions on all sides, including power lines and buildings; and the fact that there was no headwind to check the momentum of the airship.

Another achievement was the landing of the TC-5-251 on a moving steamer, loading a cargo and taking off again without halting the surface vessel. The landing was made on the after deck of the steamer *American Trader,* about three miles off Ambrose Light, N. Y., on May 10. The Chairman of the Shipping Board characterized it as a new step in the coördination of air and water transportation. When three Naval fliers were lost in Chesapeake Bay, both airships were flown daily in search of them. Fourteen flights were made with a total flying time of 50 hours.

U. S. Navy Orders Two Giant Airships

In ordering from the Goodyear-Zeppelin Corporation the construction of two large rigid airships, the Bureau of Aeronautics had the wise vision to select a size and type suitable as a long distance commercial vehicle. The ships are to be helium inflated, with a gas capacity of 6,500,000 cu. ft. That size of helium ship is comparable to one of a little less than 5,000,000 cut. ft. when hydrogen inflated. The difference in capacity is explained by the lower lifting power of the helium and by the policy of inflating the bags only to such extent that the relatively costly helium will not be lost when the gas expands.

The main rings are to be built-up transverse frames of corridor cross section, strong enough to take all the stresses without the assistance of wire bracing. The location of the two lower corridors at an angle of 45 degrees with the vertical axis will contribute materially to the support of the auxiliary rings and hence to the general structure of the assembly.



(Top) The Goodyear-Zeppelin Corp. is building two giant airships of this type for the U. S. Navy. (Bottom) Cross section of one of the airships.

The main rings of triangular meridional section are believed to possess many advantages over the flat rings used in smaller ships. They afford means of intercommunication between corridors, and together with these corridors they permit a thorough inspection of the ship. They provide excellent means for ventilation. They also provide supports for the installation of the power cars to be set inside the hull, with a consequent saving of air resistance, also affording access for quick repair and continuous inspection of motors.

Since no wire bracing is necessary for the stiffening of the rings, some provision must be made to hold the gas cells in place. For this purpose alone, a diagonal wire netting will be attached at

every other corner of the inner annular ring. No additional cord netting is necessary as would be the case with the old radial wire netting.

New Naval Airships Will Carry Planes

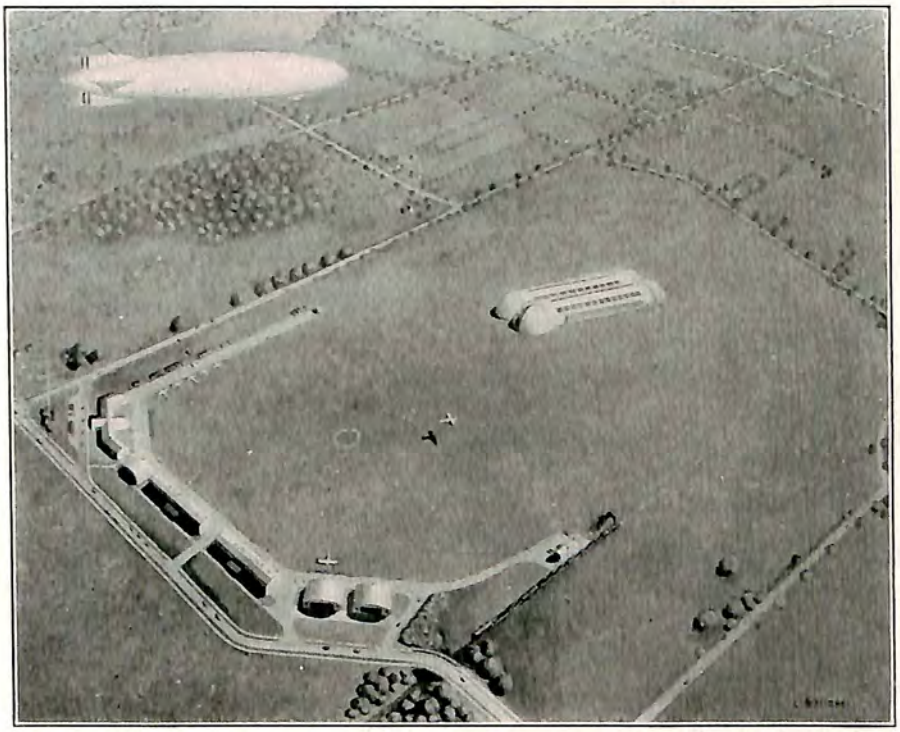
One of the most important features of the new airships will be the storage space for five completely assembled airplanes. This storage compartment, about 75 feet long and 60 feet wide, will be located at about one-third of the ship's length from the bow. Collapsible doors in the floor will cover a T-shaped opening through which a trapeze with an airplane attached may be hoisted or lowered. The airships, therefore, will be airplane carriers besides having sufficient armament to ward off attacks from all quarters.

The improvements in design and construction in the last four years may be noted by comparing the following table of characteristics, noting the difference between the *Los Angeles*, completed in 1924, and the new airships, designed in 1928, and which are designated ZR-4 and ZR-5.

	Los Angeles	*New Airships ZR-4, ZR-5*
Helium gas volume, cu. ft.	2,470,000	6,500,000
Length overall, ft.	658.3	785
Maximum diameter, ft.	90.7	132.9
Height overall, ft.	104.4	146.5
Gross lift, lbs.	153,000	403,000
Useful lift, lbs.	60,000	182,000
Number of engines.	5	8
Total horsepower	2,000	4,480
Maximum speed, knots.	63.5	72.8
Range without refueling at 50 knots cruising speed,, nautical miles.	3,500	9,180

The Goodyear-Zeppelin engineers have stated that the structural features of the new Naval airships could be easily incorporated into commercial craft. Such ships would possess the following dimensions and other characteristics: Overall length, 785 ft.; maximum diameter, 133 ft.; overall width, 138 ft.; overall height, 147 ft.; fineness ratio, 5.9; nominal gas capacity, 6,500,000 cu. ft.; dead weight, 210,000 lbs.; total lift, 403,000 lbs.; useful lift, 193,000 lbs.; high speed, 87 miles per hour; cruising speed, 75 miles per hour.

The range of the ship, while carrying 40 passengers, 20,000 pounds of mail and express in addition to a crew of 55 would be about 4,700 miles at a top speed of 87 miles an hour; 6,100 miles at a cruising speed of 75 miles an hour and 10,000 miles at a cruising speed of 60 miles an hour.



Akron Airport showing Goodyear-Zeppelin hangar as it will appear when completed.

Late in the year the Goodyear-Zeppelin Corporation began construction of the world's largest hangar upon the municipal flying field in Akron, O. It will be 1,200 ft. long, 325 ft. wide and about 200 ft. high.

The hangar will be well rounded in form and equipped with doors of a special spherical callotte design. The avoidance of sharp corners will eliminate local air conditions having extreme pressure variations while the air flow over the whole structure will be unusually smooth.

The Goodyear-Zeppelin Corporation also commenced construction in 1928 of a fleet of small non-rigid airships. Commercial aeronautical activities were started with the two passenger blimps, the *Pilgrim* and the *Puritan.*

The *Pilgrim,* built as a pioneering ship, has a gas capacity of 50,000 cu. ft. It has been used for passenger carrying, publicity and advertising work. The *Pilgrim* was the first American non-rigid ship to use an internal suspension system. The car is hung

beneath a central keel girder about 20 ft. long, which is laced into the outside of the gas bag. The keel is supported from within by cables passing up through the bag and terminating in catenary cables which run along the top of the bag. The ship is driven by the 60-h.p. motor mounted at the rear of the cabin and attains a speed of 45 miles an hour with a pilot and two passengers. The *Pilgrim* made 533 flights, a number of them for training purposes. About 300 passengers were carried, from the day of launching until the end of 1928.

The *Puritan* is a larger ship of more recent design and involving several improvements. It is inflated with 86,000 cu. ft. of helium, and equipped with two 70-h.p. radial motors giving it a speed of 58 miles an hour. It was launched Aug. 6, 1928, and in 60 days flew 8,000 miles, carried more than 600 passengers, and ran up a total of 180 hours in the air. Its range, carrying two passengers, a mechanic and a pilot, is 417 miles. Its longest non-stop flight was 410 miles over the mountains from Akron to Lakehurst, N. J.

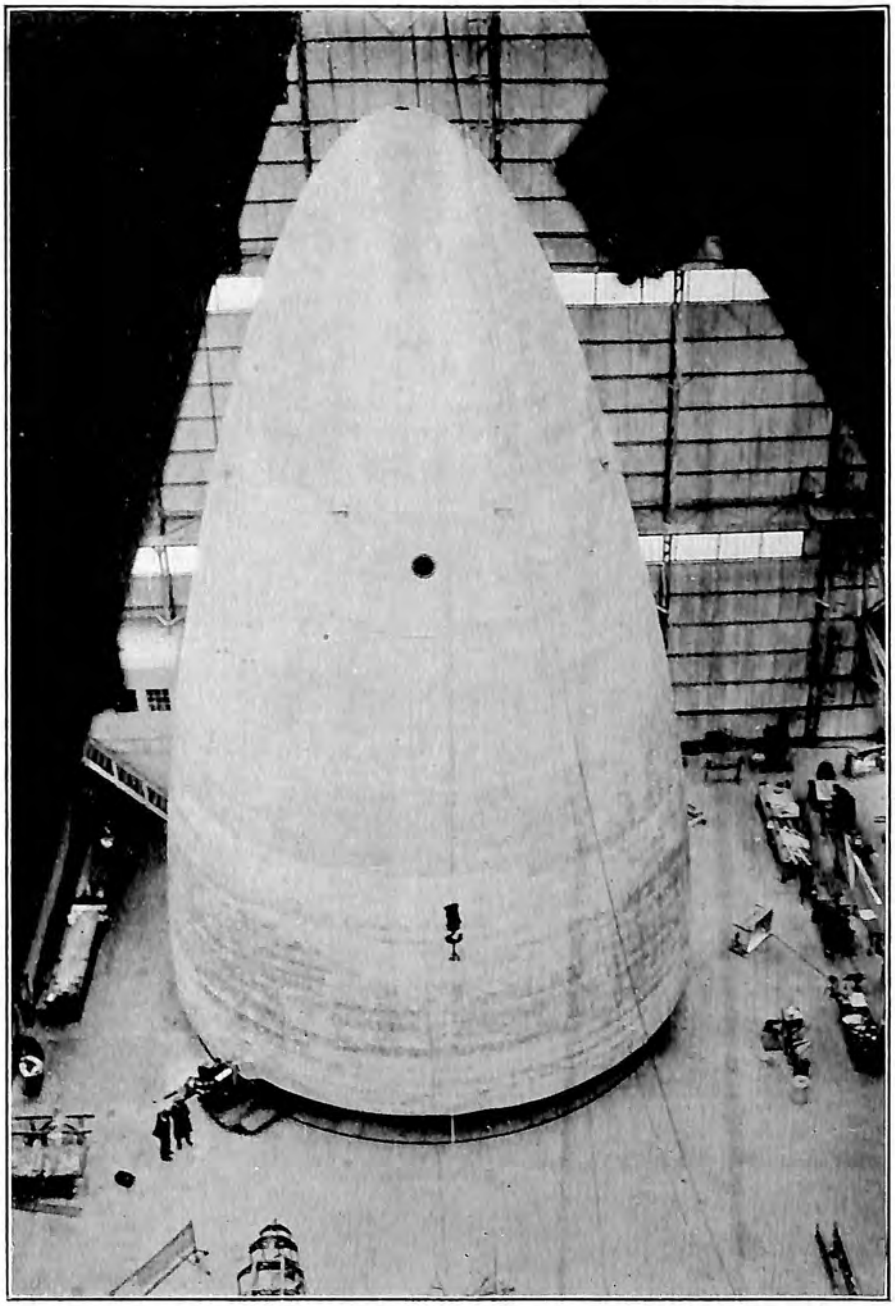
On Dec. 31 the Corporation had under construction two ships of the *Puritan* type. A larger ship, 130,000 cu. ft. with two 120-h.p. motors and carrying 8 passengers, was designed for immediate construction.

The construction in England of two 5,000,000 cu. ft. rigid airships to be completed in 1929 and used for long distance passenger and mail transportation contributed to the year's progress in the development of lighter-than-air.

Changes in Metalclad Airship

The change in the hull plating from sheet duralumin to alclad metal, because of the greater resistance of the latter to corrosion, delayed completion of the metalclad airship which the Aircraft Development Corporation, of Detroit, is building for the Navy. In spite of this major change in material on March 7, 1928, at the end of the year the two halves of the ship were completed and had been swung to a horizontal position for final assembly. Exposure tests of samples of the alclad plating, .010 inch thick, made throughout the twelve months were reported as entirely satisfactory and fully justifying the substitution of the new metal for thin sheet duralumin.

The vertical method of erection is unique and, it is reported, effects considerable economy both in labor and in time. This method is made possible by the automatic riveting machine developed by Edward J. Hill, works manager of the Corporation. The machine, operated by two men, has a capacity of 40,000 rivets in an eight-hour



Stern section of hull of metalclad airship under construction by Aircraft Development Corporation, Detroit.

shift. Using duralumin wire, fed into the machine like thread, three rows of rivets are "sewed" in one operation. The machine is mounted on a carriage which travels on a track around the perimeter of the hull section. When one transverse panel is completed, the entire hull section, which is supported by heavy pulleys swung from the roof of the hangar, is raised, and the panel riveting operation is again repeated.

The metalclad airship, which is experimental in size, with 200,000 cu. ft. gas capacity, will be inflated with helium.

During the year Airships Incorporated, of Hammondsport, N. Y., delivered to the Army Air Corps two 800,000 cu. ft. airship envelopes known as the TE primary training type. This type envelope was originally developed by this company in 1924 and 1925 for the Air Corps. One 19,000 cu. ft. and four 35,000 cu. ft. standard spherical balloons were also delivered to the Air Corps in 1928.

CHAPTER XII

CHRONOLOGY

1928

Jan. 1 — U. S. War Dept. sends aviation mission to Havana to organize Cuban Army Aviation School. Mission headed by Capt. R. Beam.

Jan. 5 — Lieut. A. M. Pride, U. S. N., lands first plane on deck of carrier *Lexington.*

Jan. 10 — Charles L. Lawrance, president Wright Aeronautical Corp., awarded Collier Trophy for 1927 development of radial aircooled engine.

Jan. 10 — Captain Hood and Lieutenant Moncrieffe leave Sidney, Australia, for Wellington, New Zealand. Lost at sea.

Jan. 11 — Lieut. Cmdr. M. A. Mitscher, N. S. N., lands first plane on deck of carrier *Saratoga.*

Jan. 14 — Maj. Louis N. Bourne, Lieut. Jacob Platcha and Sgt. B. F. Belcher, U. S. M. C., complete first non-stop flight United States to Nicaragua, Miami to Managua, 1,150 mi. in 12 hrs. 2 min.

Jan. 14 — Clarence D. Chamberlin and Roger Q. Williams in Bellanca monoplane, Wright *Whirlwind* engine, make endurance flight of 51 hrs. 52 min. at Mitchel Field, N. Y.

Jan. 20 — Master Sgt. Harry A. Chapman, Army Air Corps, receives Cheney Award for heroism during *Roma* disaster in Feb., 1922.

Jan. 24 — Paillard in France in Bernard monoplane, Jupiter 420 h. p. engine, makes record flight over 620 mi. course, 135.6 m.p.h. with useful load of 2,204 lbs.

Jan. 27 — Navy airship *Los Angeles* is successfully landed on deck of airplane carrier *Saratoga* near Newport, R. I.

Feb. 1 — National Air Transport starts daily mail and express service between Kansas City and Chicago, 454 mi.

Feb. 2 — R. Wagner in Dornier Superwal, 4 Gnome-Rhone-Jupiter 480 h.p. engines in Germany, makes record speed 110.15 m.p.h. for seaplanes, 2,204 lbs. useful load over 620 mi. course; and 130.1 m.p.h. and 111.48 m.p.h. with 8,818 lbs. over 62 and 310 mi. respectively.

Feb. 6 — Texas Air Transport starts daily mail and passenger service between Dallas and Laredo, Texas, 423 mi.

Feb. 6 — Texas Air Transport starts daily mail and passenger service between Dallas and Galveston, Texas, 308 mi.

Feb. 6 — First Pursuit Group, Air Corps, starts winter maneuvers in Northern Michigan.

Feb. 12 — Charles Holman makes record loop-the-loop flight in Laird biplane, Wright *Whirlwind* engine, 1,093 loops, at Minneapolis, Minn.

Feb. 12 — Lyle A. Thro makes record loop-the-loop flight for light planes in Alexander Eaglerock, *OX-5* engine, 543 loops, at Minneapolis, Minn.

Feb. 13 — Col. Charles A. Lindbergh lands at St. Louis, Mo., after goodwill flight beginning Dec. 13, 1927, from Washington, D. C., to Mexico City, non-stop, Guatemala, Belize, San Salvador, Nicaragua, Costa Rica, Colon, Panama, Colombia, Venezuela, Virgin Islands, San Juan, Santo Domingo, Port au Prince, Havana, in *The Spirit of St. Louis,* 9,060 mi.

Feb. 15 — President Coolidge signs bill authorizing acceptance of new site near San Antonio, Texas, for Army Air Corps training center.

Feb. 19 — Flying Association of Sweden organized to stimulate aviation.

Feb. 21	Harvey J. Brooks in Ford monoplane, 36 h.p. Ford engine, flies 972 mi. from Detroit, Mich., to Titusville, Fla.
Feb. 22	Bert Hinkler in Avro biplane, Cirrus engine, lands at Port Darwin, Australia, after first solo flight from London, 12,000 miles in 15½ days.
Feb. 26-27	Navy airship *Los Angeles* makes non-stop flight from Lakehurst, N. J., to Panama, 2,178 mi. in 40 hrs.
Feb. 27	British airplane carrier *Courageous* is commissioned.
Feb. 27	French Air Union and British Imperial Airways reduce passenger rates on London-Paris route to approximately same rates as those for first class surface transport.
Feb. 28	First aerial passenger service in Japan starts between Tokio and Osaka, with subsidy from Government.
Mar. 1-9	Lieut. B. R. Dallas, Air Corps, and Beckwith Havens in Loening Amphibian make first amphibian flight across continent, New York to San Diego, Cal., 3,300 mi. in 32 hrs. 45 min. flying time.
Mar. 5	Union Air Lines starts thrice-weekly passenger and express service between San Francisco and Portland, 549 mi.
Mar. 5	Union Air Lines starts twice-daily passenger and express service between Portland and Seattle, 153 mi.
Mar. 6	Wilmer Stultz, pilot, Miss Mabel Boll and Charles A. Levine in Bellanca monoplane *Columbia*, Wright *Whirlwind* engine, make non-stop flight, Mitchel Field, New York, to Havana, Cuba, in 14 hrs. 25 min.
Mar. 12	Alfred Trouval in France makes record loop-the-loop flight, looping 1,111 times in Morane plane, 180 h. p. Hispano-Suiza engine.
Mar. 14	The Hon. Elsie Mackay and Capt. Walter Hinchcliffe in Stinson monoplane leave Lincolnshire, England, on non-stop westbound Atlantic flight. Lost at sea.
Mar. 19	W. N. Lancaster and Mrs. Keith Miller in Avro Avian, Cirrus engine, land at Port Darwin, Australia, after flight from London.
Mar. 24	Assistant Secretary of War, F. Trubee Davison, and Maj. Gen. James E. Fechet, Chief of the Air Corps, in two Loening Amphibians arrive at France Field, Panama, on tour of inspection.
Mar. 28-30	Eddie Stinson and George Haldeman in Stinson-Detroiter, Wright *Whirlwind* engine, make record duration flight at Jacksonville, Fla., 53 hrs. 36 min. 30 sec.
Mar. 28	Ten enlisted men of the Army Air Corps jump from Ford transport at Chanute Field, Ill., in 8 2/10 sec., record time for parachute jumping in numbers.
Mar. 30	Major de Bernardi at Venice, Italy, with Macchi-52 seaplane, Fiat engine, makes record average speed 318.62 m.p.h.
Apr. 2	Kansas Air Tour covering 30 cities starts from Wichita, Kan.
Apr. 3-6	Captain Giradot and Lieutenant Cornillon of France, in Amiot S.E.C.M., Lorraine 650 h.p. engine, make round trip flight Paris-Timbuctoo, 6,500 mi. in 65½ hrs. flying time.
Apr. 9	Lieut. C. F. Schilt, U. S. M. C. pilot, awarded Congressional Medal of Honor for heroism in Nicaragua.
Apr. 12-13	Capt. Herman Köehl and Baron Ehrenfried Guenther von Huenefeld of Germany and Comdt. James Fitzmaurice of Ireland, make first westbound Atlantic flight in Junkers monoplane *Bremen*, 310 h.p. Junkers engine, from Baldonnel Airdrome, Dublin, Ireland, to Greeneley Island, Newfoundland, 36 hrs. 30 min.
Apr. 14	Maddux Air Lines starts daily passenger service between Los Angeles and San Francisco, 378 mi.

Apr. 14	Capt. Dieudonne Costes and Lieut. Cmdr. Joseph Lebrix, flying Breguet XIX Biplane, with 500 h.p. Hispano-Suiza engine, land at Le Bourget, Paris, completing their 35,000-mile flight around the world. The flight begun Oct. 14, 1927, at Paris, France, included St. Louis (West coast of Africa), Port Natal, Rio de Janeiro, Brazil; Buenos Aires, Argentina; Santiago, Chile; La Paz, Bolivia; Lima, Peru; Guayaquil, Ecuador; Panama; Caracas, Venezuela; Baranquilla, Colombia; Mexico City; New Orleans; Washington, D. C.; New York; Sharon, Pa.; Detroit; Chicago; Rock Springs, Wyo.; San Francisco. Costes and Lebrix went by boat to Japan and continued thence by air to Paris to complete their trip around the world, 338 flying hrs.
Apr. 14-21	Sixty-eight airplanes exhibited at All-American Aircraft Show in Detroit, Mich.
Apr. 15-21	Capt. Sir George Hubert Wilkins and Carl B. Eielson in Lockheed Vega, 225 h.p. Wright *Whirlwind* engine, fly from Point Barrow, Alaska, across North Polar Sea to Green Harbor, Spitzbergen, with one stop of 5 days enroute, total distance 2,200 mi.
Apr. 20	Air Corps Tactical School conducts pursuit training tests at Virginia Beach, Va.
Apr. 26	Air Corps radio laboratory plane makes successful tests with radio beacon on 349 mi. flight between Dayton, O. and Buffalo, N. Y.
Apr. 26	Commandant Guilbaud of France in Latham flying boat, twin 500 h.p. Farman engine, flies from Le Havre, France, to Bizerta, Tunis, with four passengers, 1,250 mi. in 15 hrs. 10 min.
Apr. 27	Capt. H. S. Broad in England with De Havilland "Hound," 550 h.p. Napier-Lion engine makes 158.65 m.p.h., record for airplanes with useful load of 1,102-3 lbs. over 310 mi. course; and speed record of 160.28 m.p.h. for planes with useful load of 2,204 lbs. over 62 mi. course.
Apr. 30	Lady Mary Bailey in DH-Moth, Cirrus engine, lands at Cape Town, South Africa, after 8,000 mi. solo flight from London starting Mar. 9.
Apr. 30-May 6	Aircraft Show held at Syracuse, N. Y.
May 1	Gulf Air Lines starts six times weekly mail and passenger service between New Orleans and Atlanta, Ga., 483 mi.
May 1	Pitcairn Aviation, Inc., starts six times weekly mail service between New York and Atlanta, Ga., 769 mi.
May 2-3	Lieut. Royal V. Thomas in Bellanca monoplane *Reliance* makes record solo duration flight at Mitchel Field, N. Y., 35 hrs. 25 min. 8 sec.
May 3-5	Lieuts. Arthur Gavin and Zeus Soucek in Navy PN-12 make record duration flight for seaplanes, 36 hrs. 1 min. near Philadelphia, Pa.
May 4	Ninety machines flown in military maneuvers of U. S. Air Corps at Langley Field, Va.
May 8	Monument to Nungesser, Coli and Lindbergh unveiled at Le Bourget airport, Paris.
May 8-16	Capt. Pelletier D'Oisy, in Potez biplane, flies from Paris to Akyab, India.
May 10	Air Corps T. C. airship lands on deck of *S.S. American Trader* near Ambrose Light, N. Y., transfers cargo and takes off again.
May 12	Lieut. Julian S. Dexter, Air Corps Reserve, completes aerial mapping assignment over Florida everglades, 3,000 sq. mi. photographed in two months; 65 hrs. flying time.
May 15	National Advisory Committee for Aeronautics holds third annual engineering research conference at Langley Field, Va.
May 15	Sixth Photo Section, Air Corps, completes 3,000 sq. mi. aerial mapping of northeast coast Luzon, P. I.
May 16	Seventy-five Air Corps planes stage combat exhibition with Field Artillery School of Fire at Fort Sill, Okla.
May 16	Lieut. Robt. W. Douglass, Jr., and Lieut. James E. Parker, Air Corps, in two Curtiss pursuit planes land at Bolling Field, Va., after 3,815 mi. flight from Panama Canal Zone.

May 17	Lady Mary Heath in Avro Avian, Cirrus engine, lands at Croydon, London, completing solo flight from Cape Town, South Africa, starting Feb. 12.
May 19	Maj. Charles A. Lutz wins Curtiss Marine Trophy Race at Washington, D. C., flying Curtiss Hawk, Curtiss D-12 engine, over 100 mi. course at 157.6 m.p.h.
May 24–25	Capt. Emilio Carranza, Mexican Army, in Ryan monoplane flies from San Diego, Cal. to Mexico City, 1,575 mi. in 18 hrs. 20 min.
May 25	Italian semi-rigid airship *Italia* wrecked near Spitzbergen after flight over North Pole. Some survivors later rescued including Gen. Umberto Nobile, head of expedition. Others either lost on ice or carried off in wrecked ship.
May 25–26	Lieuts. Zeus Soucek and Lisle V. Maxson, in U. S. Navy PN-12 seaplane, twin Pratt & Whitney 525 h.p. Hornet engine, make record duration flight for seaplanes carrying 1,000 kg. load, 17 hrs. 55 min. 13 sec.
May 26	Western Air Express starts daily passenger and express service between Los Angeles and San Francisco, 378 mi.
May 30	Capt. W. E. Kepner and Lieut. W. O. Eareckson, Army Air Corps, win National Elimination Balloon Race, Pittsburgh, Pa. to Weems, Va., 261½ mi. in 12 hrs.
May 31	Sir Alan and Lady Cobham land at Plymouth, England, completing 20,000 mi. flight around Africa in Short flying boat, twin Rolls-Royce engines.
May 31–June 2	Maj. Arturo Ferrarin and Maj. Carlo del Prete in Savoia-Marchetti monoplane, 550 h.p. Fiat engine, make record closed circuit flight near Rome, 4,763.7 mi. in 51 hrs. 59 min.
May 31–June 10	Capt. Charles E. Kingsford-Smith, Capt. C. T. P. Ulm, pilots, Lieut-Cmdr. Harry W. Lyon, navigator, and James Warner, radio operator, in Fokker tri-motored Wright Whirlwind monoplane, *Southern Cross*, fly from Oakland, Cal., to Brisbane, Australia, first trans-Pacific flight, stopping at Honolulu, Fiji Islands and Brisbane, 7,400 mi. in 83 hrs. 15 min. flying time.
June 1	New amendments to Air Commerce Regulations become effective under administration of Department of Commerce.
June 1	Paul R. Braniff, Inc., starts daily passenger service between Tulsa and Oklahoma City, 98 mi.
June 1	Paul R. Braniff, Inc., starts daily passenger service between Tulsa and Okmulgee, Okla., 37 mi.
June 2–3–4	Adj. Louis Crooy and Sgt. Victor Groenen of Belgium, in DH-9 make record duration flight (refueling in air) 60 hrs. 7 min.
June 6–7	Commandant Vichereck in Avia, 60 h.p. Walter engine, near Prague, Czechoslovakia makes record flight for light airplanes, 1,553 mi. over closed course.
June 9	Lieut. Earle E. Partridge for third successive time wins distinguished gunnery badge in Air Corps Machine Gunning Matches at Langley Field, Va., percentage of 627.8; Lieut. John W. Bowman, second with 544.8 and Lieut. Lotha A. Smith, third with 512.9.
June 11–12	Capt. Emilio Carranza, Mexican Army, flies Ryan monoplane, *Mexico-Excelsior* on good-will flight from Mexico City to Washington, D. C., forced down once at Moorehead City, N. C., two-thirds of flight through storms, total distance 2,175 mi. in 20 hrs. flying time.
June 14	Charles Kaszala in Hungary flying Lampich monoplane, 18 h.p. Thorutzkai engine, makes record light airplane flight Budapest to Pola, 832 mi.
June 15	United States Air Transport starts daily passenger service between New York and Washington, 201 mi.
June 15	First transfer of mail from aircraft to train made by Air Corps blimp piloted by Lieut. Karl S. Axtater and Lieut. Edward H. White, flying directly over Illinois Central train, dipping down and handing bag of mail to railway mail clerk.

June 16 — Lieut. William H. Bleakley, Air Corps, in XCO-5 plane makes altitude flight of 36,509 ft. and remains there 18 min.

June 17 — Miss Amelia Earhart, Wilmer Stultz, pilot, and Louis Gordon, mechanic, in Fokker tri-motored Wright engine monoplane *Friendship* fly from Trepassey Bay, Newfoundland, to Burry Port, Wales, in 20 hrs. 40 min. non-stop; first Atlantic flight by a woman.

June 18 — Roald Amundsen and Maj. Rene Guilbaud leave Tromsoe, Norway, on airplane search of survivors of airship *Italia*. Lost at sea.

June 21–23 — Air meet and show held at Lowell, Mass.

June 23 — Lieutenant Lundborg of Sweden rescues Gen. Umberto Nobile from ice floe where he and a few survivors from the *Italia* had been stranded.

June 23 — Lieut. B. S. Thompson, Air Corps, flies new attack plane from Buffalo, N. Y., to San Antonio, Texas, between 6 a. m. Eastern daylight saving time and 8:30 p. m. Central standard time.

June 27–28 — Lieut. Arthur Gavin, U. S. N., in PN-12, twin Pratt & Whitney 525 h.p. *Hornet* engine, makes record altitude flight for seaplanes 19,593 ft. with useful load of 2,204 lbs.

June 29–30 — Three hundred boys compete in National Model Airplane Contest, Detroit, Mich.

June 29–July 15 — Aeronautical Salon in Paris, France.

June 30 — Three hundred West Point cadets report for flying training at Langley Field, Va.

June 30 — Capt. W. E. Kepner and Lieut. W. O. Eareckson, Army Air Corps, win Gordon Bennett International Balloon Race starting from Detroit, Mich., with 12 entries representing 8 nations. Winner lands at Kendridge, Va., 460.9 mi. from starting point, giving United States permanent possession of trophy because this is third consecutive year Americans have won the race.

June 30–July 22 — Capt. C. B. D. Collyer and John H. Mears make record trip around the world, 23 days, 15 hrs. 8 sec., using Fairchild cabin monoplane, 400 h.p. Pratt & Whitney *Wasp* engine, crossing Atlantic and Pacific by steamship, traveling eastward from New York.

June 30–July 28 — John P. Wood in Sport Waco biplane, Wright *Whirlwind* engine, wins first place in the Fourth National Air Tour from Detroit, Mich., 6,300 mi.; stops at 32 cities in 15 states; 24 entries.

July 1 — Universal Air Lines starts daily passenger service between Chicago and Twin Cities, 363 mi.

July 3–5 — Maj. Arturo Ferrarin and Maj. Carlo Del Prete in Savoia-Marchetti, 550 h.p. Fiat engine, make record non-stop flight Rome, Italy, to Rouros, Brazil, 4,466 mi. in 51 hrs. 59 min.

July 5 — National Air Transport starts daily mail and express service between Tulsa and Ponca City, Okla., 76 mi.

July 5–7 — Johann Risztics and Wilhelm Zimmerman in Junkers monoplane, 280 h.p. Junkers engine, make record duration flight at Dessau, Germany, 65 hrs. 25 min.

July 10 — Boeing Air Transport starts daily mail, passenger and express service between Lincoln, Neb., and Chicago, 359 mi., besides 129 mi. between Omaha and Des Moines.

July 11 — Joseph Hermansky and Francois Machacek in Avia, 60 h.p. Walter engine, make record closed course distance flight for light planes weighing less than 881 lbs., flying 932 mi.

July 11 — Lieuts. Robt. W. Douglass, Jr., and James E. Parker, Air Corps, in two Curtiss pursuit planes arrived at France Field, Panama, on return flight from Washington, D. C.

July 11–12 — Lieut. A. W. Gorton and Chief Btswn. E. E. Reber, U. S. N., in PN-12, twin Pratt & Whitney 525 h.p. *Hornet* engines, make record flight near Philadelphia, Pa., for seaplanes with useful load of 2,204 lbs., 1,336 mi.; average speed 81 m.p.h.

July 13 — Capt. Emilio Carranza, Mexican good-will pilot, leaves Roosevelt Field, L. I., N. Y., on non-stop flight to Mexico City. Attempting a forced landing during storm in New Jersey he is killed when his plane strikes trees.

July 13 — Mme. Maryse Bastie and Maurice Drouhin in Caudron, 40 h.p. Salmson engine, make record airline flight for light planes weighing less than 881 lbs., flying 657.4 mi. from Paris to Treptow, Czechoslovakia.

July 17 — Thompson Aeronautical Corporation starts daily mail service between Chicago, Muskegon and Pontiac, Mich., 521 mi.

July 19 — Royal Air Lines starts daily passenger service between Chicago and Madison, Wis., 161 mi.

July 22 — Lieut. Paris in C.A.M.S. seaplane *Frigate* leaves Brest, France, on attempt to fly Atlantic. Flight discontinued at Azores.

July 27 — Capt. and Mrs. G. De Havilland in DH-Moth, 85 h.p. Gipsy engine, make altitude record for light planes, 19,862 feet.

July 29 — Peter Hesselbach of Germany makes American record in his glider, *Darmstadt*, 4 hrs. 5 min. at Corn Hill, Cape Cod, Mass.

Aug. 1 — New rate for air mail in United States—5 cents for first ounce and 10 cents for each additional ounce.

Aug. 1 — National Parks Airways starts daily mail and passenger service between Salt Lake City and Great Falls, Mont., 489 mi.

Aug. 1 — Continental Air Lines starts mail and passenger service between Louisville, Ky., and Cleveland, 345 mi.

Aug. 1 — National Air Transport starts nightly mail and express service between Toledo, Ohio and Detroit, Mich., 54 mi.

Aug. 2 — Capt. Frank G. Courtney, Fred Pierce, Hugh C. Gilmour and E. B. Hosmer in Dornier-Napier flying boat forced down in mid-Atlantic on westbound flight attempt. Rescued by *S.S. Minnewaska* in response to radio signals.

Aug. 3–5 — Maj. Louis Idzikowiski and Kazimir Kubala of Poland attempt to fly Atlantic westbound in Amiot biplane *Marszelak Pilsudski*. Rescued at sea by *S.S. Samos*.

Aug. 10 — Air Meet held at Colorado Springs, Colo.

Aug. 13 — Lieut. Domougeot, French Navy, makes ship-to-shore flight in Lioré-Olivier flying boat catapulted from *S.S. Ile de France*, 450 mi. from New York.

Aug. 15 — Lieuts. Ford J. Lauer and Gordon P. Saville, Air Corps, fly from Washington, D. C. to New York in 1 hr. 10 min.

Aug. 16 — Bert R. J. Hassell and Parker D. Cramer in Stinson Detroiter airplane, *Greater Rockford*, attempt flight from Rockford, Ill., to Sweden. Forced down in Greenland by lack of fuel. After long struggle over glaciers rescued by members of Michigan University Expedition in Greenland.

Aug. 18 — Air Corps parachute jumper at Brooks Field, Texas, is caught in rising air current during descent and is carried upward for several moments, then descends at 3 ft. per sec., against normal descent of 18 to 27 ft.

Aug. 20–21 — Col. Arthur Goebel, pilot, and Harry J. Tucker in Lockheed Vega plane, *Yankee Doodle*, Pratt & Whitney *Wasp* engine, make record transcontinental non-stop flight, Los Angeles, Cal., to New York, 18 hrs. 58 min.

Aug. 20 — Robertson Aircraft Corp. starts daily non-stop passenger service between St. Louis and Chicago, 251 mi.

Aug. 25 — *The City of New York*, with members of the R. E. Byrd Antarctic Expedition, sails from New York.

Sept. 1 — Montreal, Canada, and New York linked by air mail and passenger service when Colonial Air Transport starts scheduled operations.

Sept. 2	Maurice Finat in Caudron, 40 h.p. Salmson engine, makes light airplane duration record in France, 24 hrs. 36 min.
Sept. 2-6	Capt. C. D. Barnard and Flight Officer E. H. Elliott in Fokker monoplane, Jupiter engine, fly from Karachi, India, to London in 4½ days.
Sept. 5	M. Laurent Eynac becomes head of new separate Ministry of Aviation in France.
Sept. 5-Oct. 20	Captain Ramos, Lieutenant Viegas and Lieutenant Esteves of Portugal in two Vickers planes fly from Lisbon to Portuguese East Africa.
Sept. 8	Seventy-six of the 260 graduates at West Point choose Air Corps as their branch of service and are assigned to Brooks Field, Texas, for primary flying training.
Sept. 8-16	An average of 28,000 persons a day attend National Air Races and Exposition at Los Angeles, Cal. (See appendix for race statistics.)
Sept. 8-16	Five national aeronautical conventions held in Los Angeles in connection with National Air Races, including Commercial Airplane Manufacturers Section of Aeronautical Chamber of Commerce, Society of Automotive Engineers, National Aeronautical Association, National Airport Executives and California Development Association's Aviation Conference.
Sept. 10-11	Kingsford-Smith and Ulm, trans-Pacific pilots, fly their Fokker monoplane *Southern Cross* from Sidney, Australia, to Christchurch, New Zealand.
Sept. 15	Lieut. Uzal G. Ent, Air Corps, awarded Distinguished Flying Cross for heroic conduct in National Elimination Balloon Race on May 30, when Lieutenant Evert, pilot of his balloon, was struck by lightning Ent remained with him in burning balloon rather than assure own safety by jumping with parachute.
Sept. 15	Universal Air Lines starts daily passenger service between Chicago and Cleveland, 313 mi.
Sept. 15	Four British Royal Air Force Supermarine Napier flying boats, twin Napier-Lion engine, reach Singapore after 25,000 mi. flight from England via Australia, starting Oct. 14, 1927.
Sept. 18	Col. Sir Pierre van Ryneveld and Gen. A. J. Brink in DH-9, 450 h.p. Jupiter engine, make non-stop flight, Pretoria to Cape Town, S. A., 7 hrs. 25 min.
Sept. 18	Juan de la Cierva flies his autogiro from London to Paris.
Sept. 18-Oct. 18	Swedish pilot, Lindner, and Baron Von Huenefeld in Junkers monoplane fly from Berlin to Tokio, Japan.
Sept. 22	Wilkins Antarctic Expedition sails from New York.
Sept. 22	Number of lives saved by parachute jumps passes hundred mark when Lieut. Roger V. Williams jumps at San Diego, Cal.
Sept. 23	Eleven of 23 entrants finish in Los Angeles-Cincinnati Air Derby. Robt. A. Drake wins Class A Race in American Moth plane, American Cirrus engine, Charles W. Holman wins Class B Race in Laird, Wright *Whirlwind* engine, and Arthur Goebel wins non-stop race in Lockheed Vega, Pratt & Whitney *Wasp* engine, his time 15 hrs. 17 min. 30 sec.
Sept. 24	Aeronautical Chamber of Commerce of America gives testimonial dinner to motion picture industry.
Sept. 29	Capts. Pais de Ramos and Oliviere Viegas of Portugal in 2 Vickers biplanes arrive at Mozambique, Africa, after flying 9,900 miles from Lisbon.
Sept. 29	William Brock and Edward Schlee in Bellanca monoplane at Rockwell Field, Cal. make duration flight of 59 hrs. 10 min. 15 sec.
Sept. 29	Air Races held at Boise, Idaho.
Oct. 1	F. Handley Page, in England, awarded the Sir Charles Wakefield Gold Medal for designing work in Great Britain toward safety in flying, for development of the automatic slot.

Oct. 1–16	Third New England aviation exposition held in Boston, Mass.
Oct. 3–6	Air Meet and Aircraft Show held at Albany, N. Y.
Oct. 4–5	First Aeronautical Safety Conference held in New York under auspices of the Daniel Guggenheim Fund for Promotion of Aeronautics.
Oct. 5	Capt. A. Vicherek of Czechoslovakia in Avia monoplane, 60 h.p. Walter engine, makes non-stop flight, Prague to Bednodernjanovsk, Russia, 1,246 mi.
Oct. 5	U. S. Navy Department orders two rigid airships to be built by the Goodyear-Zeppelin Corp.
Oct. 6	Air Meet at Wilmington, Del.
Oct. 8–28	International aeronautical exposition held in Berlin.
Oct. 10	Capt. Wm. E. Kepner and 15 officers and enlisted men in Air Corps semi-rigid airship RS-1 land at Brooks Field, Texas, after 11 hrs. flight of 1,000 mi. from Scott Field, Ill.
Oct. 10	Last contingent of Byrd South Pole Expedition sails from San Pedro, Cal.
Oct. 10	Capt. St. Clair Streett and Capt. Albert W. Stevens, Air Corps, at Dayton, O., make record two-man altitude flight of 37,854 ft., only 564 ft. less than official world record single occupant flight.
Oct. 11–15	German Zeppelin, *Graf Zeppelin*, with crew of 40 and 20 passengers makes voyage from Friedrichshafen, Germany, to Lakehurst, N. J., detouring via Mediterranean and Bermuda to avoid storms, 111½ hrs. cruising time.
Oct. 17	Lieut. Comdr. H. C. MacDonald in DH-Moth, Gipsy engine, leaves Harbor Grace, N. F., on Atlantic flight. Lost at sea.
Oct. 18	Fred Lund in Sport Waco, Wright *Whirlwind* engine, makes first outside loop in commercial airplane, at Advance Aircraft test field, Troy, O.
Oct. 19	Six enlisted men make parachute jumps from separate planes over Brooks Field, Texas, secure machine gun dropped by parachute and begin firing within 3 min. after leaving planes.
Oct. 23–30	Aircraft show held at Boston, Mass.
Oct. 24	Capt. C. B. D. Collyer and Harry J. Tucker in Lockheed Vega plane *Yankee Doodle*, Pratt & Whitney *Wasp* engine, make non-stop flight, New York to Los Angeles in 24 hrs. 51 min.
Oct. 29–Nov. 1	German airship *Graf Zeppelin* makes return flight from United States to Friedrichshafen, Germany, in 71 hrs. 12 min.
Nov. 1	Stout Air Services starts six times weekly passenger service between Detroit and Chicago, 252 mi.
Nov. 4	Lieut. D'Arcy Greig in Supermarine-Napier S-5 monoplane flies at speed of 319.57 m.p.h. His record not official because it does not beat by 5 m.p.h. that of 318.624 made by de Bernardi in Italy.
Nov. 9–10	Air meet at Jackson, Miss.
Nov. 15	Robertson Aircraft Corp. starts daily passenger service between St. Louis and Kansas City, 235 mi.
Nov. 15	Lieut. Frank D. Klein, Air Corps, flies from Selfridge Field, Mich., to Boston, Mass., in 3 hrs. 35 min.
Nov. 17	Lieut. Lester J. Maitland and Lieut. Alfred F. Hegenberger, Air Corps, awarded Clarence H. Mackay Trophy for their flight to Honolulu in June, 1927.
Nov. 23	Lieut. Benjamin Mendez, Colombian Army, and John Todhunter in Curtiss Falcon seaplane *Ricaute* leave Curtiss Field, N. Y., on 4,600 mi. flight to Bogota, Colombia.
Dec. 1	Philadelphia Naval Air Reserve Division, wins Noel Davis Trophy awarded annually for efficiency among U. S. Naval Reserve Units.

Dec. 1 — Goodyear-Zeppelin Corp. begins construction of airship hangar at Akron, O., 1,175 ft. long, 325 ft. wide and 200 ft. high.

Dec. 1 — Interstate Air Lines starts daily mail and passenger service between Chicago and Atlanta, 623 mi.

Dec. 1 — Pitcairn Aviation Inc. starts daily mail service between Atlanta and Miami, Fla., 622 mi.

Dec. 1 — Interstate Air Line starts daily mail and passenger service between St. Louis and Evansville, Ind., 145 mi.

Dec. 1-9 — Fifty-three manufacturers exhibit 79 airplanes at International Aeronautical Exposition held in Chicago, Ill., under auspices of Aeronautical Chamber of Commerce of America, Inc.

Dec. 3 — Pacific Air Transport starts daily mail, passenger and express service between Oakland and San Jose, Cal., 38 mi.

Dec. 11 — Privates Sidney R. Glover and Paul W. Lemons are awarded the Soldiers Medal for rescuing Maj. Junius W. Jones, Air Corps, and Maj. Samuel T. Stewart, C.A.C., from drowning after airplane crash in Mississippi River near Fort Leavenworth, Kan.

Dec. 12-24 — International Civil Aeronautics Conference held in Washington, D. C.

Dec. 15 — Illinois Central Railroad issues round trip air-rail tickets enabling passengers to fly one way between St. Louis and Chicago.

Dec. 15 — Missouri State Supreme Court declares valid the bond issues for Kansas City and St. Louis municipal airports.

Dec. 15 — Northwest Airways starts daily mail, passenger and express service between Milwaukee and Green Bay, Wis., 120 mi.

Dec. 16 — Lieut. James E. Dyer, U. S. N., wins Herbert Schiff Memorial Trophy for having best record among Naval aviators for year ending June 30, Dyer's record being 1,215 hours of flying without accident.

Dec. 17 — British aircraft industry holds dinner at Science Museum, South Kensington, London, commemorating twenty-fifth anniversary of invention of airplane by Wright brothers.

Dec. 17 — International delegates attend ceremonies at Kitty Hawk, N. C., commemorating the first airplane flight ever made, Dec. 17, 1903. Orville Wright, who made it, attends the celebration.

Dec. 24 — R. S. Fogg completes emergency airplane service established Nov. 10 to flooded areas in Vermont. Total flying 15,000 mi. in 44 days.

Dec. 26 — Joaquin G. Pacheco, of Mexico, in Stinson Detroiter, Wasp engine, leaves Mexico City on good-will tour of South America.

Dec. 27 — Capt. Sir George H. Wilkins and Carl Eielson, in Lockheed Vega, *Whirlwind* engine, make first flight over Antarctic Continent.

Wilkins and Eielson Fly Over Polar Sea

"We have reached Spitzbergen after twenty and one-half hours flying. We made one stop for five days on account of bad weather."

That brief message, dated Green Harbor, Svalbard, signed by Capt. George H. Wilkins on the morning of April 22, 1928, fired the imagination of the entire world. With Lieut. Carl B. Eielson, pilot, Captain Wilkins had made what the newspapers termed the "greatest flight of all aviation" over the "top of the world," when they flew from Point Barrow to Green Harbor, Spitzbergen.

Wilkins and Eielson completed their sensational 2,200-mile flight over barren Arctic polar wastes, three parts of which had never

before been viewed by man. They had reached their destination before the world knew that they had started. They flew a Lockheed Vega cabin monoplane with a 225-h.p. Wright *Whirlwind* engine.

Carrying a load of 3,400 pounds in their 1,800-pound plane, three attempts to take off were made before they succeeded in leaving the rough and icy surface at Point Barrow. A band of 33 Eskimos shoveled snow for two days, making a runway 14 feet wide and about 5,000 feet long. A pair of metal skis broke with each attempt to take off.

For the first 500 miles the weather was clear. Dense cloud banks forced frequent changes in the course almost every hour as much as 25 degrees at a time, 22 times during the flight.

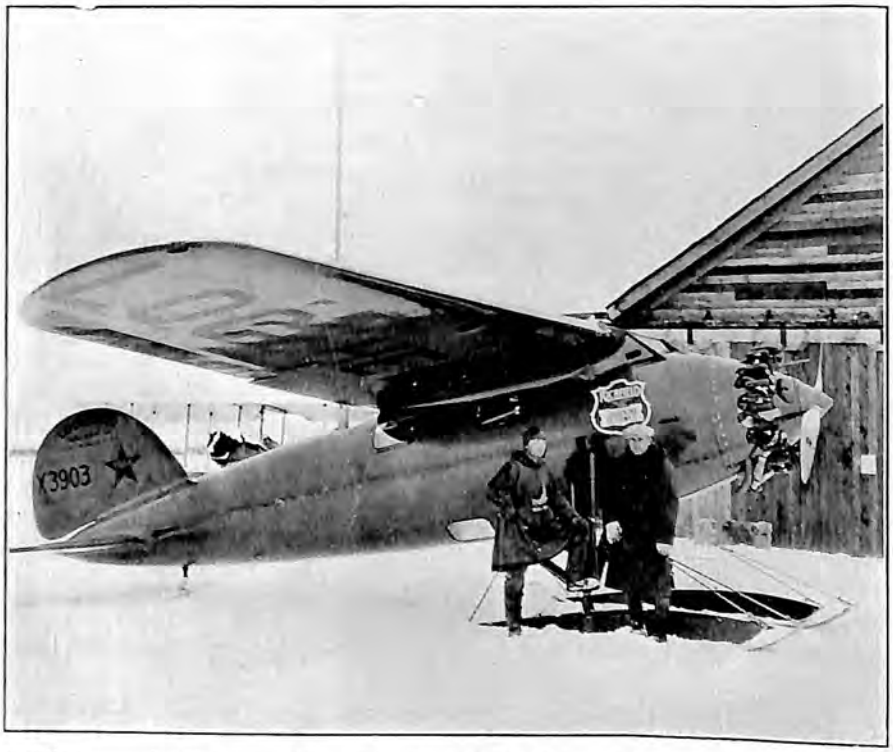
Captain Wilkins told his story in the New York Times: "We flew for an hour at 3,000 feet altitude, needing to change the course frequently. Strict attention to frequent changes made navigation strenuous but not more difficult than piloting, surrounded as we were with even grayness, no lights nor shadows.

"Then clear weather favored us right west of where Peary, Stefansson and MacMillan saw indications which led them to believe land might be in that vicinity. The horizon was clear on every side. We saw no sign of islands. Leads of open water were frequent. We saw no sign of land. The ice in general was rough and closely criss-crossed with ridges, but was not heavily pressed and showed no indication of even shallow soundings.

"There were places we might have landed for just one sounding, but getting off would have been difficult. Our engine functioned perfectly. The sun was clear and well above the horizon. Frequent sextant observations kept us more or less on our course.

"We were quite comfortable in the plane. The temperature in the cabin at the start had been 22 degrees Fahrenheit. In eight hours it had dropped to 10 degrees above. Outside it was 20 below when we started.

"Off Grant Land the coast was blanketed with high ice clouds which extended for many miles. The machine, which by this time carried a normal load, climbed above the lowest clouds at 6,000 feet. The highest banks were too high to climb over so we dodged some and plowed through others. We had hoped to check our course by actually sighting Grant Land in the distance but a heavy high storm ahead gave us an excuse to turn more southerly, and in a half hour, just 13 hours from starting, we caught fleeting glimpses of the tops of Grant Land mountains peeping through the clouds. The real flight of exploration was over but we still had 800 miles



Wilkins and Eielson with their Lockheed Vega before their flight from Point Barrow, Alaska, to Spitzbergen.

to go to reach our goal. Guided by the sun's position and our compass, we headed straight for Spitzbergen. Through the clouds we caught glimpses of the ice beneath us. Our drift indicator showed a strong wind in our favor. On the far horizon toward Greenland a heavy, stormy sky forbade a cross flight to that ice-covered country, so we edged along the storm area.

"Three hours after sighting Grant Land one lone peak of the most northerly end of Greenland showed dimly in the clouds far to the southward. Each hour Ben Eielson swung the ship steadily on the plotted course.

"Within 200 miles of Svalbard high curling cloud masses rose to heights that even our now lightly loaded plane could not reach. Ben climbed the machine to 8,000 feet and selected the lanes between the feather masses. Observations for ground speed and drift were no longer possible and we had to trust the observed sun's position and our compass.

"For an hour and a half we flew through cloud lanes, seeing

merely a streak of almost ice-free water beneath us. We could not go beneath the clouds for fear of running into the mountains.

"We knew we had gas for two, perhaps three, hours more. If only the weather were clear, we should have no trouble to locate land. To go too far east even if we landed safely would take us far inland and probably mean a tedious journey on foot over mountains and glaciers. Too far west might force us down in the sea. Southward the clouds seemed lower, so we turned in that direction, hoping to spy mountain peaks and locate our exact position.

"Suddenly two sharp peaks, almost needle-pointed, appeared beneath us. Down we spun through a break in the clouds for a closer view. The air was turbulent above the heavy clouds and between and beneath them it was boisterous. Our almost empty plane was tossed like a cork on a stormy ocean. Close to the ice-strewn water the wind was furious. Salt spray whipped from the sea filled the air. Over the land the snow drifted high and thick. To judge distance was impossible. A smooth patch of snow-covered land flashed by for a moment, then dead ahead a mountain loomed. With a quick swerve it was avoided by a narrow margin. We swung broadside to the wind and crabbed low over the water. Soon it appeared that what we had missed was an island. The glimpse was too fleeting to identify it.

"As we were running short of gas, the safest procedure was to find the smooth spot we had noticed and try to land. We did. The wind was so strong that we stopped within 30 feet after the skis touched the snow.

"We could see but a few feet on each side. An ice pick was handy. With it we discovered we were on land, fast in the ice. The machine was undamaged. We were safe. Our non-stop coast-to-coast flight had ended. The thick drift of the snow prevented us from examining our location. The only thing to do was to beat the snow from our clothes, climb into the cabin of the machine, get some sleep and await clear weather.

"When we awoke the sun shone dimly. We appeared to be on an island. Two observations gave us our position near the end of King Charles Foreland, not far from Green Harbor.

"For the next four days there was no opportunity to judge our position more accurately. High winds blew from the northwest, then changed suddenly to the southeast and back to north again. I have never seen worse weather in the spring in the Arctic. Drifts four feet high formed about and over the skis of the plane, fortunately holding her fast to the ice. We were housed comfortably in the windproof snug cabin of the plane eating biscuits and choco-

late, smoking the few cigarettes we had and patiently waiting for the weather to clear. We waited four days before the weather was fit for flying. Then we had to cut and shovel snow drifts for six hours before a clear runway for the machine was made. We soon found that our decision not to land on the pack ice with a half load was wise, for with two of us in the machine and only twenty gallons of gasoline she would not budge an inch.

"When I got out and pushed the tail she started fine, but to climb in as she moved was difficult. The first time I hung to the step and tried to climb in, but soon fell off. Eielson, unable to see behind from the pilot's seat, thought I was in and took off. When he turned he saw me forlorn on the ice. He circled and landed, slinging out a rope ladder provided for such emergency.

"I decided to hang on at all costs. We started again. As the machine gathered speed I climbed to the tail and struggled desperately to gain the cockpit. I grasped the rope with my teeth to help hang on. Eielson, feeling the weight on the tail, thought I was safe and took off, but just before he left the ground I slithered from the shiny fuselage, was struck by the tail of the machine and flung to the snow. When the snow was freed from my eyes and mouth I found that I had escaped with no more harm than loosened teeth.

"Eielson in the air soon discovered I was still on the ice, so he circled and landed again. We decided on one more try. We had been running the engine for an hour, using half our precious gasoline. The next time I stuck one foot in the cockpit and pushed with my other foot on some driftwood found on the land. As soon as the machine moved I tumbled into the cockpit regardless of bruises, and off we climbed in the air. Since the sky had cleared we had been far too busy trying to get away to think of our exact location, but soon after we circled a headland, having climbed to 3,000 feet, we could see in the distance the wireless mast at Green Harbor ice bay after having been stormbound for five days on Dead Man's Island."

An Epic of Arctic Flying

Airplanes played an important part in the rescue of the survivors of the Italian semi-rigid airship *Italia,* commanded by Gen. Umberto Nobile, wrecked on its return after a flight to the North Pole from Kings Bay, Spitzbergen, May 25, 1928. Seven nations participated in the rescue work which proved one of the most dramatic episodes in the thrilling history of polar exploration.

Twenty-four planes were used during the feverish activity which

held the entire world spellbound and waiting with intense eagerness the day-by-day radio reports of the rescue work. Intrepid aviators from Norway, Sweden, Finland, Russia, Italy, France and Holland joined in the search for the missing men. Two planes were destroyed and six lives were lost in the rescue activities.

Nobile's venture to reach the North Pole by airship began on May 11. Heavy winds and dense fog, however, forced him back to his base after an 8-hour flight. The *Italia* took the air once more on May 15 and with clear weather at the start made a 68-hour flight over uncharted Arctic waste to Franz Josef Land, across the Polar Sea to Lenin Land and return.

On May 23 the *Italia* took off again. Radio messages reported good progress toward the Pole. Twenty minutes after midnight on the morning of May 24 Nobile reported that he had arrived at the Pole. For two hours the *Italia* cruised over the "top of the world" after which she turned around. At noon on May 24 she was half way back to Kings Bay while the radio told of headwinds and fog delaying progress. Early on May 25 the *Italia* was still struggling against the wind, and then her radio ceased reporting.

It was not until June 8, two weeks after the last report, that the world was informed by radio that Nobile and a small party were safe on an ice floe. Nobile's own report, given out after he was rescued, stated:

"At 10:30 a. m. on May 25 the *Italia* was proceeding under normal conditions at 1,500 feet when she became heavy and began an extremely rapid fall which was impossible to check by either static or dynamic means, and which caused her to strike the ice in less than two minutes. The cabin part of the superstructure was torn off and smashed, while the airship was carried rapidly away in an easterly direction."

In the fall, Vincenzo Pomella, chief mechanician, was killed. Nobile was injured and Natale Ceccioni, engineer, received a broken leg. The others who reached the ice alive were Pilot Mariano, Navigator Zappi, Lieutenant Viglieri; two meteorologists, Dr. Behounek and Dr. Finn Malmgren; Giuseppe Bagi, radio operator, and a mechanic, Troiani.

The shock knocked off several tons of ice and relieved the *Italia* of its weight, also that of the gondola and machinery. She bounded back into the air carrying six of the crew. The crippled ship rose swiftly, out of control. Some thought she disappeared in the clouds. Other believe they saw a "high column of dense black smoke envelop the ship 20 minutes after the crash." Two theories have been advanced, one that the gas exploded; the other,

that the smoke might have come from fuel dumped out to lighten the ship and which caught fire upon hitting the ground.

Luckily most of the instruments in the gondola were saved, undamaged. The radio operator set up his emergency apparatus and soon received messages, although it was nearly two weeks before he was able to get a message out to the world telling of the disaster. On May 30 it was dceided that Dr. Malmgren, Mariano and Zappi should attempt to reach the mainland of Northeastland and thence, if possible, make their way westward to North Cape and summon aid.

The others waited on the ice floe. On June 8 their radio to the *Citta di Milano*, the base supply ship, was answered, and the outside world knew their location. Haste was imperative, Nobile pleaded, for the Arctic sun was melting the ice and breaking up the floes. Until then reconnaissance by sea, land and air had proven ineffective in the search for the castaways.

Capt. Roald Amundsen, veteran Arctic explorer; Com. Rene Guilbaud, noted French pilot; Lieut. Lief Dietricsen, the Norwegian explorer; Lieut. Albert de Cuverville, French pilot; Emile Valette, radio operator; and Gilbert, mechanic, hopped off from Tromoso, Norway, for Kings Bay to seek Nobile. For three hours they reported by radio; the rest was silence. Two months later a pontoon identified as one used on Amundsen's plane was found floating off the Fugloe Islands north of Tromoso.

On the day Amundsen left Tromoso, Nobile and his comrades on the ice saw two rescue planes, piloted by Riiser-Larsen and Luetzow-Holm, pass over their little tent which they had dyed red to attract attention. But the planes maintained about 900 feet altitude and in the mist the frantic men below were overlooked. Thrice in as many days they suffered the same disappointment.

On June 20 the Italian pilot, Major Umberto Maddalena, guiding his course by radio signals between Nobile, the *Citta di Milano* and his own plane, found the camp, swooped down to within 150 feet of the ice and dropped hundreds of pounds of needed food, medicines and other stores. Two days later he returned and dropped additional supplies. The ice was too soft and the open spaces in the water too small to permit a landing by any plane.

However, on June 24, a month after the wreck, Einar-Paal Lundborg, a Swedish lieutenant, in a tiny machine barely capable of carrying two passengers, accomplished the almost impossible feat when he set his plane down on the rugged ice a few yards from the Nobile camp.

Lundborg was carrying a mechanic so could take off only one

survivor. Believing the rescue of the six men to be a matter of only a few hours, Lundborg prevailed upon Nobile to go with him first because the General's experience was needed at the supply base ship to help direct the search for the missing *Italia*. Lundborg and the others on the ice prevailed and Nobile went first. On his return trip Lundborg, in attempting to take off again over the jagged surface of the ice floe, damaged his plane so that he himself became a prisoner on the ice.

He remained there until July 5 when a comrade, Lieutenant Schyberg, made another landing on the ice floe and succeeded in taking him off.

Flying from then on was impossible. Fog prevented further attempts at rescue from the air. Rescuers and "rescuers of rescuers" had a difficult time of it. Captain Sora and three men had vanished in an attempt to locate the Nobile survivors. Later, it was learned, they had crossed from the mainland of Northeastland to Foyn Island.

Babushin, the Russian aviator, was lost for five days.

The Russian icebreaker, *Krassin*, arrived and began pushing through the massive floes. On July 11 the Russian pilot, Chukhnovsky, in a plane from the icebreaker, sighted Zappi and Mariano, who with Malmgren had set off over the floes from the Nobile camp to reach the mainland. They said that Malmgren had died of exposure. They had been on the ice for 43 days and without food for 13 days. On July 16 Schyberg directed the rescue of Captain Sora and his party on Foyn Island. In the end twelve men were still missing, the six who had drifted away with the gas bag of the *Italia* and the six members of Captain Amundsen's party.

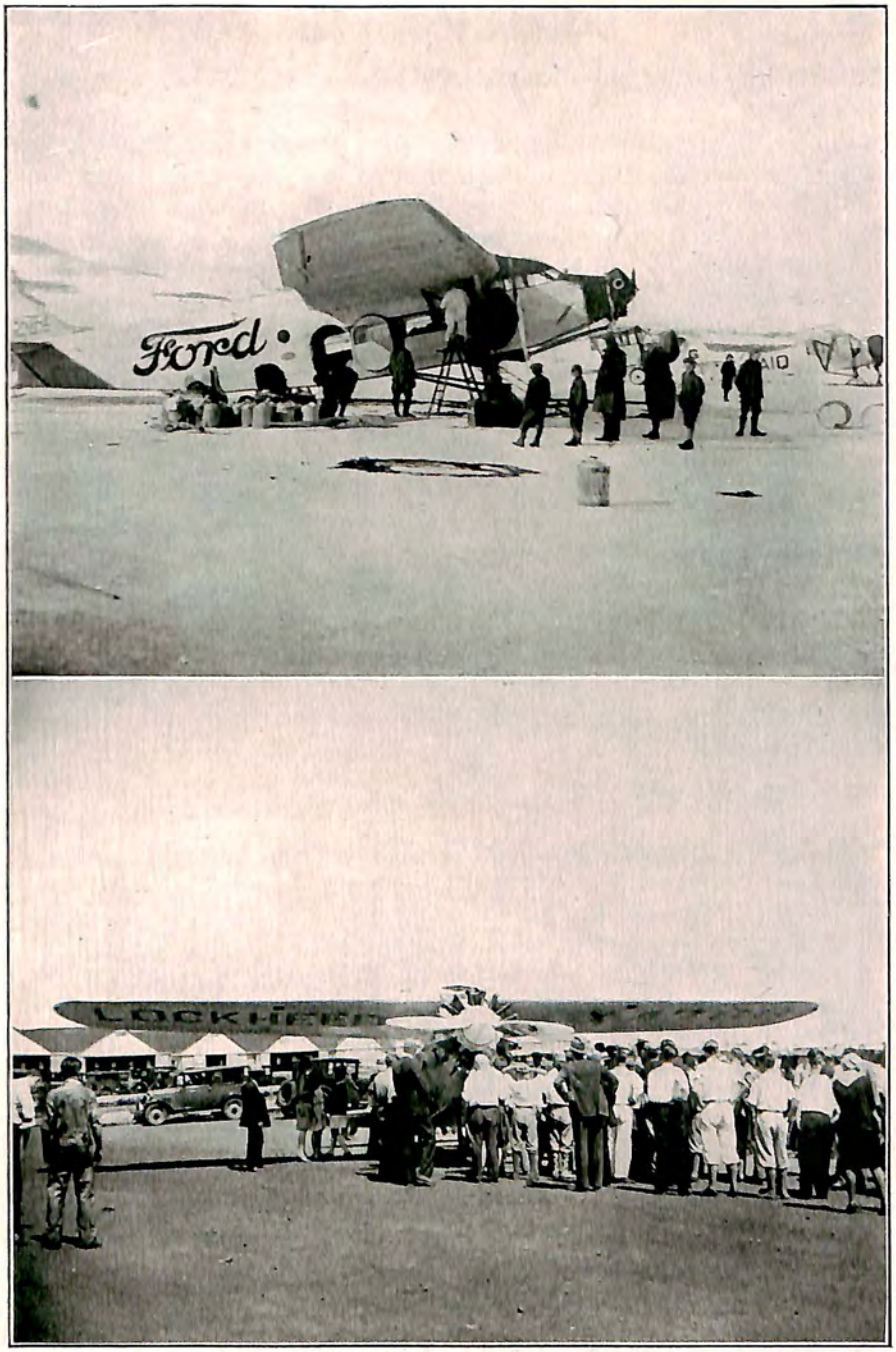
The Graf Zeppelin

The Atlantic flight of the *Graf Zeppelin* is described at length in Chapter XI.

Record Distance Flight of the Year

Capt. Arturo Ferrarin and Major C. P. del Prete, Italian aviators, had made the record non-stop distance flight of the year when on July 5, 1928, they landed their Savoia-Marchetti plane at Touros, near Natal, Brazil. They had flown from Rome, Italy, covering approximately 4,466 miles in 51 hours and 59 minutes.

Using the same plane in which they had made a record duration a few weeks before, Ferrarin and del Prete flew over the Mediterranean through the Strait of Gibraltar and along the coast of Africa to Cape Gala where they set their course across the



(Top) Loading Ford transport with supplies for relief of *Bremen* at Greeneley Island. (Bottom) Colonel Arthur Goebel landing at Curtiss Field, N. Y. after record transcontinental flight in the Lockheed Vega *Yankee Doodle.*

Atlantic by way of the Cape Verde Islands and thence straight to Natal.

Their flight was striking because of the trying conditions which they encountered. Intense heat threatened to overheat the motors as they skirted the African coast. Fog, mist, low hanging clouds and strong head winds became successive obstacles as they approached the coast of South America. The hot winds from the African deserts, they reported, set the water in their radiator boiling until it registered 197 degrees Fahrenheit. At times they had to climb as high as 12,000 feet to get over the cloud banks near the equator.

The South American coast was sighted at Cape San Rocco. Here poor visibility forced them to fly within a few hundred feet of the surface. Groping their way blindly they passed Rio Mossoro and reached Port Natal where the fog was so thick that they were unable to find the flying field. As the fuel supply was nearly exhausted they turned around, seeking another landing place. Near the village of Touros the fuel gave out entirely and they were forced to land on the soft sandy beach, which mired the wheels and wrenched the landing gear so that further flying was impossible. But they had spanned the vast distance from Rome to Brazil in a single flight.

Marine Corps Hero Wins Congressional Medal

On April 9, 1928, President Coolidge at the White House presented the Congressional Medal of Honor to Lieut. C. Frank Schilt of the U. S. Marine Corps, for remarkable flying services during a battle with rebel forces in Nicaragua. The citation awarding to Lieutenant Schilt the most important decoration bestowed by the Government reads:

"For extraordinary heroism distinguished by conspicuous gallantry and intrepidity at the risk of his life above and beyond the call of duty. On the 6th, 7th and 8th of January, 1928, at Quilali, Nicaragua, Lieutenant Schilt, then a member of a Marine Corps expedition which had suffered severe losses in killed and wounded, volunteered under almost impossible conditions to evacuate the wounded by air and transport a relief commanding officer to assume charge of a very serious situation. Lieutenant Schilt bravely undertook this dangerous and vitally important task and by taking off a total of ten times in the rough, rolling street of the partially burned village, under hostile infantry fire on each occasion, succeeded by almost superhuman skill, combined with personal courage of the highest order, in accomplishing his mission, thereby actually

(Left) Capt. A. W. Stevens and Capt. St. Clair Streett, Army Air Corps, with the equipment for their record altitude flight. (Right) Lt. C. Frank Schilt, Marine Corps, awarded Congressional Medal of Honor for heroism in Nicaragua.

saving three lives and bringing supplies and succor to others in desperate need."

Trans-Pacific Flight of the Southern Cross

Four men in an airplane traversed the 7,400 miles from Oakland, Cal., to Brisbane, Australia, within eight and a half days in June, 1928. They were Squadron-Leader Charles E. Kingsford-Smith, Fl.-Lieut. Charles T. P. Ulm, Australians and pilot-commanders; Lieut.-Cmdr. Harry W. Lyon, navigator, and James W. Warner, radio operator. The last two were Americans. Their machine was the *Southern Cross,* a Fokker monoplane powered with three Wright *Whirlwind* engines.

When the *Southern Cross* took off from the Oakland airport on the morning of May 31 she carried a total load of 15,807 pounds and soon was making a speed of about 90 miles an hour. The Farallon Islands drifted into view through the mist and that was the last land the voyagers were to see for 27 hours. For two hours they checked up on the radio beacon and then had to climb to 2,000 feet to scale a great white-pennacled mountain of clouds. For hours they flew above cloud banks. Then the mass closed in about the plane. They climbed to another thousand feet.

In mid-afternoon the sky cleared and cruising was a simple matter. They made good time until nightfall when they put the machine up to 4,000 feet and rode under the stars. Toward midnight they ran into heavy clouds and rain; for 15 minutes the plane was jolted and bumped in the rough air. They climbed to nearly a mile above the surface. Headwinds cut down their speed to about 77 miles an hour.

Two hours later they sighted a steamer. For an hour they had clear weather. Again they ran into a storm. Climbing to 6,000 feet they got above the clouds and sped merrily along at times nearly a mile and a half high. At dawn they were 377 miles off Honolulu. They sighted the city at noon, having made their first hop of 2,408 miles in 27 hours and 25 minutes.

Early the next morning they set out for Suva, Fiji Islands, crediting the Army and Navy air forces with having provided facilities which enabled them to maintain their schedule. Leaving Wheeler Field they flew to Barking Sands on Kauai Island, about 100 miles distant, where a supply of fuel awaited them. Loading the ship they took off again shortly after 5 o'clock that morning. Trouble with one of the radio generators was adjusted. They then thought they saw a gas leak.

That provided a scare until they found it to be water from the condensation of cold gasoline in the pipe. Then rainstorms sped across their course. An hour later the radio receiving gear went out of action. The rain meanwhile charged at the *Southern Cross* from every direction. Heavily loaded and flying at only 600 feet above the water and lashed by the rain its flight did not appear very promising.

Visibility shrunk steadily until the fliers had to climb to 1,000 feet where another tropical rainstorm hit them. Down they went again to 600 feet and remained there, preferring to fly through rain than to exhaust their fuel by maintaining higher altitudes. The wind, however, drove them up twice inside of an hour, and the rain filtered through the windshields until they were soaking wet.

That evening they were riding at a mile and a half high through a black storm, buffeted by gales and at intervals forced to climb higher to escape the clouds. At 8,000 feet they finally gazed down into a sea of tossing vapor, mountainous in form, but above them beckoned the star from which their ship derived its name. At about midnight they crossed the equator. By dead reckoning they corrected their course and made a bee-line for Suva.

There was nothing roseate about that next dawn. They were worried about their gasoline. More wind and rain, forcing them

The *Southern Cross* arriving over Sydney, Australia.

to roller-coast up and down from a mile high to 400 feet above the water, threatened to deplete the fuel supply. At 9 o'clock they were still fighting the wind. The radio was operated constantly to give their exact position in case they required help. Deciding to pump gasoline from the main tank, a hand operation, they found that they had 7 hours' supply. That was cheering, and 3 hours later they sighted Koro Island. At 3 o'clock that afternoon, on June 5, they landed at Suva, Fiji, having covered the 3,144 miles in 34 hours and 30 minutes of non-stop over-water flying. It made theirs one of the most remarkable flights of the year.

On the morning of June 8 they left Suva for Brisbane. This stage of their flight was marred by an oversight. They had forgotten to oil their earth-inductor compass and it ceased to function, and they had to fly by steering compasses, striking the Australian coast 110 miles above Brisbane. They also had to contend with more storms and clouds, often flying at 9,000 feet where the air was bitterly cold, wet and generally disagreeable. It was nearly 10 o'clock on the morning of June 9 when they saw a long gray shadow along the horizon ahead. It was Australia. They had spanned the Pacific from the United States to the southern commonwealth in 83 hours and 15 minutes flying time.

First Woman to Fly the Atlantic

Succeeding in a venture which during the year had cost the lives of three other women, Miss Amelia Earhart, American social-service

worker and licensed pilot, won the distinction of being the first woman to fly across the Atlantic. With Wilmer Stultz, pilot, and Louis Gordon, mechanic, Miss Earhart took off from Trepassey Bay, Newfoundland, June 17, 1928. They landed at Burry Port, Wales, the next day. The Fokker monoplane *Friendship*, powered with three Wright Whirlwind motors and equipped with pontoons, covered the distance of more than 2,000 miles in 20 hours and 40 minutes. It was the first time that a pontooned machine had flown the Atlantic.

The *Friendship* took off from the harbor at Trepassey after five attempts had been made to get the heavily laden plane off the water. It finally succeeded after some of the gasoline had been dropped.

Except for the first hour over the Atlantic after leaving Newfoundland the flyers never saw the sea until they arrived at the eastern Irish coast. They flew through fog, rain and snow most of the time, Stultz putting the plane up as high as 12,000 feet to get out of the bad weather. A 30 mile an hour tail wind aided progress materially. Twice during the night they received radio bearings from ships at sea. Dawn, however, found the radio not working.

Poor visibility forced Stultz to bring the *Friendship* down on the Welsh coast after Valentia, Ireland, had been passed. The gasoline supply was nearly exhausted.

"I did not take the controls of the machine as I had planned to," Miss Earhart said, narrating her flight. "Because of the clouds it was necessary for a pilot to be at the controls who could fly 'blind.' That is by instruments alone. This I could not do. Everything that was done to bring us across was done by Wilmer Stultz and 'Slim' Gordon."

A Record Altitude Flight

Rising to a height of 37,854 feet two Air Corps officers, Capt. St. Clair Streett, pilot, and Capt. Albert W. Stevens, observer and photographer, on Oct. 10, 1928, made a new altitude record when they ascended to the highest mark above the ground ever reached by an airplane carrying more than one occupant. The world's altitude record for airplanes was made July 25, 1927, when Lieut. C. C. Champion, U. S. Navy, reached 38,418 feet. Streett and Stevens came within 564 feet of that official record which had been made by an aviator flying alone.

They left Wright Field, Dayton, Ohio, at 11 o'clock in the morning. Intense cold, 76 degrees below zero (Fahrenheit), caused the

metal parts to shrink. Throttle and supercharger controls were rendered immovable. The plane clung to the same altitude for 24 minutes before the pilot managed to get it down into somewhat warmer air which restored the controls to normal.

The liquid oxygen, used on the flight for the first time, functioned perfectly; and no ill effects were experienced during the sojourn in the upper air regions. Despite the intense cold at the ceiling of the plane, Stevens was able to manipulate his camera without the least difficulty. A small gadget, slightly larger than a rifle cartridge, enabled him to move his fingers as nimbly as though he had been working on the ground. This cartridge is a miniature electric heater slipped into an asbestos pocket across the fingers of the heavy leather mittens, permitting the observer to use his hands at all times for camera work at high altitudes. Just to test the effectiveness of this little device, which was fed from the ignition battery, Stevens momentarily slipped it off one hand. The moment he did so, however, his fingers started to become numb.

The fliers wore electrically heated goggles. A 3/8-inch hole was drilled just over the pupil of the eye in each lens to enable the wearer to see in the event the rest of the lens became coated with frost. The condition anticipated became an actuality during the flight. When the plane reached the upper air regions where the intense cold prevailed, the goggles became coated with frost. Had it not been for the small hole drilled in each lens, they would not have been able to see at all.

Because the plane had stuck at one point for half an hour the gasoline supply played out nearly four miles above the surface and Streett had to glide to a landing with his engine dead. He brought the plane to earth 70 miles from Dayton, over which it had been hovering at the top of the climb.

33 Square Miles on One Photograph

On Sept. 23, 1928, Lieut. James H. Doolittle, pilot, accompanied by Captain Stevens, made an altitude flight at Dayton to test photographic and other high altitude equipment. The altitude reached was 37,200 feet, as determined from preliminary calculations of photographs, subject to a check of the focal length of the lens.

The ascent consumed one hour and 25 minutes, including 20 minutes at the ceiling of the plane. The descent to the ground required 45 minutes. It appears that the oxygen carried was not sufficient for the two occupants of the plane. Stevens temporarily lost consciousness, and Doolittle became semi-unconscious just be-

fore turning the nose of the plane downward. Both revived completely as lower altitudes were reached.

At the maximum altitude, a temperature of 70.6 degrees below zero (Fahrenheit) was encountered. The clock froze, as did one of the spirit levels of the camera, also a spot on Stevens' cheek. Doolittle found the controls difficult to manipulate because of the extreme cold. The camera was covered with ice.

Eighteen photographs were obtained, several from the peak height. In spite of a scattering of clouds at 6,000 feet, they showed the highways and outstanding structures of the territory beneath with remarkable clarity. So distinct were the pictures, in fact, that they could stand enlargement to ten diameters. Under war conditions they would be of untold military value. The area covered by the exposure was 33 square miles.

Coast-to-Coast Non-Stop Flights

From Los Angeles, Cal., to New York in 18 hours and 58 minutes without stopping was the record set by Col. Arthur Goebel on Aug. 19-20, 1928. With him was a passenger, Harry Tucker, of Santa Monica, Cal. Their plane, *Yankee Doodle,* was a commercial Lockheed Vega monoplane powered with a Pratt & Whitney 400 h.p. *Wasp* engine.

The machine averaged 144 miles an hour throughout the flight of 2,710 miles, which took it over Albuquerque, New Mexico, St. Louis, Mo., near Pittsburgh, Pa., and into New York. Part of the flight was made at an altitude of 10,000 feet. The high mountains in the West had to be traversed with a full load, which included 450 gallons of gasoline and 25 gallons of oil.

The flight marked the steady improvement in planes and engines for it was made in eight hours less time than that of Kelly and Macready on their non-stop flight over the same route five years before. It also beat the best train time of 69 hours and 11 minutes.

The *Yankee Doodle* made another sensational flight on Oct. 24-25, 1928, when Capt. C. B. D. Collyer, pilot, and Harry Tucker, passenger, flew from New York to Los Angeles, non-stop, in 24 hours and 51 minutes. Most of the trip was made in fog, storms and headwinds.

National Elimination Balloon Race

Pilots in the 1928 National Elimination Balloon Race held at Bettis Field, Pittsburgh, Pa., May 30, encountered unexpected and abnormal weather conditions. Shortly after 6 o'clock, when the last balloon had departed, a severe thunderstorm, accompanied by

hail, struck Bettis Field. Meteorological disturbances in the vicinity of Pittsburgh were reported by the U. S. Weather Bureau, but neither the pilots nor the authorities in charge of the race considered the weather forecast of sufficient importance to suggest postponement of the start.

Within approximately three hours after the start of the race, 11 of the 14 balloons had been forced down by thunderstorms; three of these balloons, the U. S. Army No. 3, Goodyear 5, and the *City of Cleveland,* being struck by lightning which resulted in the death of Lieut. Paul Evert, pilot of Army No. 3, and Walter W. Morton, aide in the Goodyear 5. Ward T. Van Orman, pilot of the Goodyear 5, was stunned and suffered a broken leg and bruises. J. F. Cooper was stunned and seriously burned when lightning struck the *City of Cleveland;* C. K. Wollam, the pilot, jumped and landed safely with his parachute, his balloon landing easily a short distance away as a result of the lightened load. Capt. William E. Kepner, pilot of the Army No. 1, and Lieut. William O. Eareckson were declared winners of the race and the Litchfield Trophy.

Army Pilots Win International Balloon Race

The 22nd annual International Balloon Race for the James Gordon Bennett Trophy was started from Detroit, Mich., June 30, 1928. There were 12 entries representing 8 nations. The race was won by the U. S. Army Air Corps balloon *United States,* piloted by Capt. William E. Kepner with Lieut. William O. Eareckson as aide. They landed near Kendridge, Va., 460.9 miles from the starting point after a flight which took them over the Blue Ridge Mountains in West Virginia and at times led them to ascend 20,000 feet above sea level.

Their victory won for the United States permanent possession of this, the second James Gordon Bennett trophy, for it was the third consecutive time Americans had won the classic. Complete statistics of the race will be found in the Appendix.

National Air Races of 1928

The National Air Races and aeronautical show were held at Mines Field, Los Angeles, Cal., Sept. 8 to 16, 1928. Elaborate and adequate preparations on the part of the California Air Race Association, which held the races under sanction of the National Aeronautic Association, assured the success of the venture from the start.

Those who have never managed an air race program of that

National Air Races at Mines Field, Los Angeles

magnitude cannot realize the difficulties and problems involved. Officials of the California Race Association, therefore, are to be congratulated for the attention paid to the small details which, however trivial, might have determined the success or failure of the entire program. That the half million persons who attended the races were more than satisfied was evidenced by the fact that the crowds remained until the finish of each day's program. That alone justified the money spent by the race sponsors in preparations and prize money. Cash prizes alone aggregated about $80,000 for the 26 events.

Participation of the Army, Navy and Marine Corps pilots, while not so extensive as that witnessed in the past, was no less impressive. Those aerial arms of the defensive establishment were ably represented by many of their best pilots and machines. The "Three Musketeers" of the Army Air Corps and the "Three Sea Hawks" of the Navy Bureau of Aeronautics gave the crowds plenty of excitement when each day they took the air in a series of breathless fighting maneuvers.

An attempt to stage a non-stop race from coast-to-coast for the first time was partially marred by exceptionally bad weather. There were 6 entrants in the transcontinental non-stop derby. None finished under the non-stop conditions, though Col. Arthur Goebel flew from New York to Prescott, Ariz., in his Lockheed Vega, powered with a Pratt & Whitney *Wasp* engine. Goebel was forced down at Prescott on his course and still able to fly into

Los Angeles had he not exhausted his gasoline supply. Unusually heavy headwinds had held him back all the way across the Middle West, thus draining the fuel tanks.

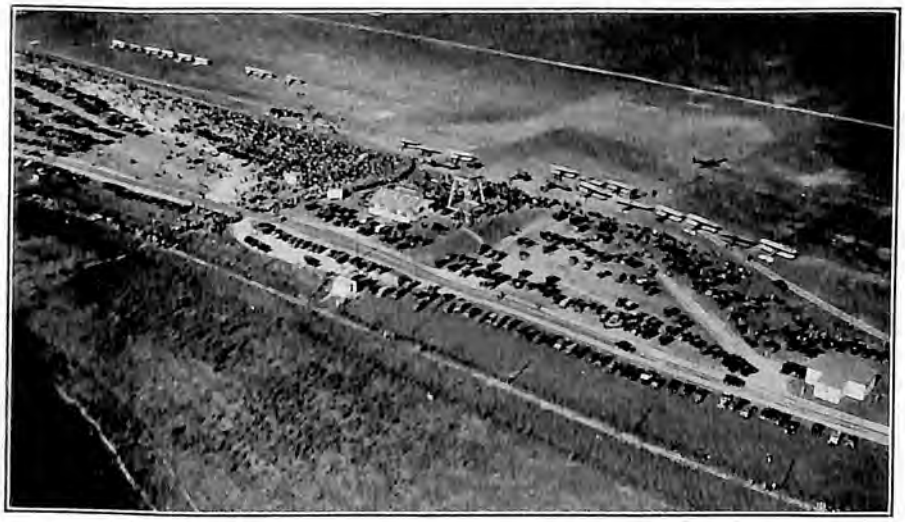
Three other transcontinental air races finished at Mines Field, with Earl Rowland in a Cessna plane, Warner powered, the winner of the Class A Race, leading 23 others who finished; John Livingston in a Waco-10, *Whirlwind* powered winning Class B Race ahead of 17 others to finish, and Robert W. Cantwell in a Lockheed Vega, *Wasp* powered, winning Class C, ahead of 17 others to finish. A complete tabulation of the National Air Races will be found in the Appendix.

Forty-two airplanes and 14 engines were displayed at the exposition in the building at the entrance to Mines Field.

Chicago Holds Greatest Show Under Auspices of the Chamber

With fifty-three manufacturers exhibiting seventy-nine airplanes ranging from huge tri-motored transports to tiny single-seat sport models, the First International Aeronautical Exposition held at the Chicago Coliseum and the First Regiment Armory Dec. 1 to 9, 1928, under the auspices of the Aeronautical Chamber of Commerce of America, proved to be the greatest aviation show of the year.

Coincident with the show was the arrival in the United States of more than 200 official delegates, representing 50 nations, to



Finish of Los Angeles-Cincinnati air races at Lunken Airport, Cincinnati, Sept. 23, 1928.

attend the International Civil Aeronautics Conference opening in Washington Dec. 12. In his formal invitation to the governments President Coolidge had expressly mentioned the Exposition as something worth attending, and he also stated that the date had been set to make possible the presence of the delegates.

They were flown to Chicago in a fleet of 14 multi-engined transports. On arrival they were received and entertained informally by officials of the Aeronautical Chamber of Commerce, and later were guests at a formal banquet tendered by the Chicago Association of Commerce.

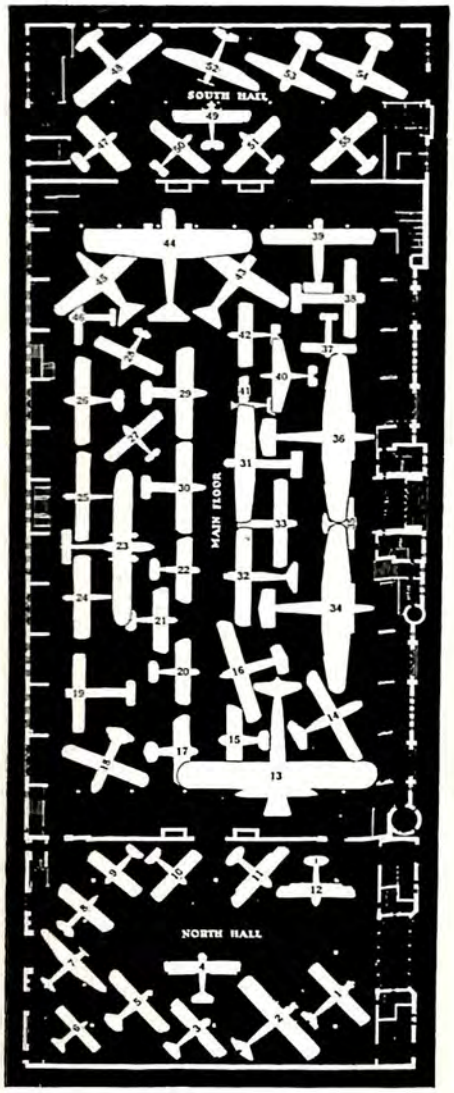
The exposition brought together for the first time the most impressive array of commercial airplanes ever assembled in this country, and reflected the tremendous expansion that has taken place in the aircraft industry since the first postwar aircraft show, held in New York in March, 1919. At that show the 34 aircraft displayed were entirely military in character. The Chicago exhibition of 1928 was strictly representative of the commercial machines produced by a rapidly expanding industry. More than 100,000 persons visited the exposition which also attracted the leading figures in aviation. The show was well attended by aircraft and engine manufacturers, dealers and distributors from every state. Substantial orders were placed.

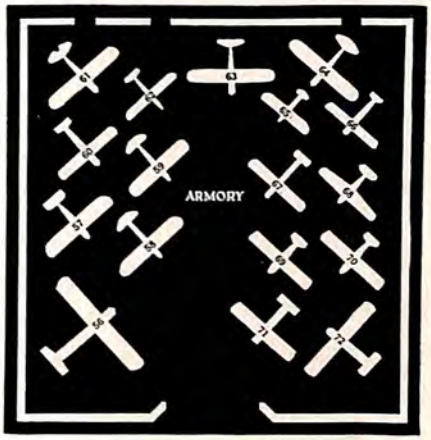
Luxury and convenience were dominating features of the airplanes exhibited. Upholstered chairs with brightly polished nickel and sterling silver fixtures adorned the 40 cabin planes. Dome and side lights with silk curtained windows in the cabins of the air yachts rivaled the business desks, typewriters and Pullman berths of the larger transports, five types of which were on display.

The engines, navigating instruments and other equipment were equally interesting. Twenty-five different types of aircraft engines, each varying in design and horsepower, were exhibited by 18 manufacturers. They included the smallest low-powered engines of a few cylinders to the biggest products of American factories.

In the accessories class the 131 manufacturers of miscellaneous aircraft equipment displayed goggles, electrically heated flying clothes, silver fixtures, model hangars, field lighting, instruments, wheels, brakes and parts. The Department of Commerce had in operation a complete display of the lighting equipment used on the air mail routes.

The demand for space at the Chicago show exceeded all expectations. Before the doors were opened to the public three big buildings were necessary to house all the planes. In the main Coliseum 34 planes were displayed, 12 in the North Hall and 10





Floor plan of International Aeronautical Exposition, Chicago, Dec. 1-9, 1928. (Left) The Coliseum. (Above) 1st Regiment Armory.

in the South Hall. The first Regiment Armory accommodated 17 machines while the Greer Building, connected with the Coliseum by an archway, had six planes on view.

The 9 days of the exposition were marked by a series of important meetings. All of these were held in the Stevens Hotel. An important conference was that which resulted in the formation of the organization of a Flying School Committee of the Aeronautical Chamber of Commerce; it established six definite standards

by which flying schools throughout the country are to be judged in the Chamber's move to eliminate unreliable training institutions.

Other meetings resulting in permanent organizations included the Airports, Fuel and Lubricants and Publishers Section of the Chamber. Aeronautical engineering meetings held jointly with the Society of Automotive Engineers developed discussions of interest to the industry.

From the start the success of the exposition had been assured by the large number of exhibitors. The quality of their products displayed to advantage before the purchasing elements in all branches of aviation proved to the public that American aviation had grown into a full-fledged industry and was entitled to recognition as a business to be supported by all.

Exhibitors of Airplanes

Acme Aircraft Corporation	Chicago, Ill.
Advance Aircraft Company (Waco)	Troy, Ohio
Aerial Service Corp.	Hammondsport, N. Y.
Aeromarine Klemm Corp.	Keyport, N. J.
Aire-Kraft, Inc.	Washington, Pa.
Airworthy Airplane Co.	Chicago, Ill.
Alexander Aircraft Corp.	Colorado Springs, Colo.
Alliance Aircraft Co.	Alliance, Ohio
American Eagle Aircraft Corp.	Kansas City, Mo.
Arrow Aircraft and Motors Corp.	Lincoln, Neb.
Atlantic Aircraft Corp. (Fokker)	Hasbrouck Heights, N. J.
Bellanca Aircraft Corp.	New Castle, Del.
Boeing Airplane Co.	Seattle, Wash.
Buhl Aircraft Co.	Marysville, Mich.
Butler Aircraft Corp.	Kansas City, Mo.
Campbell Peterson & Co. (Avro)	New York, N. Y.
Capital Aircraft Corp.	Lansing, Mich.
Cessna Aircraft Co., The	Wichita, Kan.
Commandaire, Inc.	Little Rock, Ark.
Consolidated Aircraft Corp.	Buffalo, N. Y.
Curtiss Aeroplane & Motor Co.	Garden City, N. Y.
Curtiss Flying Service	Garden City, N. Y.
Curtiss Robertson Airplane Mfg. Co.	St. Louis, Mo.
Driggs Aircraft Corp.	Lansing, Mich.
Fairchild Aviation Corp.	New York, N. Y.
Ford Motor Co.	Dearborn, Mich.
Gates Day Aircraft Corp.	Paterson, N. J.
General Airplanes Corp.	Buffalo, N. Y.
Great Lakes Aircraft Corp.	Cleveland, Ohio
Hall-Aluminum Aircraft Corp.	Buffalo, N. Y.
Hamilton Metalplane Co.	Milwaukee, Wis.
Heath Airplane Co.	Chicago, Ill.
Keystone Aircraft Corp.	Bristol, Pa.
Kreider Reisner Aircraft Co.	Hagerstown, Md.
Kruetzer Corp., Joseph	Los Angeles, Calif.
Laird Airplane Co., E. M.	Chicago, Ill.
Lockheed Aircraft Corp.	Los Angeles, Calif.
Loening Aeronautical Engineering Corp.	New York, N. Y.
Mahoney-Ryan Aircraft Corp.	Anglum, Mo.
Mohawk Aircraft Corp.	Minneapolis, Minn.
Monarch Aircraft Co., Inc.	Riverside, Ill.
Mono-Aircraft, Inc.	Moline, Ill.
Moth Aircraft Corp.	New York, N. Y.
National Air Transport, Inc.	Chicago, Ill.
Phantom Knight Aircraft Corp.	Oak Park, Ill.
Pitcairn Aircraft, Inc.	Philadelphia, Pa.
Sikorsky Mfg. Corp.	College Pt., L. I., N. Y.
Simplex Aircraft Corp.	Defiance, Ohio
Spartan Aircraft Corp.	Tulsa, Okla.
Star Aircraft Co.	Bartlesville, Okla.
Stearman Aircraft Co.	Wichita, Kan.

Stinson Aircraft Corp.	Northville, Mich.
Stinson School of Aviation	Detroit, Mich.
Swallow Airplane Co.	Wichita, Kan.
Szekely Aircraft Corp.	Holland, Mich.
Travel Air Mfg. Co.	Wichita, Kan.
Chance Vought Corp.	Long Island City, N. Y.
Wallace Aircraft Co.	Chicago, Ill.

Exhibitors of Engines

Aeronautical Products Corporation	Naugatuck, Conn.
Axelson Machine Company	Los Angeles, Calif.
Aircraft Engine Corporation	Berkeley, Calif.
E. W. Bliss Co. (Bristol Jupiter)	Brooklyn, N. Y.
Brownback Motor Laboratories, Inc. (Anzani)	New York, N. Y.
Campbell, Peterson & Company (Cirrus Motors)	New York, N. Y.
Curtiss Aeroplane & Motor Co.	Garden City, N. Y.
Fairchild Aviation Corp.	Farmingdale, N. Y.
K. G. Frank (Siemens-Halske)	New York, N. Y.
Kinner Airplane Motor Corp.	Glendale, Calif.
Michigan Screw Company	Lansing, Mich.
Marvin A. Northrop	Minneapolis, Minn.
Pratt & Whitney Aircraft Co.	Hartford, Conn.
Spartan Aircraft Corp. (Walter)	Tulsa, Okla.
Szekely Aircraft Corp.	Holland, Mich.
Velie Motors Corp.	Moline, Ill.
Warner Aircraft Corp.	Detroit, Mich.
Wright Aeronautical Corp.	Paterson, N. J.

Aircraft Accessories

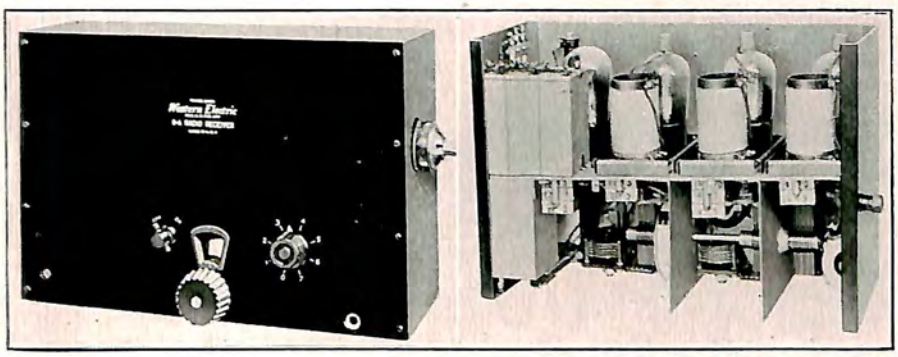
A. C. Spark Plug Co., Flint, Mich.	Spark plugs
Advance Laboratories, Inc., Chicago, Ill.	
"Aero Digest," New York, N. Y.	Aviation Publication
Aero Guides, Inc., New York, N. Y.	Airport Markers
Aerovane Utilities Corp., New York, N. Y.	Airport Markers
Aero Model Co., Chicago, Ill.	Flying Models
Aero Supply Manufacturing Co., Inc., College Point, N. Y.	Aircraft small parts
"Airports," Flushing, N. Y.	Aviation Publication
"Air Transportation," New York, N. Y.	Aviation Publication
"Airway Age," New York, N. Y.	Aviation Publication
Allith Prouty Co., Danville, Ill.	
Aluminum Company of America, Pittsburgh, Pa.	Aluminum products
American Airports Corp., New York, N. Y.	Model airport
"American Aviator," New York, N. Y.	Aviation Publication
American Rolling Mills, Middletown, O.	Sheet metal
American Varnish Co., Chicago, Ill.	Varnish
Armco Culvert Manufacturers Assn., Middletown, O.	Drainage products
Atkinson Aviation Co., Inc., Gary, Ind.	Training school
Austin Company, Cleveland, O.	Airport builders and Engineers
Aviation Publishing Company, New York, N. Y.	Aviation Publication
Balsa Wood Company, Inc., New York, N. Y.	Balsa Wood products
B. B. T. Corporation of America, Philadelphia, Pa.	Flood lights
Belden Manufacturing Company, Chicago, Ill.	Insulation and parts
Bendix Brake Company, South Bend, Ind.	Wheels and brakes
Berry Bros., Detroit, Mich.	Aircraft finishes
Binks Spray Equipment Company, Chicago, Ill.	Paint—Spray guns
Black & Decker Manufacturing Co., Towson, Md.	Portable tools
Sidney Blumenthal & Company, Inc., New York, N. Y.	Mohair fabrics
Bohn Aluminum & Brass Corporation, Detroit, Mich.	Aluminum products
Canvas-Leather Specialty Co., Trenton, N. J.	Flying clothing
Celotex Company, Chicago, Ill.	Sound insulating material
Champion Spark Plug Co., Toledo, Ohio	Spark Plugs
Chicago Aeronautical Service, Inc., Chicago, Ill.	Flying school
Chilton Class Journal Co., Philadelphia, Pa.	Technical Publication
Consolidated Instrument Co. of America, Inc., New York, N. Y.	Instruments
Crouse-Hinds Company, Syracuse, N. Y.	Lighting Equipment
DeWalt Products Corp., Leola, Pa.	Woodworking machinery
Eclipse Machine Co., East Orange, N. J.	Starters
Department of Commerce, Washington, D. C.	Model Airport Exhibit
Elgin National Watch Company, Chicago, Ill.	Instruments
Ex-cell-O Tool & Mfg. Co., Detroit, Mich.	Tools
Endicott Forging & Mfg. Co., Inc., Endicott, N. Y.	Drop forgings
Electric Storage Battery Company, Philadelphia, Pa.	Batteries
Fairchild Aerial Camera Corporation, New York, N. Y.	Aerial Cameras
Firestone Tire & Rubber Company, Akron, O.	Tires
Fleischmann Transportation Co., New York, N. Y.	Balsa Wood
Flying Publishing Co., New York, N. Y.	Aviation Publication

Follmer, Clogg & Co., Lancaster, Pa.....Parachutes
Gardner Propellor Works, Forest Park, Ill.....Propellers
General Electric Company, Schenectady, N. Y.....Lights and Instruments
Globe Superior Corporation, Abingdon, Ill.....Flying clothing
Goodrich Rubber Company, Akron, O.....Tires
Goodyear Tire & Rubber Company, Akron, O.....Tires
Greer College, Chicago, Ill.....Aviation school
Hall Aluminum Aircraft Corp., Buffalo, N. Y.....Aluminum products
Hamilton Aero Mfg. Co., Milwaukee, Wis.....Metal Propellors
Harwen Products Co., New York, N. Y.....Electrical appliances
Haskelite Manufacturing Corp., Chicago, Ill.....Waterproof gluing and Plywood
Stewart Hartshorn Company, New York, N. Y.....Aircraft cables
Heywood Starter Corp., Detroit, Mich.....Engine air starters
Horlick Malted Milk Company, Racine, Wis.....Malted Milk
International Derrick & Equipment Company, Columbus, O.....Derricks
Irving Air Chute Company, Inc., Buffalo, N. Y.....Parachutes
Johnson Airplane & Supply Co., Dayton, O.....Aircraft parts
Kawneer Company, Niles, Mich.....Streamline steel tubing
Kendall Refining Company, Bradford, Pa.....Petroleum products
Leece-Neville Company, Cleveland, O.....Electrical equipment
Linde Air Products Company, New York, N. Y.....Air products
Macwhyte Company, Kenosha, Wis.....Streamline wires
McGill Metal Co., Valparaiso, Ind.....Ball-bearings
E. B. Meyrowitz, Inc., New York, N. Y.....Goggles
Milligans Subscription Agency, Toronto, Ont.....
Moto-Meter Company, Inc., Long Island City, N. Y.....Distance thermometers
National Carbide Sales, New York, N. Y.....Flood lights
National Steel Products Co., Dayton, O.....Bearings
New Departure Mfg. Co., Bristol, Conn.....Ball-bearings
New York Rubber Company, New York, N. Y.....Seat cushions
Nicholas-Beazley-Airplane Co., Inc., Marshall, Mo.....Aircraft parts
Norma Hoffmann Bearings Corp., Stamford, Conn.....Ball-bearings
Opco Co., Inc., Buffalo, N. Y.....Oils and lubricants
Packard Electric Company, Warren, O.....Lighting Cable
Pan American Airways, Inc., New York, N. Y.....Maps Air line schedules, etc
Paragon Engineers, Inc., Baltimore, Md.....Propellers
Parker & Co., Philadelphia, Pa.....Aviation insurance
Parker Appliance Company, Cleveland, O.....Fittings
Pennsylvania Railroad Co., Philadelphia, Pa.....Air and Rail route
Phister Manufacturing Co., Cincinnati, O.....Fire extinguishers
Pioneer Instrument Company, Brooklyn, N. Y.....Instruments
Plycor Company, Chicago, Ill.....Ply wood
Popular Aviation Publishing Co., Chicago, Ill.....Aviation Publication
Purox Company, Chicago, Ill.....Welding equipment
Pyle-National Company, Chicago, Ill.....Lights
Pyrene Manufacturing Company, Newark, N. J.....Fire-fighting equipment
Quaker State Oil Refining Co., Oil City, Pa.....Oils
Rand McNally & Company, Chicago, Ill.....Maps
H. H. Robertson Company, Pittsburgh, Pa.....Model hangar
John A. Roebling's Sons, Trenton, N. J.....Wire and wire rope
Rome Wire Company, Rome, N. Y.....Electrical wires
Robertson Aircraft Corporation, Anglum County, St. Louis, Mo.....Aircraft parts
Russell Parachute Company, San Diego, Calif.....Parachutes
Scintilla Magneto Co., Inc., Sidney, N. Y.....Magnetos
Screw Machine Specialty Co., Chicago, Ill.....Parts
B. Russell Shaw Company, Inc., St. Louis, Mo.....Airport engineers
S. K. F. Industries, Inc., New York, N. Y.....Ball-bearings
Snap-on Wrench Company, Chicago, Ill.....Wrenches
A. G. Spaulding & Bros., New York, N. Y.....Flying clothing
Standard Oil Company (Indiana) Chicago, Ill.....Oils and gas
Standard Steel Propeller Co., West Homestead, Pa.....Propellers
Strauss & Buegeleisen, Brooklyn, N. Y.....Goggles
Streloff-Naughton Corp., Long Island City, N. Y.....Aluminum parts
Stromberg Motor Devices, Chicago, Ill.....Carburetors
Summerill Tubing Co., Bridgeport, Pa.....Tubing
Supreme Propeller Company, Wichita, Kan.....Propellers
Taylor Instrument Companies, Rochester, N. Y.....Instruments
Texas Company, New York, N. Y.....Oil and gas
Texas Pacific Coal & Oil Co., Fort Worth, Tex.....Oil and gas
Tide Water Oil Sales Corp., New York, N. Y.....Lubricating oils
Timken Roller Bearing Company, Canton, O.....Roller-bearings
E. S. Twining & Company, New York, N. Y.....Fabrics
U. S. Airplane Co., Chicago, Ill.....
Vacuum Oil Company, New York, N. Y.....Oils
Van Schaack Bros. Chemical Works, Inc., Chicago, Ill.....Aircraft Dope
Vellumoid Company, Worcester, Mass.....Packing and Gaskets
Edgar T. Ward's Sons, Inc., Philadelphia, Pa.....Tubing Distributors
"Western Flying," Los Angeles.....Aviation Publication

Westinghouse Electric & Mfg. Co., South Bend, Ind.....Lighting equipment
Westinghouse Lamp Company, New York, N. Y.....Lamps
Wilson Steel Products Company, Chicago, Ill.....Aircraft Controls
Wood Conversion Company, Chicago, Ill.....Insulating Products
Wyman-Gordon Company, Worcester, Mass.....Drop Forgings

Miscellaneous

American Air Transport.....Chicago, Ill.
American Glider.....Dearborn, Mich.
Chicago Traffic Asso.....Chicago, Ill.
Gray Goose Air Lines Co.....Chicago, Ill.
National Aeronautic Association.....Washington, D. C.
Paramount Aircraft Company.....Saginaw, Mich.
Post Office Department.....Washington, D. C
Society of Automotive Engineers.....New York, N. Y



(Right) Western Electric aircraft radio receiver for reception of Department of Commerce beacon and weather signals, front view. (Left) Rear view with cover and shield removed.

Orville Wright and Senator Hiram Bingham, President of the National Aeronautic Association, at Kitty Hawk when the Association's tablet commemorating the anniversary of the first flight was unveiled Dec. 17, 1928.

CHAPTER XIII

WORLD AVIATION IN 1928

THE International Civil Aeronautics Conference held in Washington, D. C., Dec. 12, 13 and 14, 1928, while intended primarily to honor Orville and Wilbur Wright on the twenty-fifth anniversary of their invention of the airplane, at the same time achieved another purpose. It focused public attention on the fact that the whole world is developing aviation rapidly. The 200 delegates and officials of foreign governments by their presence at the Conference testified to the importance with which matters aeronautical are viewed abroad.

Convened at the suggestion of President Coolidge and authorized by an Act of Congress the Conference offered another opportunity for the nations to get together and discuss the mutual problems incident to commercial and private operation of flying machines.

The American delegation included these twelve:

Orville Wright, the guest of honor; William F. Whiting, Secretary of Commerce; Hiram Bingham, United States Senator and president of the National Aeronautical Association; Nelson T. Johnson, Assistant Secretary of State; F. Trubee Davison, Assistant Secretary of War; Edward P. Warner, Assistant Secretary of the Navy; William P. MacCracken, Jr., Assistant Secretary of Commerce; W. Irving Glover, Assistant Postmaster General; Dr. Joseph S. Ames, Chairman of the National Advisory Committee for Aeronautics; Lester D. Gardner, President, Aeronautical Chamber of Commerce of America; Harry F. Guggenheim, President of The Daniel Guggenheim Fund for the Promotion of Aeronautics; and Col. Charles A. Lindbergh.

A feature of the Conference was the pilgrimage to Kitty Hawk, N. C., where the visitors, accompanied by Orville Wright, saw the unveiling of the National Aeronautic Association's tablet commemorating the first flight on Dec. 17, 1903.

In the quarter of a century which has elapsed other nations have had their first flights, their flying heroes and their geniuses of design. More persons have acquired the habit of flying and using aircraft to carry things. All governments have adopted policies of expansion in the air.

The extent to which their programs were developed in 1928 is summarized in this review of the activities in each country.

Albania

The three air services of Albania were connected with those in Italy beginning April 21, 1928, when the Societa Aerea Mediterranea inaugurated its twice a week service between Valona and Brindisi, 81 miles. The same company operates round trip services between Tirana and Scutari, 60 miles, Tirana and Koritza, 78 miles, and between Tirana and Valona, 62 miles.

Argentina

The maintenance of the weekly air mail service between Argentina and France throughout the year, progress made and plans for additional services connecting Argentina with neighboring countries, increased flying by members of the several air clubs, the construction of airports and generally heightened interest were among the aeronautic developments in Argentina in 1928.

The French Compagnie Generale Aeropostale, using its own aircraft, flew regularly once a week in each direction between the military airport at Buenos Aires and the north coast of Brazil. Mail was carried at night between Buenos Aires and southern Brazil.

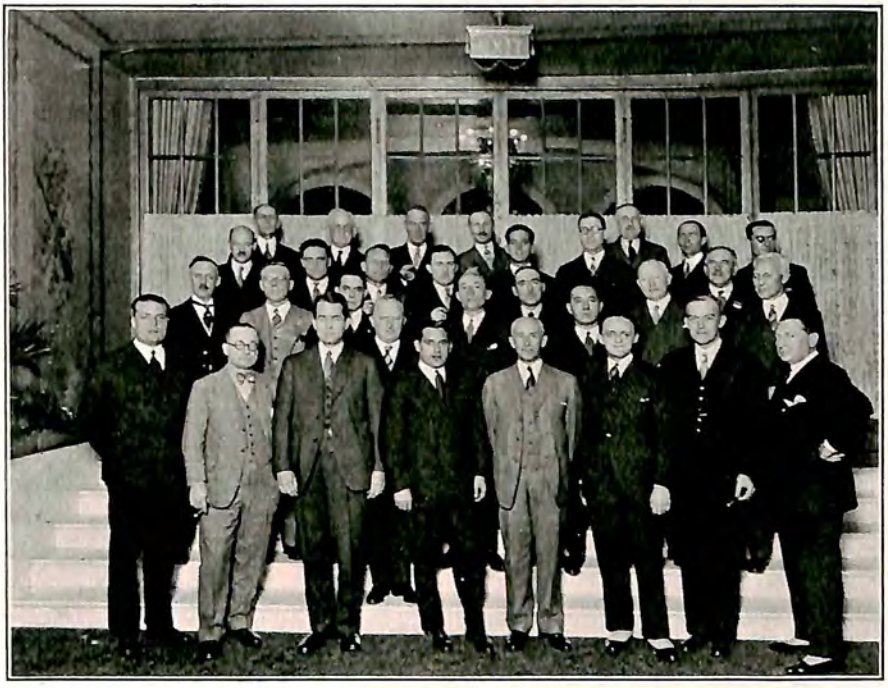
The departure of the Aeropostale plane from the capital at midnight aroused interest in lighting facilities as well as means of communication and weather reporting services. The company had permission to extend its service to Asuncion, Paraguay, and was mapping out its route to that city. Plans were under way for a trans-Andean service between Buenos Aires and Santiago, Chile, to start April 1, 1929. Extension to cities in the south of Argentina by the same company was under discussion.

The Director of Civil Aeronautics had addressed a communication to each of the more important municipalities, asking them to provide airports. Landing facilities for seaplanes used in the service between Argentina and Uruguay were prepared during the year.

There are a number of military and civil airports scattered throughout the country, generally near the larger cities and towns. While civil aircraft may use military fields, civil authorities have been quick to establish fields under municipal or state ownership and flying clubs have contributed several smaller airports, some of which have weather forecasting stations, shelter, repair facilities and other conveniences. A proposed budget provided 3,780,000 paper pesos for civil aviation in 1929.

Australia

With an area greater than that of the Continental United States and a population of 6,000,000, Australia offers wonderful oppor-



Delegates to International Civil Aeronautics Conference, Washington, D. C. at luncheon tendered by Commander Scaroni, Italian Aerial Attaché.

tunities for the development of civil air transportation. There are vast areas of the country which are not served by railroads or highways, and great periods of time are required for correspondence and transportation to be carried out over these areas. The three principal regular air transportation companies employ several aircraft and pilots over a few thousand miles of regular air route. There are 120 aircraft registered for civil purposes, and many are used by landowners living in remote areas of the country.

The Western Australia Airways, Ltd., of Perth, Western Australia, operates 12 British-made aircraft over its route between Perth and Derby, 1,540 miles.

By a contract with the Commonwealth Government, the company will operate 14-passenger machines on a 1,500 mile service between Perth and Adelaide, via Kalgoorlie, Rawlinna, Forrest, Cook and Ceduna. This service will connect the existing line of the company on the West Coast with those in the southeast of the country. In accordance with the contract, which requires the service to be maintained for 5 years, the regular flights were to begin in April,

1929. By this service Perth and Adelaide would be brought within 24 hours of each other, and 4 days saved for mail or passengers traveling between Melbourne and the West Coast.

Eight planes were operated by the Queensland and Northern Territory Air Services, between Brisbane and Camooweal, a distance of 1,250 miles, and on a branch line of 220 miles from Clonclarry to Normanton. The company receives a subsidy for operation between Charleville, Camooweal and Normanton. The extension from Charleville to Brisbane was opened late in the year.

The Australian Aerial Services operates 11 planes on a weekly service between Adelaide and Cootamundra, via Mildura, Hay, and Norrendera, a distance of 578 miles. The Courier Aircraft, Ltd., operates between Brisbane and Toowoomba. The Matthews Aviation Company and the Shaw Ross Aviation Company, of Port Melbourne, Victoria, carry out air taxi and other work. Several pilots in various parts of the country maintain sight-seeing and taxi services. Several additional services are proposed in Australia, one that German interests operate a seaplane service between Australia and New Zealand.

There were 65 privately owned planes in 1928. Aircraft provide the only effective means of communication between the coast and the gold mines in that part of New Guinea under Australian mandate, and they are used regularly.

The appropriations for civil aviation have amounted to £115,000 annually. Beginning in 1928 and for the next two years £200,000 additional will be appropriated for the promotion of civil air transportation. Part of that will be spent shortly for lighting equipment on a route between Brisbane and Melbourne. In September, 1928, there were 80 airports and 97 emergency landing fields in Australia. There were 23 airports in Western Australia and 16 in New South Wales.

Austria

The Austrian Air Transportation Company in 1928 either ran its own service or cooperated with French, German and Italian lines in linking together all important centers in Europe. Express service made possible flights between Berlin and Rome in a single day. The Austrian company's planes in 1928 flew 383,002 miles, compared with 234,043 miles in 1927. They carried 5,477 passengers, compared with 4,272 in 1927, 6,910 kilograms of mail, as against 1,699 kilograms, and 97,337 kilograms of baggage and express, as against 60,835 in 1927. A total of 2,810 flights was made in 1928. The safety record was 100 per cent. The regularity of flights on schedule

during the summer season was 91.5 per cent, and for the entire year 85 per cent; and the percentage of capacity load actually carried was 44.8 per cent.

Belgium and the Belgian Congo

Belgian planes were operated on the Belgian air lines between London, Ostend, Brussels and Cologne, 340 miles. A new service was maintained between Brussels and Antwerp, 30 miles. The operating company which has a monopoly of air transportation in Belgium and the Belgian Congo, is the Societe Anonyme Belge d'Exploitation de la Navigacion Aerienne or (Sabena).

The greater part of the company's lines are in the Belgian Congo between Boma and Leopoldville, between Leopoldville and Elizabethville, between Leopoldville and Coquilhatville, between Luebo and Lusambo, and between Luebo and Chikapa, a total of 2,195 miles. Flights are made every 15 days and are scheduled so that quick connection is made with European steamers at Boma. Tri-motored planes are employed between Boma, Leopoldville and Elizabethville.

During the first six months of 1928, all the machines flew 108,046 kilometers, carrying 879 passengers and 11,641 kilograms of mail, baggage and express.

The Sabena subsidy was fixed at 3,100,000 francs per year, beginning in 1924. The government was to pledge 6,300,000 francs per year for five years and purchase 2,000,000 francs of additional capital stock of the company, the capital to be raised from 6,000,000 to 10,000,000 francs in return for more extensive services in the Belgian Congo. These extensions have been made in part and others are planned. As the 5-year agreement between the company and the government drew to a close, a new agreement was considered whereby the company would be completely reorganized and capital increased from 6 to 20 million francs. It was proposed that the sum of 6,300,000 francs be paid for subsidies for the European services of the company on a ton-kilometer capacity basis. A further payment annually to cover in part the purchase of new aircraft for use in Europe was proposed. In return the company would fly planes to a total capacity of 260,000 ton-kilometers on European services during daylight hours and 300,000 ton-kilometers on night services. No subsidy was fixed for the Belgian Congo services, because they would soon be on a self-supporting basis. The Colonial Government, however, guaranteed eight-tenths of the available load capacity on all flights in the Congo.

The government provides airports at Brussels, Ostend and Ant-

werp. The company owns 6 well equipped airports, with complete installation, and 74 emergency landing fields in the Congo. The Government provides weather forecasting services and transmits them at frequent intervals for the free use of the company's pilots.

The single manufacturing company in Belgium engaged in the production of aircraft is the Societe Anonyme Belge de Constructions Aeronautiques (or Sabca). The company builds all the planes required for the Belgian military air forces and for the Sabena.

Bermuda

The Islands, with an area of only 20 square miles, have seen very little of aviation and no regular air service has been undertaken, although Imperial Airways of England has considered starting a service between Bermuda and the United States, and between Bermuda and British West Indian Islands.

Bolivia

The maintenance of regular services over a wide range of altitudes and in widely varying temperatures in Bolivia indicates complete success with air transportation there. A school for pilots was started in January, 1928.

The Lloyd Aereo Boliviano operated regularly between Cochabamba, Vallegrande and Santa Cruz and between Todos los Santos, Cochabamba and Trinidad, a total distance of 600 miles.

A limited radio service is used and new plans include a complete system to serve the planes over all routes. Some 200,000 bolivianos have been spent by the government for airports and much work has been done by the military forces.

Brazil

About 25 French planes, 13 pilots, many mechanics, and 120 other persons are employed in the South American section of the French Compagnie Generale Aeropostale. The company is known in Brazil as Companhia Aeronautica Brazileira, established with a capital of approximately $494,000. The French Government granted a subsidy of 38,000,000 francs for 1928 to apply to the section of its service between Dakar and Buenos Aires.

Merchant vessels are employed on the routes between Dakar and the north coast of Brazil. Approximately 2,200 miles of the company's route is in Brazil and one flight in each direction is made every week. The planes fly at night from Buenos Aires to Southern Brazil.

No passengers were carried in 1928 but the operators planned to carry passengers in 1929.

The company has done a great deal of experimental flying into

the interior of Brazil and between various cities along the coast with a view to providing supplementary or branch air services which would connect with the main line from France to Argentina.

German interests known in Brazil as the Syndicato Condor Ltda., have been authorized to maintain services between cities along the coast under a decree registered November 8, 1927. The present service of the company is between Rio de Janeiro and Rio Grande do Sul, via Santos Paranagua, Sao Francisco, Florianopolis, Laguana, Porto Alegre and Pelotas. This service covers 900 miles. It is planned later to extend the line to Buenos Aires, Argentina, and northward from Rio de Janeiro to Manaos, over several cities along the northeast coast of the country.

Flights were made once a week in each direction over the existing route until September 21, 1928, when a twice-a-week service was started, direct from Rio de Janeiro through the intermediate points to Porto Alegre. Connection was made there with seaplanes for Pelotas and Rio Grande do Sul. Passengers, mail, and express were carried.

The Aircraft Operating Company, Ltd., of England, was given a contract late in the year to make an aerial photograph and map of the city of Rio de Janeiro.

A Brazilian company known as Empreza Transporte Aereos was formed for the purpose of providing air services between Rio de Janeiro and other points in the republic.

It was announced in August that the Condor Syndicate would provide a regular service between Rio de Janeiro and Sao Paulo in which passengers, mail and express would be carried. Several other proposals have been brought forward for air services in various parts of the country.

There are no aircraft factories in Brazil and no manufacturing is done there, although aeronautic equipment of the military and naval forces is repaired by those branches. A law was proposed in 1928 which would encourage the introduction of aircraft building plants in Brazil, but it was not certain how soon such projects could be developed.

Bulgaria

The first Bulgarian Aviation Company operated between Sofia-Rousse-Varna, 257 miles, during the year. The French Compagnie Internacionale de Navagacion Aerienne which has permission from the Bulgarian Government to operate across that country flew three trips a week between Belgrade and Constantinople via Sofia throughout 1928. That route is the eastern portion of the French line between Paris and Constantinople.

Bulgaria has no military or naval aviation. All aeronautic activities are administered by a bureau which is a division of the Ministry of Railways, Posts and Telegraphs.

There are airports at Varna, Gorna-Orchovitza, and Kazanlik, at each of which there is a hangar for two airplanes, and a larger airport at Bojourishte near Sofia. There are 20 emergency landing fields between Sofia and Varna. There were 44 State-owned aircraft, including 2 seaplanes, in Bulgaria in 1928.

Canada

The Canadian Government encourages commercial aviation by assisting the 16 flying clubs located at several cities throughout the Dominion. The clubs must provide a flying field for land or seaplanes which complies with the regulations fixed by the Government, provide for the housing, repair, and maintenance of all aircraft and equipment supplied by the Government; arrange for the services of an approved and qualified instructor and of a licensed air engineer; and have a membership of at least 30 members who wish to qualify as pilots in addition to at least 10 members already qualified and desirous of continuing to fly. Upon approval of a club the Government issues 2 licensed airplanes and promises 1 additional airplane a year for five years, provided they are needed.

At the end of 1928 there were 2,400 members of the existing clubs. They had flown 8,100 hours during the year. Private pilots' licenses were issued to 125 flying club members and commercial pilots' licenses to 29 members. During the year 233 commercial planes were licensed compared to 67 in 1927.

The appropriation for the Royal Canadian Air Forces for the fiscal year 1927–28 was $1,559,949. It was increased to $1,669,694 for 1928-29.

Appropriations for civil air operations, that is flying operations for the Civil Government departments in connection with aerial photographic surveys, forestry patrols, forestry and grain pests, transportation, etc., the control of civil aviation, establishing air routes, airports and airship bases, aeronautical engineering, etc., for the fiscal year 1928–29 were $3,195,037 compared with $2,332,284 for the preceding year.

A number of American and British firms have branches in Canada. The DeHavilland Aircraft Company of England has a branch plant at Toronto for the assembly and service of its aircraft. Armstrong-Siddeley Motors, Ltd., has at Ottawa a branch for the service, assembly and repair of its engines. The Reid Aircraft Company, designers of an all-metal airplane, has established a plant at Montreal.

The Canadian Pratt & Whitney Aircraft Company, Ltd., was organized for the assembling and servicing of "Wasp" and "Hornet" motors at Montreal. The Canadian Aircraft Company was established at Winnipeg early in the year for the construction of three passenger biplanes. The Canadian Wright, Ltd., of Montreal, assembled its first motor in March, 1928, and plans were made for continuous production of that line.

Air Transport operators carried 250,000 pounds of air mail in 1928. With more than 25 planes in use, Western Canada Airways, Ltd., was the largest operator in Canada. The Pacific Airways, Ltd., of Vancouver, was absorbed in July. A contract with the Post Office Department called for the carriage of up to 800 pounds of mail a trip between Rolling Portage and Red Lake, 300 miles, beginning January 25, 1928. Later, extensions were made to include weekly flights from Rolling Portage to Narrow Lake and Woman Lake, 450 miles. The company was authorized to carry mail between the Pass, Schist Lake and Gold Lake. On October 22 a twice-a-week service was begun between Winnipeg, Regina, Calgary, Saskatoon and Winnipeg, 1,900 miles. A mail service was operated in December and suspended till the following spring. A plan to provide regular services between Winnipeg and Omaha, Neb., via Fargo, N. D., was being developed late in the year in co-operation with an American company.

The Post Office Department made contracts late in 1927 with Transcontinental Airways, Ltd., to fly mail between Murray Bay, Seven Islands and Anticosti Island, 350 miles, and between Moncton and the Magdalen Islands, 120 miles. This is the first winter mail service ever provided for the Magdalen Islands. Fairchild planes were equipped with "Wasp" engines and a ski-float combination permitting landings on water, ice or snow.

Flights were made once a week during the winter of 1927 and renewed late in 1928. Later, a contract was made with the company for carrying the mail between Montreal and Rimouski, 350 miles, twice a week, and between Montreal and Ottawa, 110 miles, once a week. Arrangements were also made for carrying express over the routes. The Montreal-Rimouski service provides quicker communication with points in Europe, for steamer mail is transferred at Rimousiki. From one to four days in each direction are saved.

The Canadian Airways Company, Ltd., received from the Dominion Government an air mail contract for two round trips a week between Montreal and Toronto, 325 miles. The service became a daily one from October 1, and by December 8, 1928, 46,094 pounds of mail had been flown on that route.

The British Columbia Airways, Ltd., operated between Victoria, Seattle and Victoria, 280 miles. Traffic demands were so heavy in August that 36 passengers were refused places. The air mail and express service was to be developed in 1929.

The London Air Transport, Ltd., started a mail service in December between Leanington, Ont., and Pelee Island in Lake Erie.

Chile

There was no commercial aviation in Chile during 1928 although several plans for providing air mail, passenger and good services were discussed, such as a service by the Chilean military air forces between points in north Chile, the extension of the service to Peru, a possible line between Chilean cities and the heart of Bolivia, and a line over the Andes, between Chile and Argentina. The government granted the French Aeropostale a concession by which it would carry mail between Chile and France, over the existing route between Buenos Aires and France. Within 18 months from the signing of the concession of February 1, 1928, the company was authorized to operate airplanes regularly into Chile from Buenos Aires. Military landing fields were made available.

China

There is no regular air transportation in China, although the country is poorly equipped with modern means of communication and lends itself well to development of aviation. More than 3,000 planes were believed to be in China during 1928. Practically all of those machines were in military use or in storage. It is possible that the actual number of aircraft within the country and capable of flying, is much smaller, for large numbers of those counted in 1928 never had been set up for operation. Many which had been flown were wartime models, mostly from European countries.

Several new planes were purchased late in the year, among them a few American commercial types. The Chinese Government requires a special permit for the entry of each machine, and the United States Government has arranged to permit the exportation to China of strictly commercial aircraft.

Several of the machines in flying condition and of those being purchased are in use or will be used by flying schools. An important flying school is that at Amoy, and known as the Sukien Peoples Aviation School, established September 28, 1928.

Apparently the new Government is anxious to have air services established and is using every opportunity to promote plans and means for providing them. Although in most cases these plans are not well developed, the following proposed services are indic-

ative of what may be expected: Air lines are planned by either public officials or private companies between Canton and Hong Kong; Shanghai and Nanking, Shanghai and Huanchow; Nanking, Shanghai and Hankow; Shanghai and Tientsin; Peking and Hankow; Canton and Wuchang; Hong Kong and Shanghai; and elsewhere. The Japan Air Transportation Company made a flight in March between Osaka, Japan, and Shanghai, in a large seaplane and proposed to start a regular service between those points.

In line with these proposed services several airports have been projected. The military airport for the Royal Air Force of Great Britain at Hong Kong will be improved considerably with funds appropriated by the British Government.

Colombia

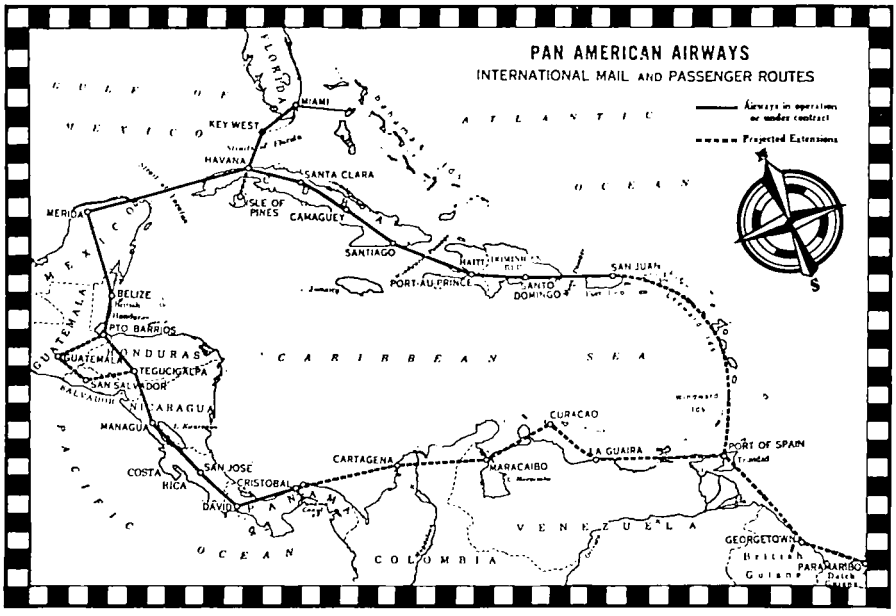
In 1928 there were 17 planes in civil operation in Colombia, 15 in regular air service. The Sociedad Colombo Alemana de Transportes Aeros had 12 seaplanes. The Compania Santandereana de Aviacion, associated with the Scadta company, used 2 land planes in its service between Bucaramanga and La Gomez, 80 kilometers daily. The Andian National Corporation had 2 seaplanes in general operations.

The "Scadta" company operated daily between Barranquilla and Girardot, 625 miles along the Magdalena River; weekly between Girardot and Neiva, farther up the Magdalena, 94 miles; weekly between Barranquilla and Buenaventura via Cartagena, Lorica, Sautata, and other cities, 520 miles, and weekly between Buenaventura and Guayaquil, Ecuador, 475 miles. The Government appropriated $10,000 for civil aviation in 1928.

Cuba

Using tri-motored American-built Fokkers, the Pan-American Airways, Inc., inaugurated its daily service between Havana and Key West, on Oct. 27, 1927. Under contracts with the postal authorities of the Cuban and United States Governments, the company carried mail in both directions. After a few weeks of regular operation, the company began carrying passengers and express. On Sept. 15, 1928, the service was extended to Miami, Fla. During the first year of operation, the company carried more than 18,000,000 letters and 1,200 passengers between Cuba and the United States.

Beginning in January, 1929, that company's service was expanded. Sixteen Fokker F-10 tri-motored planes, 3 Sikorsky and 2 Loening amphibian planes were to be employed. Six of the Fok-



kers were assigned to the Cuban service. The schedule between Miami and Havana was changed to two round trips a day.

On November 6, 1928, it was decreed that several airports should be established around the coast of Cuba for the use of civil aircraft. Those on the North Coast will be at Bahia Honda, Mariel, Havana, Matanzas, Cardenas, Sagua, Caibarien, Nuevitas, Puerto Tarafa, Manati, Puerto Padre, Gibara, Banes, Nipe, Antilla, Sagua de Tanamo and Baracoa, and on the South Coast, Guantanamo, Santiago de Cuba, Manzanillo, Santa Cruz del Sur, Jucaro, Tunas de Zaza, Trinidad, Casilda, Cienfuegos, Batabano, Nueva Gerona and Los Indios.

Czechoslovakia

The Czechoslovak State Air Lines operated 8 planes in 1928. The company's daily mail, passenger and express services were maintained between Prague, Marienbad, Cassel and Rotterdam, 520 miles, and (in co-operation with German and Austrian companies) between Vienna, Prague, Dresden and Berlin, 345 miles, and (in co-operation with Austrian and Italian companies) between Prague, Bruno, Vienna, Klagenfurt and Venice, 214 miles. An express service was maintained by the three companies jointly, in addition to the regular service between Berlin, Dresden, Prague and Vienna.

There are four manufacturers of aircraft in Czechoslovakia, and

those producers have brought out several types of small planes which have proved successful. They produce machines of their own type, and under license, machines designed in other European countries. An American motor is built under license.

Denmark

Six passenger Fokkers were operated by the Danish Air Transportation Company during 1928 in their twice-a-day service between Copenhagen and Hamburg, Germany, 181 miles. The Government paid a subsidy of 250,000 crowns a year. Of this, 100,000 crowns was for equipment and the rest for operation.

Dominican Republic

The West Indian Aerial Express, incorporated in the Dominican Republic, established two services on December 3, 1927. The first route was between Santo Domingo and San Juan, Porto Rico, 250 miles, over which three flights a week were made. The second was a weekly service between Santo Domingo and Port-au-Prince, Haiti, 180 miles. On March 1, the service was extended to Santiago, Cuba, and weekly flights were made. A 4-passenger single-engined monoplane and 2 3-passenger single-motored planes were used for taxi and sightseeing flights. The traffic increased during 1928, and was handled without accident of any kind, although much of the flying was over water.

The Dominican Republic and the Republic of Haiti entered into contracts with the company for the carriage of air mail, and the former gave other assistance. In April, 1928, there were airports available at San Juan, Santo Domingo, Port-au-Prince, St. Croix, St. Thomas, San Pedro de Macoris, Barahona, Enriquillo, Cape Haitian, Port-of-Paix, Guantanamo and Santiago.

Late in the year contracts were made with the Pan-American Airways, Inc., which succeeded the older company, and plans were made for a regular service beginning in 1929.

Ecuador

A service between Colombian cities and Guayaquil, Ecuador, was started by the Scadta Company of Colombia, August 11, 1928. Fortnightly flights were made during most of the year between Buenaventura, Colombia and Guayaquil. Late in the year the schedule was changed to once a week. In December the line of the Aviation Corporation of Peru, between Lima and Talara in that country was extended to Guayaquil, so that Guayaquil was in connection by air with Peruvian cities once a week.

The contract with the Scadta company, signed on June 30, 1928,

does not provide a subsidy to be paid by the Government, but permits the company to use designated airports, fix its own rates and operate between Ecuador and Colombia for a period of 25 years.

Egypt

The only regular air service touching Egyptian territory is that of the Imperial Airways, Ltd., which maintains a regular service between Cairo and Basra.

Appropriation approved by the Superior Council on Nov. 7, 1927, included $20,000 for grading and other work on the Cairo airport, $490,000 for the construction of the airport at Cairo, $15,000 for the construction of an airport at Alexandria and $53,500 for equipment at the Cairo airport. Late in 1928 additional sums were approved to carry on the construction of other large airports, one at Almaza near Cairo, and the other at Kekaela, near Alexandria. The second will be completed first because it will be the first airport reached by planes from Europe. The Imperial Airways has been using a part of the military airport at Cairo. There is no military or naval air force under the Egyptian Government. The British Royal Air Force maintains units in the territory.

Estonia

Five planes were employed by the Estonian Aeronaut Company in its service between Tallinn and Helsingfors, 54 miles, in 1928.

The company maintained the service in co-operation with a Finnish company during a part of 1927 and in January, 1928, they started their joint winter service. The Estonian company ceased operations in the early spring and its liquidation was started on April 1, 1928. The subsidies of the Government proved insufficient. The Finnish company was authorized to continue the service throughout 1928. The German-Russian company, Deruluft, which has operated between Berlin and Moscow, started a branch line from Konigsburg to Leningrad over Riga and Tallinn. The service was maintained daily until October.

Finland

The Aero O-Y of Helsingfors, Finland, operated 15 large passenger planes in 1928 between Finland, Estonia and Sweden. The service was suspended on November 10 with plans for its resumption early in January, 1929.

The company co-operated with the Swedish Air Transportation Company in maintaining the line between Helsingfors and Stockholm via Abo, 232 miles. The 10-passenger plane *Suomi* was employed in this service during the summer months. That plane alter-

Navy Seaplane.

nated with the Swedish Plane *Uptland*. The service on this route was maintained between April 30 and September 30 for passengers. It was continued until October 1 for mail. The company's planes flew 121,210 miles and carried 3,201 passengers, 10,062 kilograms of mail and 37,353 kilograms of baggage and express. The company also operated a short service between Helsingfors and Viborn.

France

On July 1, 1928, the French air lines had 241 planes in either active use or reserve. More than half of them had been flown for four years or more. Two had been used since 1920, 13 since 1921, 73 since 1922, 24 since 1923, and 16 since 1924. There were over 700 motors. One hundred and twenty pilots were employed. The growth of traffic on the network of French air lines, most of which serve several countries, continued in 1928. At the end of the year further extensions were projected.

The Compagnie Generale Aeropostale operated a mail, passenger, and express service daily between Toulouse and Casablanca via Perpignan, Barcelona, Alicante, Malaga, Tangier and Rabat, 1,146 miles. A branch line with a similar service linked Marseilles

and Perpignan, 171 miles. Flights were made weekly between Casablanca and Dakar, 1,770 miles. Mail which was carried from Paris by train on Thursday and from Toulouse on Friday was flown to Dakar whence fast steamers carried it to Natal, Brazil. From Natal the company's planes flew it to Buenos Aires, Argentina, a distance of 2,700 miles. The scheduled time of carriage from France to Argentina was 9 days.

The company also maintained a once-a-week service between Paris and Biarritz via Bordeaux, 450 miles. The company planned to start a weekly service in 1929 between Bordeaux and Toulouse and a three-times-a-week service between Paris and Madrid.

The Compagnie Air Union operated a mail, passenger and express service between Paris and London, 233 miles. Flights were made from one to four or five times a day, including Sunday, depending on the season and traffic. The company inaugurated a second-class service on this route late in 1927 and was able thus to attract additional passengers. A daily flight was made in each direction between Paris and Marseilles via Lyon, 454 miles, and between Lyon and Geneva, 70 miles. This branch line was maintained only during the better seasons of the year. A twice-a-week service (except in winter) was operated between Antibes, Ajaccio and Tunis, 534 miles. The Air Union Lignes d'Orient projected 46 round trip flights for 1929 between Marseilles, Athens and a point in Syria.

The Compagnie Internationale de Navigation Aérienne maintained its mail, passenger and express service on these lines: Paris-Strasbourg - Nuremberg - Prague - Vienna - Budapest - Belgrade - Bucharest-Constantinople (1,731 miles); Belgrade-Sofia-Constantinople (517 miles); and Prague-Warsaw (395 miles). Flights were made daily except on the Belgrade-Sofia-Constantinople section where there were three a week. The company is expected to start a twice-a-week service between Constantinople, Aleppo and Bagdad in 1929.

The Société Generale de Transport Aerien (Lignes Farman) continued its daily service between Paris, Brussels, Rotterdam and Amsterdam, 286 miles, and its three-times-a-week flights between Paris, Cologne and Berlin, 600 miles. Planes of the Deutsche Luft Hansa flew on the remaining three days. In 1929 the company was to extend its line from Amsterdam to Malmo and change the Paris-Berlin service to a daily schedule in 1929.

The Compagnie Aérienne France-Algerie operated an air mail and goods service three times a week between Marseilles and Algiers, 485 miles, and nine round trips a week were scheduled for 1929.

Measured by passenger and metric ton-kilometers, it has been

estimated by the French authorities, passenger traffic in 1928 increased about 160 per cent, baggage and express traffic about 125 per cent and mail traffic about 20 per cent over the preceding year.

France is a leading European country in the production of aeronautic equipment, with about 30 manufacturers of planes and 10 builders of aircraft engines. The financial status of the production industry was considered grave at the beginning of 1928, and some units failed. It was expected, however, that most of the companies would weather the period of adversity which was caused by the restriction of credits, cutting off of foreign markets because of the stabilization of the franc, and other forces. Much dependence is placed on the steady demand for military equipment.

The Government's policy of allocating its orders regularly keeps the factories steadily employed. The companies specialize in military aircraft for the French and other European governments. Practically the only demand for commercial aircraft in France is for those used by the operators of regular air lines. Manufacturers have been unable to afford research and development work and, admittedly, their products are not equal to the needs of the air transport operators. The Government eventually may carry on the necessary research work in order to overcome that difficulty.

Four Ministries of the French Government formerly were directly concerned with aviation. The lack of co-ordination and a series of airplane accidents culminating in the death of the Minister of Commerce were factors leading to a major change in 1928. The Ministry of Air was established.

That had been preceded by the formation of two important committees after a decree of the Government issued, April 24, 1928. The first committee, long sought by private aeronautic interests, was called the Permanent High Committee for Aeronautics and included the Ministers for War, Navy, Colonies, Commerce and Postal Service. The purpose was the co-ordination of efforts and common study of all problems. The second committee, formed by a representative of each air transport company, was designed to provide a program for acquisition of material and the financial organization of the companies.

The Ministry of Air was authorized by an official decree of Oct. 2, 1928, and M. Laurent-Eynac, former Under Secretary for Aviation, was chosen to head the Ministry. The control of commercial, military, naval and colonial aviation in all their phases passed under the direct supervision of the new Minister.

The Minister of Air late in 1928 was represented as favoring the consolidation of operating companies. The Compagnie Inter-

nationale de Navigation Aérienne and the Farman Lignes had agreed on a common organization to operate the system linking Central and Southern Europe. The Air Union and the Air Union-Orient Lines had practically agreed on an arrangement for operating the lines from London to Marseilles and the proposed line to French Indo China via Syria.

The 1929 appropriation for all government aeronautic activities amounted to 1,769,652,780 francs (over $70,000,000) compared with 1,045,649,140 francs for 1928. The allowance for commercial aviation was 218,174,140 francs for 1928. For that year 618,000,000 francs for military aviation and 209,475,000 francs for civil aviation were voted.

The aeronautic appropriations for 1929 include:

	Francs
General expenses and civil aviation	551,495,655
Military and Naval Aviation, national	924,549,620
Military and Naval Aviation, Algeria and Tunisia	45,880,090
New material	104,658,000
Morocco	58,223,140
Army of the Levant	48,080,380
Colonial aviation	36,765,895
Total	1,769,652,780

The biggest item for civil aviation was 172,300,000 francs as subsidies to air transport companies. The second largest item was for research, experimentation and development of new equipment, 130,000,000 francs compared with 40,000,000 in 1928.

Late in December, 1928, the Government decided to make 30-year contracts with the companies instead of the 10-year arrangements then existing, and participate in their capitalization to the extent of 25 per cent.

The Government will have the right to buy the air lines after 10 years without any indemnity and an arrangement may be terminated at any time the Government find the company concerned is not obtaining satisfactory results. The Government will guarantee interest on approved loans obtained by the companies and will aid them to meet obligations by temporary advances. The subsidy at present granted the companies under the form of a mileage allowance, according to the types of planes used will no longer be thus fixed. It will be a sliding scale to permit of adjustment according to the degree of independence reached by the operators.

In addition to the State participation of the capital, the railroad and other companies were to take parts. In the 60,000,000 franc capital issue following the fusion of the Air Union and the

Asst. Secy. of War F. Trubee Davison, Major General James E. Fechet, Chief of the Air Corps, Capt. Ira C. Eaker and Lt. Muir S. Fairchild with Loening Amphibian on Panama inspection flight.

Air Union-Lignes d'Orient it was thought that the Northern Railway Company, the Paris-Lyon-Mediterranean Railway Company, the French State Railways, the Messageries Maritimes Steamship Company, and the Suez Canal Company would figure. It was believed that aircraft manufacturers would soon lose much of their control over the operating companies.

There are 5 airports, 20 regular landing fields, 43 emergency landing fields, and 9 seaplane bases in France. The Government has spent 105,000,000 francs on the system of airports and airways, and plans a greater expenditure for their improvement and extension. A plan for providing an airport at each seaport was developed in 1928. There are a number of beacons at airports and along the airways but these will have to be supplemented to permit night flying. A night service is planned for the Paris-London route in 1929.

There are a number of weather reporting and wireless stations used to prepare and disseminate weather data and provide communications for the air lines. These services are highly organized and co-ordinated with those in England, Belgium, the Netherlands, and Germany.

Germany

There were 535 airplanes in operation in Germany during 1928. Six hundred and nineteen motors were used on those planes. Of the total, 488 had one motor, 10 had two and 37 were tri-motored. The planes were divided as follows: air service operators, 183; experimental stations, 65; flying schools, 94; sport flying, 117; German Government, 8; advertising concerns, newspapers and individuals, 21; and airplane factories, 47.

The Deutsche Luft Hansa operated 158 planes during 1928. It started operating 30 air lines in April, 1926, and added 24 lines within a few months. The number had increased to 90 in the summer of 1928. Eighty-four of these, covering 15,511 miles, were operated by the company while six, 3,029 miles in length, were maintained in co-operation with foreign companies. Special freight services were operated between London, Amsterdam, Hanover and Berlin and between Paris, Cologne, Essen, Mulheim and Berlin. A non-stop flight in each direction between Berlin and Paris was made on Sunday. Sunday flights were made regularly also between Krefeld, Essen and Mulheim and between Krefeld and Cologne.

A number of express services were provided. An example is the Berlin to Zurich route over which the fast planes flew, non-stop in 5 hours. An arrangement was made with the Mitropa Company for the sale of food and refreshments and management of sleeping accommodations on all German planes and the operation of restaurants and hotels at airports. The Mitropa Company operates dining and sleeping cars on European railroads.

The short daylight hours of the winter do not permit of long flights and, for other reasons, including the weather and airport conditions, the air transport service is reduced in winter. While some 60,000 kilometers were covered each day during the summer of 1928, the figure was reduced to 16,000 kilometers a day during the transitional period in November and to 8,000 kilometers in December.

Following the successful introduction of the through air and rail freight service in 1927 the Luft Hansa arranged with the German Railroad Company for the transfer of passengers, effective Sept. 1, 1928. Passengers may start a journey by air or first class railway and change to the other at will and with little formality.

In 1928 passenger traffic increased 8 per cent, freight traffic 61 per cent, baggage 6 per cent and mail 1 per cent, while the distance flown increased 10 per cent. These increases were smaller than those of 1927 over the 1926 traffic.

Air traffic of the Deutsche Luft Hansa for the three years is as follows: (Figures are for actual traffic, i.e., a passenger is counted as 1 passenger whether he traveled over one or four stages of an air line.)

	1928 (Estimated)	*1927*	*1926*
Kilometers flown	10,150,000	9,208,029	6,141,479
Passengers carried	111,000	102,681	56,268
Express carried (kgs.)	1,030,000	641,186	258,464
Baggage carried (kgs.)	870,000	821,921	385,945
Mail carried (kgs.)	485,000	479,816	301,945

There are about 15 important German manufacturers of airplanes. They built 301 planes in 1927 and approximately the same number in 1928. These companies and the 5 principal airplane motor builders are aided by the Government.

Germany is not a member of the International Convention for Air Navigation but treaties governing air transportation have been made with several countries, including France, Belgium, Czechoslovakia, Great Britain, Italy and Spain. There is no military or naval aviation. Civil aviation is controlled in Germany by the Air Department of the Department of Transportation and Communication. Airports are owned and controlled largely by States and municipalities and airways are controlled in part by States.

The National, State and municipal governments aid generously in the promotion of air transportation. They spend some 80,000,000 marks annually for this purpose, the National Government contributing over half of this aid.

The National Government appropriations for the 3 years were:

	Fiscal Year 1926-27 (marks)	*Fiscal Year 1927-28 (marks)*	*Fiscal Year 1928-29 (marks)*
Aeronautic wireless service	485,000	950,000	1,067,895
Exhibitions and competitions	2,000,000	2,000,000	2,000,000
Meteorological services	1,194,000	1,800,000	1,800,000
Scientific development	16,000,000	8,700,000	19,500,000
Aldershot Experimental Station	1,950,000	2,700,000	4,500,000
Air transport subsidies	15,571,500	22,065,000	20,165,000
Appliances for safety, maps and plans.	4,350,000	3,000,000	1,700,000
Glider and light plane development, and training of personnel	5,100,000	4,700,000	4,650,000
Aid to Aerodynamics Experimental Institute at Gottingen	150,000	200,000	100,000
Aid to aircraft museum	1,500	3,500	3,500
Total	46,802,000	46,118,500	55,486,395

Extensive weather reporting and communications services are provided. Numerous tax exemptions, grants and other direct and indirect aids are given by public authority. The national subsidy payments alone amount to some 53 cents a mile flown by single-motored, and about 72 cents a mile for multi-motored planes.

It was announced in August, 1928, that the Templehof airport at Berlin would be thoroughly reconstructed and modernized. There were 54 arrivals and departures a day there during the busy season and the hotel and other facilities became inadequate.

Improvements of some sort were made at most of the 56 well equipped airports and regular landing fields during the year. The Deutsche Luft Hansa recommended the restriction of building heights in order to permit of a rise of 1 meter in 20 flown from the borders of airports for a sufficient distance to reach a height of 25 meters. This restriction would continue in the same order over an area 2 kilometers wide in all directions from airports. High obstructions are marked by red Neon lights. The questions of improving airport facilities and airways received much attention during 1928.

There are two lighted airways for night flying between Berlin, Danzig and Konigsberg, 400 miles; and between Berlin and Hanover, 157 miles. It was planned to light the Hanover-Essen-Mulheim-Cologne and the Berlin-Halle-Leipzig routes in 1929. Lights on the Munich-Vienna and the Munich-Fuerth-Nürnberg-Frankfort-Heidelberg-Basel routes, at least to the German borders, are planned for 1930. Electric beacons with a range of 50-60 kilometers will be placed on towers at intervals of 25-30 kilometers. Smaller beacons with a range of 10-15 kilometers will be placed 5 kilometers apart. The lights will be distinguishable by their colors. Radio beacons and emergency landing fields, the latter at 50-60 kilometer intervals, will be provided. The estimated cost of the proposed lighting system is 80,000 marks for each 250 kilometers of line.

Great Britain

The Imperial Airways, Ltd., London, used 15 large airplanes in regular service during 1928, and employed 3 smaller planes for special flights at that time, when there were 4 large planes under construction for the company.

The company maintained a regular passenger, mail and express service between London and Paris, 225 miles, making one to four or five round trips a day. The London-Paris-Basel (484) miles) route was covered once a day, as was the London-Brussels-Cologne (311 miles) route. Weekly flights were made between Southhampton

Naval planes drop a remarkable smoke screen.

and Guernsey, 121 miles. Weekly flights were made regularly, also, over the Cairo to Basra route, 1,090 miles, via Gaza, Rutbah and Bagdad. The first-class passenger fare from London to Paris was £4 4s. 6d. and for the *Silver Wing De Lux* service £4 15s. From London to Basle, the fare was £7 10s. The fare from London to Brussels was £3 10s., and from London to Cologne, £5. The fare from Cairo to Basra was £39, and from Cairo to Bagdad, £32.

There were 4,487 pounds of letter mail carried in 1924, 9,412 pounds in 1925, 12,195 pounds in 1926, 45,574 pounds in 1927, and, estimated, 64,535 pounds in 1928. The parcel mail amounted to 29,109 pounds in 1924, 56,248 pounds in 1925, 75,728 pounds in 1926, and 75,388 pounds on the European services alone in 1927. The estimated quantity for the European services alone in 1928 was 103,850 pounds.

It was proposed to extend the Cairo to Basra service to Karachi, India, beginning in April, 1929. Later the service between Basle, Switzerland, and Cairo, will be put in order, so that the full trip from London to Karachi can be made in seven days. Other air services between the British Isles and Europe and within the Isles are

under discussion. A plan for a combined road and air service to link all parts of England is being projected by the Imperial Airways. Express Motors, Ltd., will carry passengers and express to London by sleeping coaches, for transfer to the aircraft which operates between London and continental points.

There are about 20 airplane manufacturers in Great Britain, and many of them make aircraft engines. A few engine builders do not make aircraft. The trend has been toward all-metal construction, improvement in strength of planes and refinement in engine design. Of course the British industry depends principally upon the military and naval air services for its market.

All aeronautic activities of the British Government are controlled by the Secretary of State for Air. Civil aeronautics is governed by the Director of Civil Aviation, who heads the Department of Civil Aviation of the Air Ministry.

In addition to many aids, the cost of which cannot be easily computed, the Government will have spent £3,840,686 for the promotion of civil air transportation during the eight years ending on March 1, 1929. Of that sum £1,613,380 is direct aid in the form of subsidies. The following is a table of recent appropriations for civil aviation:

Appropriations for Civil Aeronautics

(For fiscal years ending March 31)

	1929	*1928*	*1927*
Civil airports	£ 29,000	£ 28,000	£ 30,000
Air routes, surveys, etc	29,000	31,000	30,000
Technical equipment	8,000	16,000	14,000
Works, buildings and lands	93,000	150,000	216,000
Miscellaneous	2,000	2,000	2,000
Civil Aviation subsidies	266,000	247,000	180,000
Gross Total	£427,000	£474,000	£472,000
Appropriations in aid	12,000	10,000	11,000
Net Total	£415,000	£464,000	£461,000

It will be noted that the appropriations for works, building and lands have been decreased, while those for subsidies were increasing.

A new agreement with Imperial Airways was reached in 1928, which will become effective April 1, 1929, and be a substitute for all existing agreements with the Government. It will extend to April 1, 1939. The subsidy payments under this arrangement amount to £335,000 for each of the first two years, £310,000 for each of the next four years, £220,000 for the seventh year, £170,-

000 for the eighth year, £120,000 for the ninth year, and £70,000 for the tenth, the final year.

The amount for each year will be divided and allocated in definite proportion to the European services, the England to Egypt section and the Egypt to India section. The Government will turn over to the company 2 large machines and will retain an interest in the direction of the company's affairs. It is provided that obsolescence on the company's aircraft shall be figured at the rate of not less than 25 per cent a year, unless otherwise directed by the Secretary of State for Air. This will permit two complete replacements of types of aircraft during the life of the agreement. It is hoped, of course, that at the end of the agreement, conditions will be such that the subsidy no longer will be required.

The company's aircraft were valued on the books as of March 31, 1928, at £249,915. The company's stock outstanding amounted at that time to £473,656. The company was able to show a profit of £72,567 for the year ended March 31, 1928. This result was reached, of course, after the receipt of the cash subsidy from the Government.

The Government continued to maintain its excellent weather forecasting and communication services. Improvements at the London airport, Croydon, were completed during the year. There are 14 licensed airports for the public use of aircraft in the British Isles. In addition, there are a number of emergency landing fields and the military airports may be used in emergency.

Military appropriations for the fiscal year ending March 31, 1929, included:

	1929	*1928*
Pay, etc., of the Air Force	£ 4,273,000	£ 4,261,000
Quartering stores (except technical), supplies and transport	1,872,000	1,945,000
Technical and warlike stores	8,130,000	8,489,000
Works, buildings, and lands	1,920,000	2,377,000
Medical services	318,000	315,000
Educational services	515,000	529,000
Auxiliary and reserve forces	554,000	500,400
Civil aviation	427,000	474,000
Meteorological and miscellaneous effective service	243,000	179,000
Air ministry	659,000	710,000
Total	£18,911,100	£19,779,400
Noneffective service, half pay, pensions, etc.	224,000	207,000
Total	£19,135,100	£19,986,000

Greece

An Italian air transport company operates between Brindisi and Constantinople, and makes Athens a regular port of call. The only airplane factory is operated by the Blackburn company, financed by British subjects. The Government late in 1928 granted concessions to a Greek company to operate all internal air lines. About $4,000,000 was appropriated for the Army and Navy air services for 1928–29.

Guatemala

Three new American cabin planes were to be employed by the Government in a regular service between Guatemala City and Flores, in the Department of Peten, in 1929. Mails and passengers were to be carried in a few hours as compared with 14 to 18 days required under old conditions. The 3 aircraft, purchased by public subscription, were to be operated by military pilots.

Haiti

Four American planes were employed by the West Indian Aerial Express in two services during 1928, one of which was once a week between Santo Domingo and Port-au-Prince, 180 miles. In 12 months, ending September 30, 1928, 70 planes arrived in Port au Prince, carrying 48 passengers, while 69 machines departed, carrying 68 passengers. The West Indian Aerial Express was succeeded by the Pan-American Airways, Inc., which was to start a service early in 1929 between San Juan, Porto Rico, and Miami.

Haiti has no laws regulating civil aeronautics, and there are no air services maintained by the Government. The United States Marine Corps carries officials and mail for the United States and the Haitian Government between Port-au-Prince and Cape Haitien, Hinche, Port-de-Paix, and Jeremie.

Hungary

The Hungarian Air Transportation Company employed 14 Fokker planes in ts daily services in coöperation with the Deutsche Luft Hansa between Budapest and Vienna, 137 miles, and in coöperation with the Austrian Air Transportation Company between Budapest and Graz, Austria, 180 miles, and with the French Compagnie Internationale de Navigation Aerienne, stopping at Budapest on its Paris to Constantinople line. Its planes as well as those of the German, Austrian and Hungarian companies use the Budapest airport.

The Hungarian Air Transportation Company made arrangements with the Weiss Manfred Manufacturing Company to build Fokker and Heinkel planes at Budapest. The Weiss company started work through its subsidiary, the Airplane Manufacturing Company, Ltd., purchased a large tract of land which may also be used for an airport. It has the advantage of lying in the city and being available for both land and seaplanes.

Iceland

It was reported that an Icelandic aviation company had been formed with capital of £20,000 for the maintenance of air services between Raykjavik and various parts of the country. A German plane, with a pilot and two mechanics, was flown to Iceland in June and commenced flying under the administration of the German Luft Hansa. It was said that because of the small capitalization of the local company, it was believed the German interests were merely studying the possibility of establishing an Atlantic service, using Iceland as a base.

India

The policy of the Government has been to avoid operation of air services, but to encourage private enterprise in every way possible. Weather forecasting and communication services will be provided by the Government for any services that may be established. The Government has assisted in the formation of flying clubs and in the provision of airports, and has set up a Directorate of Civil Aviation.

An airship base at Karachi was made available for the airship service which was to be started between England and India in 1929. A total of $5,400,000 had been spent on the base at Karachi, and subsidies were to be granted.

The National Airways Company, Ltd., was formed in 1928 for the purpose of opening a service between Calcutta and Rangoon, operating both land and seaplanes. There was rumor of this company co-operating with the Imperial Airways on air routes in India, and between India and London.

The Bengal Air Transport Company was formed for commercial flying between Bengal and neighboring provinces. The Air Taxi and Transport Company, Ltd., was organized to furnish passenger and express freight service between various parts of India. The Eastern Airways, Ltd., of Bombay, proposed to organize services for passengers, mails and express between Bombay and Karachi, between Karachi and Delhi, and between Bombay and Calcutta, as well as between Bombay and Madras.

Imperial Airways announced that in 1929 regular weekly service would be extended to Karachi, from Basra, the present terminus of the Cairo-Basra line. The company planned to start a through service from London to Karachi via Basel, Switzerland, and points in Italy, Greece and Egypt.

The Royal Air Navigation Company of the Netherlands has carried out experimental flights across India to the Netherland East Indies, and expects to operate a regular service between the two countries.

Irish Free State

In December, 1928, it was announced that an 8-passenger De Havilland plane would be used in a regular service between Belfast, Glasgow and Liverpool. The venture was to be financed by Glasgow business men.

There is no civil airport in the country, but Baldonnel Field, near Dublin, operated by the military air forces, can be used by civil aircraft.

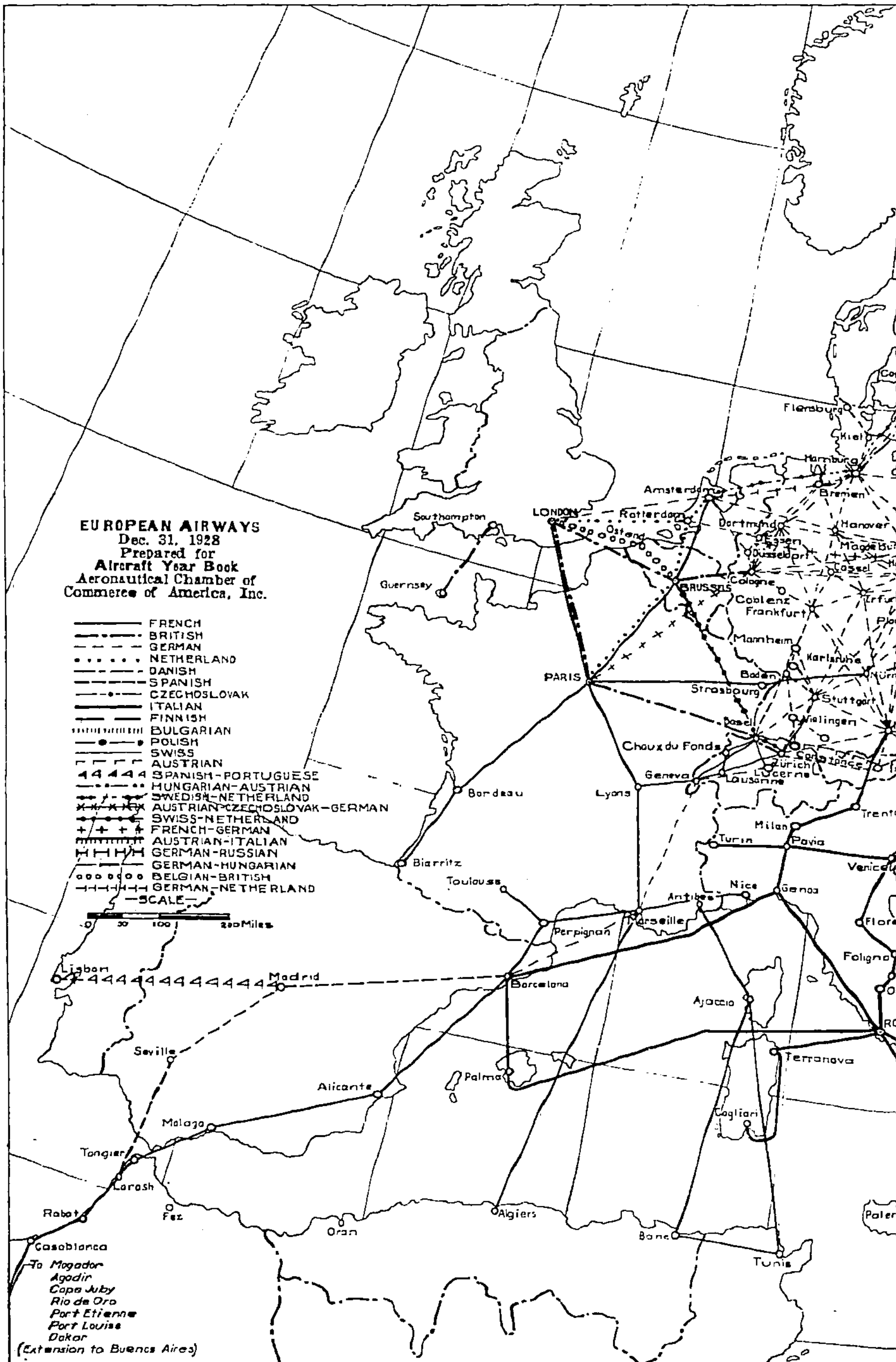
The Irish Free State is a member of the International Convention for Air Navigation and has its own military and naval air forces, each with a director responsible to the Minister for Defense, through the Chief of the General Staff.

Italy

The year witnessed a continuous expansion of civil air operations and an increase in use of the air services in Italy. The extension of air lines increased over 1927, and plans were made for additional lines in 1929. Late in 1928 there were 42 seaplanes and 12 land planes regularly employed on Italian air lines, with 44 pilots, 45 mechanics and 12 radio operators. Details of the equipment used as are follows:

Trieste-Turin and Trieste-Zara-Ancona, 10 single-motored seaplanes; Rome-Genoa and Rome-Naples-Palermo, 9 twin-motored seaplanes; Rome-Barcelona and Rome-Tripoli-Benghazi, 4 four-motored seaplanes; Brindisi-Athens-Constantinople, 8 bimotored seaplanes; Rome-Venice-Vienna, 1 trimotored airplane and 8 single-engine planes; Rome-Cagliari, 3 twin-motored seaplanes; Brindisi-Valona, a trimotored seaplane; Albanian routes, a single-motored seaplane and 3 single-motored planes; Rome-Milan-Munich, 6 trimotored planes.

The Societa Italiana Servizli Aerei operated the Turin-Pavia-Venice line throughout the greater part of 1928, but because of the


EUROPEAN AIRWAYS
Dec. 31, 1928
Prepared for
Aircraft Year Book
Aeronautical Chamber of
Commerce of America, Inc.
FRENCH
BRITISH
GERMAN
NETHERLAND
DANISH
SPANISH
CZECHOSLOVAK
ITALIAN
FINNISH
BULGARIAN
POLISH
SWISS
AUSTRIAN
SPANISH-PORTUGUESE
HUNGARIAN-AUSTRIAN
SWEDISH-NETHERLAND
AUSTRIAN-CZECHOSLOVAK-GERMAN
SWISS-NETHERLAND
FRENCH-GERMAN
AUSTRIAN-ITALIAN
GERMAN-RUSSIAN
GERMAN-HUNGARIAN
BELGIAN-BRITISH
GERMAN-NETHERLAND
SCALE
0
50
100
200 Miles
Flensburg
Kiel
Hamburg
Bremen
Amsterdam
LONDON
Rotterdam
Southampton
Ostend
Dortmund
Hanover
Essen
Dusseldorf
Cassel
Guernsey
BRUSSELS
Cologne
Coblenz
Frankfurt
Mannheim
Karlsruhe
PARIS
Baden
Strasbourg
Stuttgart
Basel
Chaux du Fonds
Constance
Zurich
Lucerne
Geneva
Lausanne
Bordeau
Lyons
Trent
Milan
Turin
Pavia
Biarritz
Toulouse
Nice
Antibes
Genoa
Perpignan
Marseille
Lisbon
Madrid
Barcelona
Ajaccio
Seville
Palma
Terranova
Alicante
Cagliari
Malaga
Tangier
Larash
Rabat
Fez
Algiers
Oran
Bone
Tunis
Casablanca
To Mogador
Agadir
Cape Juby
Rio de Oro
Port Etienne
Port Louise
Dakar
(Extension to Buenos Aires)


OSLO
HELSINGFORS
Leningrad
Finnish-Estonian
STOCKHOLM
Finnish-Swedish
Tallinn
Gottenburg
Kalmar
RIGA
MOSCOW
Malmo
Memel
KOVNO
Smolensk
Tilsit
Stolp
Danzig
Koenigsberg
Elbing
Stralsund
Lübeck
Swinemünde
Allenstein
Schwerin
Stettin
Posen
WARSAW
BERLIN
Lodz
Breslau
Dresden
Leipzig
Görlitz
PRAGUE
Karlsbad
Gleiwitz
Cracow
Lemberg
Brno
Bratislava
Czernowitz
Salzburg
Reichenhall
VIENNA
Innsbruck
Graz
BUDAPEST
Klagenfurt
Trieste
Lussinpiccolo
Zara
BELGRADE
BUCHAREST
SOFIA
Varna
Scutari
Tirana
CONSTANTINOPLE
Naples
Brindisi
Valona
Kortscha
ATHENS
Syracus
To Tripoli

fogs and rough weather on the western portion of the route a change was made late in 1928 so that for a few weeks the service was scheduled to be operated as follows: Trieste-Zara-Antona-Venice, Trieste-Lussinpiccolo-Zara, 160 miles, except for a few weeks during the winter the services were daily. In November, 1928, they were reduced to three flights per week.

The Societa Anonima di Navigazione Aerea operated between Genoa and Rome, 267 miles, and between Rome and Palermo via Naples, 398 miles. Beginning Nov. 1, 1928, the company started a service between Rome, Siracusa and Tripoli, 751 miles. Beginning Nov. 5, 1928, the same company started a weekly service between Rome, Genoa, and Barcelona, 633 miles.

The Societa Anonima Aeroespresso Italiana continued its mail, passenger and express service between Brindisi-Athens-Constantinople, 893 miles.

The Societa Transadriatica maintained daily mail, passenger, and express service between Rome and Venice, 310 miles. The company's planes fly three days a week between Venice-Klagenfurt-Graz-Vienna, 317 miles. On the other three days of each week planes of the Austrian Air Transportation Company fly over that route.

The Societa Anonima Avio Linee Italianne started a three-times-a-week service between Rome and Milan, Oct. 29, 1928. The Milan, Trento, Monaco section was started May 13, 1928, and three flights a week were made during the summer months. The entire route is 472 miles long.

The Societa Aerea Mediterranea started a Rome-Terranova-Cagliari, 317 miles, service April 21, 1928. The company's three-times-a-week service between Brindisi and Valona, 81 miles, began April 21, 1928.

The Italian system of airways, measuring 5,155 miles in length, were to be increased in 1929 by an extension from Tripoli to Bengasi and by additional services within Italy.

The latest reports state that there are 14 manufacturers of aircraft and aircraft motors in Italy. Four make commercial planes. In order to sponsor pleasure flying the Government in 1928 offered inducements in the way of bonuses to factories which could produce a light plane at reasonable cost. As a result Italian factories turned out 8 types of two-place 85 hp. planes to sell at approximately $2,600.

All aviation is controlled by the Air Ministry, headed by Premier Mussolini, who is assisted by the Under Secretary of State for Aviation, General Italo Balbo. General Balbo has a Chief of

Staff directly charged with problems of military and naval aviation.

The appropriation for civil aviation in 1928-29 totaled 49,830,000 lire, as follows:

	Lire
For subsidies to commercial airlines	48,500,000
For exhibition and other advertising	500,000
For expenses for the erection of State controlled post at Civil Airports	500,000
For aerological and meteorological service	330,000
Total for civil aviation	49,830,000

Subsidies for commercial flying in Italy during 1928 amounted to approximately one-half of the cost of the operations. In addition to that aid the Government took part in the capitalization of companies, exempted them from customs and other taxes on fuel and lubricants and on the necessary equipment to be imported, as well as other charges.

There are 13 airports for land planes and 13 for seaplanes in Italy, Sicily and Sardinia. Each of the four colonies has a single authorized landing field and an airport for seaplanes. There are two fields for dirigibles in Italy and one in Sicily. The Littorio airport at Rome, opened early in 1928, was promoted by the National Aeronautical Company.

The new Milan airport will have a basin for seaplanes and will be 2,500 meters long by 200 meters wide and 629 meters deep.

Japan

In addition to the army and navy arsenals which manufacture aircraft several private companies are engaged in the new industry, including 6 important plane builders and 4 aircraft engine manufacturers. These companies build to their own designs and also have several foreign designs under license.

Civil aviation is directed by the Bureau of Aviation in the Ministry of Communications. There were 275 licensed pilots in 1928. A requirement for the first class license is 300 hours of flying.

There were five regular air mail services in Japan in 1928. The Togai Teiki Kokukai using 10 planes made daily flights between Tokyo and Osaka, 292 miles, and maintained, with 3 planes, a weekly service between Tokyo and Sendai, 230 miles. Nippon Koku Kubushiki Kaisha used 8 seaplanes in services between Osaka and Fukuoka, 304 miles, twice a week, and between Osaka and Beppa, 251 miles, three times a week. Nippon Koku Yuso Kenkyujo, with

5 seaplanes, maintained a service three times a week between Sakai, Imajaru and Oita, 251 miles.

The Bureau of Civil Aeronautics developed the plan for a 10,000,000 yen corporation to operate the Tokyo-Diaren and Osaka-Shanghai services. This became the Japan Air Transportation Co., the promoters of which announced in August that 80,000 shares were allotted to five large private banks and 120,000 shares to the public. An initial payment of 12.50 yen was required on the shares, worth 50 yen each. The Government decided to aid the company further by spending 1,248,000 yen in 1929-30, 1,280,000 yen in 1930-31, and 1,316,000 yen in 1931-32, on all airways. The Government arranged to give a subsidy of 19,970,000 yen during 11 years.

Radio stations for the airways were established at Tokyo, Hakone, Nara, Osaka and Fukuoka. Route marks were prepared at eight places between Tokyo and Fukuoka.

A preliminary flight between Osaka, Fukuoka and Shanghai, China, 900 miles, was made by a large seaplane in October, when it was announced that the Japan Air Transportation Co. would serve the three cities regularly. Flights were made over another proposed route of the company, between Tokyo and Dairen, Manchuria, via Osaka, Fukuoka and Keijo, 1,289 miles.

The company planned to start both international services on April 1, 1929. Six Super-Universal Fokker monoplanes from the United States and powered with "Jupiter" engines and 6 Fokker F7-3M's from the Netherlands and powered with Wright "Whirlwind" engines were to be used. Large seaplanes were to be operated on the Fukuoka-Shanghai section, 562 miles. Daily flights in each direction over both routes were to be made with mail, passengers and express.

There are 42 civil airports and landing fields in Japan, but the only one well-equipped is at Osaka. The airports at Tokyo and Fukuoka are practically complete. There are no lighting facilities for night flying.

Ten rebuilt planes are employed at a civil pilots' training school at Nogaya.

The Imperial Aviation Society aids in the development of civil aviation. Funds were collected in 1928 to attempt a Pacific flight in a large Japanese plane.

Latvia

The Berlin-Moscow service of the German-Russian Air Transportation Company was started via Riga on May 10, 1928. A new

service by the same company was inaugurated on June 7, 1928, from Riga to Leningrad, Russia, via Tallinn, Estonia. Both services were terminated before the end of the year.

Mexico

Eleven planes were operated by the Mexican Aviation Company in 1928, including 4 Standard planes, 2 Travel Airs and 5 Fairchild monoplanes. The company continued to carry on the work for which it was organized, that is, the carrying of payrolls for the petroleum companies at and near Tampico. In addition the company's regular service between Tampico and Mexico City, which was inaugurated April 15, 1928, continued throughout the year. This route of 250 miles via Tuxpan was covered in 3 hours regularly.

On Nov. 1, 1928, the company started its 640 miles service three times a week between Vera Cruz, Minatitlan, Villahermosa, Ciudad Del Carmen, Campeche and Merida. Soon the planes were filled to capacity as the air route proved popular for transport of passengers, mail and express between Mexico City and the other points. It was planned to start a daily air mail service between Brownsville, Texas, and Mexico City on March 9, 1929, following arrangements made between the Post Office Departments of Mexico and the United States.

On the Mexico-Tampico route 15,106 kilograms of mail and 1,285 passengers were carried during 1928. On the Vera Cruz-Merida route the company's planes carried 8,669 kilograms of mail, and 320 passengers during the period of operation from November to the end of the year. They flew a total of 389,078 miles. Some 2,230 passengers were carried in the company's taxi service which was independent of the regular line.

A daily air mail service was provided by the Mexican Government between Mexico City and Laredo via Queretaro, Potosi and Monterey. This service was maintained with military airplanes and flown by military pilots. It proved successful from an operating standpoint.

Several planes were built in 1928 at a factory in Tia Juana. Machines for military service are produced at the Government plant in Mexico City.

Netherlands and Netherlands East Indies

The Royal Air Navigation Company (K. L. M.), the only air transport line in Holland, operated 21 Fokker planes during 1928,

between Amsterdam, Rotterdam, London, Paris, Brussels, Copenhagen, Malmo, Hamburg and Zurich.

The operating table of the company follows:

	1928	*1927*	*1926*
Miles flown	1,007,720	817,031	556,007
Passengers carried	17,165	12,916	6,275
Express (Lbs.)	1,516,639	886,122	562,451
Letter mail (Lbs.)	77,360	41,478	5,227

The company has been one of the most successful in Europe. Its operating costs per ton kilometer of traffic carried has been reduced with constantly increasing operations.

Several experimental flights were made between Holland and the Netherlands East Indies during the year, and plans were laid for increasing these flights until within two or three years regular service could be made available.

There are three manufacturers of aircraft in Holland, but no motors are built. The most important building company is that which manufactures the Fokker planes. Another company has produced several Dornier machines for the Government, and the third has built a number of sport planes.

Two Fokker monoplanes were operated by the Netherlands East Indies Air Navigation Company on its daily services between Batavia and Bandoeng and between Batavia and Semarang. The planes were flown from the Netherlands to the East Indies. It is planned to extend the service from Batavia to Singapore, British Straits Settlements, via Palembang and Medan.

New Zealand

There were no regular air services, but approximately 8 aircraft were owned and employed by flying clubs and individuals in New Zealand during 1928. An American airplane was imported late in the year. The Government purchased 8 British planes, four of which were to be given to two flying clubs. Appropriations for the air forces totaled £33,206 for the fiscal year.

Air transport lines between Great Britain and New Zealand, via Australia, have been considered.

Nicaragua

A 4-passenger American plane was operated by the Tela Railroad Company in its twice-a-week service between Tela San Pedro and Tegucigalpa, 160 miles. Another modern plane, much smaller

and carrying two passengers, was used for aerial photographic work and company transport. Other than these new American planes, there were no aircraft employed in civil undertakings. The Pan-American Airways, Inc., was to start in 1929 a regular service via Tegucigalpa, on its route between Miami and Panama.

Norway

The Deutsche Luft Hansa operated a three-times-a-week service between Oslo, Gothenburg, Copenhagen and Stettin from May 20 to Sept. 1, 1928. About 700 passengers were flown.

A Norwegian company, the Norske Luftruter, is interested in providing air services within Norway. For the fiscal year 1927-28 about $13,000 was appropriated for civil aviation, $7,500 for an airport and $2,500 for experimental flying. During 1929 $2,500 was to be spent improving the airport at Oslo.

Paraguay

The air service to be provided by the French company Aeropostale operating between France and Argentina was not started during the year, although experimental flights were made between Argentina and Asuncion. Company experts surveyed landing field sites along the route and efforts were made to establish facilities at the Uruguayan capital. The French company planned to start operations early in 1929.

Persia

The extension of services by the Junkers Company of Germany, and Teheran, Persia, was an important development in Persia, a country of wide distances and few highways.

A weekly service between Teheran and Bushire, via Ispahan and Khorramabad, 510 miles, was started April 20, 1928. The Teheran-Pehlevi service was started Feb. 11. A third line is that between Teheran and Kasr-i-Shirin, 400 miles, on the Iraq frontier where connection is made with train service on the railroad to Bagdad. In November, 1928, the company's planes flew 19,872 miles and carried 600 passengers, 500 kgs. of mail and 7,500 kgs. of baggage and express.

Peru

Civil air transportation made great progress in Peru during 1928 when three regular air services were maintained with constantly increasing traffic.

By a decree of May 28, 1928, the Huff-Daland Dusters, Inc., an American organization, which has been dusting cotton fields in Peru for several years, was granted permission to establish an air mail, passenger and express service in Peru, and between Peru and the United States. Later the concession was transferred to the Peruvian Airways Corporation. The regular weekly service of the company was started on Sept. 13, 1928, with a Fairchild 5-passenger cabin monoplane powered with a "Whirlwind" engine. Mail dispatched from Lima on the morning following the departure of the mail steamer for the United States is delivered to the vessel at Talara on the following afternoon. The extra charge for carrying a letter by air is equivalent to 20 cents.

From Sept. 13 to Dec. 31, 1928, the Peruvian Airways Corporation carried 135 passengers and flew more than 24,800 miles. It was planned to extend the Peruvian Airways from Talara to the Panama Canal where connections will be made with the Pan-American Airways, and later, to make extensions to Chilean and Argentine cities.

On June 6, 1928, the Compania de Aviacion Faucett S. A. was granted permission to maintain regular air mail, passenger and goods services along the Peruvian coast. Elmer Faucett, an American, has been in Peru since 1920 operating an aerial taxi service and has landed with surgeons, patients, business travelers, and Government officials at every important town in Peru. His flying has averaged 35,000 miles a year with 300 passengers annually. Following the formation of the corporation with Peruvian and American capital 2 Stinson-Detroiter 6-passenger monoplanes equipped with "Whirlwind" motors were purchased, and regular flights were started in September.

One of the company's planes leaves the airport at Lima for Talara over the same route of the Peruvian Airways Corporation on Tuesdays and returns to Lima on Wednesdays. On Friday one of the planes leaves Lima for Arequipa in Southern Peru, a distance of 550 miles, via intermediate points, with stops according to traffic requirements. The company up to Dec. 31, 1928, carried 242 passengers in regular flights over a distance of 30,000 miles and also flew 100 persons on sightseeing trips about Lima.

Another commercial service, although it is maintained by the Peruvian Naval air forces, is that between La Merced and Iquitos, authorized by a supreme resolution of Sept. 20, 1926. This route of 600 miles lies over a chain of mountains and along the Amazon and branches of that river. Six Keystone planes equipped with "Whirlwind" motors, with capacity for 2 passengers, a pilot and

400 pounds of mail or baggage and fuel for 400 miles of flight were put in service on Jan. 3, 1928.

During the year 9,000 pounds of mail, about 14,000 pounds of personal baggage, some express, and 140 passengers were carried in a total of 80,000 miles of flying. The service became very popular during the summer and it was necessary to book passage as early as six weeks in advance to obtain a place during a regular flight.

In 1928 about 40,000 acres of cotton were dusted by the Huff-Daland organization and contracts were arranged for dusting 24,000 acres during 1929. It is expected that this acreage will be increased greatly during the early part of 1929. The Keystone plane designed especially for this work carries 600 pounds of poison and the operations have been highly successful.

For 1929 the Government appropriated $19,440,000 for the Iquitos Air Line. Approximately $96,000 was allowed for purchases of equipment and material and $48,000 for the naval air station at Ancon. In addition approximately $440,000 was to be spent for new military aircraft.

Philippine Islands

The Philippine Airways, Inc., was formed late in 1927 with $15,000 capital, of which one-half was paid in promptly. The company was authorized under its charter to operate a training school and regular air transport, engage in aerial photography, exhibition flights and other work.

Regular air services have not been started, but the company has carried passengers on sightseeing flights about the city of Manila for a charge of $10 a person. One American plane is employed by the company. Another American plane is owned by an individual who flies about the Islands in connection with his business.

Poland

The Polish Air Line maintained a service most of the year between Danzig-Warsaw-Lemberg, 380 miles, between Warsaw-Krakow-Lemberg, 190 miles, and Lodz-Warsaw, 75 miles. The Aero Company of Posen operated a regular line during the summer between Posen and Warsaw, 180 miles, and between Posen and Lodz, 116 miles.

During the first 10 months of 1928 the Polish lines made 3,492 flights, covered 650,000 miles and carried 6,593 passengers, 217,825 kilograms of express and 28,784 kilograms of mail.

The concessions for both companies expired at the end of 1928,

and beginning Jan. 1, 1929, the Polish Government through the Ministry of Communications, was to operate through the Air Navigation Company (or Lot), take over all civil air transportation services and also operate others soon to be established.

The French Campagnie Internationale de Navigation Aérienne maintains its daily service between Paris and Warsaw. That company's concession in Poland will expire Dec. 31, 1930.

For the fiscal year 1927-28 an appropriation of 6,500,000 zlotys was granted for the development of civil aviation. Of this sum 5,400,000 zlotys was distributed as a subsidy according to the mileage flown. The Government provides meteorological information by wireless to the operating planes every two hours and at each airport, from 24 meteorological stations and observatories.

Porto Rico

The West Indian Aerial Express, Inc., maintained an office at San Juan, and operated from the military airport near the city from December, 1927, until late in 1928.

Portugal

The Services Aerios Portugueses, Ltd., in cooperation with the Union Aerea Espanola started their Lisbon-Madrid and Lisbon-Seville lines in June, 1927. Junkers G-24 planes were used. The Lisbon-Seville service was discontinued in March, 1928, but the 305-mile route between Lisbon and Madrid was covered by three round trips a week through the year.

A service between Lisbon and the Azores and one between Lisbon and Portuguese East Africa have been proposed. Portuguese flyers have covered the latter route of 9,000 miles in 51 days.

Rumania

The Government started an experimental air mail, express and passenger service between Bucharest and Cluj, Bucharest, Jalatz and Kischineff, Bucharest, Jassay and Czernowitz in August, 1928. In October the schedule was changed to three trips a week on each line. Passenger fares were about the same as railroad fares. From Aug. 20 to Sept. 20, the line carried 2,095 passengers and 3,467 kilograms of mail and express.

An aircraft manufacturing plant was opened in October at Braso, 100 miles north of Bucharest. It was planned to produce 300 airplanes and 300 engines annually. Formerly aircraft were manufactured at the Astra Works, but that plant has been abandoned.

About $1,548,000 was appropriated for personnel and materials for 1928. The subsidy allowance was $9,000 and that for airports $9,600. The subsidy was paid to the French company operating the service between Paris and Constantinople. The Government provides the airports. That at Bucharest is equipped with radio direction finding apparatus, a weather reporting service, which sends weather information to other airports.

Russia

The Ukranian Air Navigation Co. in 1928 operated 1,813 miles of air lines between Moscow, Charkow, Artemovsk, Rostow, Mineralniie, Wodi, Grosnii, Petrowsk, Baku and Tiflis. It was reported that the company's planes carried 2,664 passengers and 29,633 kilos of express in their daily service which was maintained during the warm months. The company cooperated with the Junkers concern in Persia by exchanging traffic at Baku, in accordance with agreements made late in 1927 by the companies and the governments concerned.

The Dobrolet, Volunteer Aviation Co., of Moscow, maintained services at less frequent intervals over 3,900 miles of lines. The routes extended from Tashkent to Diushambe via Samarkand and Termez, Tashkent to Kobul, Fremze to Ata via Alma, and between Irkutsk and Yakutsk, with a branch leading to the Bodaibo region. German and Russian equipment were used.

The Deruluft, German-Russian Air Transportation Co., operated planes carrying 6 passengers, a pilot and a mechanic, of the Fokker III, and Dornier all-metal types on its Berlin-Danzig-Konigsberg-Riga-Smolensk-Moscow service, 1,153 miles, maintained from May 10 till Nov. 1. The same company used Junkers 4-passenger planes in its branch line service, opened for the first time between Riga and Leningrad via Tallinn, 386 miles, from June 7 until Nov. 1. Both services were to be resumed April 1, 1929.

All told, Russion air lines covered 14,427 miles of routes in 1928, as against 7,022 miles in 1927. There were no fatalities in either year.

Civil as well as military and naval aviation are controlled by the People's Commissary for Armies and Navy, under which comes the Commander of Military Aviation. His General Staff includes managers of all branches of aviation. The Air Military Academy is the most important among several schools. Russia has 6 aircraft factories and other shops, a technical research and other aviation organizations. The Moscow Aero-Hydrodynamic Institute has three aerodynamic tunnels.

The Soviet Government granted the equivalent of $1,310,000 in subsidies for the private operators during a recent fiscal year. It has given additional aid and encouragement.

Several societies were merged, forming the "Ossoaviachim," with a membership of 4,000,000 persons who are called upon to give varying sums to aid the development of the military air forces.

Siam

Some commercial flights have been made by the military air forces in Siam, and there are airports established at Donmuang, Chieng Mai and Ubol. All of these are equipped with custom facilities and other necessities for civil aircraft.

There is a military factory near Bangkok, where planes are built for the air forces. French engines are imported, and a large number of complete French aircraft are in use by the army.

Special arrangements have been made for the carriage of air mail from Siam to Europe on the planes of the Royal Air Navigation Company of the Netherlands, which make frequent flights over the route between Holland and the Netherland East Indies.

Spain

German planes were used in a mail service started Jan. 7, 1928, between Madrid and Barcelona, 325 miles, and operated by the Compania Iberia de Transportes Aerea S. A. of Madrid. The service connects with the Deutsche Luft Hansa between Barcelona and Germany via Marseilles and cities in Switzerland. Connection is made also with the French line between France and South America via points in North Africa, and since December, 1928, with the Italian line operating between Barcelona and points in Italy.

The Compania Española de Trafico Aereo operates a daily service between Seville and Larasch, 125 miles. The short service between Spain and Spanish Morocco has been in operation for several years and has proved successful.

Prior to 1928 the civil air policy of the Spanish Government provided for the granting of concessions for each and every suggested route. During the years between 1924 and 1928 more than a dozen concessions were approved and only two resulted in regular air services, the Seville-Larasch and the Madrid-Lisbon-Seville lines. Early in 1928 the Government adopted a new policy.

It provided for a monopoly on all civil air transportation in Spain with the exception of the airship service to be developed

Army planes over Taal Volcano, Hawaii.

between Seville and Argentina. A new company was awarded the monopoly Dec. 31, 1928.

Existing operating companies, financial institutions and the aeronautical manufacturing industry are represented in the new company which must have a minimum capital of three times the 3,000,000 pesetas granted by the Government as a subsidy for the first year. For the year 1929 3,000,000 pesetas was appropriated to subsidize regular air services and 1,000,000 pesetas was allocated for the construction and maintenance of airports.

The Compania Colon Aeronautica, which holds the concession for the airship service between Spain and Argentina, continued to develop its terminal facilities at Seville. The mooring tower will be 50 meters high. Repair facilities, lodgings, and other conveniences will be prepared. The total cost of the terminal when completed will be about 30,000,000 pesetas.

The 1929 budget contains the following appropriations: For the presidency for Superior Council of Aeronautics, 183,000 pesetas; for the aeronautic personnel in the Ministry of War, 6,761,864 pesetas; for other purposes, Ministry of War, 22,103,130 pesetas; for the naval air forces, Ministry of Marine, 2,710,453 pesetas.

Straits Settlements

There was no regular air service in the Straits Settlements during the year, but the Eastern Airways, Ltd., proposed to the Colonial Government that it provide financial aid and a mail contract for a service to be provided twice a week, and later daily, between Singapore, Port Swettanham and Penang, 425 miles. It was planned to coöperate with the Netherlands East Indian Company and extend the service to important cities in the Netherlands East Indies. Ultimately, it is expected, the proposed service in the Straits Settlements will be a link in the air line between Great Britain and Australia.

The light airplane club of Singapore, with 116 members, has the distinction of being the only light seaplane club in the world.

Sweden

Eight planes were employed by the Swedish Air Transportation Co. in a daily mail, passenger and express service over the routes, Malmo-Copenhagen-Hamburg-Amsterdam, 453 miles; and Stockholm-Abo-Helsingfors, 258 miles.

The traffic of the Swedish company since its formation is shown here:

Year	*Kilometers flown*	*Passengers carried (No.)*	*Mail carried (Kgs.)*	*Express and baggage carried (Kgs.)*
1924	154,860	3,230	1,072	481
1925	348,187	10,026	7,058	48,981
1926	340,933	10,176	9,998	57,795
1927	328,882	14,695	6,998	83,035
1928	335,618	14,948	15,291	84,915
Totals	1,508,480	53,075	40,417	275,207

Switzerland

Two Swiss companies used 35 planes in their several services operated between April and October, 1928. The Ad Astra Company maintained passenger, mail and express service between Geneva, Lausanne, Cheux de Fonds and Basle and between Lausanne, Bienne and Zurich. German, Austrian and British companies also serve Switzerland.

On the four Swiss lines, measuring 894 kilometers in length, the planes flew 183,416 kilometers in a total of 1,664 flying hours, carried 2,090 passengers, 23,312 kilograms of mail, 34,162 kilograms of

express and 2,488 kilograms of baggage. The planes flew with about one-third, as an average, of the space filled.

A contract was signed on March 21, 1928, by the air transportation companies and the Swiss Federal Railways providing for the exchange of express traffic. Arrangements were made for any carrier concerned to accept express for shipment over any existing service and for convenient exchanges of such shipments.

Turkey

About 175 planes are reported in operation in Turkey and most of them are used by the military forces.

The French Compagnie Internationale de Navigation Aerienne operates between Constantinople and Belgrade, Yugoslavia. It maintained three flights a week between Belgrade and Constantinople via Bucharest, and the same number via Sofia during the first three and last two months of the year. There were daily flights in 1928, by way of Sofia. There is no field lighting equipment, but weather reporting and communication services are provided by the army. The San Stefano airport is reached by automobile in 45 minutes from Constantinople.

The Societa Aeroespresso Italiana maintains a three-times-a-week service between Constantinople, Athens and Brindisi. During the summer months, its planes fly from Constantinople to Brindisi, and vice versa, within the light hours of one day, while in winter two days are required for the flight. That compares with the three-day flight between Constantinople and Paris over the French route during the winter months, and three days less six hours during the summer months.

A factory was built in Turkey by German interests and the intention was to supply the military forces with planes made locally. It is reported, however, that plans failed to materialize, and that the factory probably will cease all operations, which have been limited practically to the repair and maintenance of military aircraft.

Details of the Government appropriations for aeronautics are not published, but have been estimated as the equivalent of $1,500,000 for the year ended May 31, 1928.

The principal force tending to develop aviation and air transportation in Turkey is the Aviation League, supported by the Government and the public. The League, with a membership of 200,000, is reported to have purchased 69 aircraft, named after cities in the country, and placed them at the disposal of the military forces. Its plan includes several air lines within Turkey.

Union of South Africa

There was no regular air service in the Union during the year, although plans announced late in 1927 for a service between Johannesburg and Durban are expected to materialize. The Government has provided £8,000 annually as a cash subsidy for the operators, African Airways, Ltd. In addition to this cash subsidy the Government will pay for the transportation of mails.

A mooring mast will be erected at Durban, to be used by the British airships which are to ply between Great Britain, South Africa and India.

The airplane is used privately to transport large quantities of diamonds which have been sent out by air. Several flights between South Africa and England have been made, and interest in aviation is increasing throughout the Union.

Uruguay

The French company, Aéropostale, started weekly services between Buenos Aires and cities in Brazil in November, 1927. In January, 1928, the weekly service was connected with that extending from France to Dakar on the west coast of Africa by means of ocean vessels between Natal on the north coast of Brazil and Dakar.

A daily service between Montevideo and Buenos Aires was scheduled to begin under the direction of the Argentine company, Compania de Taxi Aero, which planned to employ 3 cabin seaplanes. Each plane would carry passengers, express and mail.

Venezuela

Military aviation is under the control of the Ministry of War and Marine and under the direct supervision of the Director of Military Aviation, Col. Daniel Lopez Henrique. He is also director of the School of Military Aviation at Caracas. Colonel Lindbergh during his visit to Venezuela stopped at the airport of Maracay, which is under the direct supervision of the Ministry. Several emergency landing fields have been laid out in different parts of the republic, but they are for the use of military authorities only.

Yugoslavia

The French Compagnie Internationale de Navigation Aérienne maintained a daily service between Paris and Belgrade throughout most of the year. From Belgrade to Constantinople the schedule was three times a week. The Yugoslav Air Transportation Company started its mail, passenger and express service between Bel-

grade and Zagreb, 235 miles, on Feb. 15, 1928. The company planned to extend operations from Belgrade to Sarajevo and Podgoritzea.

It was reported that the Ministry of Commerce had granted permission for a company known as the Airplane Motor Industry, Ltd., to erect an airplane building factory at Rakovice.

Vought *Corsair* amphibian with Pratt & Whitney *Wasp* engine.

CHAPTER XIV

TECHNICAL DEVELOPMENT

THE engineering and design branches of the American aircraft industry in 1928 based their work on a firm foundation of technical standards. Broadly, the trend was toward the evolution of types rather than revolution in design.

The efficient operations of the Department of Commerce in examining and approving planes and engines and their success in making such equipment encouraged the constructors to start quantity production on a number of orthodox types. At the same time experimentation in engineering and design was carried on throughout the industry, with the result that it was in a healthy, vigorous state at the end of the year.

The commercial plane manufacturers had produced a group of well-developed types for all uses, and they had attained improved performance through both increased power and aerodynamic refinement.

The engine builders, while conducting experiments with new designs, were producing a variety of motors sufficient to cover the entire field, thus giving the plane designers more latitude than formerly in the selection of a power plant.

The 3-place, open cockpit biplane maintained its leadership in point of numbers produced. Continuous refinement has brought these general purpose planes to a fair degree of efficiency; they represent a marked improvement over the war machines from which they were developed. Reasons for their popularity may be found in their low cost and simplicity.

All the 3-place open planes were of the single bay tractor type, designed originally for the Curtiss OX-5 engine, and weighing, fully loaded, between 2,000 and 2,650 pounds. However, the large production of this type in 1928 and the limited supply of OX-5 engines resulted in some confusion, and several manufacturers began offering such machines with other power plants.

While the substitution of more powerful motors served to increase the performance, it also placed those planes in a higher price class. That in turn created a market for the new light plane with modern engines replacing the low-priced OX-5 motors out of the war surplus.

The light sport plane had been undergoing a rather belated de-

velopment in the United States and the fact that it made progress during the year may be attributed to the production of proper motors. Still, the demand for such a type was growing with the increased number of persons taking pilot instruction and the organization of light plane clubs for the purpose of teaching their members to fly. While few of the light machines reached the production stage in 1928, several models were scheduled to be manufactured in quantity.

They range between 1,000 and 2,000 pounds in weight and have motors of 50 to 110 horsepower. They are about evenly divided between single and double wing types. The biplanes are principally of the 2-place tandem type. The monoplanes are mostly of semi-cantilever construction.

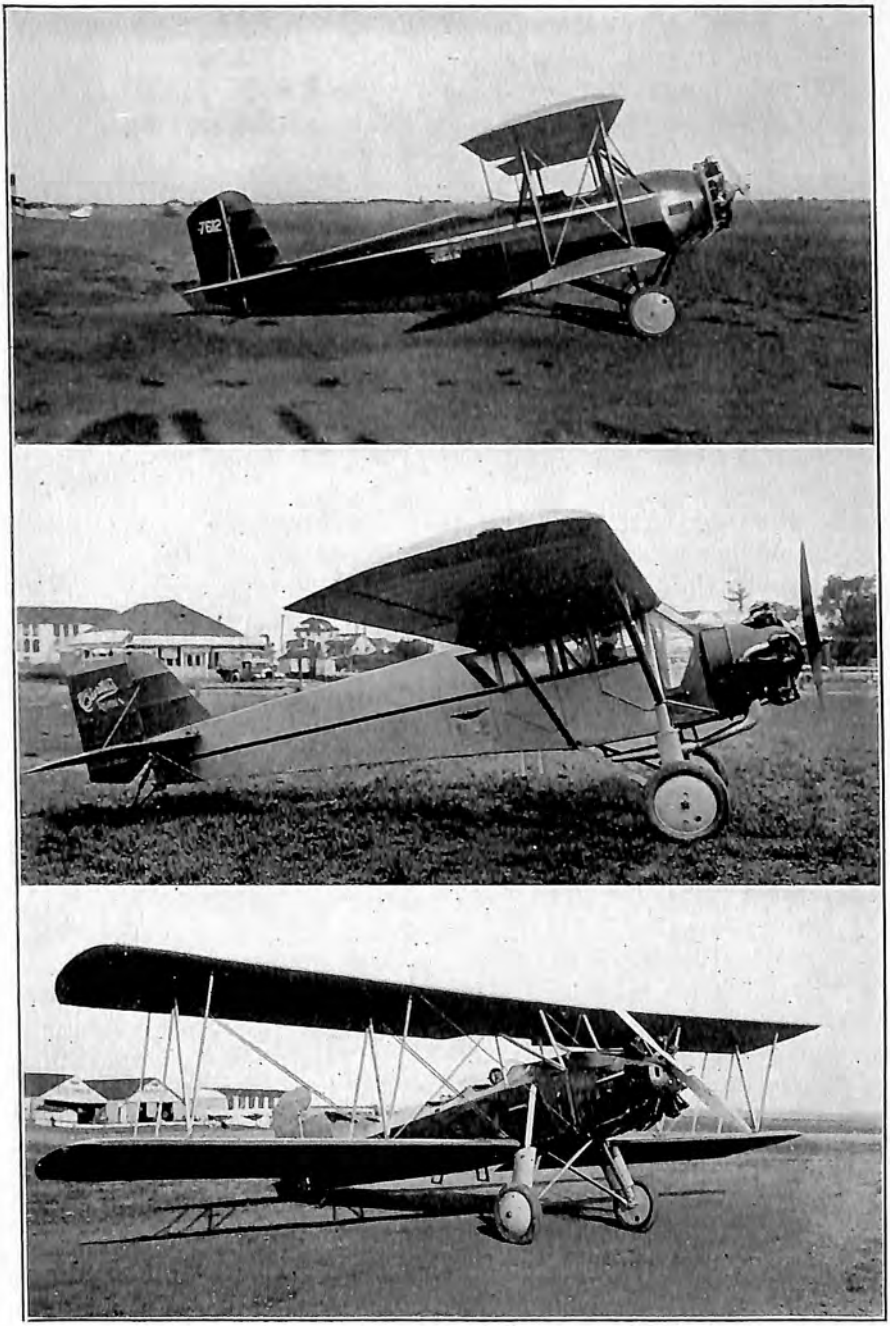
While a number of the designers seemed to favor the open cockpit type for training, the production of the Curtiss "Robin" with OX-5 engine, an enclosed cabin monoplane, demonstrated by its performance that such types might be as efficient as the open ship.

The "Robin" has also attracted attention to the advantages of an enclosed cabin plane even in the low-priced class. Another cabin monoplane produced during the year is the Aerial Service Corporation's "Mercury Kitten" with all-metal wing structure. Among the biplanes within that light weight range are the Consolidated "Husky Junior" with Warner "Scarab" engine, and the Swallow T-P with OX-5 or any other engine between 80 and 100 horsepower.

The low wing monoplane for sport or training is also found in the above weight range, and the type promises to meet with favor. Representative of the group is the Fairchild-21, with tail structure of alclad aluminum alloy, and the Aeromarine-Klemm, an adaptation of an original German design.

Relatively large numbers of the Wright "Whirlwind" powered cabin monoplanes popularized by the Atlantic flights, including the Ryan and Stinson types, were produced without fundamental changes. They weighed between 3,000 and 4,000 pounds, with wings of uniform thickness, braced externally with struts and with the section attached to the top of the fuselage.

The large transport planes were attracting more attention at the end of the year than ever before, interest being caused by the rapid development of the passenger carrying lines and the growing volume of air mail and express. Several new types were in production and many others were being planned. The big planes were distinguished for increased pay load capacity and improved



(Top) Spartan biplane. (Center) Curtiss *Robin* 3-place cabin monoplane with Curtiss *Challenger* engine. (Bottom) Curtiss *Fledgling* training plane, *Challenger* powered.

performance, among them being the Boeing Model 80, Fokker F-10 and F-10-A and the Keystone "Patrician," all tri-engined, the first a biplane and the others monoplanes.

The Fokker planes follow the practice of laminated plywood wing and welded steel tubing and fabric for the fuselage, and are powered with three Pratt & Whitney "Wasp" engines. The Keystone "Patrician" is powered with three Wright "Cyclone" engines and has a welded steel tube wing and fuselage structure. The Boeing transport plane, with three "Wasps" or "Hornets," is of conventional construction.

Prior to 1928 the trend appeared to lie in the direction of cabin monoplanes, with the open machines of the biplane type. There were at that time few open monoplanes. During the year, however, several cabin biplanes were developed.

In the multi-motored group the cabin biplane was represented by the previously mentioned Boeing Model 80. In the single engine lower weight class there were several cabin biplanes of recent design.

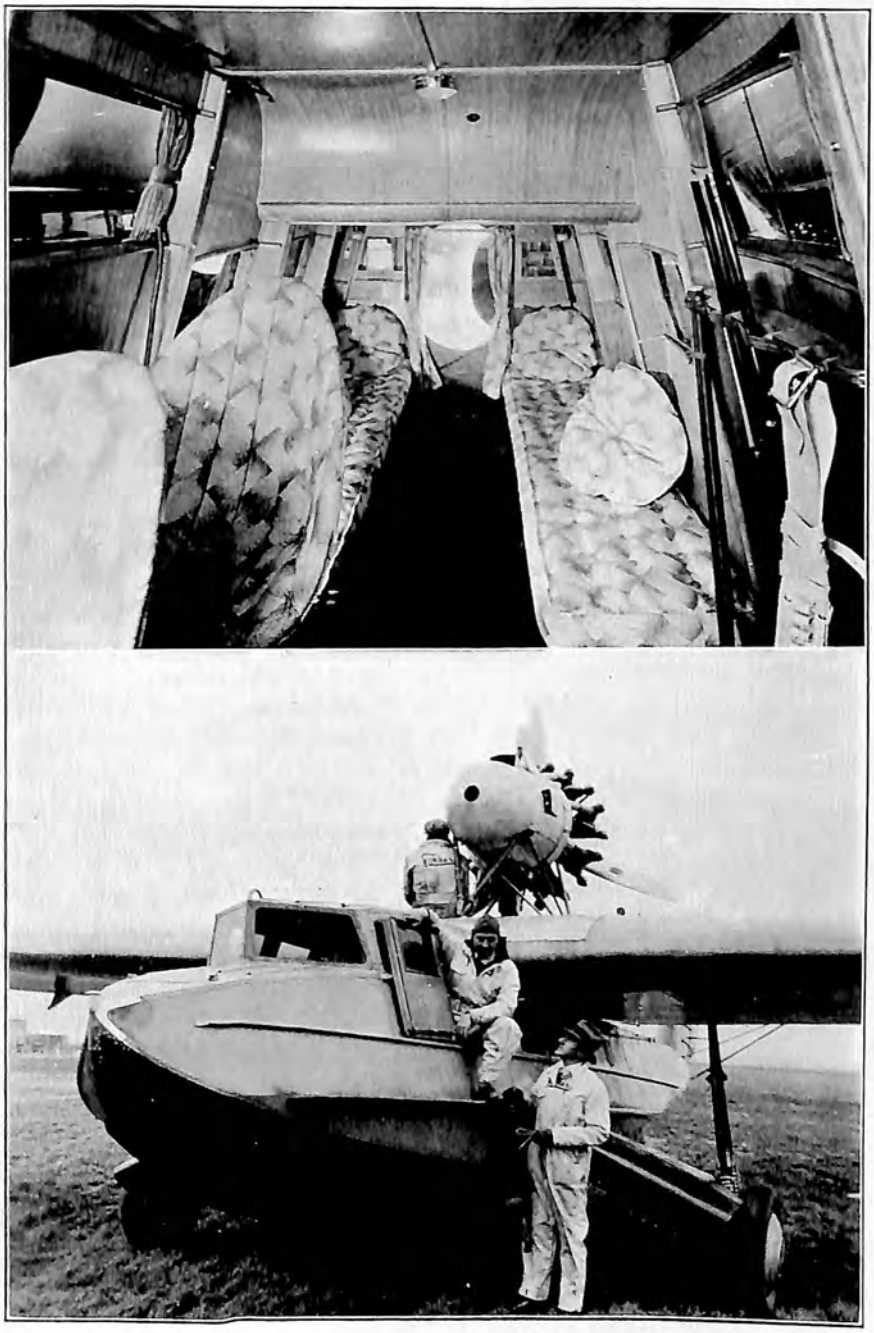
The light tri-engined plane represented another new development, and several models were scheduled for production in 1929. Meanwhile, a number of American designers were convinced that the day of the six or ten engine plane is not far distant, and the experiments of the European designers along that line were being watched with considerable interest.

There was more activity in the amphibian field than ever before. Several successful amphibians were either developed or existing types improved and put in production during the year, notably the Loening "Air Yacht," the Fairchild, Fokker, Ireland and Sikorsky, and in the lighter class the Vought pontoon "Corsair."

The Fokker amphibian, which was introduced late in 1928, is a monoplane; a feature of the design is the mounting of the engine in a streamlined nacelle above the wing. The installation is of the pusher type. The retractable landing gear is mounted in two wing stubs hinged to the side of the all-metal hull and the stubs provide lateral stability while the craft is on the water.

Flying boats received more attention in 1928 than in several years. Consolidated built the XPY-1 for the Navy, a twin-engine monoplane with boat hull 62 feet long and convertible into a commercial transport carrying 32 persons. Boeing built several B-1E flying boats, a single engine commercial type with enclosed cabin seating 5 passengers and a pilot.

Interest in the Cierva autogiro was not confined to Europe where its inventor made improvements in the machine in 1928 and



Fokker Amphibian. (Top) Interior of cabin. (Bottom) Front view.

flew it from London to Paris. In the United States, Pitcairn was conducting experiments with the Cierva model. At the same time the Curtiss company was continuing its experiments with a new helicopter design.

The principal of employing a central airfoil body to replace the conventional fuselage and contribute to the lift was applied during the year by both Bellanca and Burnelli. The Burnelli plane is a 20-passenger twin-engine metal monoplane powered with two Curtiss geared "Conqueror" engines aggregating 1,200 horsepower.

While not as numerous as in the commercial field, several new types of military and naval machines were developed. Largely, however, both services took production on types which had passed through their experimental tests in 1927.

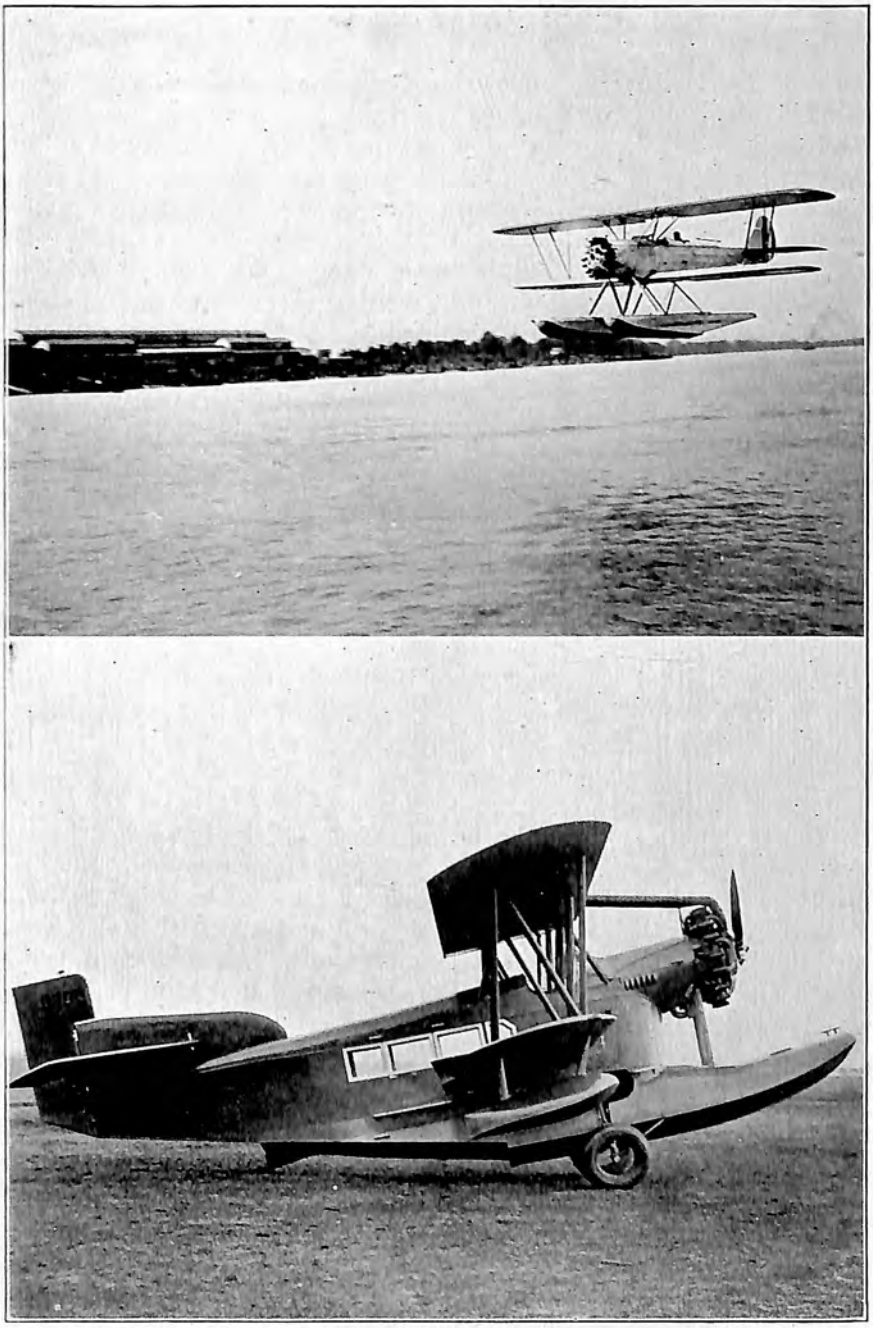
The Army Air Corps made tests with a new model amphibian incorporating a new vee-type aircooled power plant and a single landing wheel in the center of the hull. Two biplane types of bombers, the XB-2 and XLB-6, were placed in production. The Air Corps also procured for high altitude work pursuit planes powered with Curtiss D-12-F engines with side-type superchargers.

A new fighting plane developed for the Navy Bureau of Aeronautics showed superiority over previous types, while two types of training planes were produced for the Navy during the year. In general, however, both services were using standard equipment; among the planes were the Boeing F4B single seater ship fighter, Curtiss "Hawk" and "Sea Hawk," Loening Amphibian, and Keystone "Panther," a bomber, and the Vought "Corsair."

The Vought "Corsair" was equipped with automatic wing slots which in flight tests proved effective and permitted the plane to be brought out of a spin almost instantly. There was very little loss in aerodynamic efficiency.

The Vought "Corsair" pontoon amphibian was adopted by the Navy, principally for carrier use. The Vought gear is one of the simplest devices yet developed. It permits the "Corsair" amphibian to be quickly converted back to a landplane of maximum performance, when desired, with no penalties for the amphibious feature. This conversion feature had not previously been incorporated in any other military amphibian, and is of great value in emergencies since it makes immediately available, for aircraft carrier use, stripped fighting and observation planes with extraordinary altitude and maneuverability characteristics and speed.

Despite the trend toward metal structure only a few metal-sheathed planes were developed in 1928, and fabric remained the common covering material. One of the metal planes, however,



(Top) Keystone *Pronto* over Delaware River. (Bottom) Keystone-Loening passenger amphibian powered with Wright *Cyclone*.

marked the beginning of the use of the monocoque type of structure in metal construction. It was built by the Thaden company and embodied a new type of multi-spar wing. A number of designers were working on multi-spar wings at the end of the year.

A few of the recent airplanes have tapered wings but designers in general have not adopted the practice, possibly because of the production difficulties involved when wings with a number of rib sizes are to be manufactured in quantities. However, the increased aerodynamic efficiency thus obtained has led several designers to seek a solution of the production problem. The use of large dies for stamping metal forms in production quantities promises to become a factor in cost reduction. The Curtiss Company has constructed commercial plane ribs of one piece by means of stamping and forming dies.

Attempts to reduce parasite drag resulted in a much higher degree of streamlining. One company developed a full cantilever landing gear in which all of the shock absorbing mechanism is housed within the fuselage where it does not contribute to resistance.

Wing fuel tanks proved more popular because they permit of gravity feed to the carburetor. Fuel distribution systems and other forms of airplane plumbing were not changed to any extent, though efforts were being made to eliminate fuel line failure as a cause of forced landings.

The year was marked by tremendous activity in production of engines of all sizes. Both aircooled and watercooled types appeared to have their own separate fields, the latter still employed by the Air Corps for high altitude work and speed flying, though the development of aircooled radial engines threatened to break down at least part of the other's supremacy in that kind of service.

Among the experiments with Diesel type engines for aircraft was that of the Packard Motor Car Co. The Packard Diesel is in form of a 9-cylinder aircooled radial of about 200 horsepower using fuel oil under the injection principle. The engine was flown several times under test and was reported to have shown much promise. Development of a Diesel engine would result in fundamental changes in airplane design.

Two six cylinder engines of the staggered radial or double throw crankshaft type were developed during the year, notably the Curtiss "Challenger," 170 h.p. at 1800 r.p.m. Another was the Brownback C-400 rated at 100 horsepower.

In the radial engine group, one of the most important developments of the year was the production of a geared type of en-

(Top) *Eaglerock Bullet* of Alexander Aircraft Co. (Center) Thaden all-metal monoplane *Argonaut.* (Bottom) Keystone *Patrician.*

gine by the Pratt & Whitney Aircraft Co. Its geared "Hornet," Series B, with 2:1 reduction gear, and with 1860 cubic inch displacement against the 1690 of the Series A "Hornet," weighs approximately the same and is rated at 50 more horsepower than the older type. The geared "Hornet" beecame standard equipment in several types of planes. Pratt & Whitney also built and flew a number of geared "Wasps" in 1928.

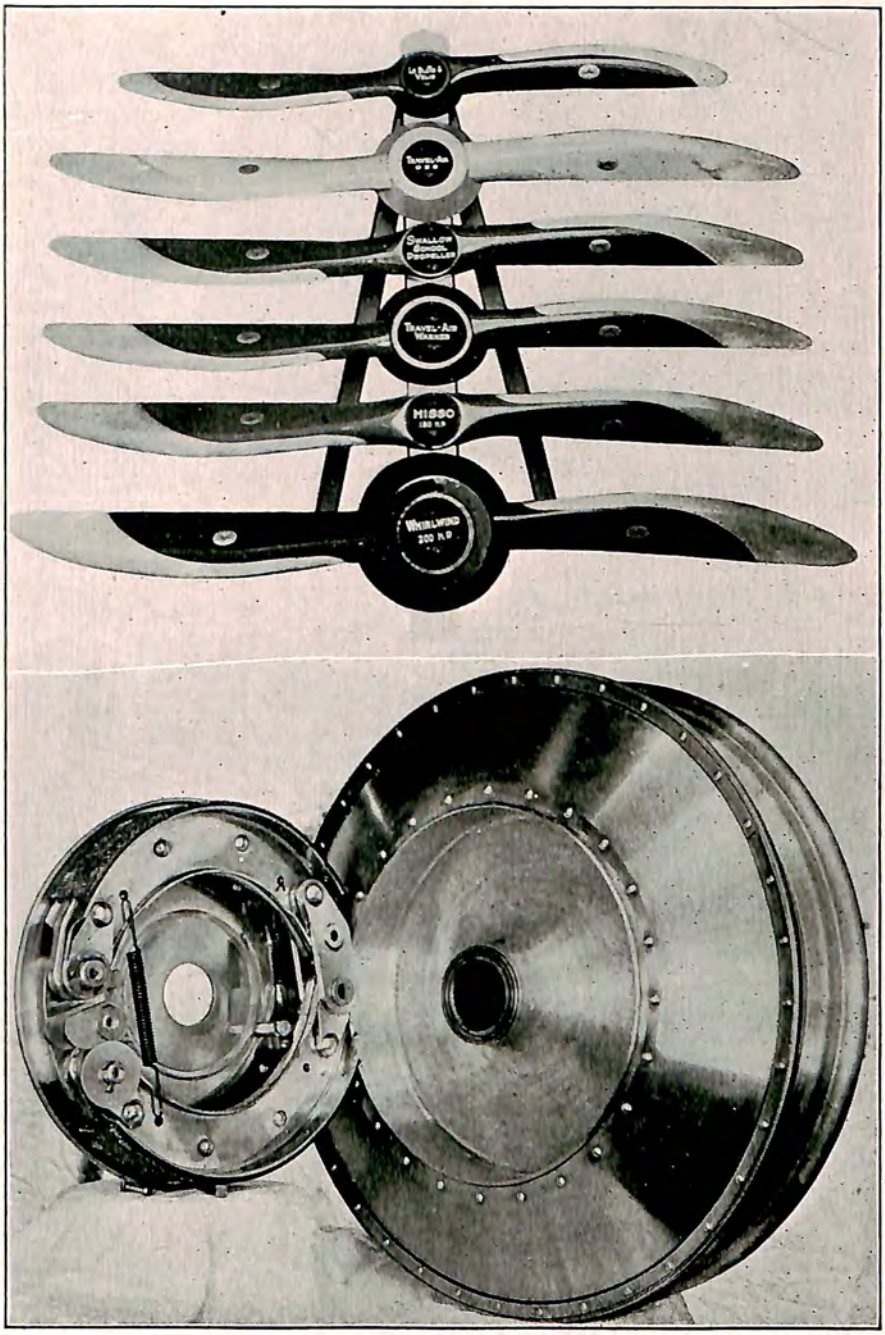
Several departures from conventional American practice in design were embodied in the new "Whirlwind" series developed by the Wright Aeronautical Corporation. This series constitutes three engines of five, seven and nine cylinder types and having practically all of their major parts interchangeable, 150, 225, and 300 horsepower with weights materially reduced. The induction system, unusual in engines of their size, is a General Electric Rotary impellor mounted in the diffuser chamber and producing positive control of mixture.

In practically all of the new radial engines the accessories and push rods have been placed at the rear and the valve actuating mechanism enclosed. The return of the one piece master rod of the big end type and the split type crankshaft is also noticeable in the new designs. The prevalent type of cylinder construction is the steel finned barrel with cast aluminum alloy head screwed and shrunk on the barrel and with bronze valve seats shrunk into the heads. Aluminum heads bolted and shrunk onto steel or cast iron cylinder barrels have characterized the design of several of the smaller engines.

The possibility of increasing efficiency by refinement was demonstrated in the radial engine cowling developed late in 1928 by the National Advisory Committee for Aeronautics. The cowling was designed especially for the Wright "Whirlwind" J-5 engine. When tested on an AT-5A Army plane an increase of from 10 to 19 miles an hour in speed resulted.

The cowling encloses the engine completely except for small openings in the front permitting circulation of cooling air around the specially designed interior. Experiments leading to its development were conducted by Frederic E. Weick in the new 20-foot propeller research wind tunnel at Langley Field. A number of manufacturers at the end of the year were planning to incorporate the cowling in their new planes.

Among the new cylinder in line types of aircooled engine of lower horsepower were the new Wright "Gipsy" and the Aeronautical Products Company's "Scorpion. Both engines are designed for light sport and training planes.



(Top) Supreme propellers. (Bottom) Bendix-Ladden disc wheel and brake.

A phase of power plant design which attracted some attention during the year was that of superchargers. When the efficiency of supercharged engines, even at some altitudes below 10,000 feet, is considered, it is safe to predict even more rapid development in this direction.

There was also a notable improvement in propellers, both in efficiency and in the processes by which they are manufactured, and which tended to reduce costs. Metal propellers gained such popularity during the year that they threatened to supplant wood entirely. At the same time much was being done to develop the variable and adjustable metal air screws.

Many new instruments and accessories were developed during 1928. Self-starters were coming into more general use and electric lighting systems were being supplied as standard equipment on a large percentage of planes.

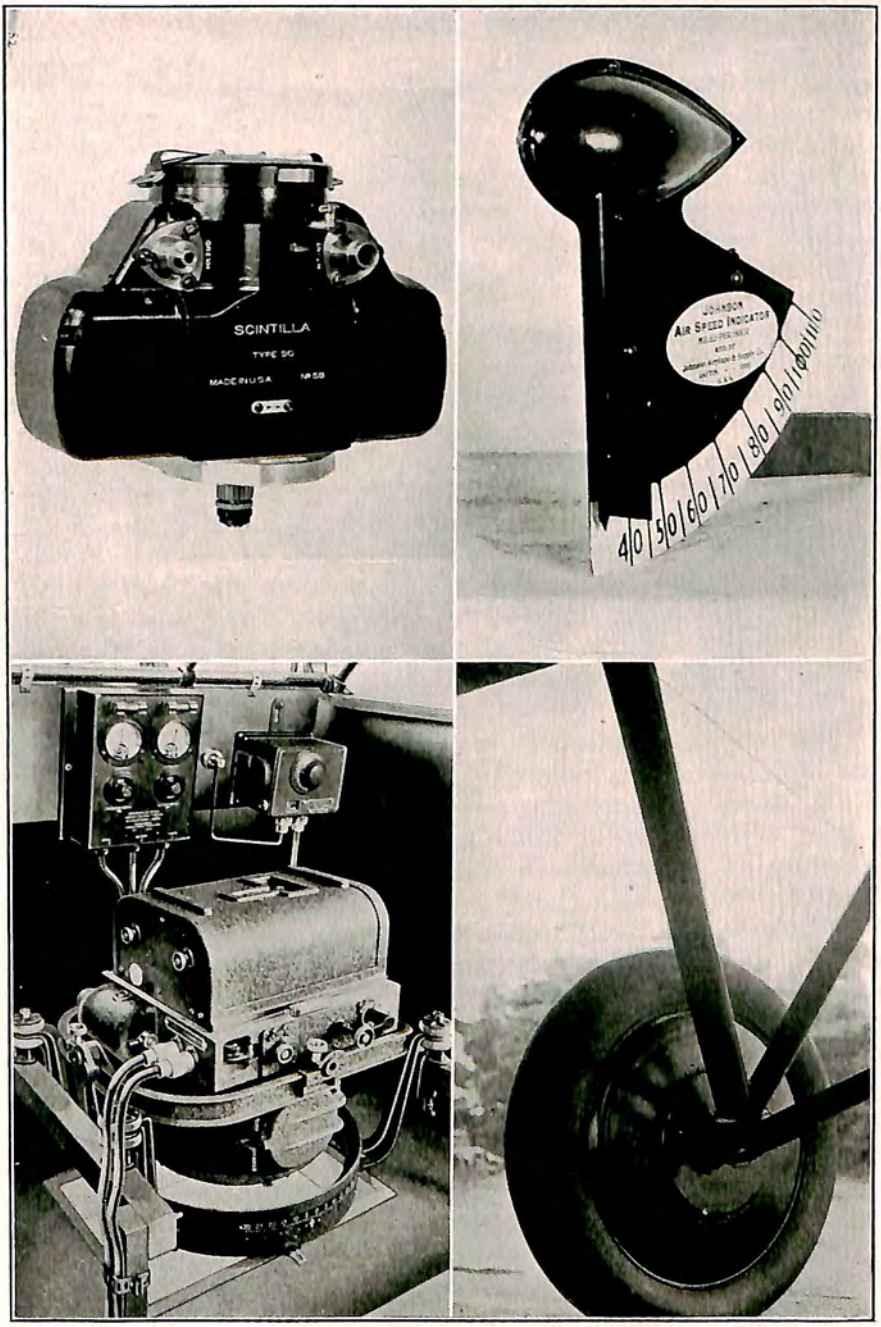
Single unit, indirectly lighted instrument panels, with rheostats to control the intensity of illumination, have also become popular and there is a tendency toward standardization in instrument sizes.

Among the new instruments of the year were the Fuel Flow Meter, which indicates the rate of flow of gasoline through the fuel line and therefore the consumption of the engine; the Air Distance Recorder, which measures through the use of a venturi tube the actual distance flown; the Ice Warning Indicator, which indicates in the pilot's cockpit the temperature of the air around the wing and thus warns the pilot when he is approaching the critical temperature for ice formation, and the Titterington Micrometer Compensator, which simplifies the process of magnetic compensation.

Several types of amphibian landing gear were developed and at least two land planes designed with retractable landing gear.

The use of Bendix brakes and wheels instead of tail skids is purely an American development. While a number of planes produced in the United States had wheels and brakes, with the practice becoming general, none of the European machines were equipped with tail wheels.

Much airport equipment was produced and considerable research work accomplished, tending to improve lighting of fields and airways. Special lamps for airport lighting were developed by the Westinghouse and General Electric companies and several new types of lenses and projectors designed. A device which turns on the field lights automatically when a plane approaches was demonstrated by the Westinghouse Company. The apparatus is a microphone system and an audio frequency amplifier which actuates the lighting control relay when the sound of the approaching plane



(Top, left) Scintilla vertical double aircraft magneto. (Right) Johnson Airplane & Supply Co. strut air speed indicator. (Bottom, left) Fairchild military aerial camera. (Right) Johnson steel disc wheel with brake.

reaches the microphone. Neon lights were used effectively in several types of beacons, and were especially useful under conditions of poor visibility.

The sectional steel hangar was generally in use during the year while the demand for small individual hangars increased with the number of private owners. Several manufacturers produced such hangars in the form of a T-shaped unit just large enough to accommodate one plane.

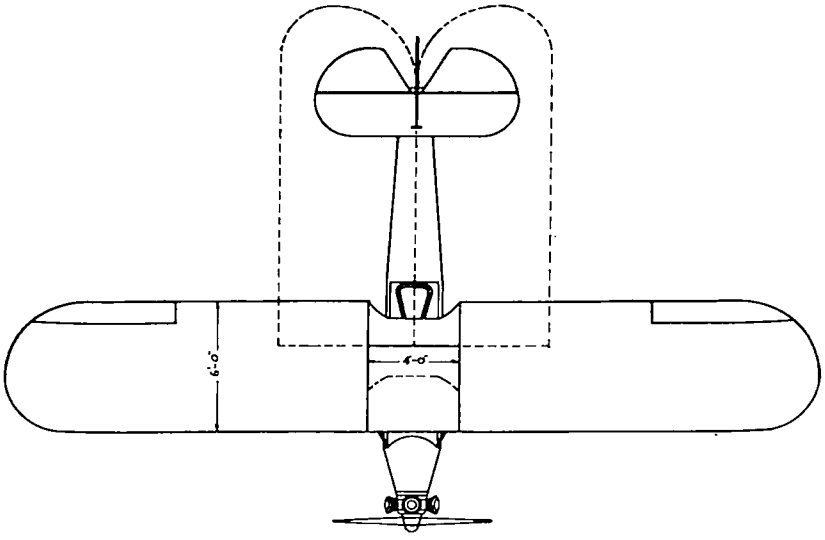
The radio beacon was more highly developed, and it proved practicable in several spectacular cases. Commercial and military organizations equipped airplanes as flying radio laboratories. Intensive experiments on interplane communication were under way at the end of the year. Much had been learned about shielding the electric system of an airplane to eliminate interference with its radio equipment. With that important problem solved, rapid developments in airplane radio communication were promised for the near future.

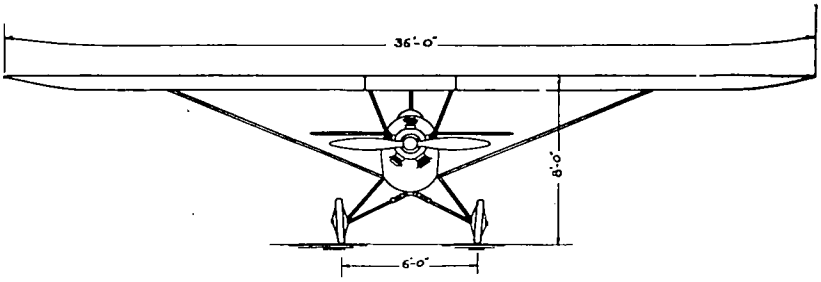
Development of deep-sea airdromes, landing platforms for airplanes, based on the designs of Edward R. Armstrong, received further impetus late in the year when plans were made for constructing an experimental Armstrong seadrome between New York and Bermuda.

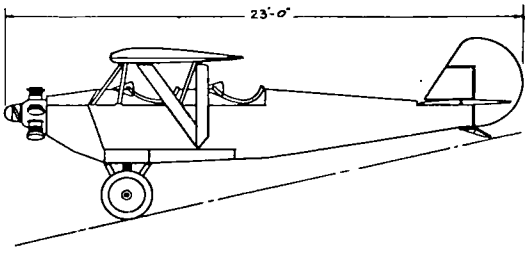
The project contemplated a steel platform 1,200 feet long, 400 feet wide and riding normally about 100 feet above the surface of the water, with a machine shop, hotel and restaurant, and a radio beacon, besides other airdrome facilities. Chains more than 21,000 feet long and attached to a special anchoring device invented by Mr. Armstrong, were to hold the "floating island" in place.

Work on the model seadrome was to be started during the summer of 1929. If it proved successful, others were to be built at intervals across the Atlantic.

AIRCRAFT AND ENGINE DESIGN SECTION

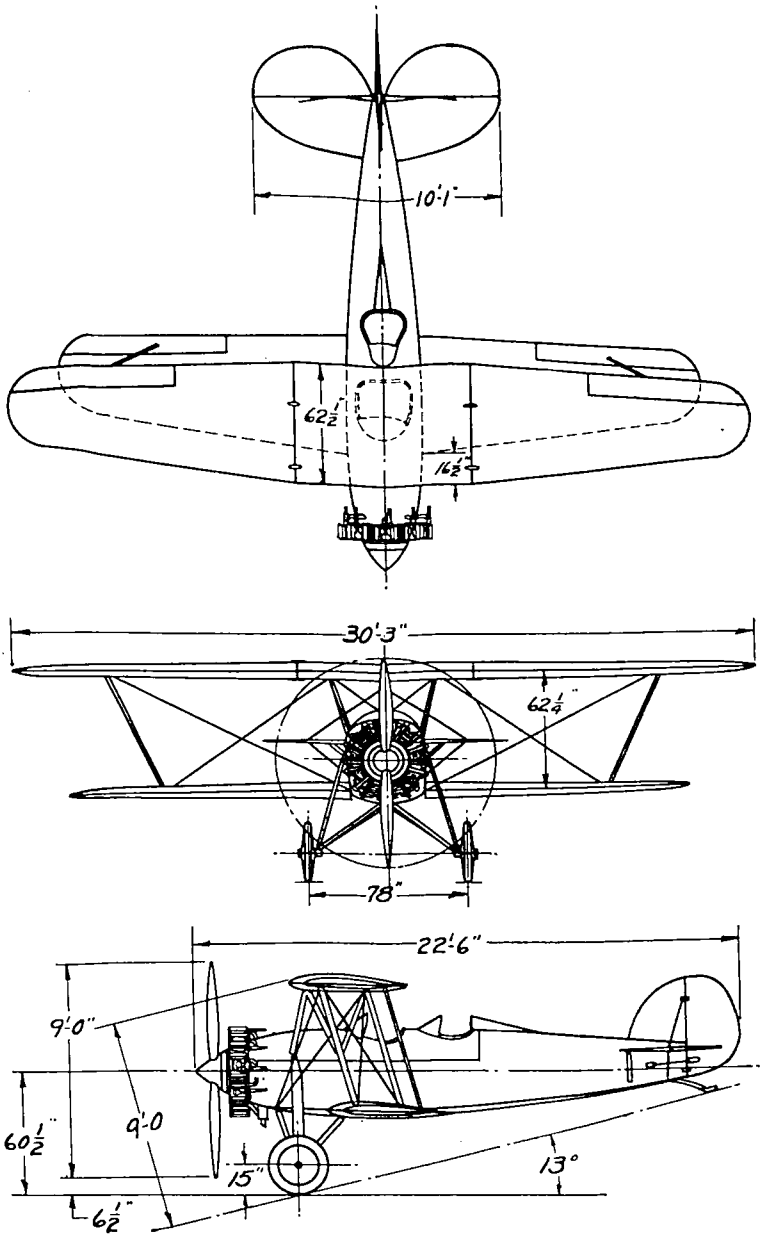






ACME AIRCRAFT CORPORATION
ROCKFORD, ILL.

MONOPLANE MODEL-"21" 2-PLACE
ENGINE—VELIE
248

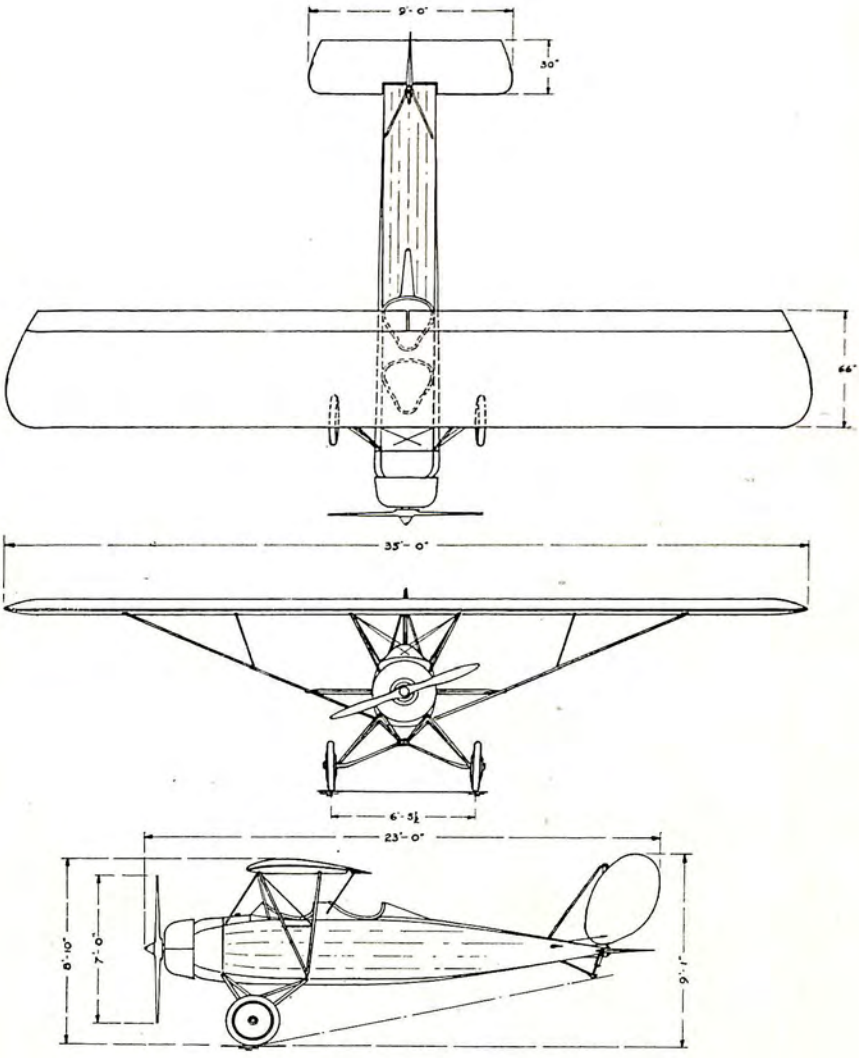


The Advance Aircraft Company

Troy, Ohio

"Sport Waco"

Engine—Hispano Suiza 180 H.P. or
Wright "Whirlwind" or
Wright J-6 300 H.P.

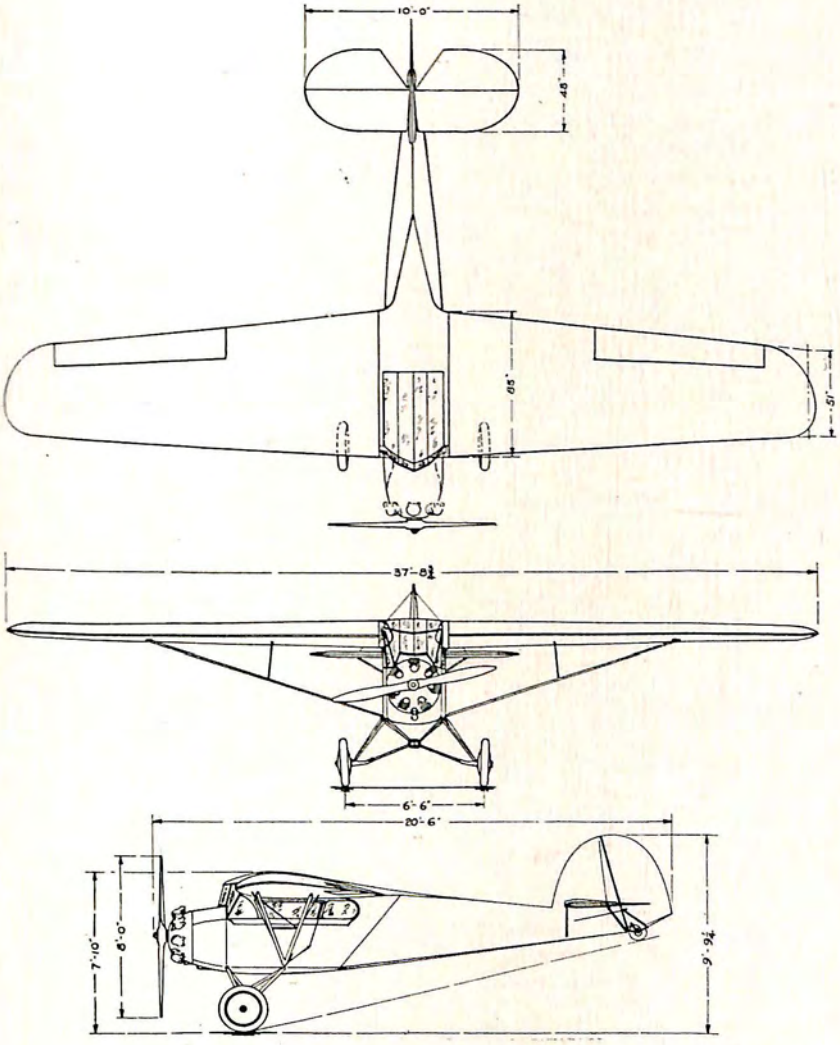


Aerial Service Corporation

Hammondsport, N. Y.

Primary Training Monoplane

Engine—Velie 70 H.P.

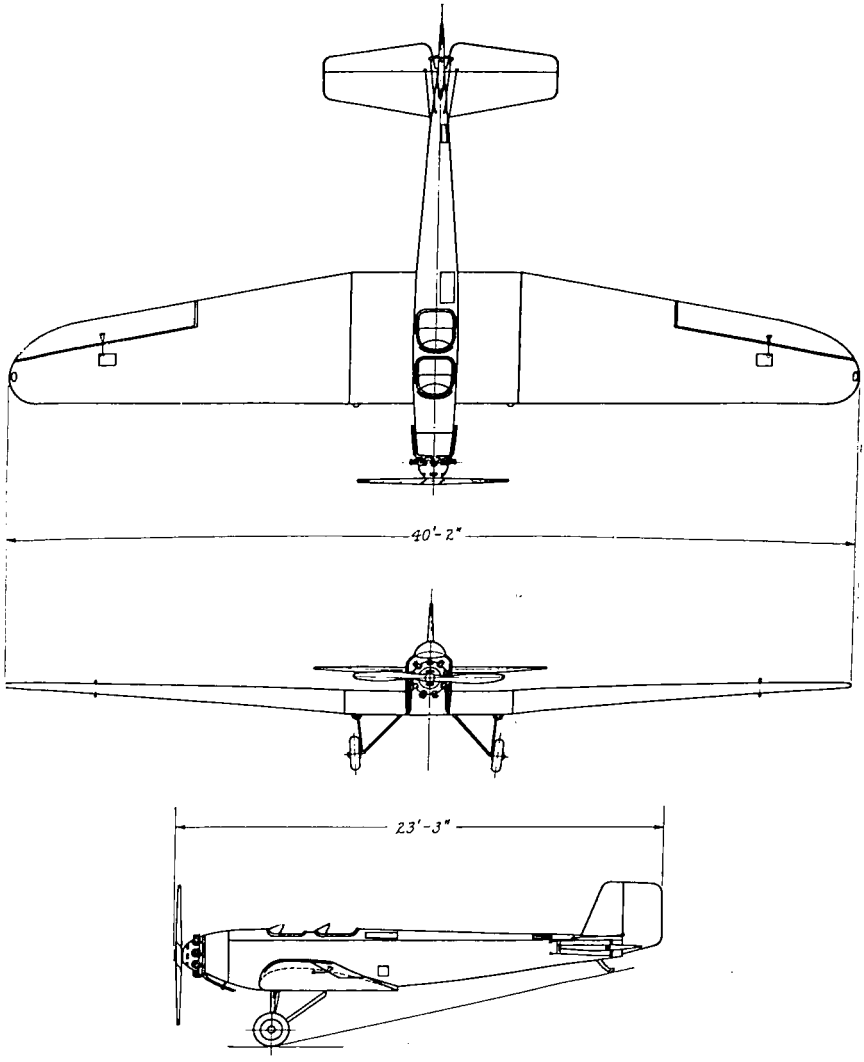


AERIAL SERVICE CORPORATION

HAMMONDSPORT, N. Y.

"MERCURY KITTEN" CABIN MONOPLANE

ENGINE—WARNER 110 H.P.

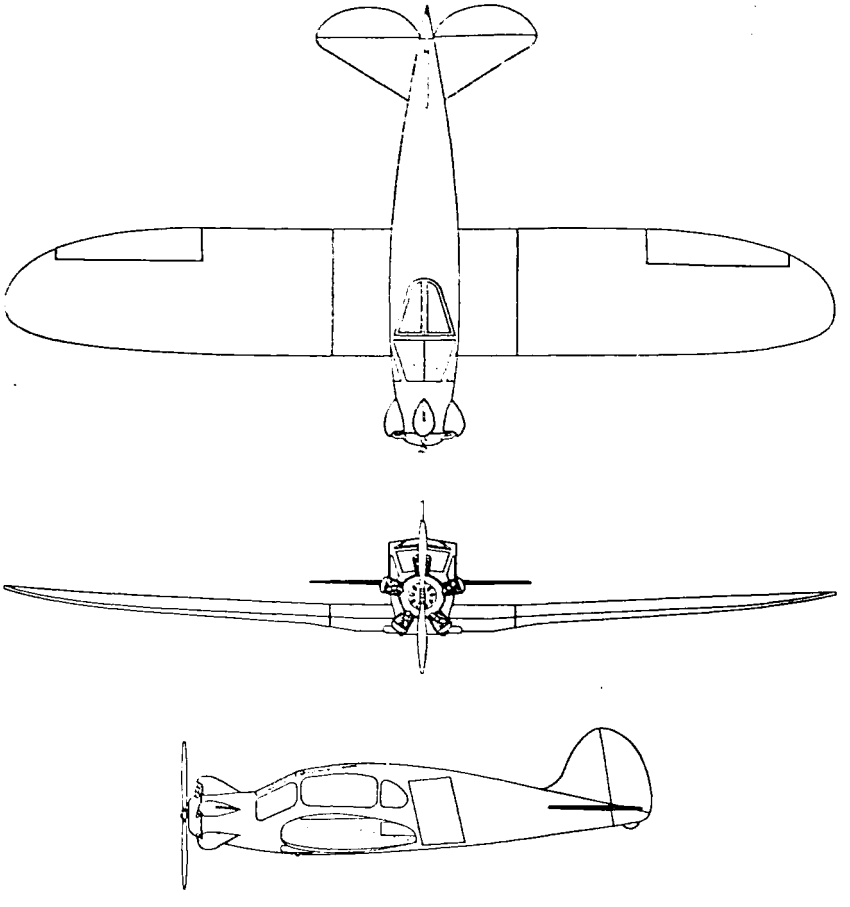


Aeromarine Klemm Corporation

Keyport, N. J.

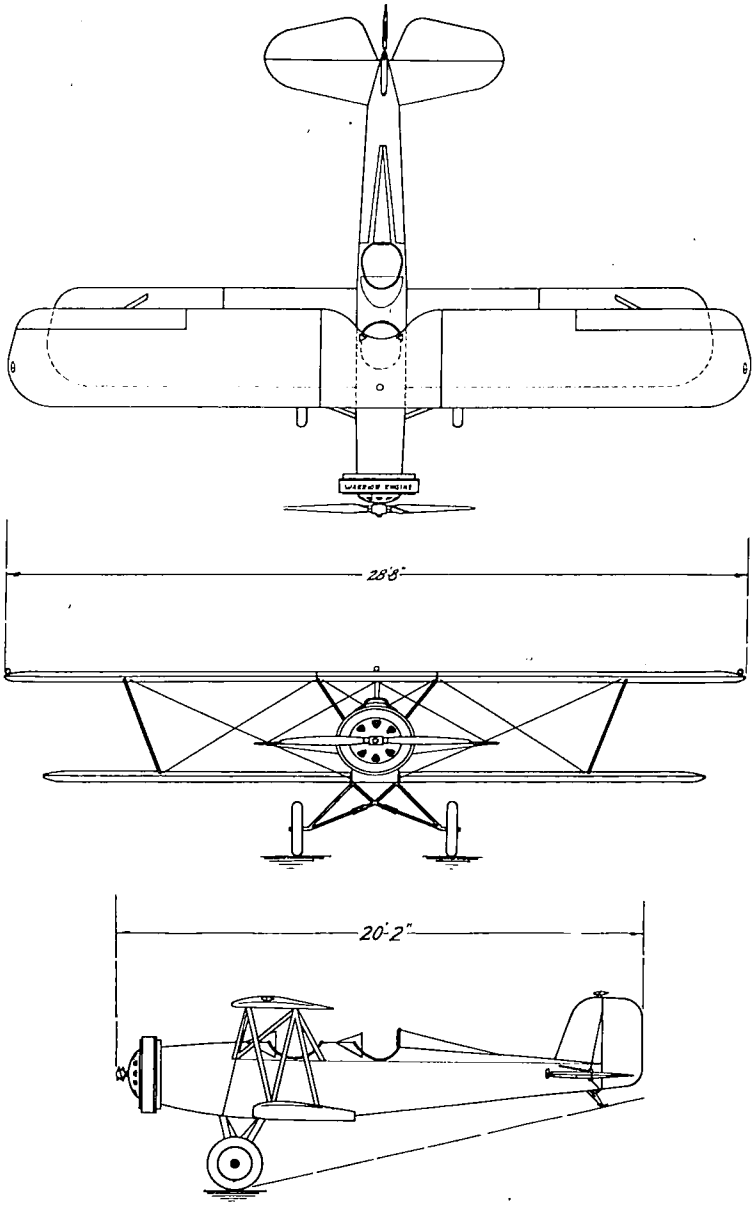
"Klemm Monoplane" 2-Place

Engine—40 H.P. "Salmson"



ALEXANDER INDUSTRIES, INC.
AIRCRAFT DIVISION
COLORADO SPRINGS, COLO.

"EAGLEROCK BULLET" 4-PLACE CLOSED MONOPLANE
ENGINE—WRIGHT "WHIRLWIND" OR KINNER OR "COMET"

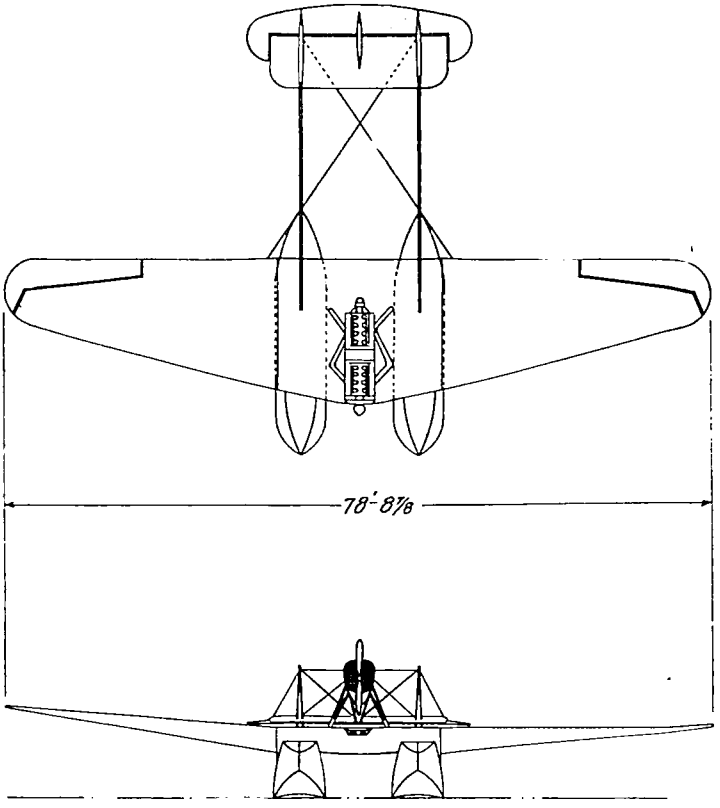


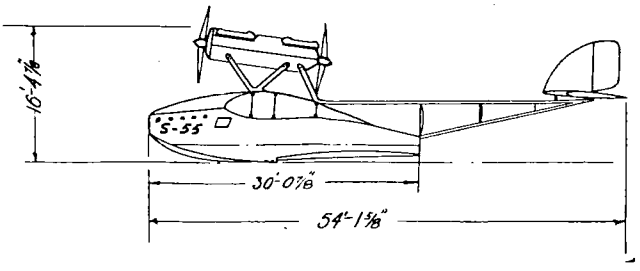
Alliance Aircraft Corp.

Alliance, Ohio

"Argo" 3-Place

Engine—Hess "Warrior"

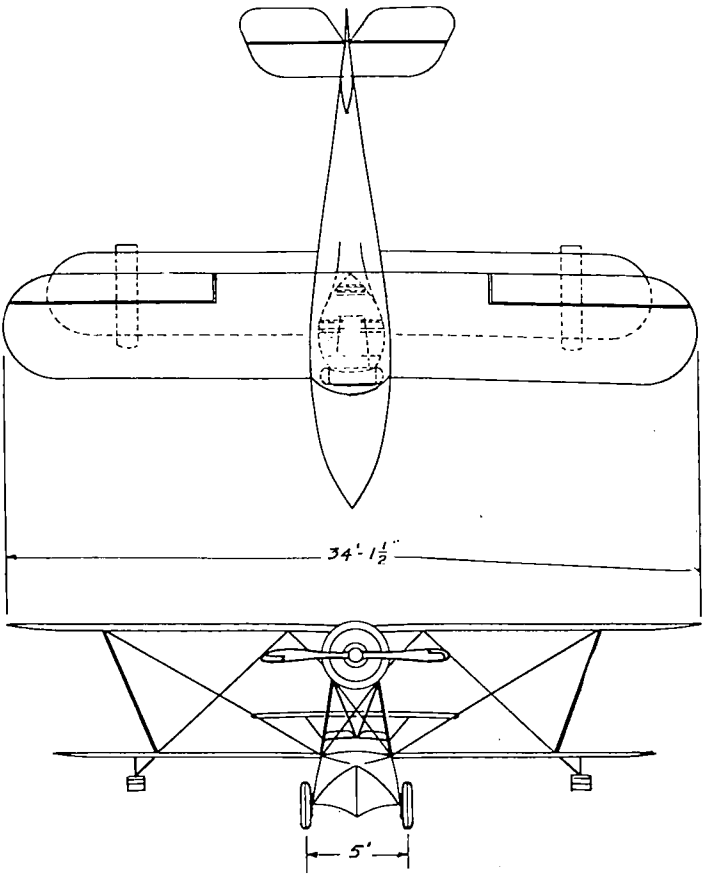




AMERICAN AERONAUTICAL CORP.

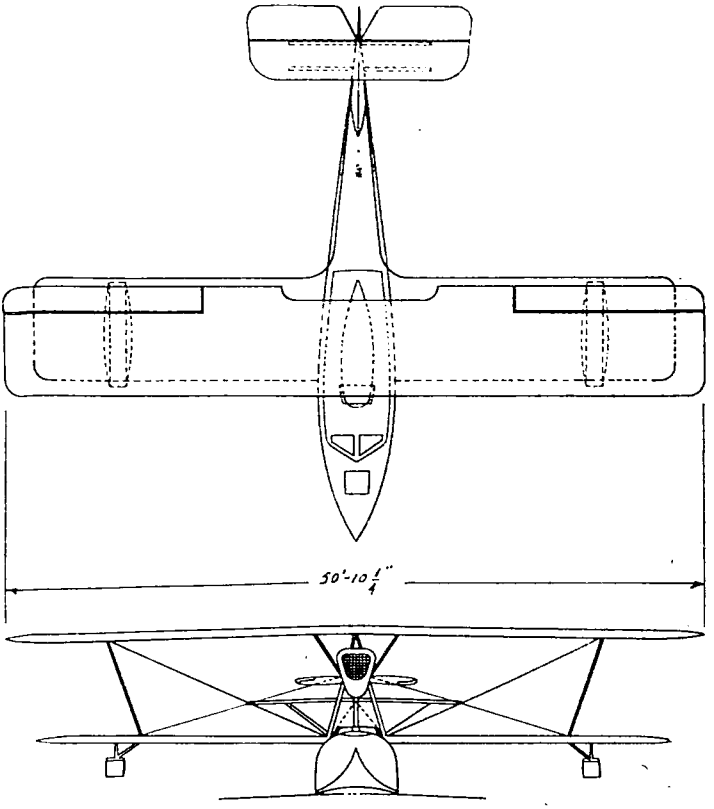
NEW YORK

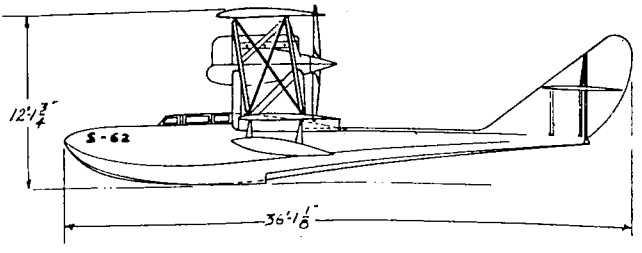
AMERICAN MARCHETTI S-55 14 PASSENGERS



AMERICAN AERONAUTICAL CORP.
NEW YORK

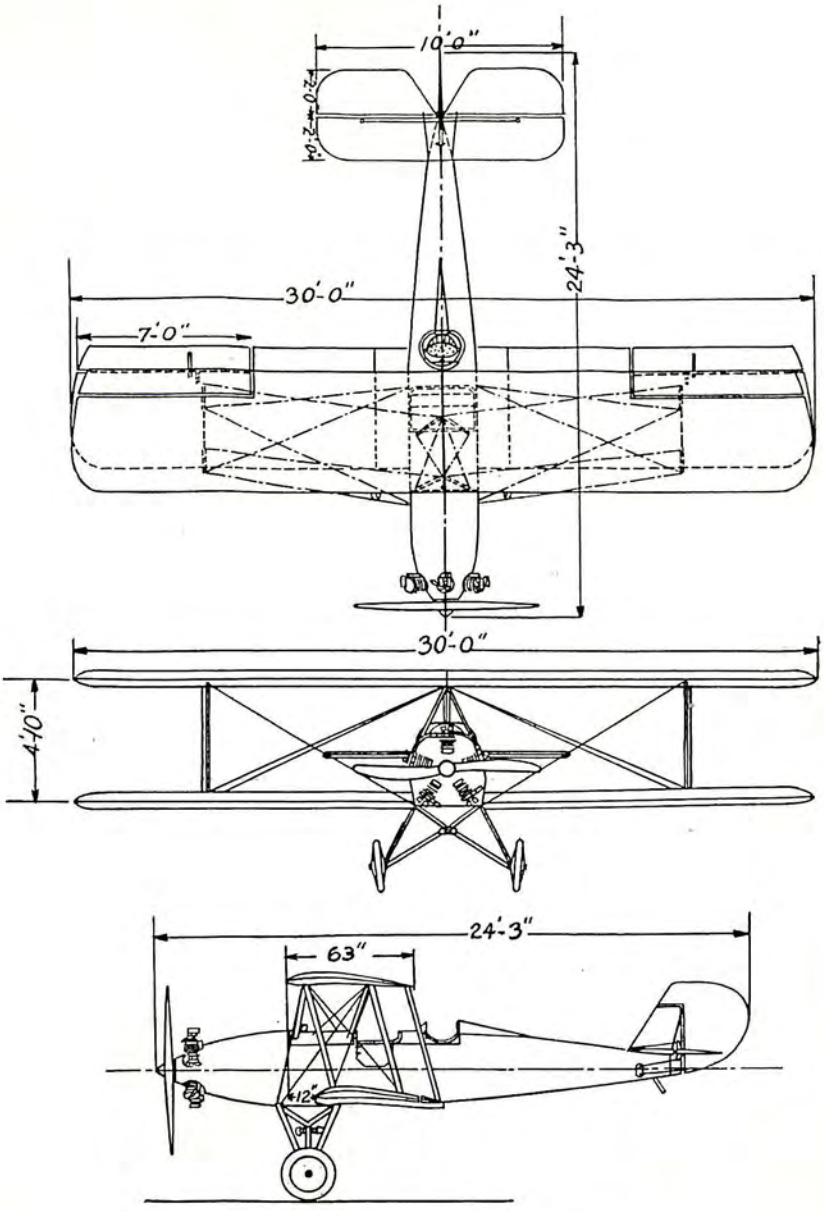
AMERICAN MARCHETTI
MODEL S-56 SPORT AMPHIBIAN 3 PASSENGERS
ENGINE—100 H.P.





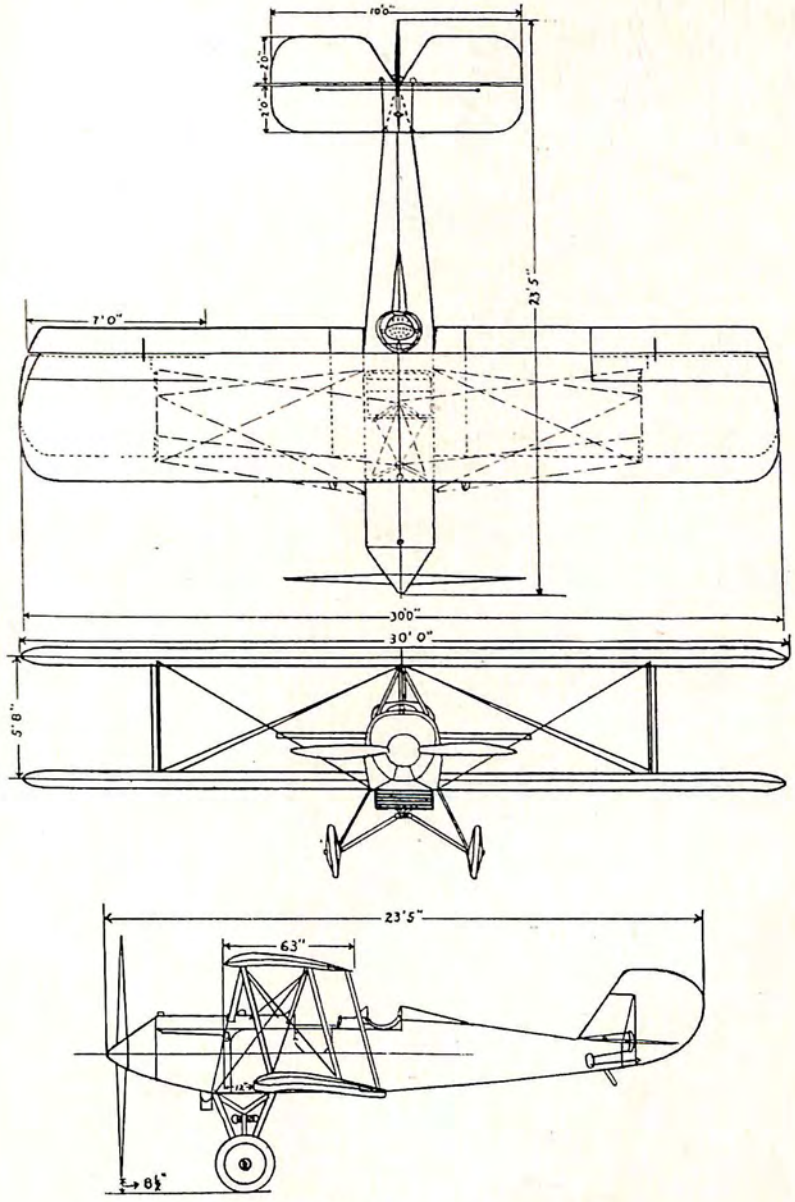
AMERICAN AERONAUTICAL CORP.
NEW YORK

AMERICAN MARCHETTI
MODEL S-62 7 PASSENGERS CABIN BIPLANE
ENGINE—ISOTTA FRASCHINI



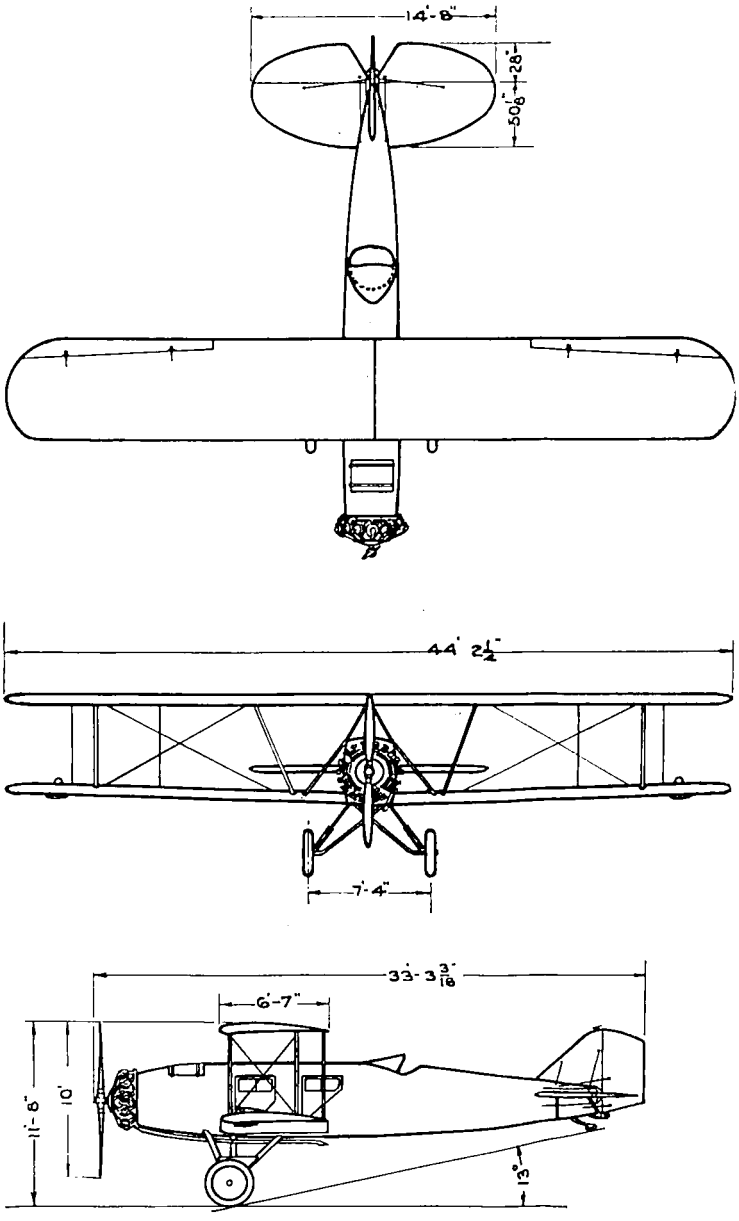
AMERICAN EAGLE AIRCRAFT CORP.
KANSAS CITY, MO.

MODEL A-129 3-PLACE
ENGINE—KINNER
258



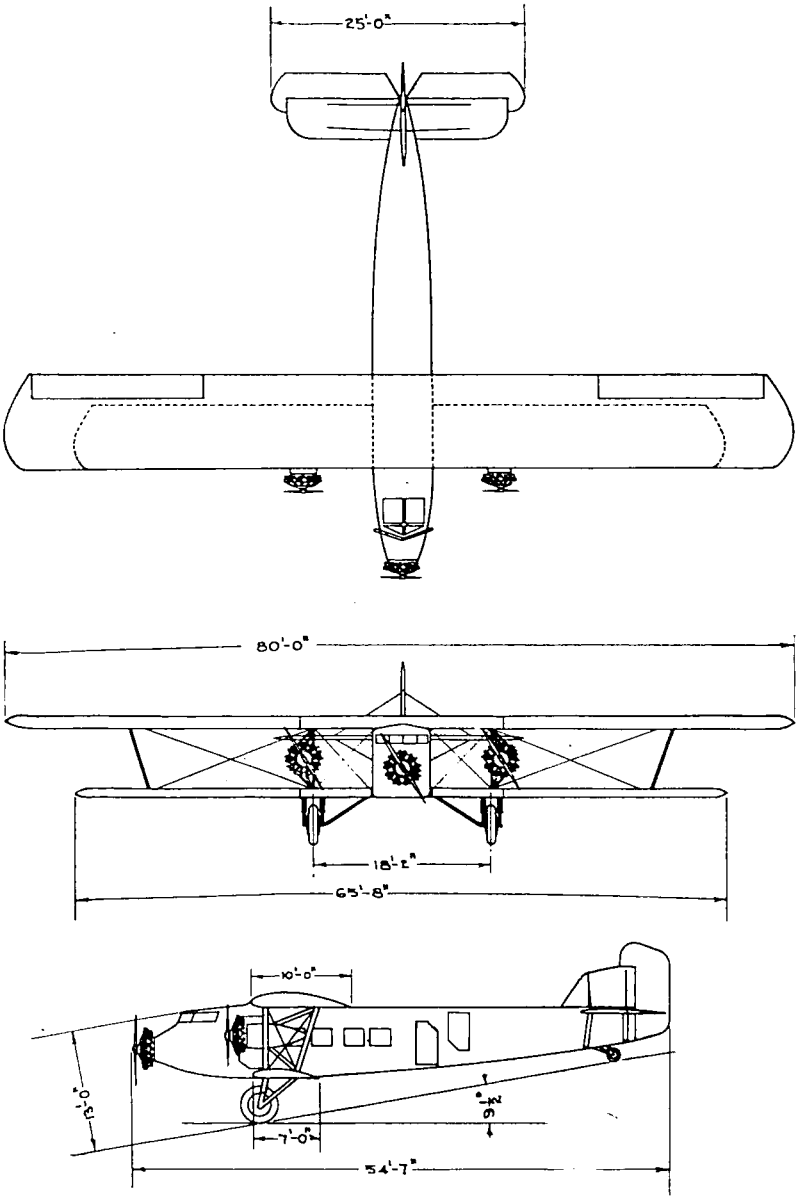
AMERICAN EAGLE AIRCRAFT CORP.
KANSAS CITY, MO.

MODEL A-129 3-PLACE
ENGINE—CURTISS OX-5



BOEING AIRPLANE COMPANY
SEATTLE, WASH.

MAIL PLANE "40-C"
ENGINE—PRATT & WHITNEY "WASP"

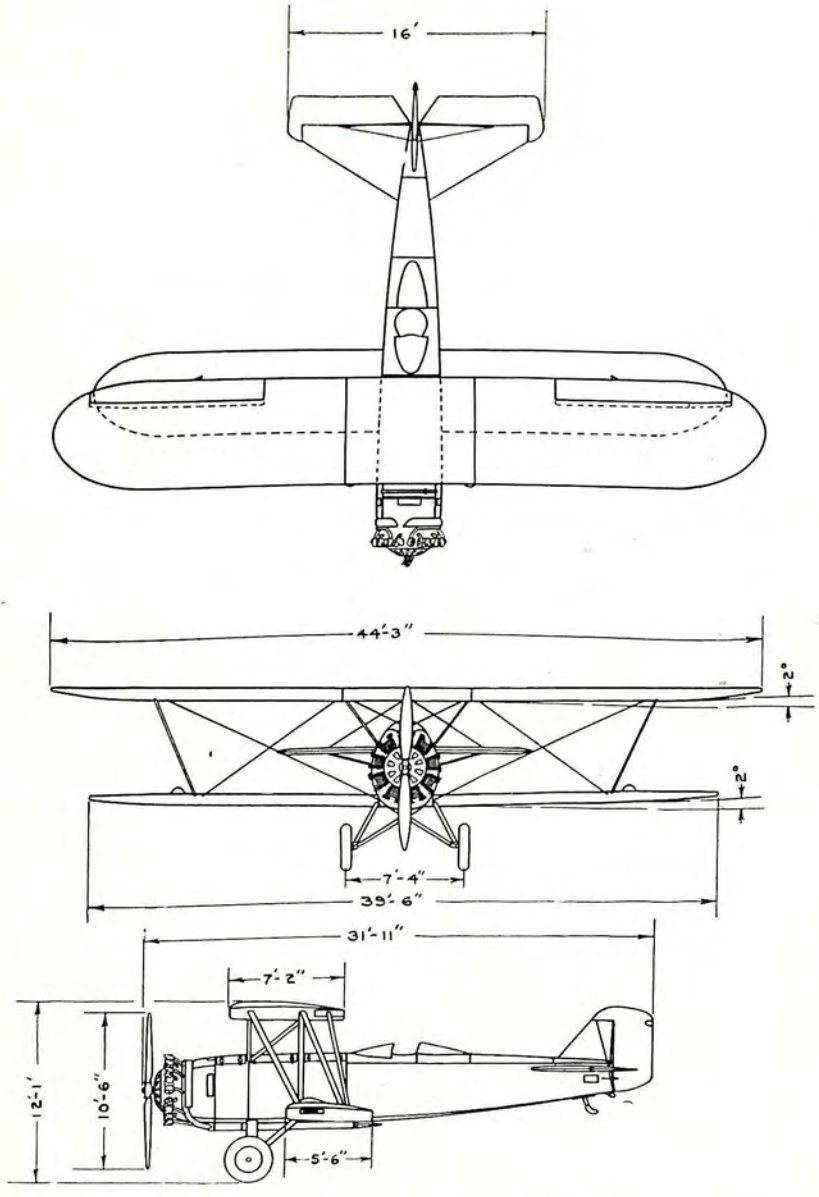


Boeing Airplane Company

Seattle, Wash.

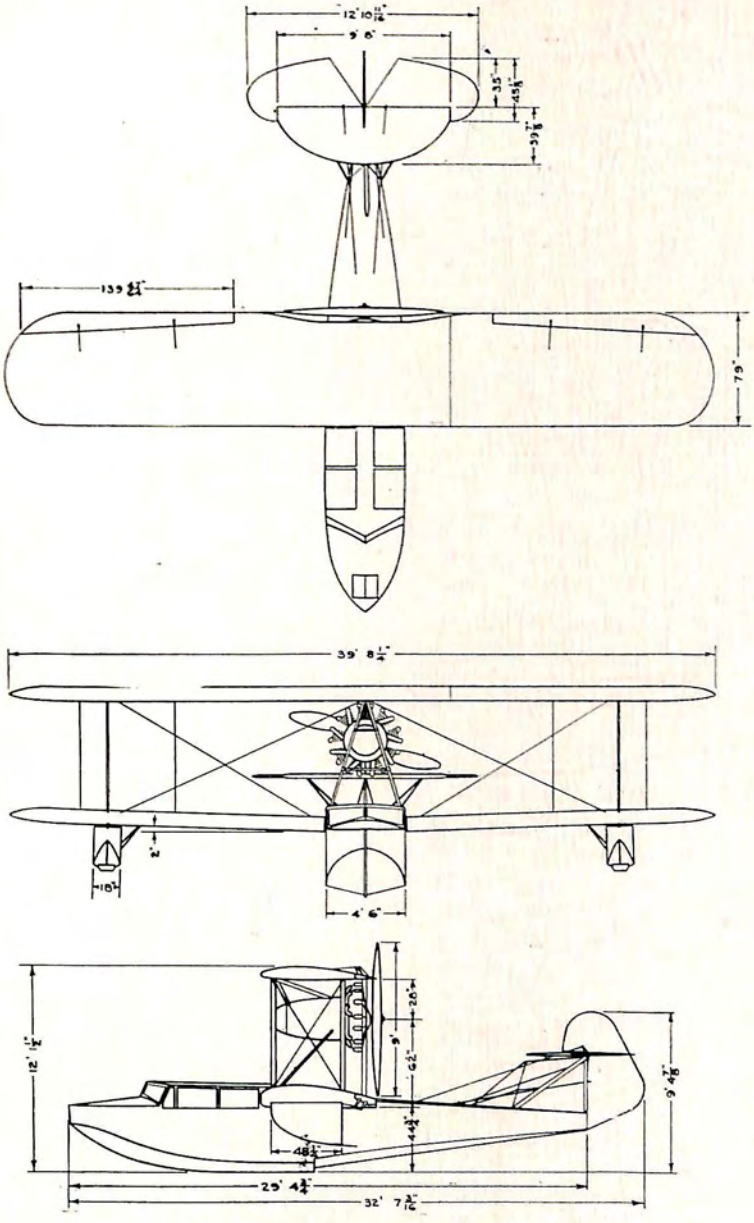
Transport Design "80"

Engines—Pratt & Whitney "Wasp"



BOEING AIRPLANE COMPANY
SEATTLE, WASH.

MAIL PLANE "95"
ENGINE—PRATT & WHITNEY "WASP"

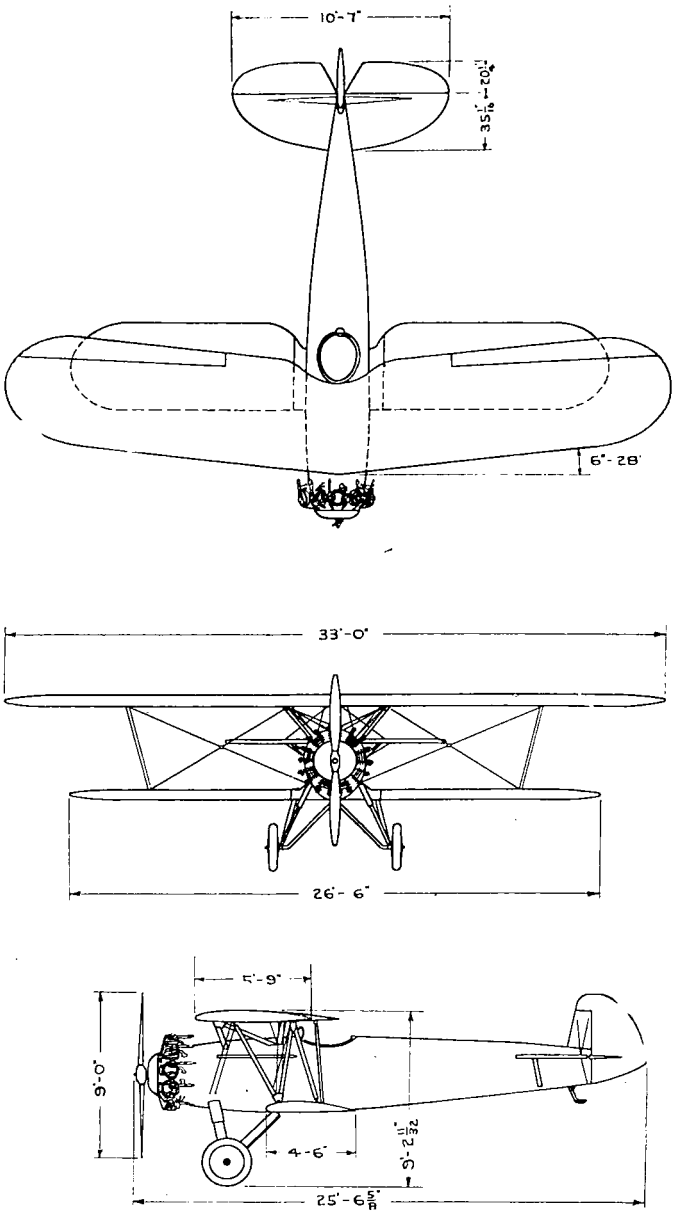


Boeing Airplane Company

Seattle, Wash.

Commercial Flying Boat Model "B-1E"

Engine—Pratt & Whitney "Wasp"

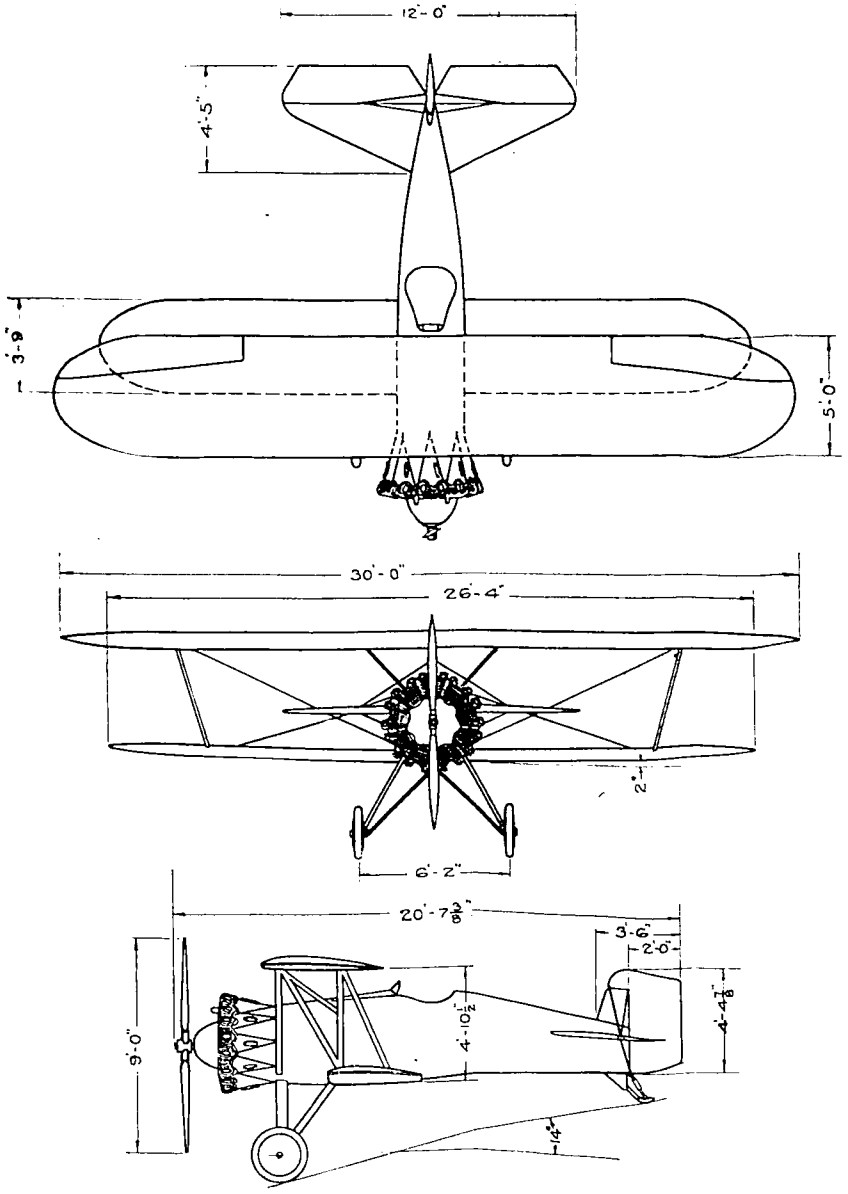


BOEING AIRPLANE COMPANY

SEATTLE, WASH.

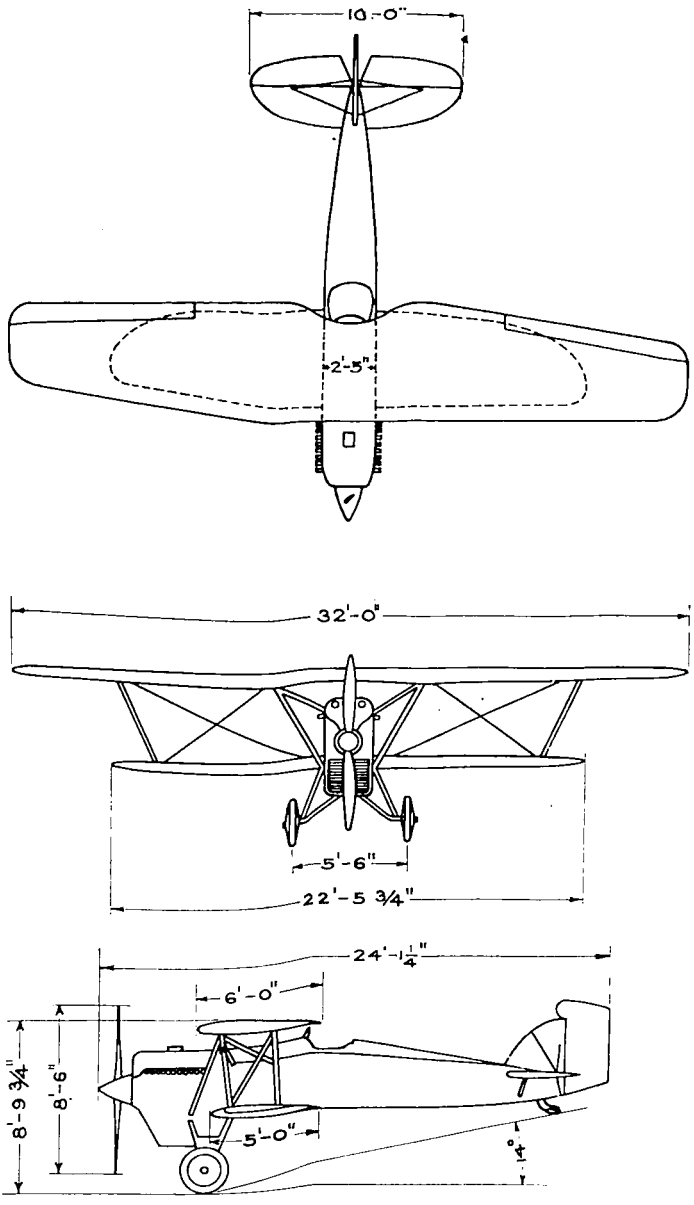
CARRIER TYPE "FIGHTER F 3B-1"

ENGINE—PRATT & WHITNEY "WASP"



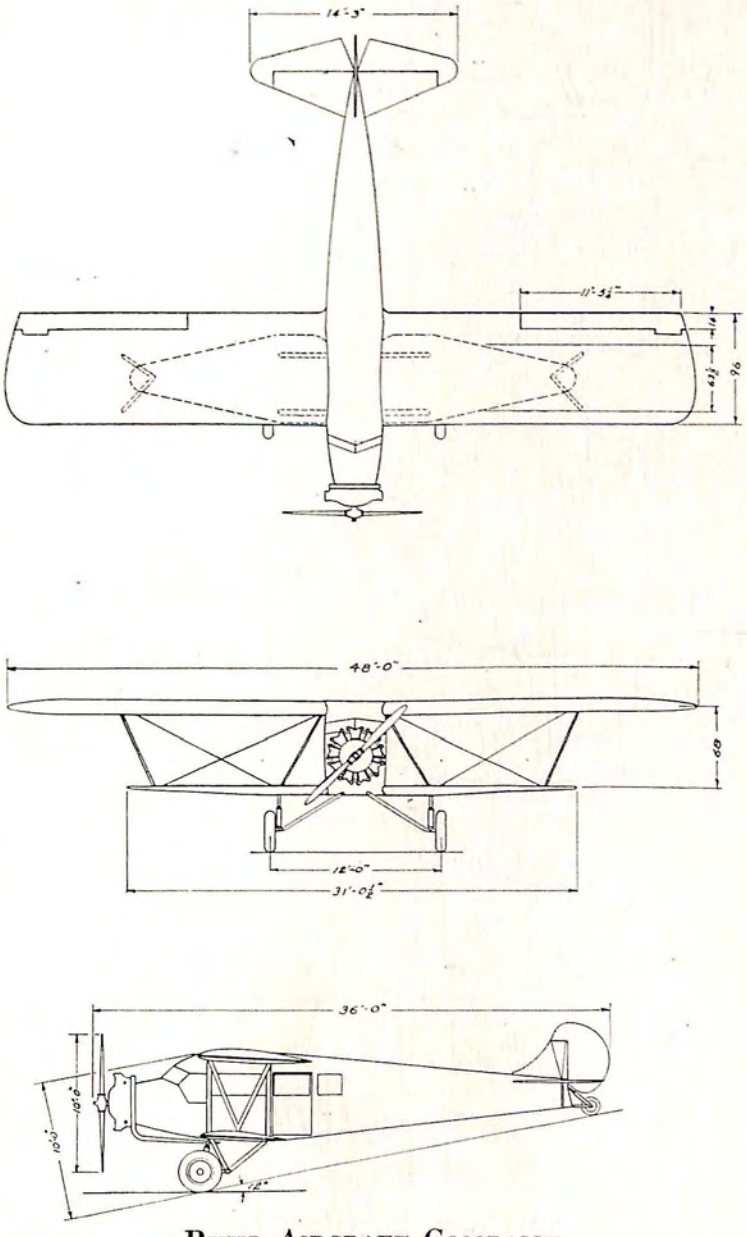
BOEING AIRPLANE COMPANY
SEATTLE, WASH.

CARRIER TYPE "FIGHTER F 4B-1"
ENGINE—PRATT & WHITNEY "WASP"



Boeing Airplane Company
Seattle, Wash.

Pursuit Model "XP-7"
Engine—Curtiss V-1570

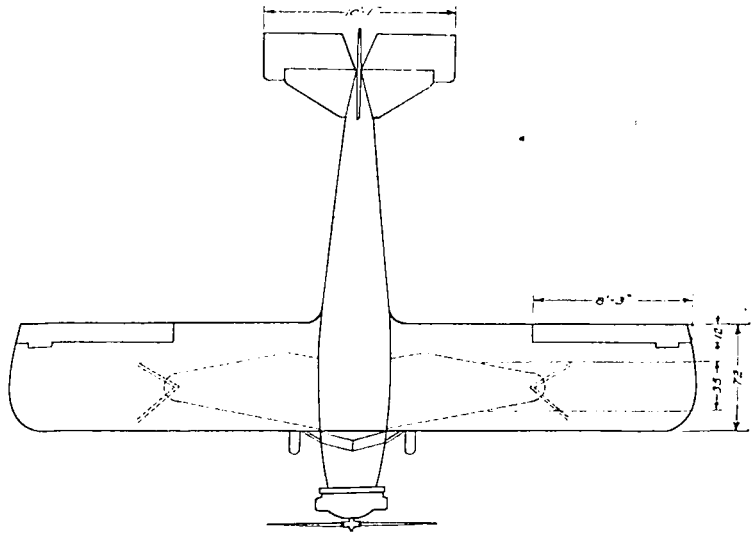


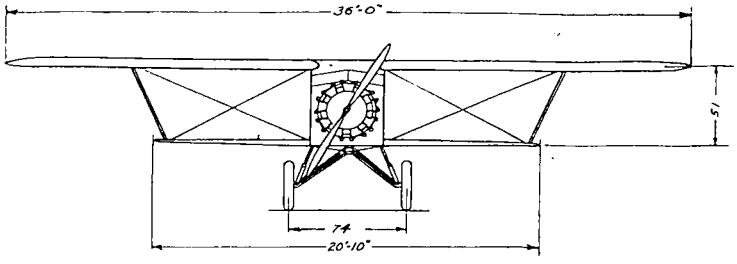
Buhl Aircraft Company

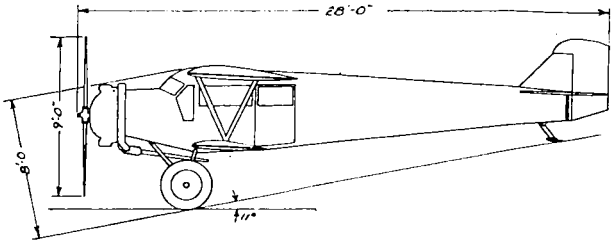
Marysville, Mich.

Buhl "Senior Airsedan" Type CA-8

Engine—Pratt & Whitney "Wasp" or Wright "Cyclone"





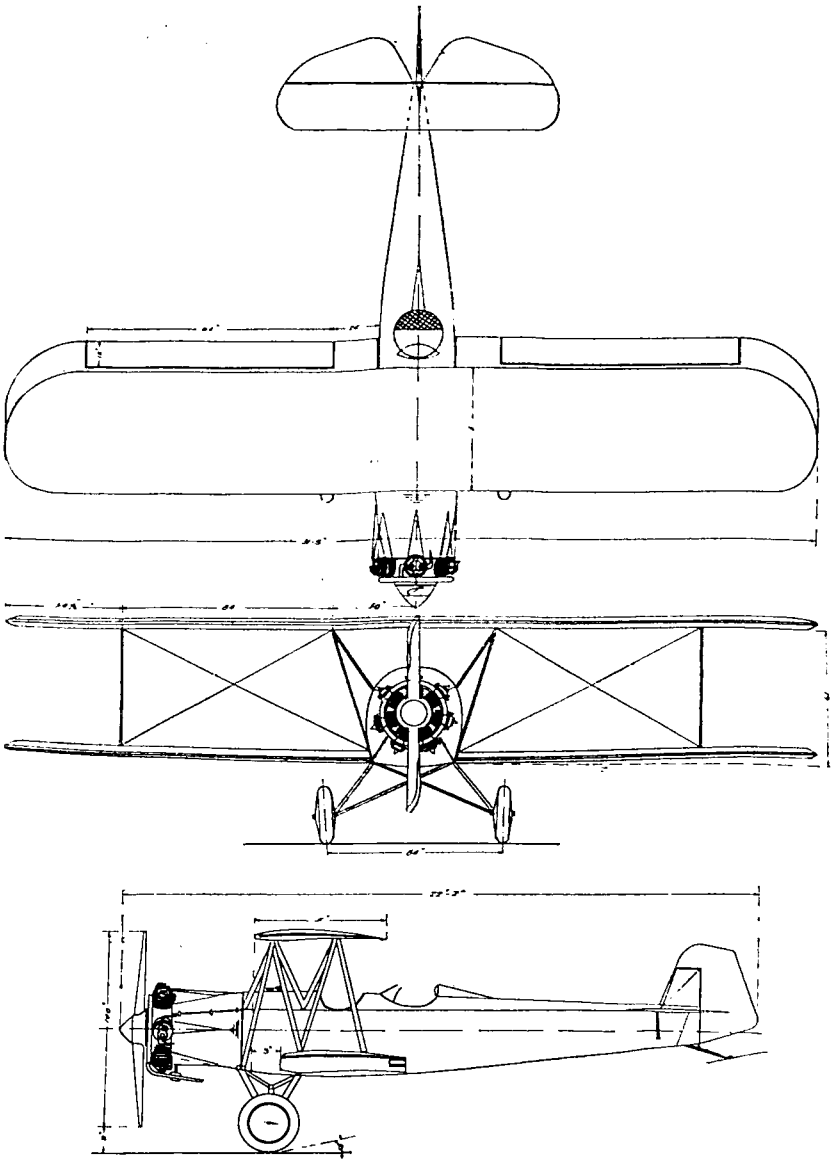


BUHL AIRCRAFT COMPANY

MARYSVILLE, MICH.

"SPORT AIRSEDAN" TYPE CA-3C

ENGINE—WRIGHT "WHIRLWIND"

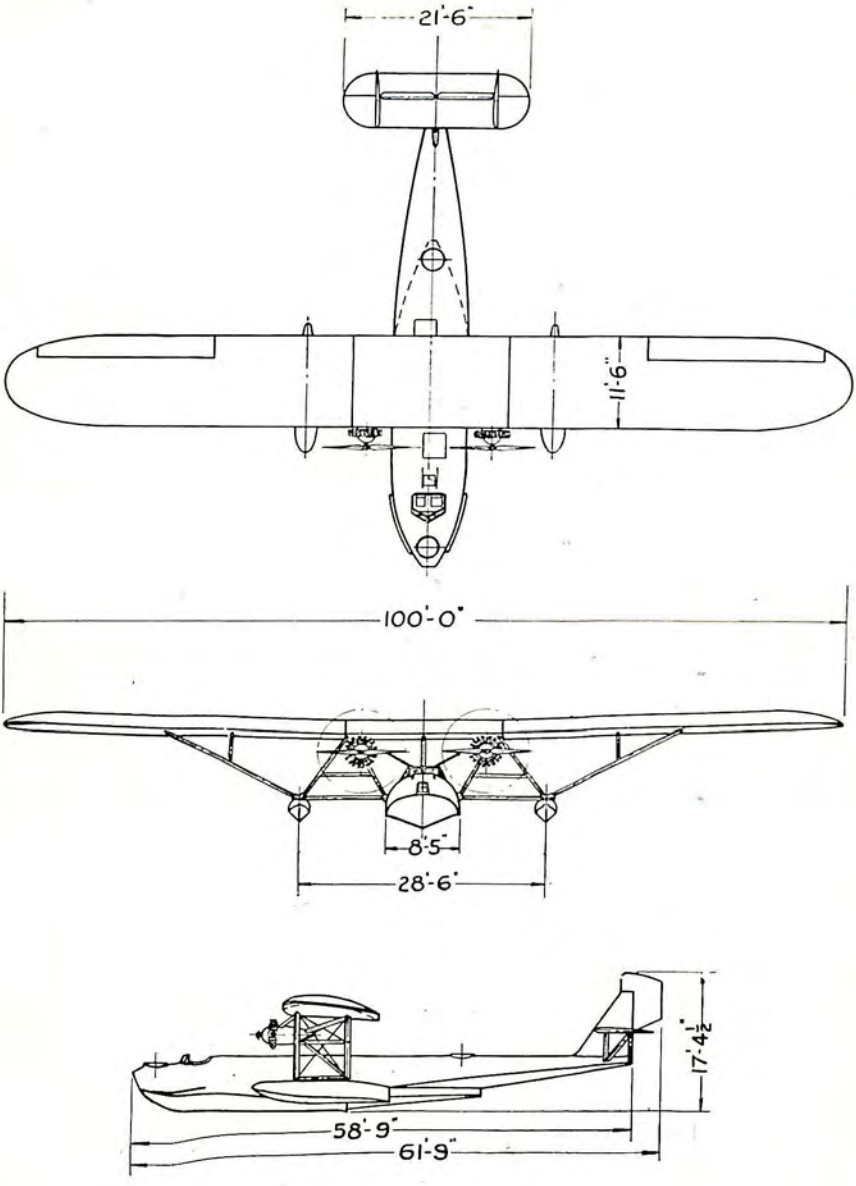


Command-Aire Incorporated

Little Rock, Ark.

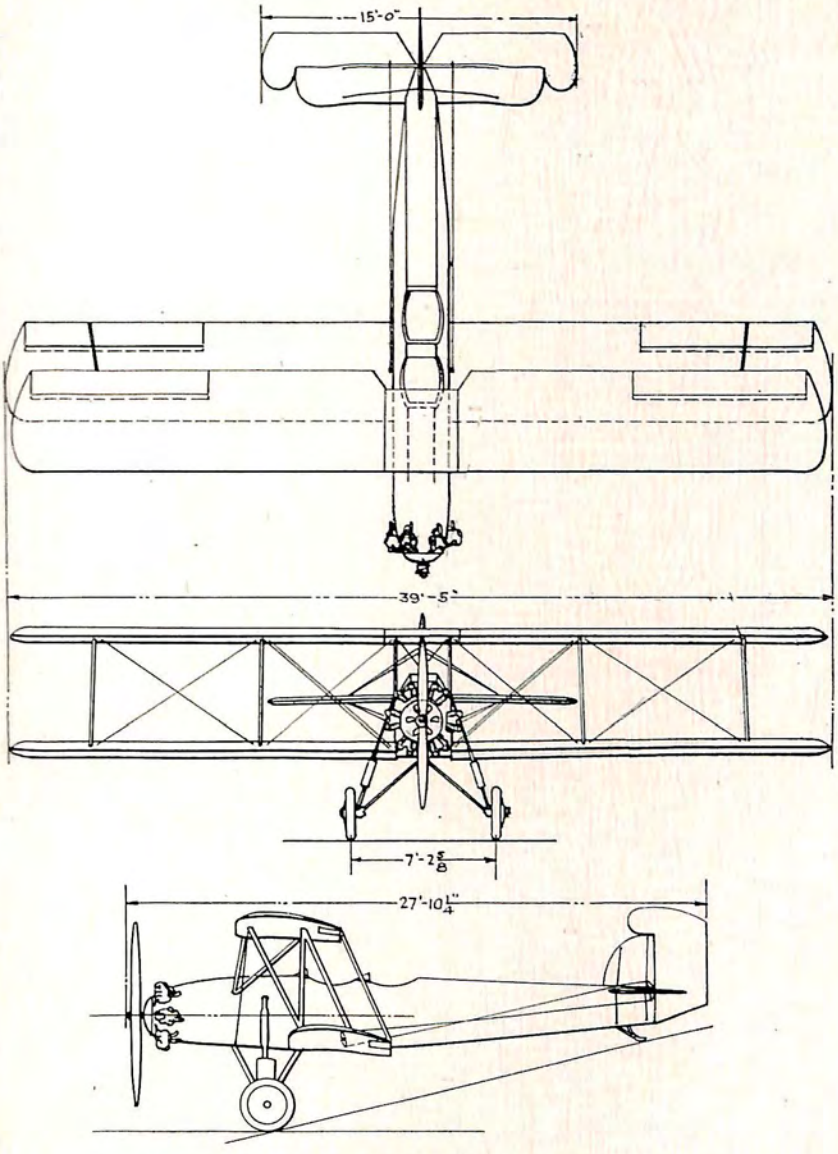
Type 3-C-3-A Biplane
3-C-3-B

Engine—Warner or
Siemens S.H.—14



CONSOLIDATED AIRCRAFT CORPORATION
BUFFALO, N. Y.

"XPY-1 FLYING BOAT" MONOPLANE TRIPLE FLOATS
2 ENGINES—PRATT & WHITNEY "WASP"

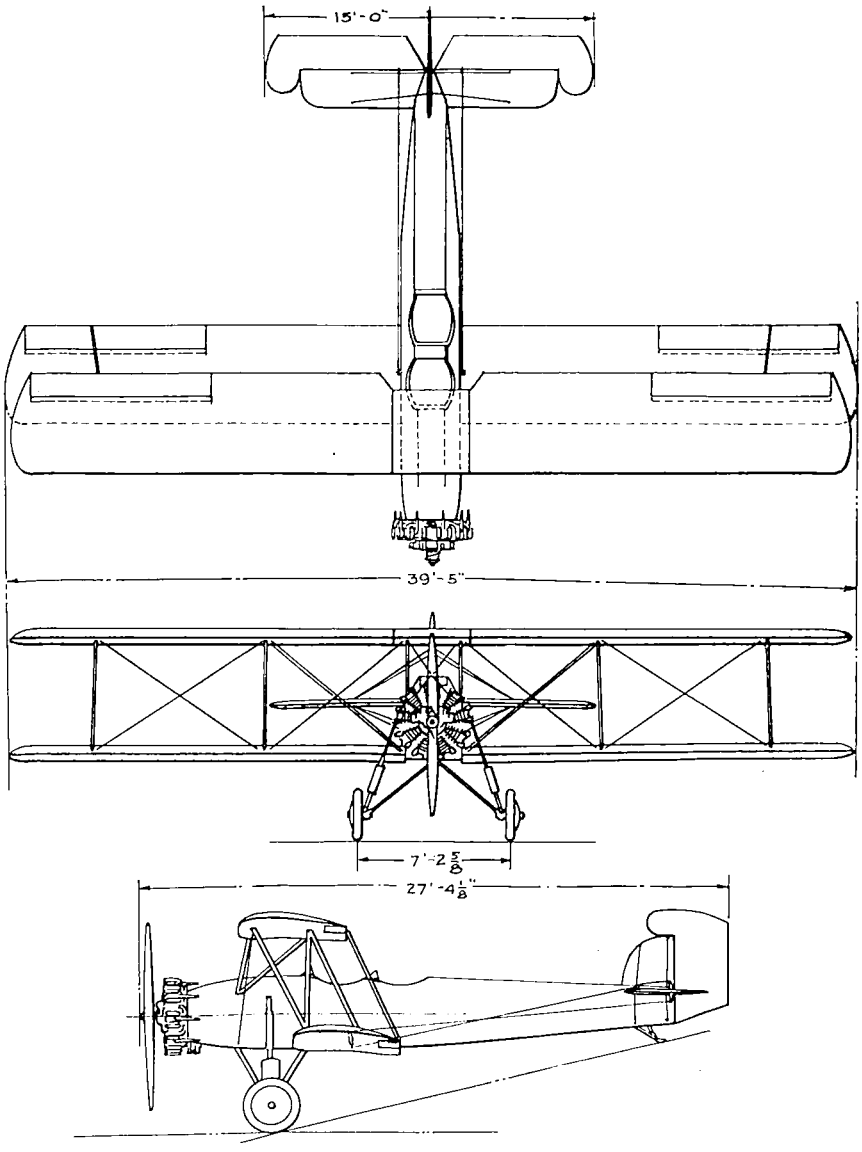


CURTISS AEROPLANE & MOTOR CO., INC.

GARDEN CITY, LONG ISLAND, N. Y.

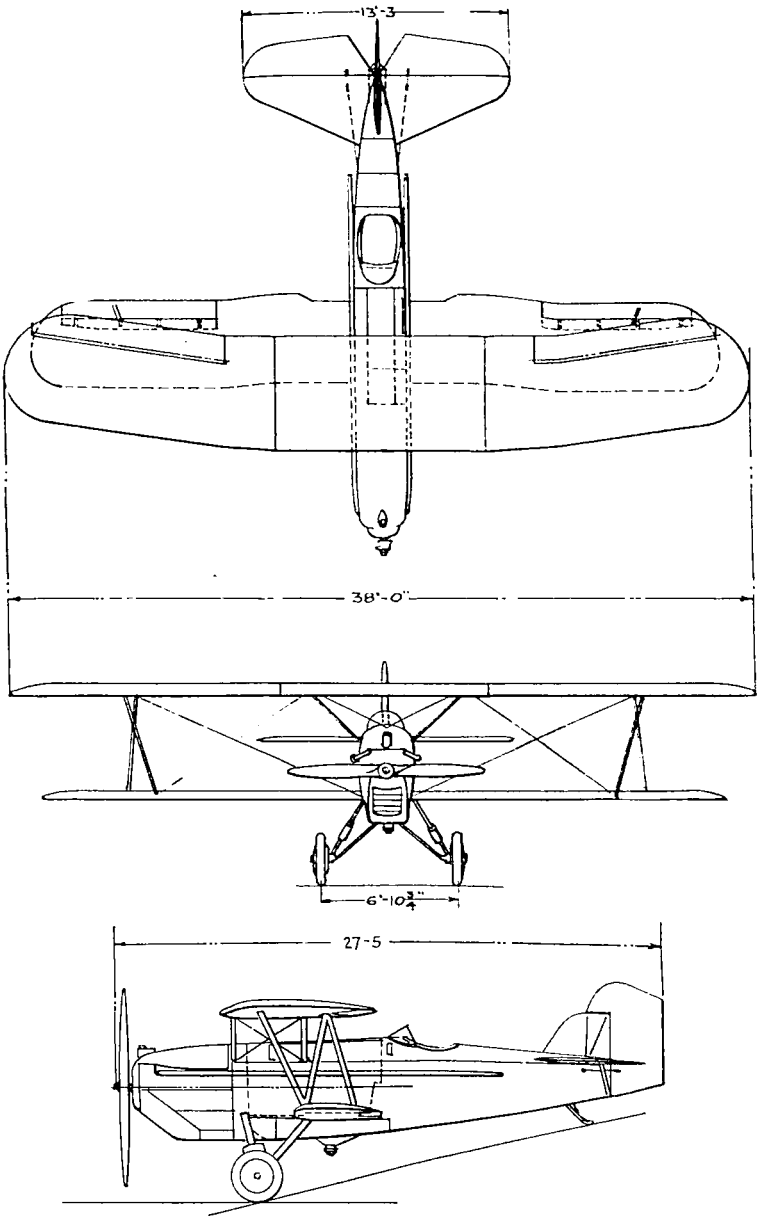
"FLEDGLING" TRAINING PLANE

ENGINE—CURTISS "CHALLENGER"



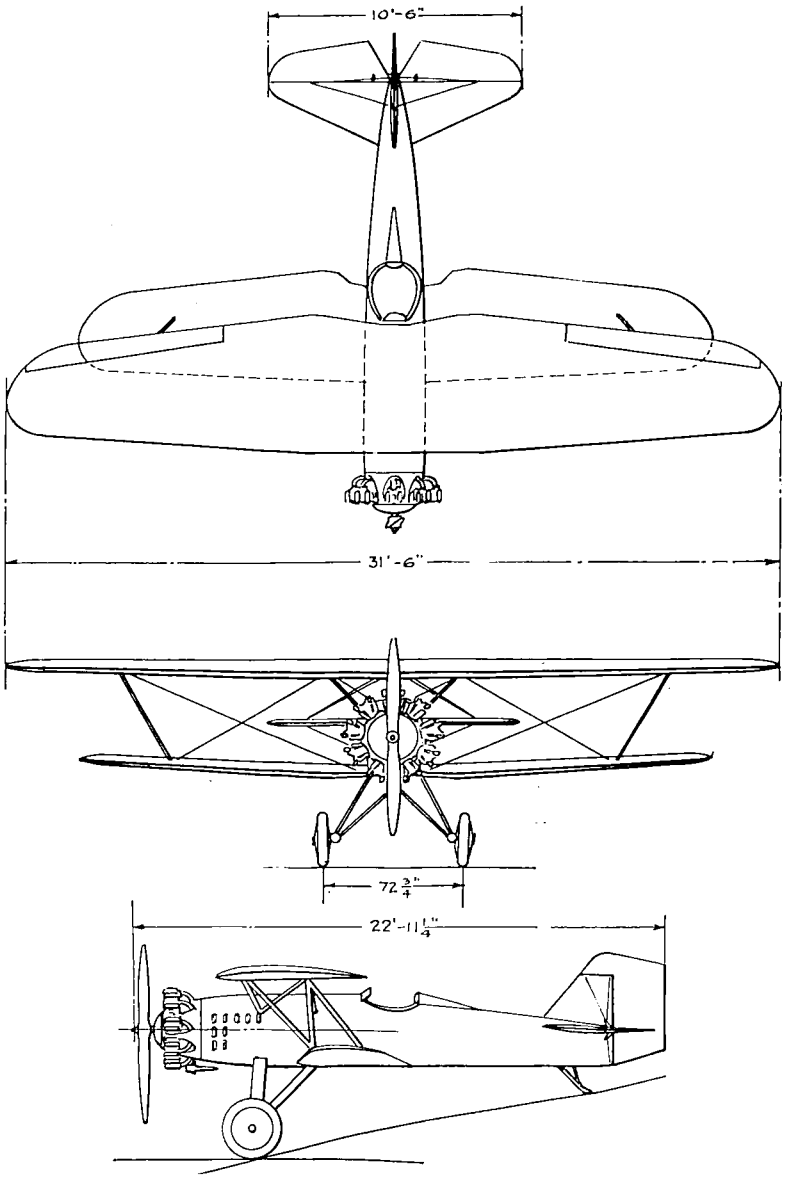
CURTISS AEROPLANE & MOTOR CO., INC.
GARDEN CITY, LONG ISLAND, N. Y.

"FLEDGLING" NAVY TRAINING PLANE N2C-1
ENGINE—WRIGHT "WHIRLWIND"



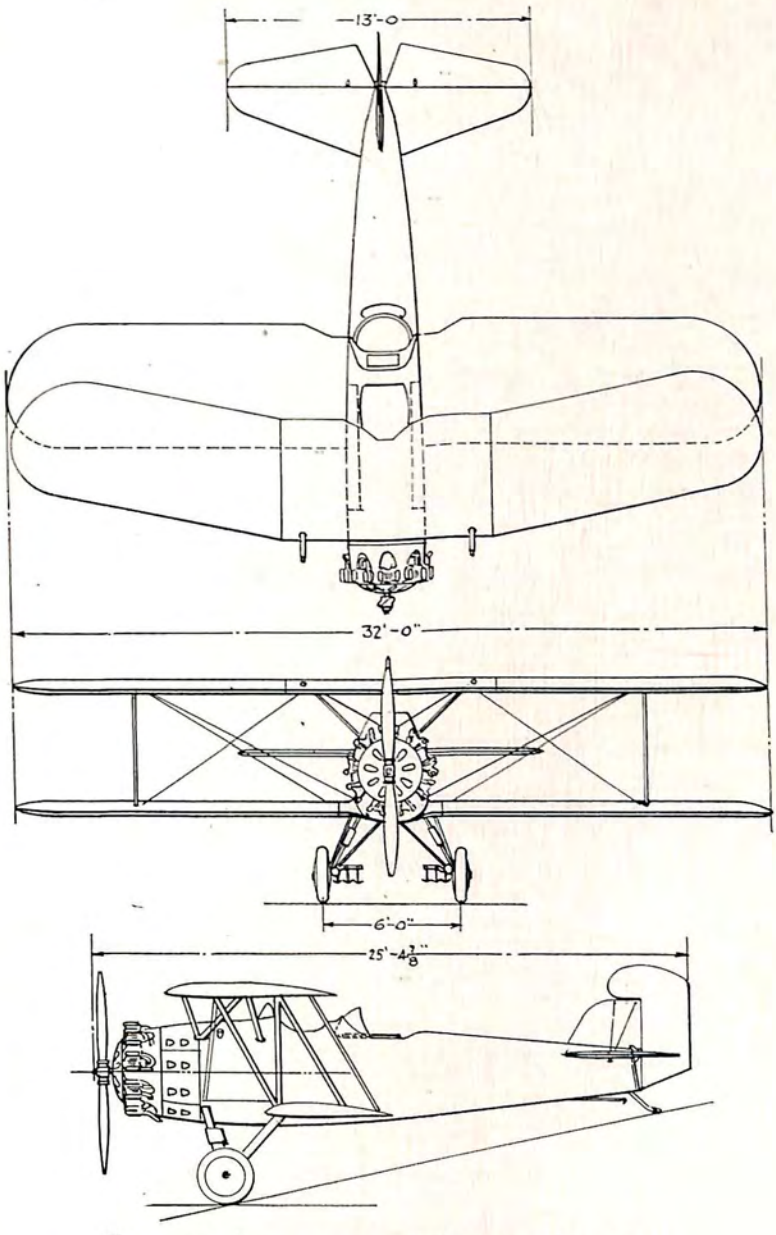
CURTISS AEROPLANE & MOTOR CO., INC.
GARDEN CITY, LONG ISLAND, N. Y.

"FALCON" MAIL PLANE
ENGINE—"LIBERTY"



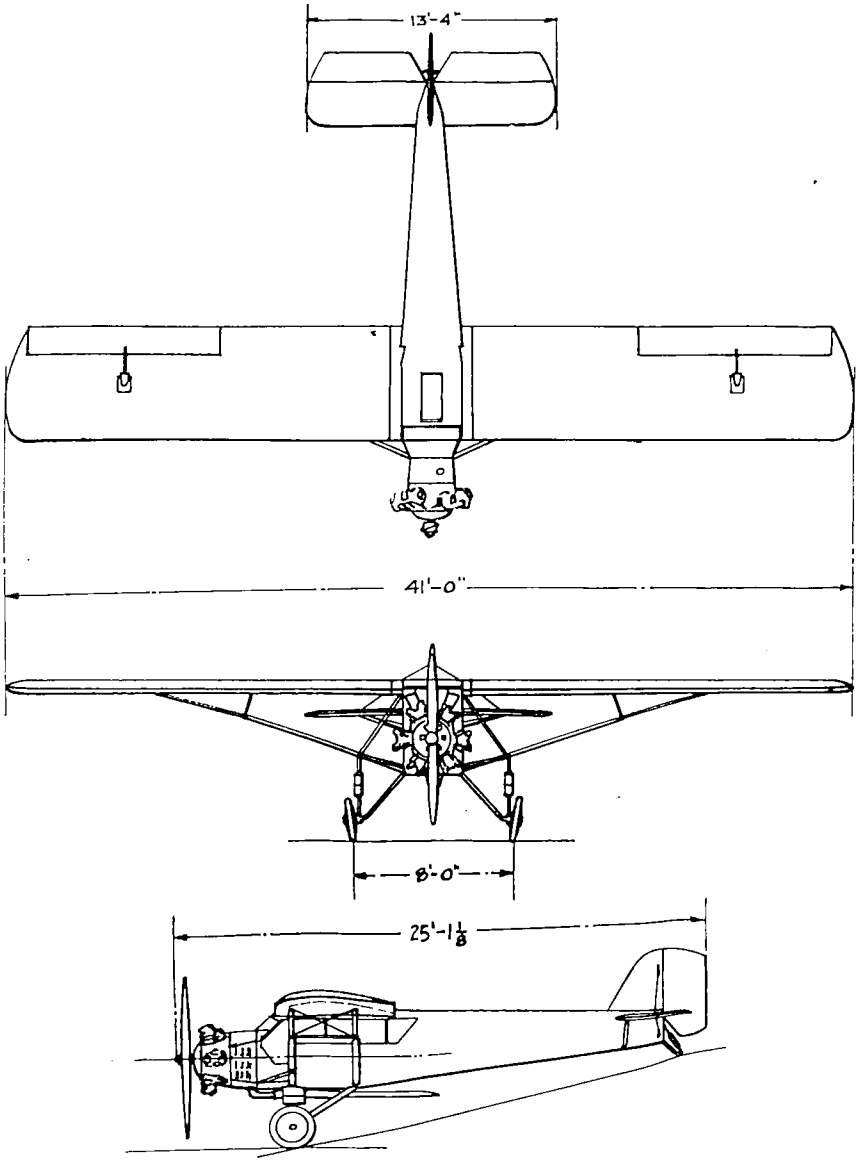
CURTISS AEROPLANE & MOTOR CO., INC.
GARDEN CITY, LONG ISLAND, N. Y.

"HAWK" PURSUIT P-3A
ENGINE—PRATT & WHITNEY "WASP"



CURTISS AEROPLANE & MOTOR CO., INC.
GARDEN CITY, LONG ISLAND, N. Y.

NAVY TWO-SEATER FIGHTER XF8C-2
ENGINE—PRATT & WHITNEY "WASP"

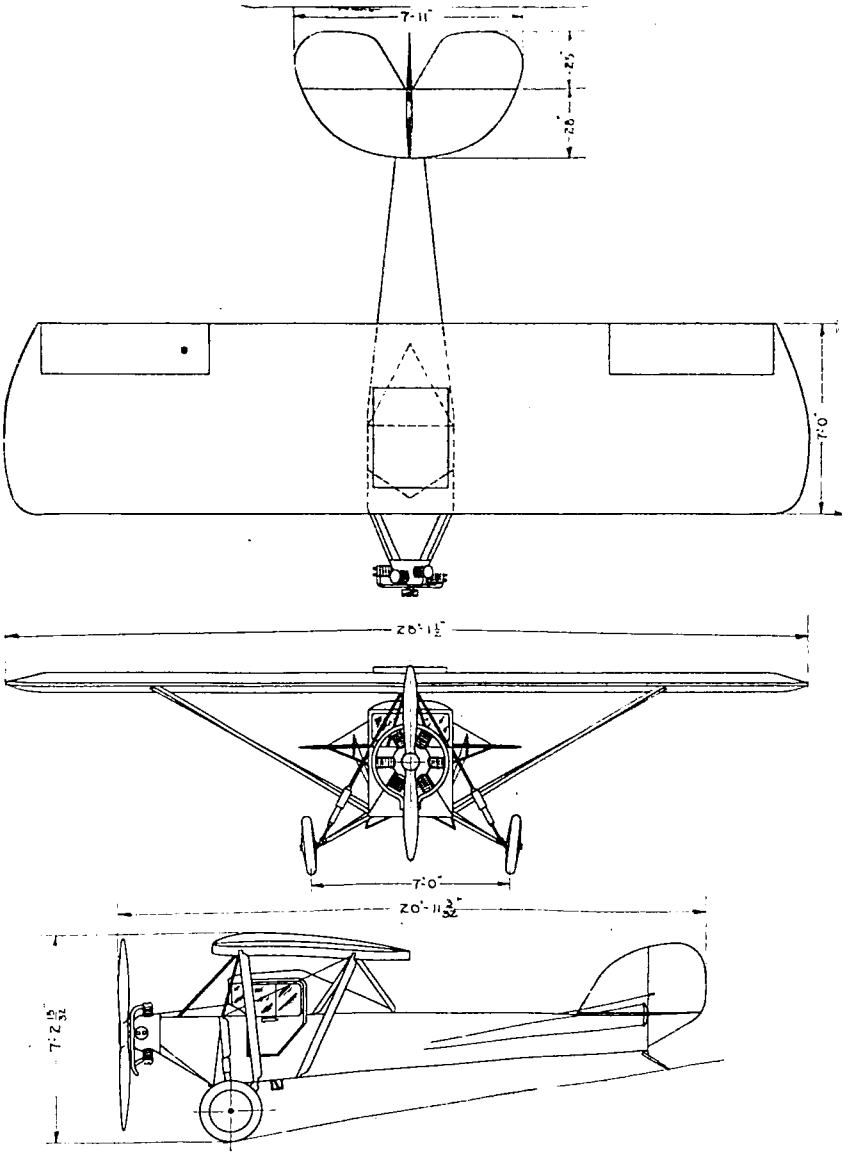


CURTISS-ROBERTSON AIRPLANE MFG. CO.

ST. LOUIS, MO.

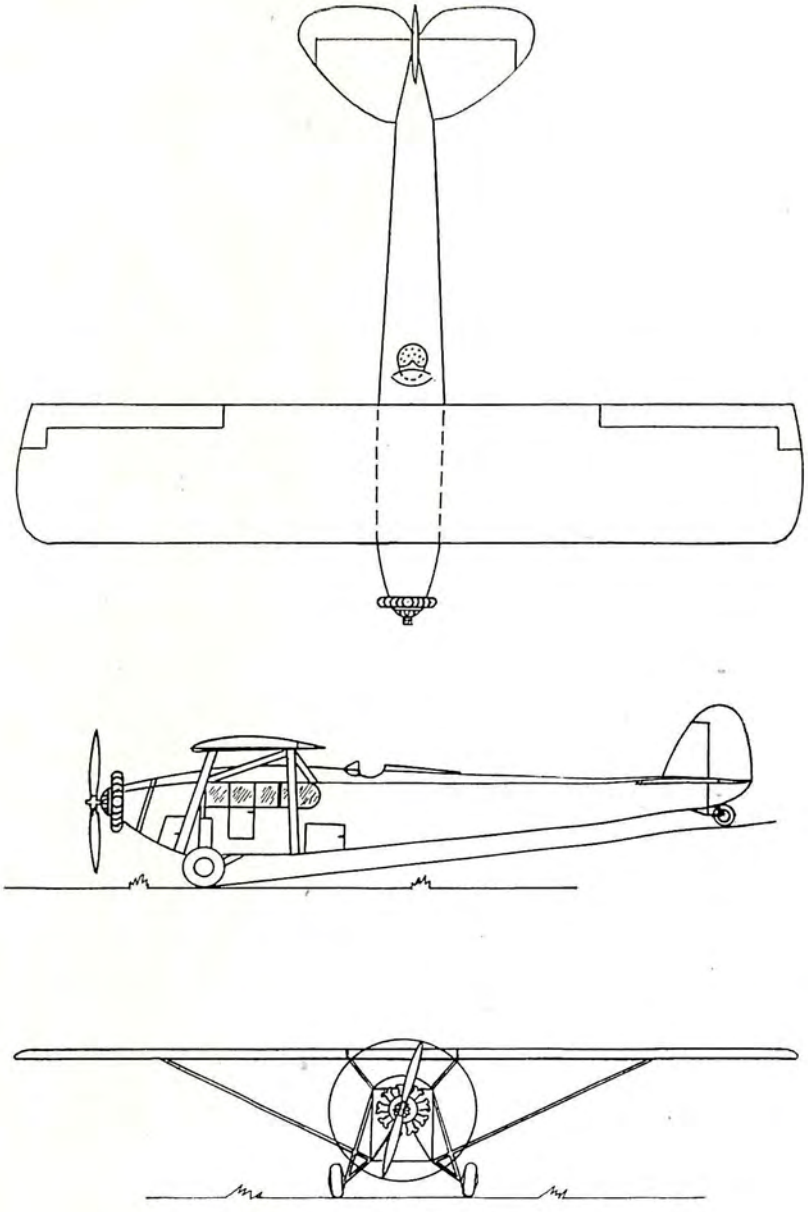
"ROBIN" CABIN MONOPLANE

ENGINE—CURTISS "CHALLENGER"



G. ELIAS & BRO., INC.
BUFFALO, N. Y.

CABIN MONOPLANE "EC-1"
ENGINE—ANZANI 80 H.P.

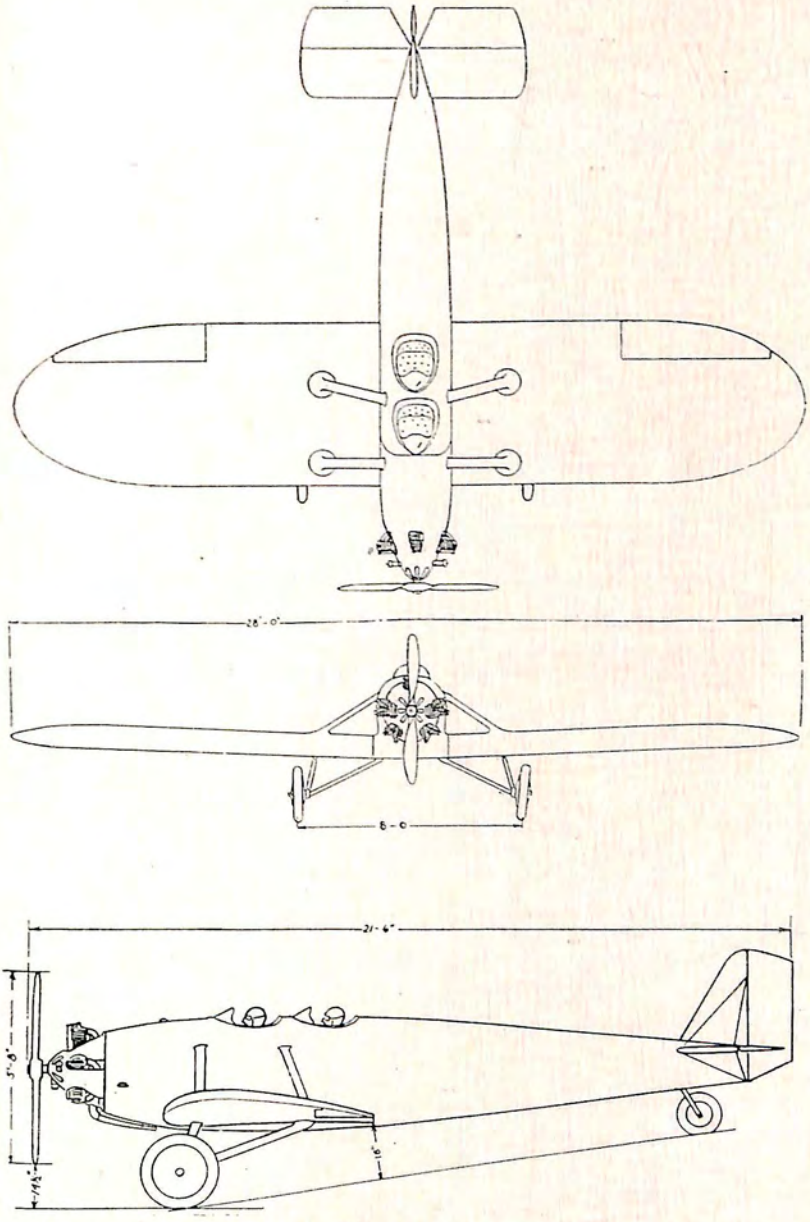


G. Elias & Bro., Inc.

Buffalo, N. Y.

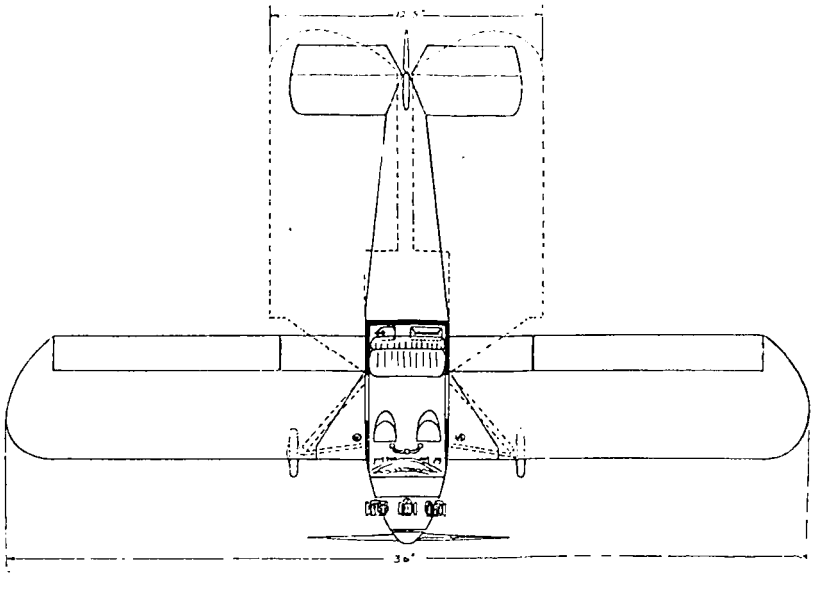
"Airmobile" EC-3 Cabin Monoplane

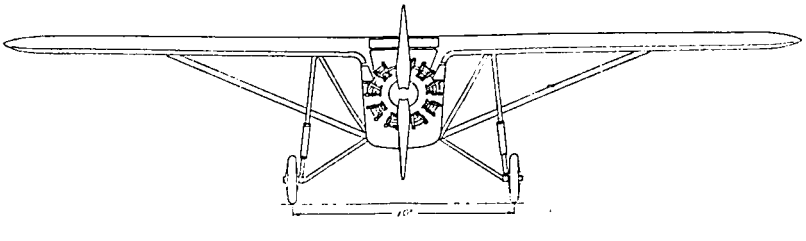
Engine—"Liberty"

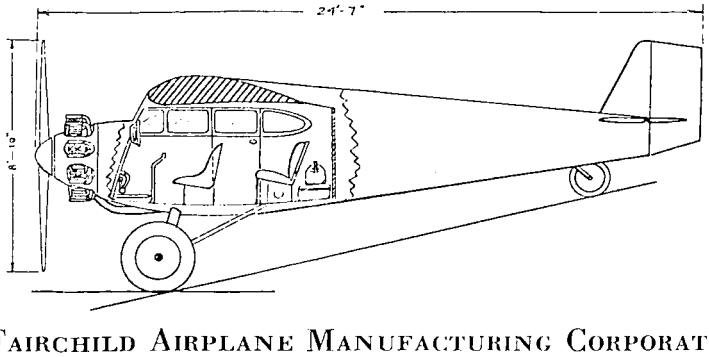


FAIRCHILD AIRPLANE MANUFACTURING CORPORATION
FARMINGDALE, LONG ISLAND, N. Y.

"FAIRCHILD-21" LOW WING MONOPLANE
ENGINE—80 H.P. "GENET"





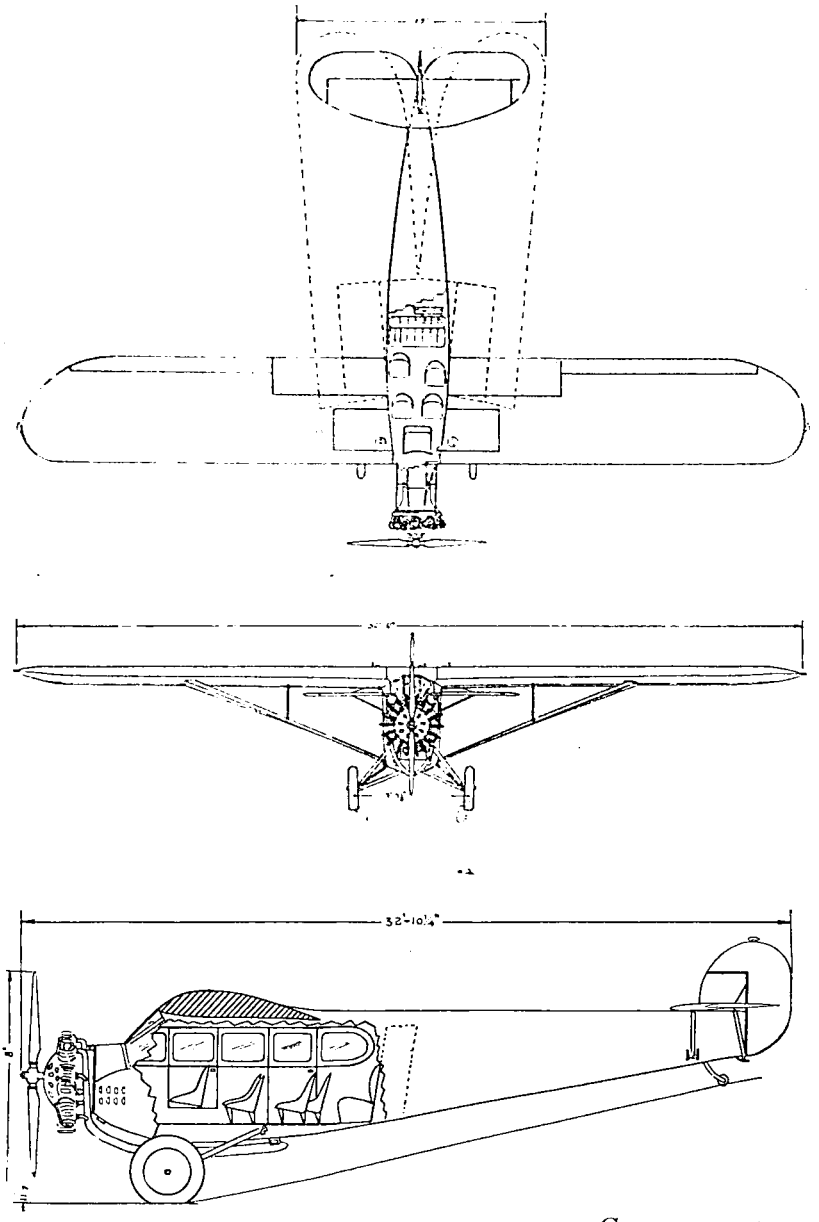


FAIRCHILD AIRPLANE MANUFACTURING CORPORATION

FARMINGDALE, LONG ISLAND, N. Y.

"FAIRCHILD-41" 4-PLACE CABIN MONOPLANE

ENGINE—WRIGHT "WHIRLWIND"

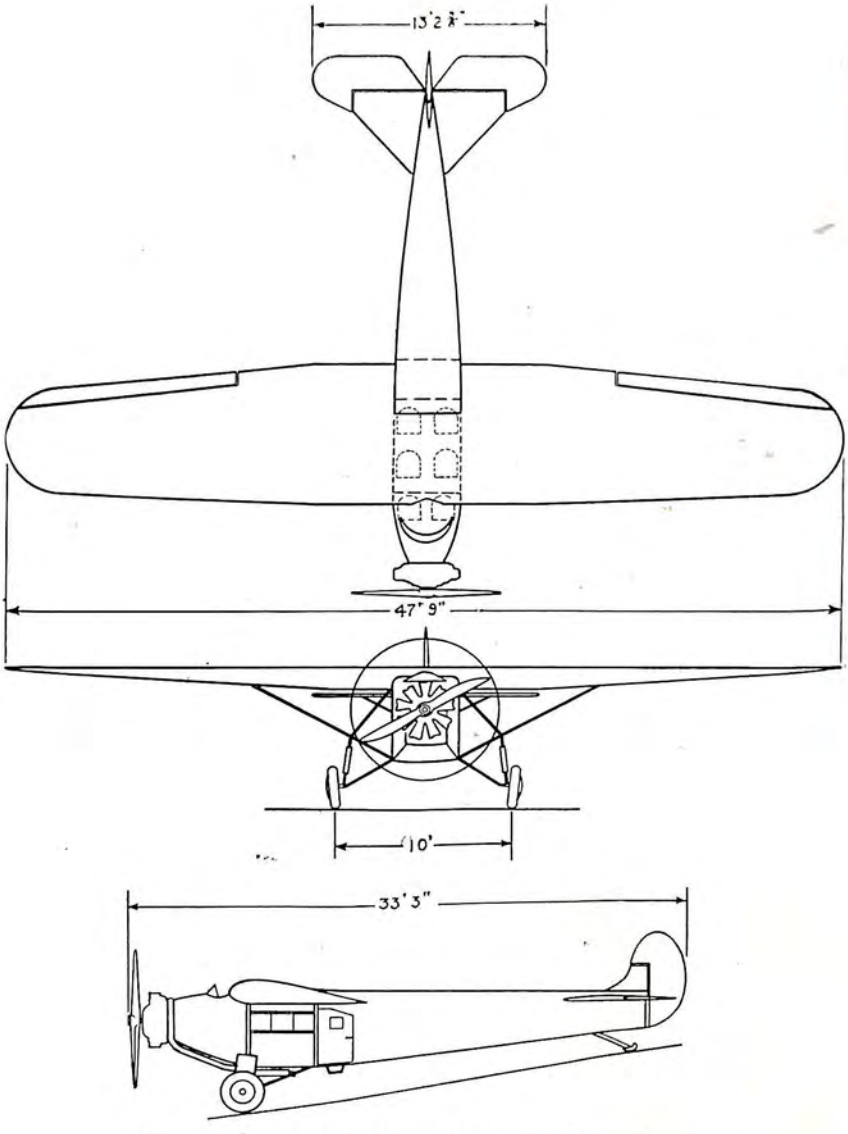


FAIRCHILD AIRPLANE MANUFACTURING CORPORATION

FARMINGDALE, LONG ISLAND, N. Y.

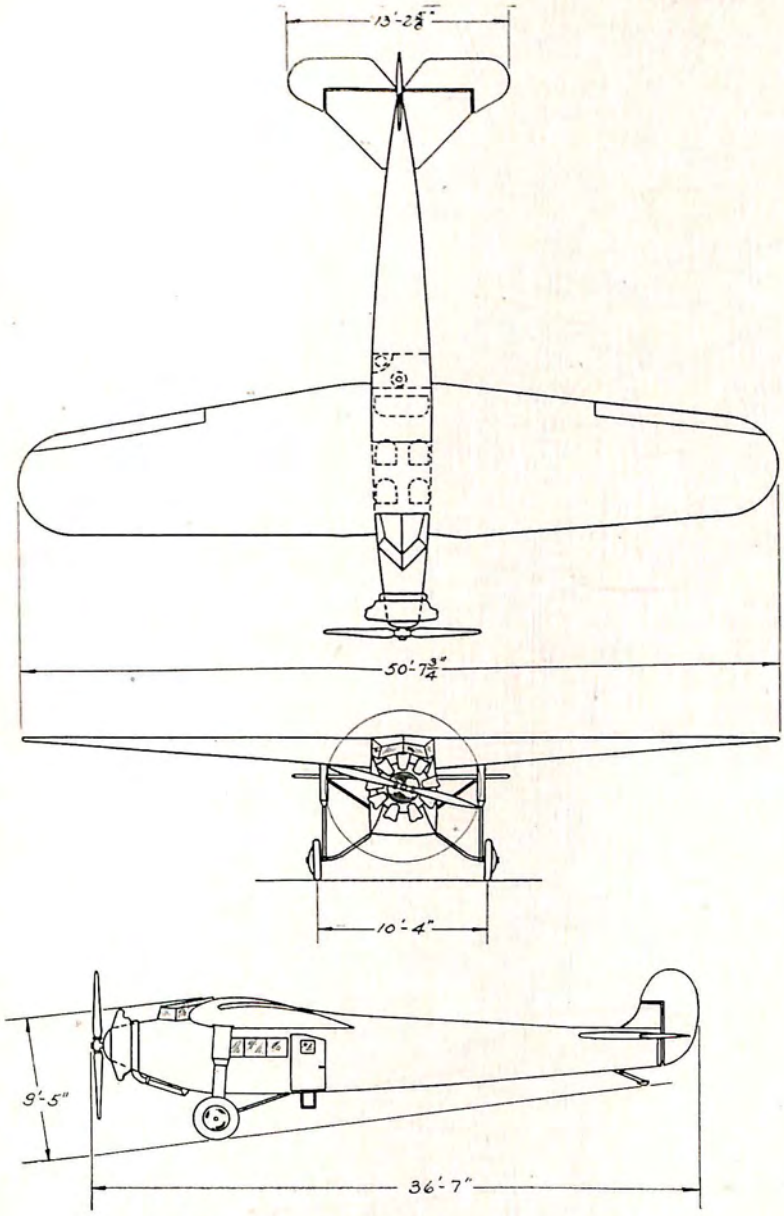
"FAIRCHILD-71" 6-PASSENGER CABIN MONOPLANE

ENGINE—PRATT & WHITNEY "WASP"



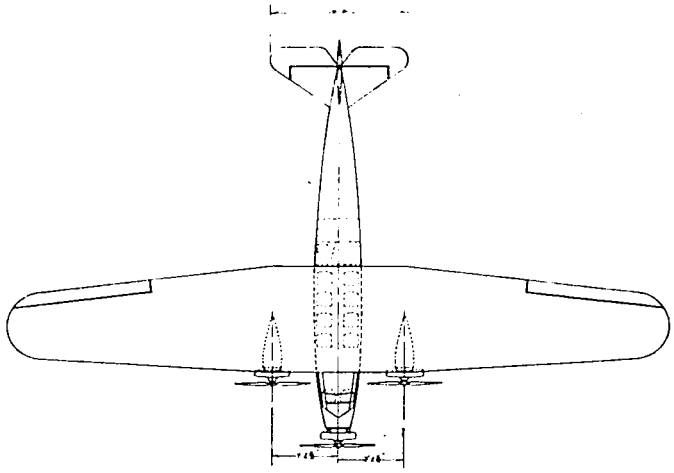
FOKKER AIRCRAFT CORP. OF AMERICA
NEW YORK

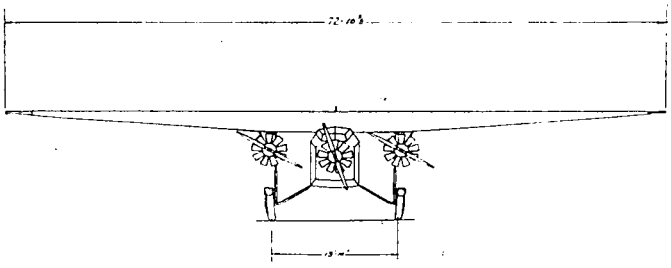
"UNIVERSAL" TRANSPORT
ENGINE—WRIGHT "WHIRLWIND"

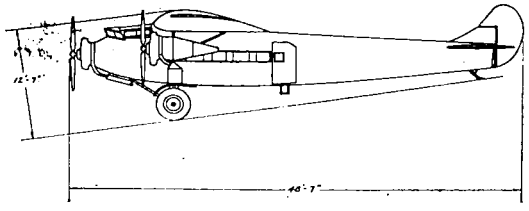


FOKKER AIRCRAFT CORP. OF AMERICA
NEW YORK

"SUPER-UNIVERSAL" TRANSPORT
ENGINE—PRATT & WHITNEY "WASP"





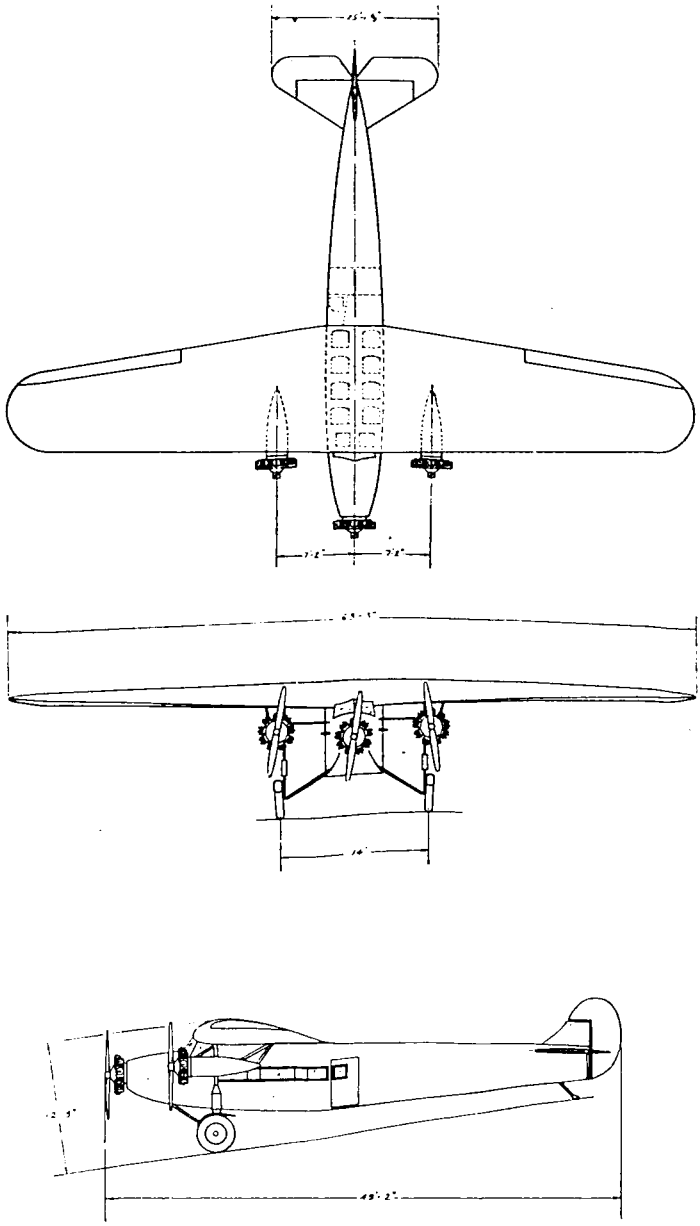


FOKKER AIRCRAFT CORP. OF AMERICA

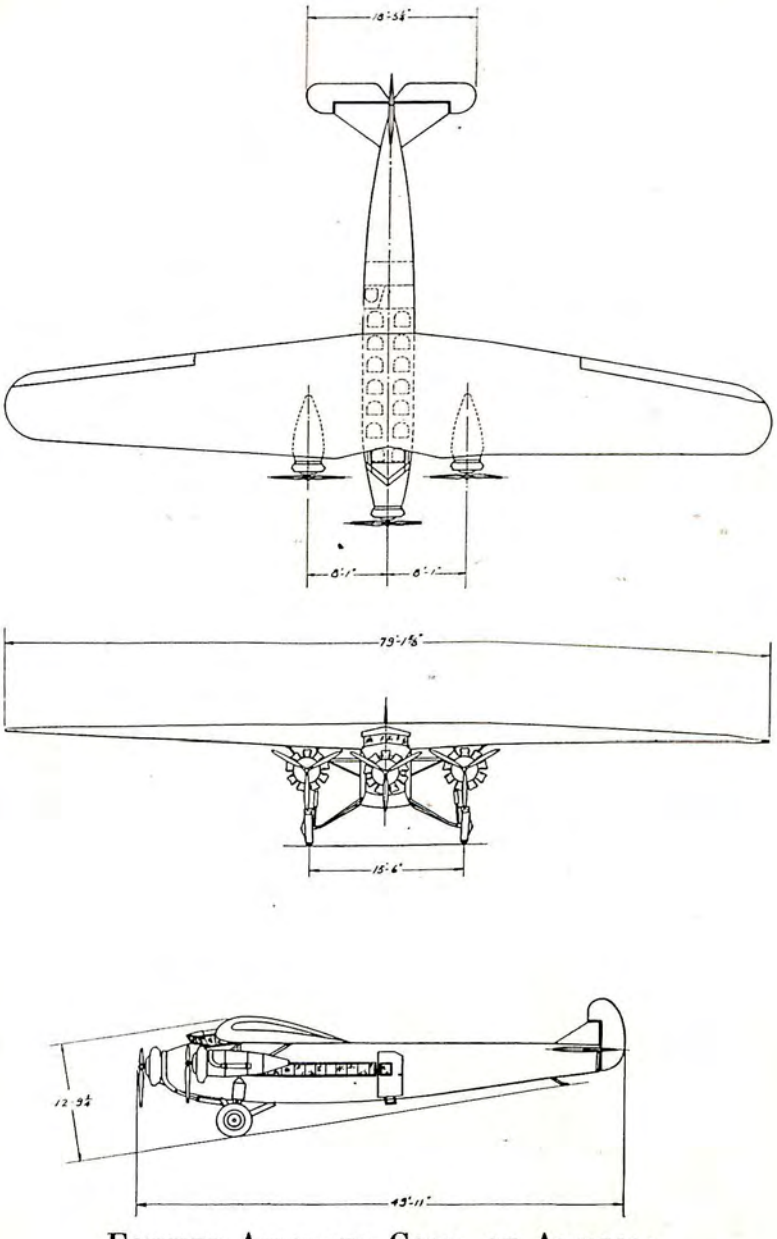
NEW YORK

C-2A TRANSPORT

3 ENGINES—WRIGHT "J-5"

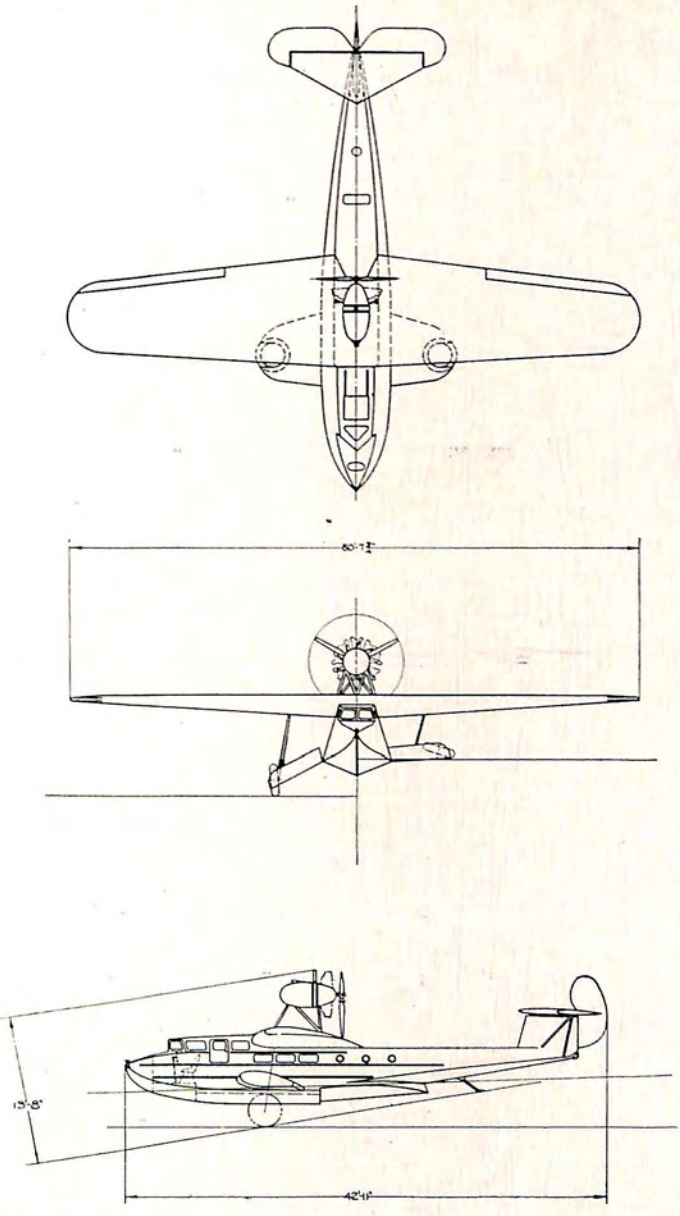


FOKKER AIRCRAFT CORP. OF AMERICA
NEW YORK
F-7 TRANSPORT
3 ENGINES—WRIGHT "WHIRLWIND"



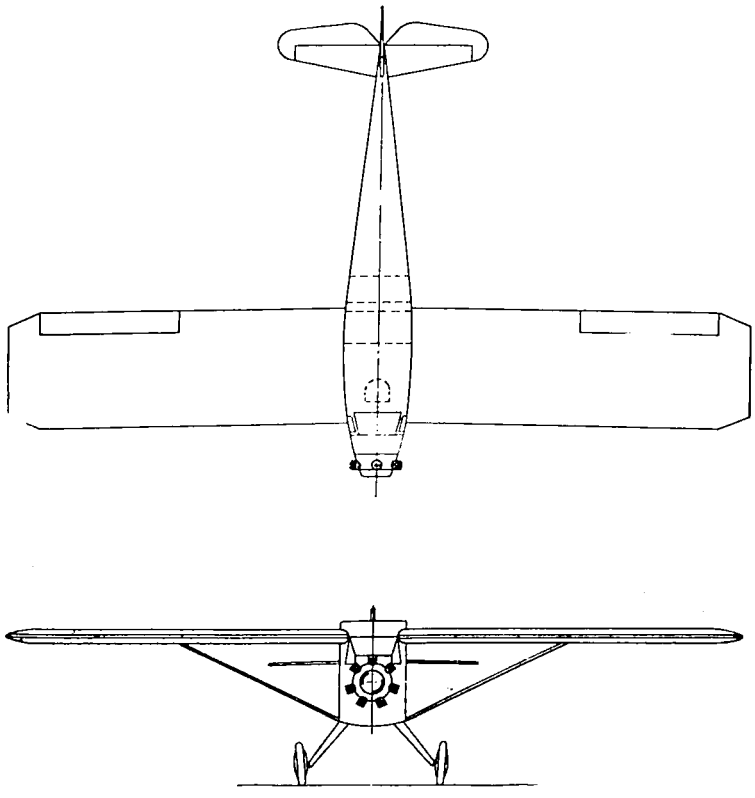
FOKKER AIRCRAFT CORP. OF AMERICA
NEW YORK

"F-10 TRANSPORT" 12 PASSENGERS
3 ENGINES—PRATT & WHITNEY "WASP"



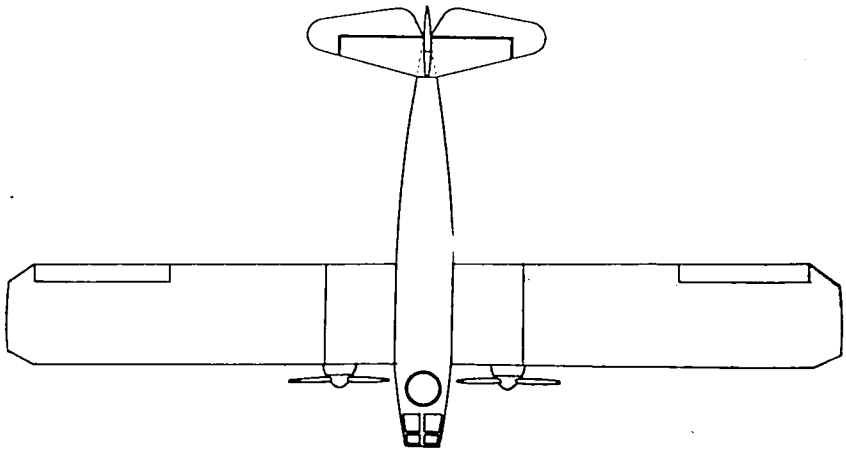
Fokker Aircraft Corp. of America
New York

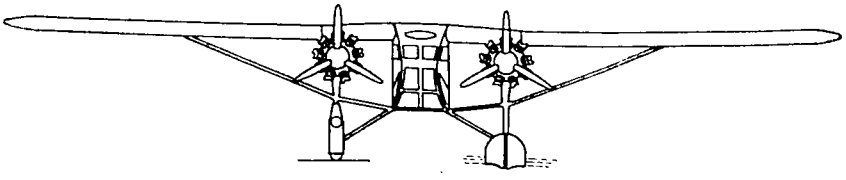
"F-11 Amphibian" 6 Passengers
Engine—Pratt & Whitney "Hornet" or
Wright "Cyclone"

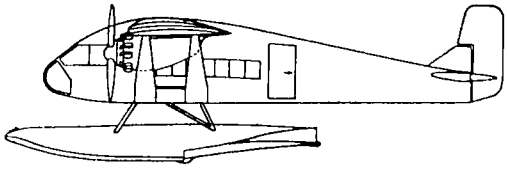


GENERAL AIRPLANES CORP.
BUFFALO, N. Y.

"ARISTOCRAT" 3-PLACE CABIN
ENGINE—WARNER 110 H.P.

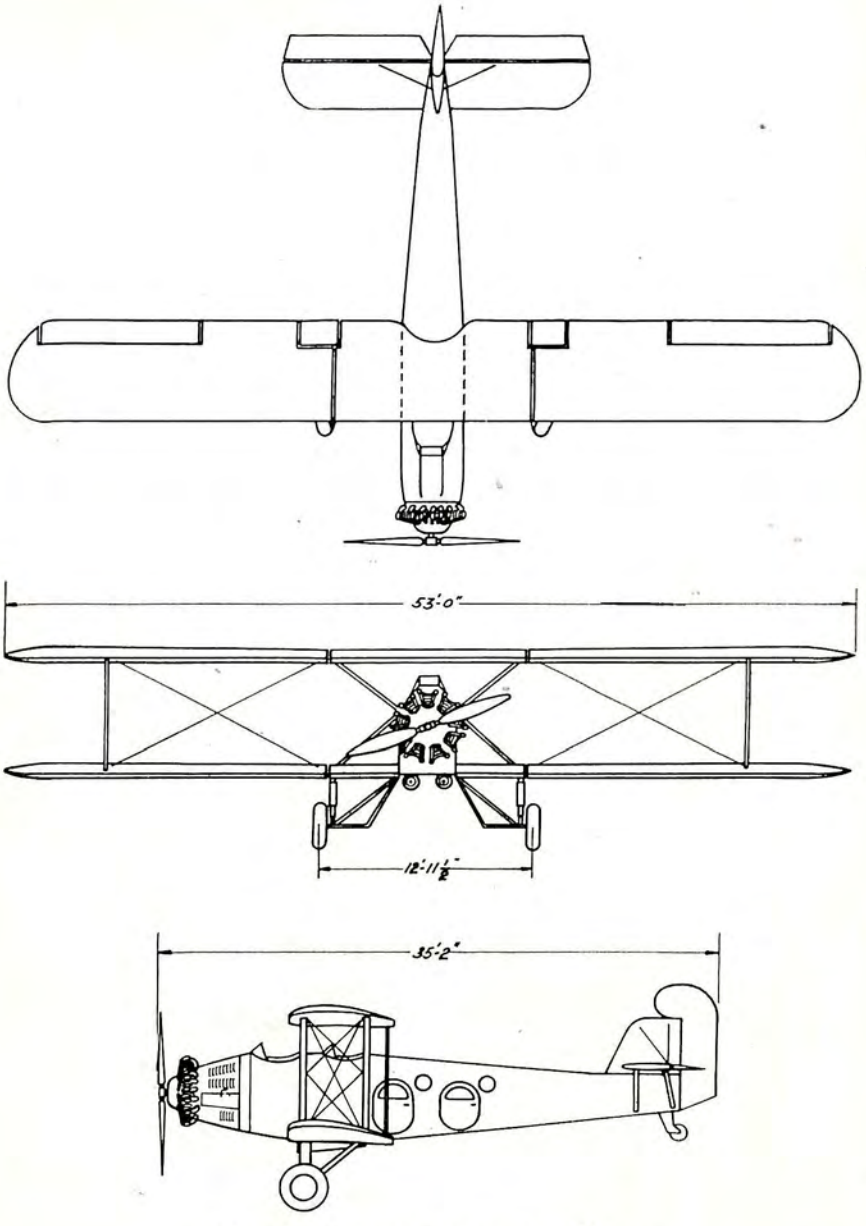






GENERAL AIRPLANES CORP.
BUFFALO, N. Y.

"SURVEYOR" PHOTOGRAPHIC
TWO ENGINES—WRIGHT J-6 300 H.P.

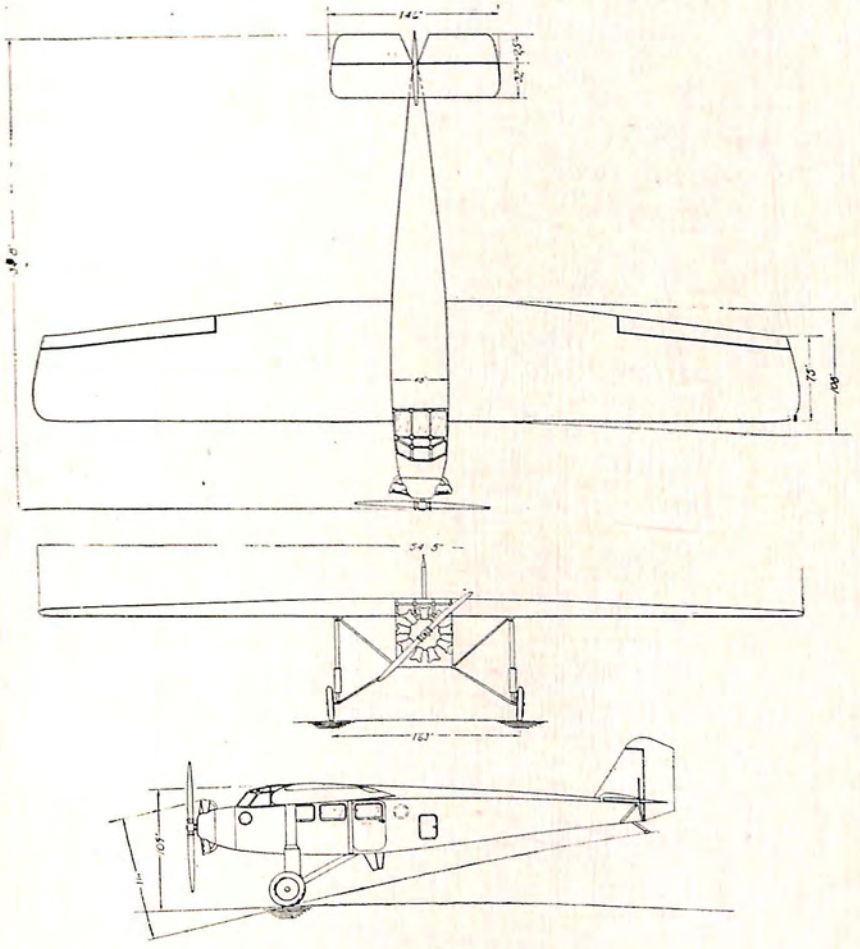


Great Lakes Aircraft Corp.

Cleveland, O.

Great Lakes No. 1, 8-Place

Engine—Pratt & Whitney "Hornet" or Wright "Cyclone"

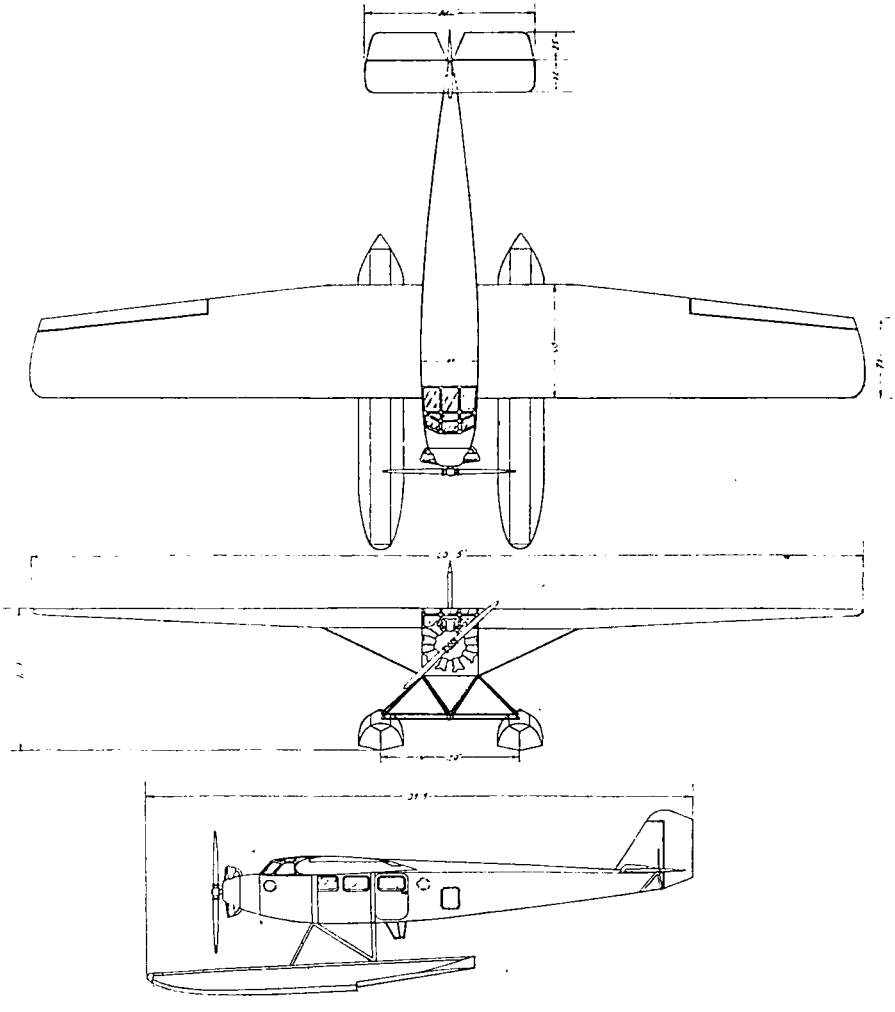


Hamilton Metalplane Co.

Milwaukee, Wis.

Metal Cabin Airplane

Engine—Pratt & Whitney "Wasp" or
Pratt & Whitney "Hornet"

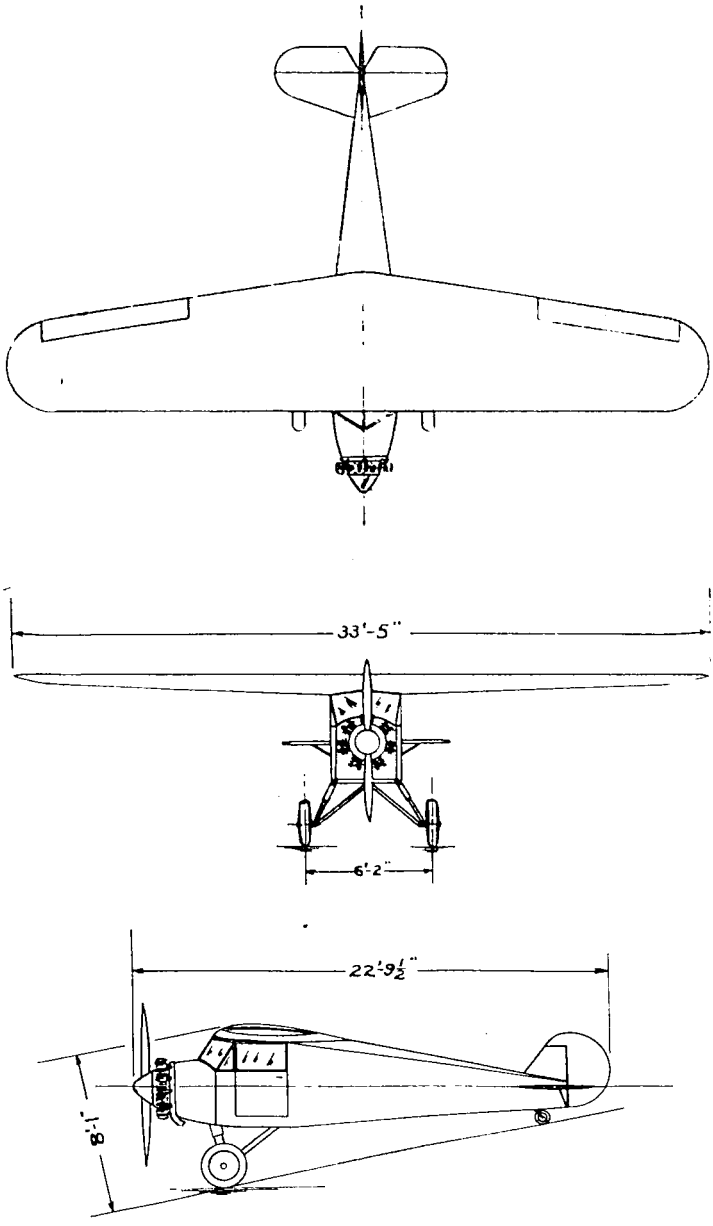


Hamilton Metalplane Co.

Milwaukee, Wis.

Metal Cabin Seaplane

Engine—Pratt & Whitney "Wasp" or
Pratt & Whitney "Hornet"

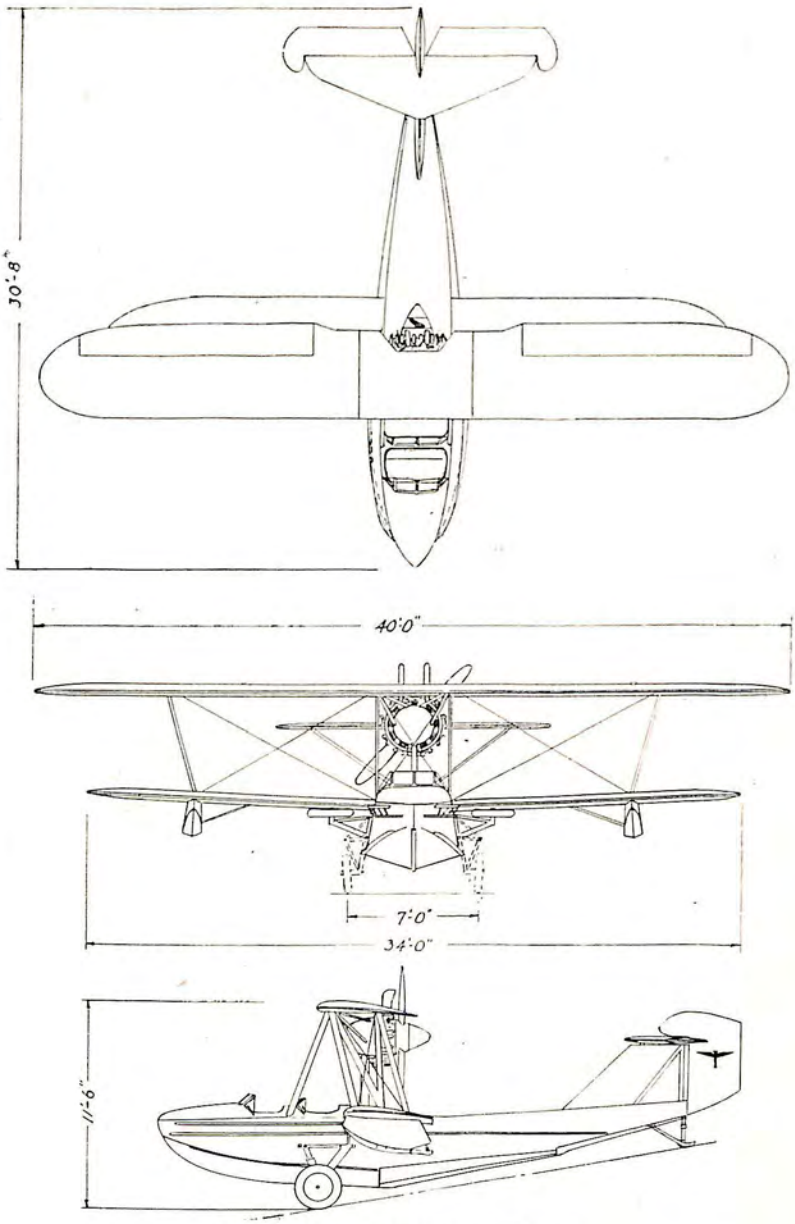


Huntington Aircraft Corp.

Bridgeport, Conn.

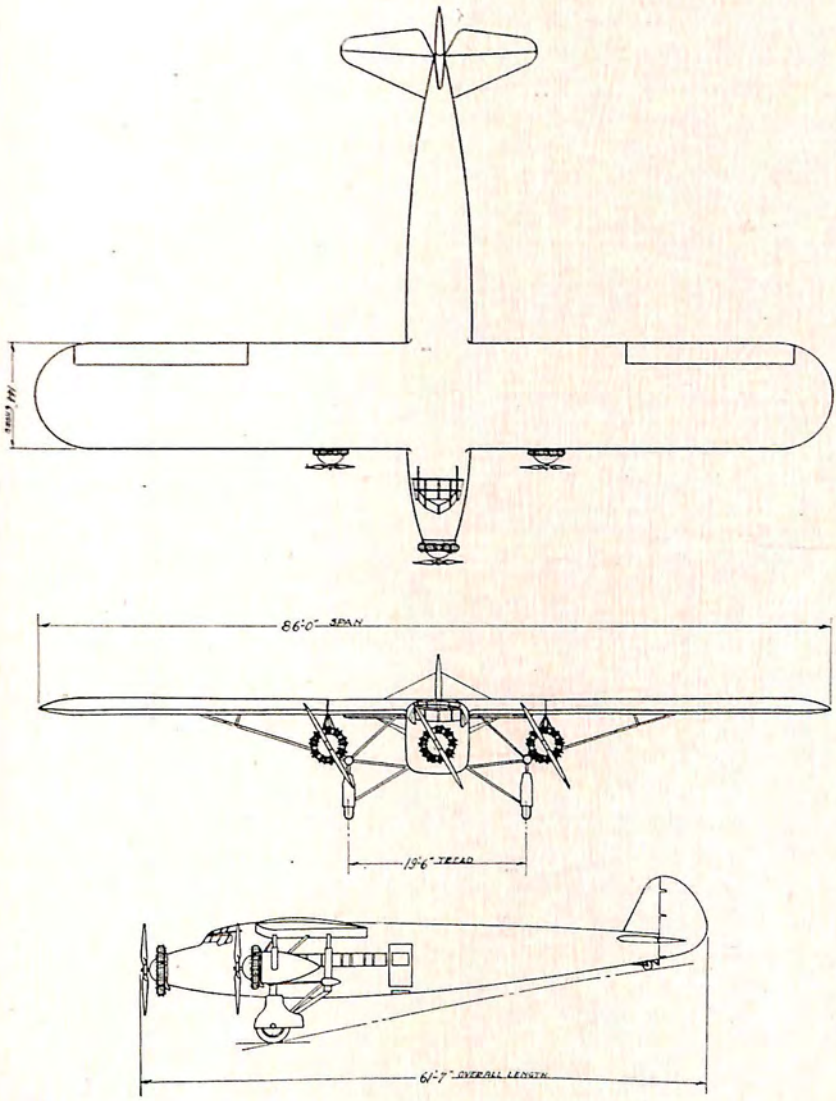
"Model 11" 2 Passengers

Engine—Warner "Scarab"

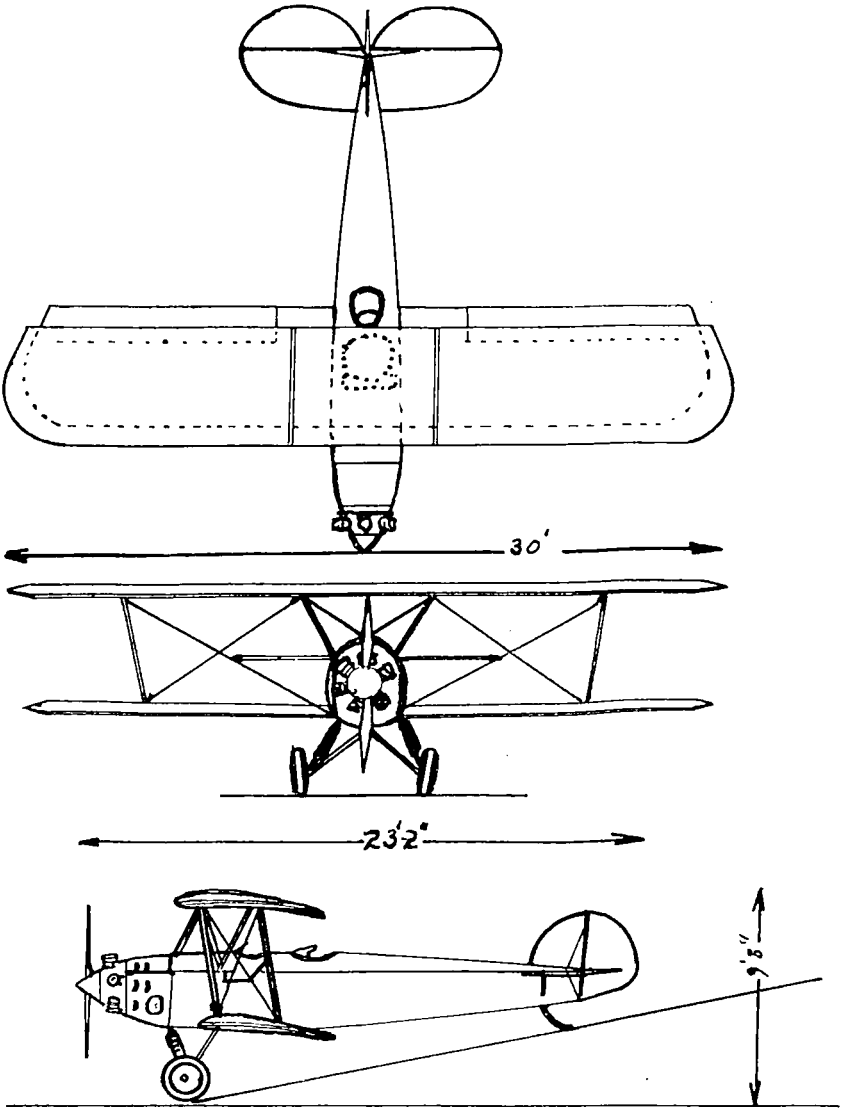


IRELAND AIRCRAFT INC.
GARDEN CITY, LONG ISLAND, N. Y.

AMPHIBIAN
ENGINE—WRIGHT "WHIRLWIND"



KEYSTONE AIRCRAFT CORP.
BRISTOL, PA.
"PATRICIAN" K-78
3 ENGINES—WRIGHT "CYCLONE"

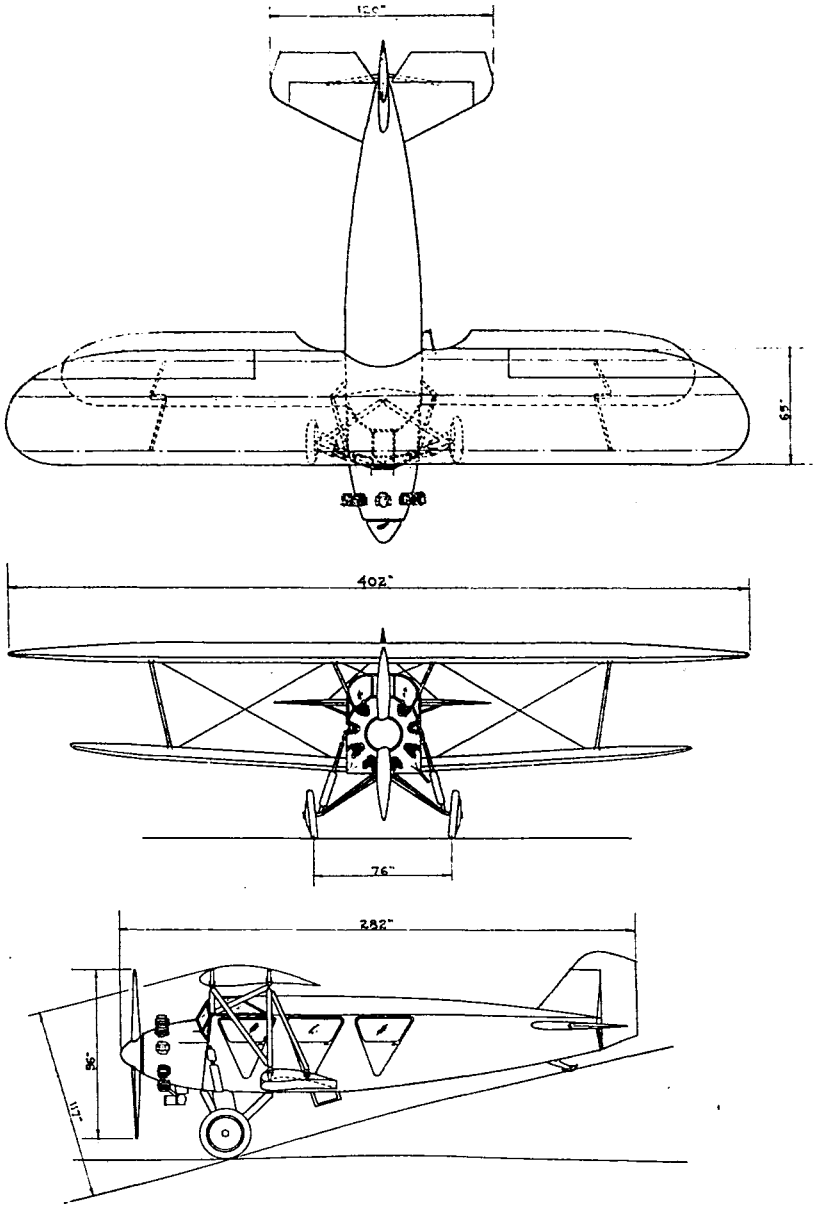


KREIDER REISNER AIRCRAFT CO., INC.

HAGERSTOWN, MD.

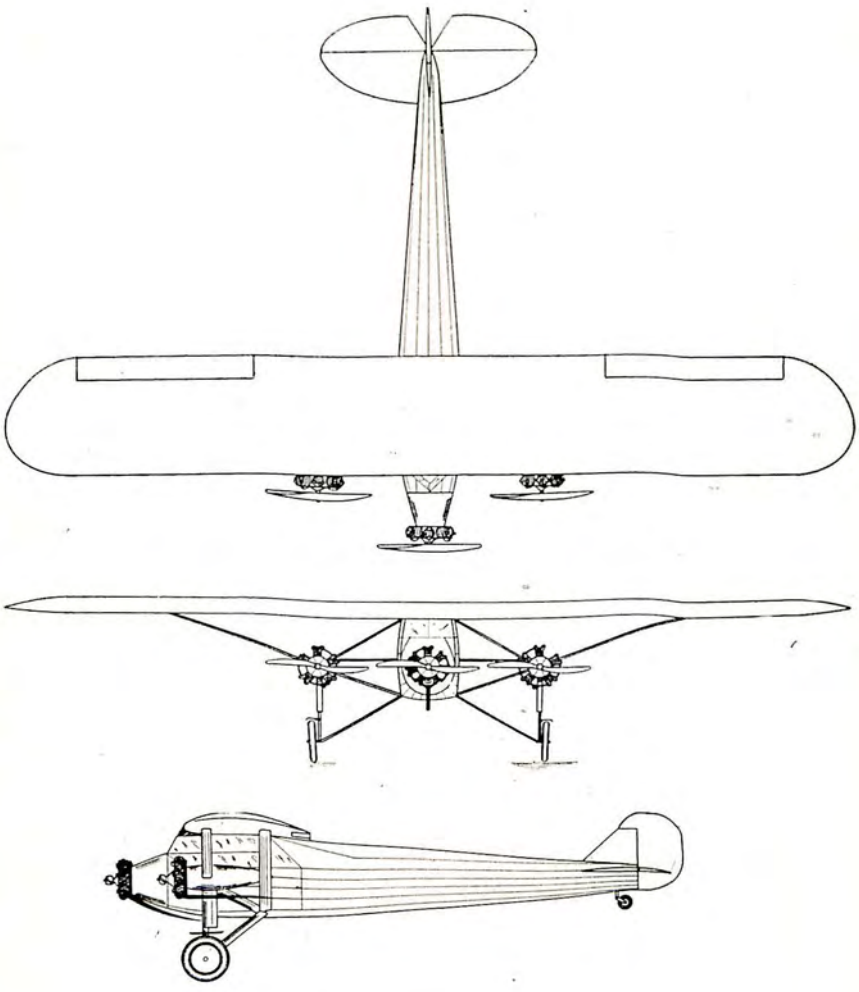
MODEL "C-5"

ENGINE—WARNER 110 H.P.



KNOLL AIRCRAFT CORP.
WICHITA, KAN.

KN-1 4-PLACE CABIN BIPLANE
ENGINE—WRIGHT "WHIRLWIND"

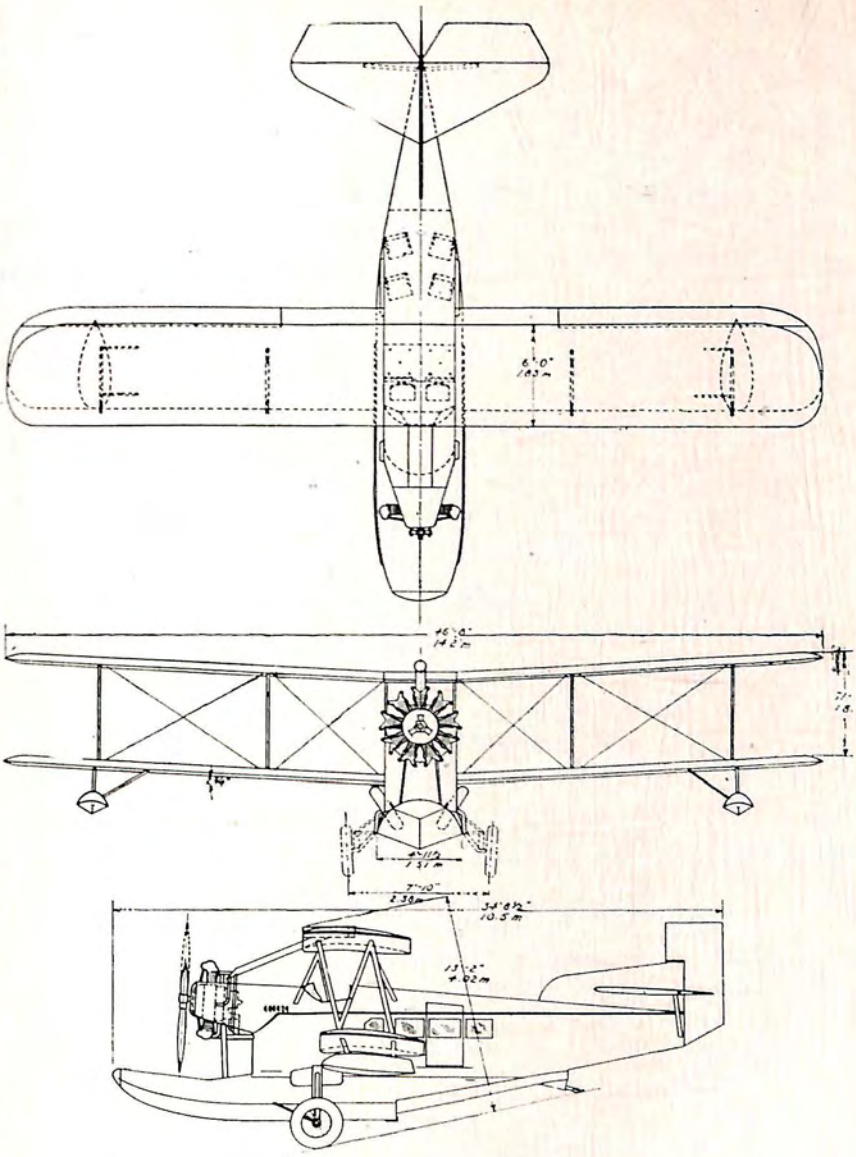


JOSEPH KREUTZER CORPORATION

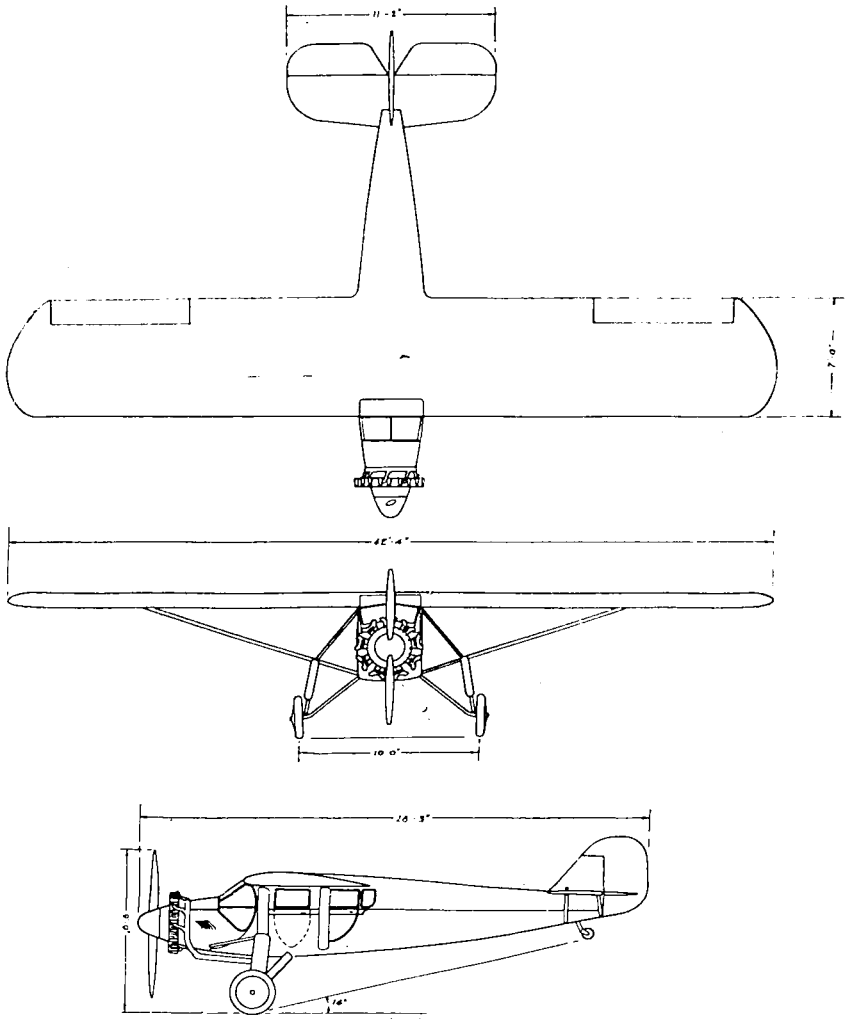
AIRCRAFT DIVISION—LOS ANGELES, CALIF.

36-CLM "AIR COACH" 6-PLACE

3 ENGINES



LOENING AERONAUTICAL ENGINEERING CORP.
NEW YORK CITY
DIVISION OF KEYSTONE AIRCRAFT CORP.
BRISTOL, PA.
KEYSTONE-LOENING AMPHIBIAN "AIR YACHT"
8 PASSENGERS
ENGINE—WRIGHT "CYCLONE"

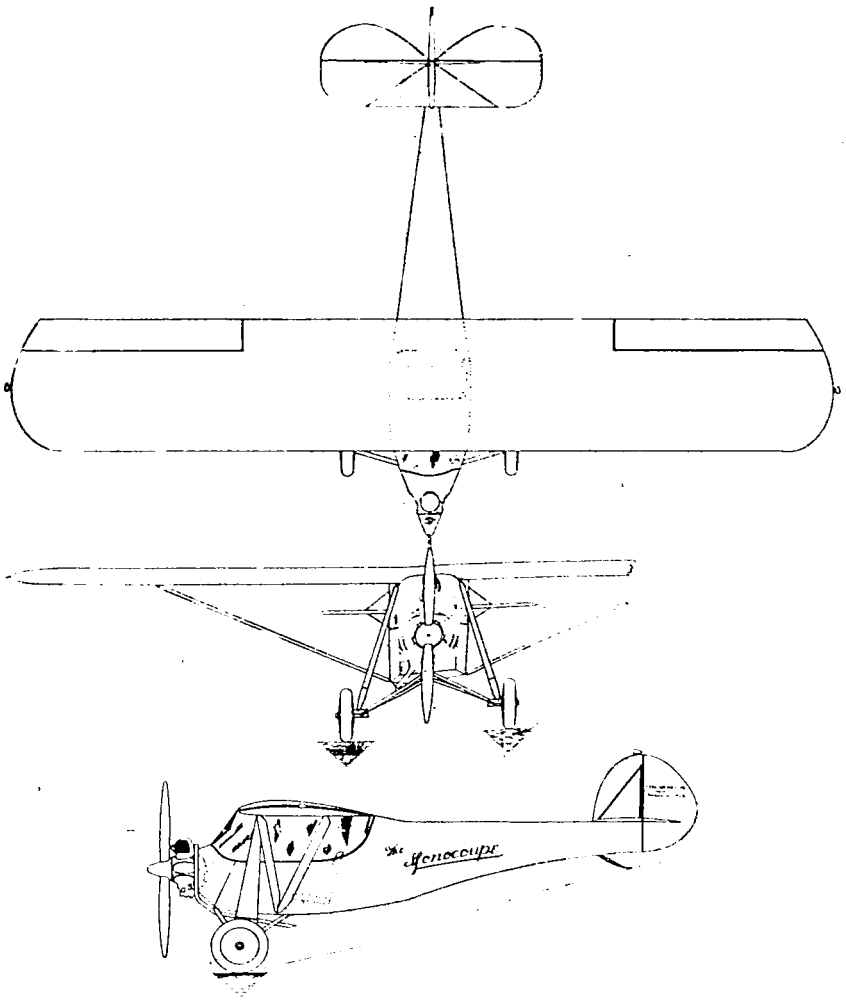


MAHONEY-RYAN AIRCRAFT CORPORATION

ST. LOUIS, MO.

RYAN B-5 "BROUGHAM"

ENGINE—WRIGHT "WHIRLWIND"

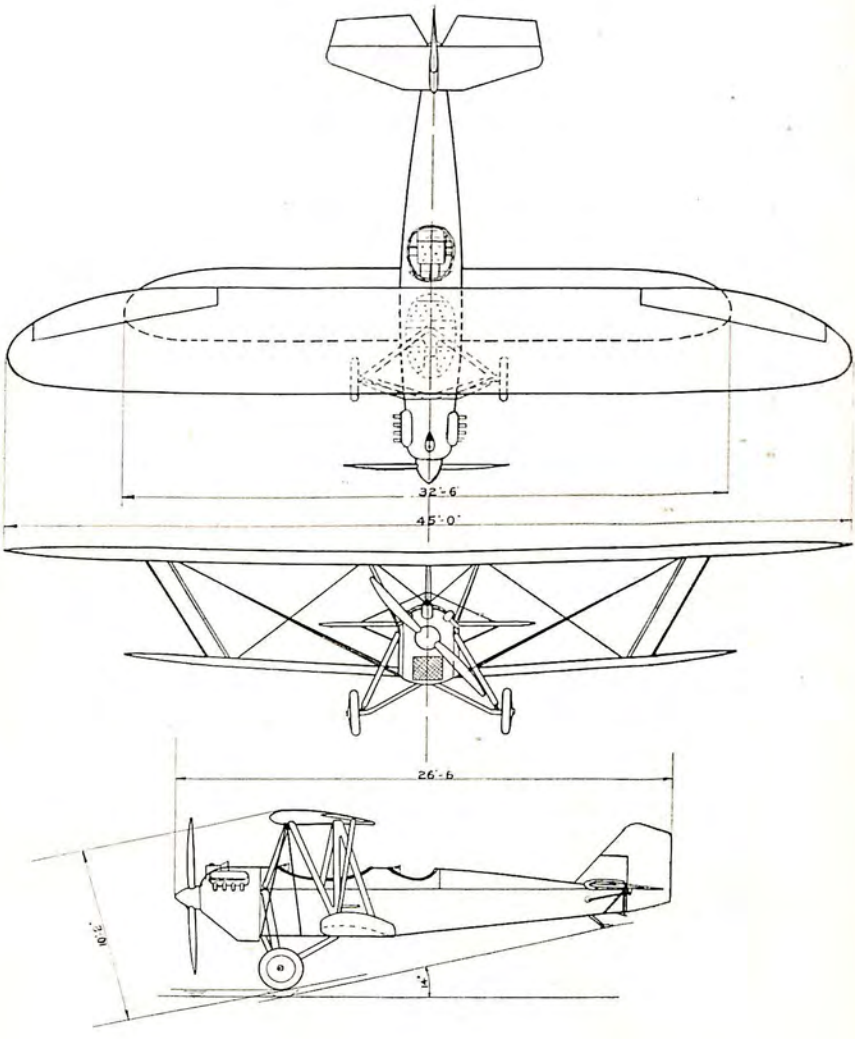


Mono Aircraft, Inc.

Moline, Ill.

"Monocoupe" 2-Place

Engine—Velie "M-5"

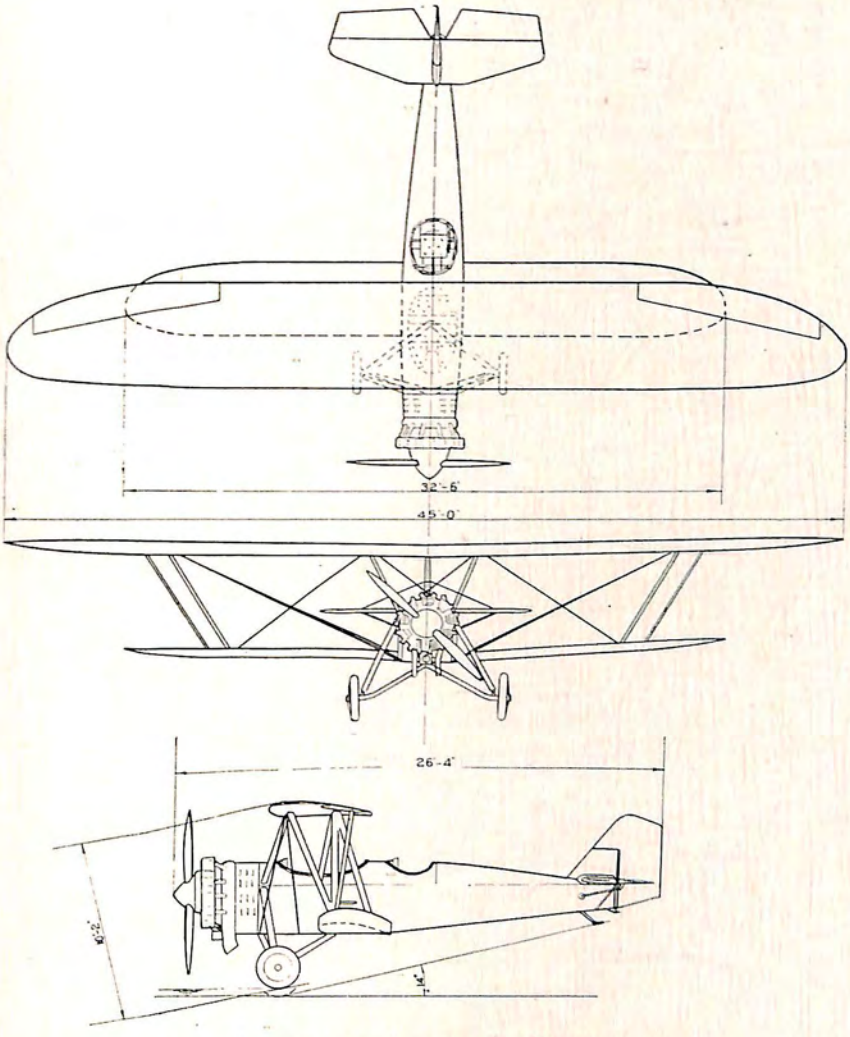


NEW STANDARD AIRCRAFT CORPORATION

PATERSON, N. J.

MODEL GD-24 5 POLB-HS 180 H.P.

ENGINE—"HISPANO SUIZA"

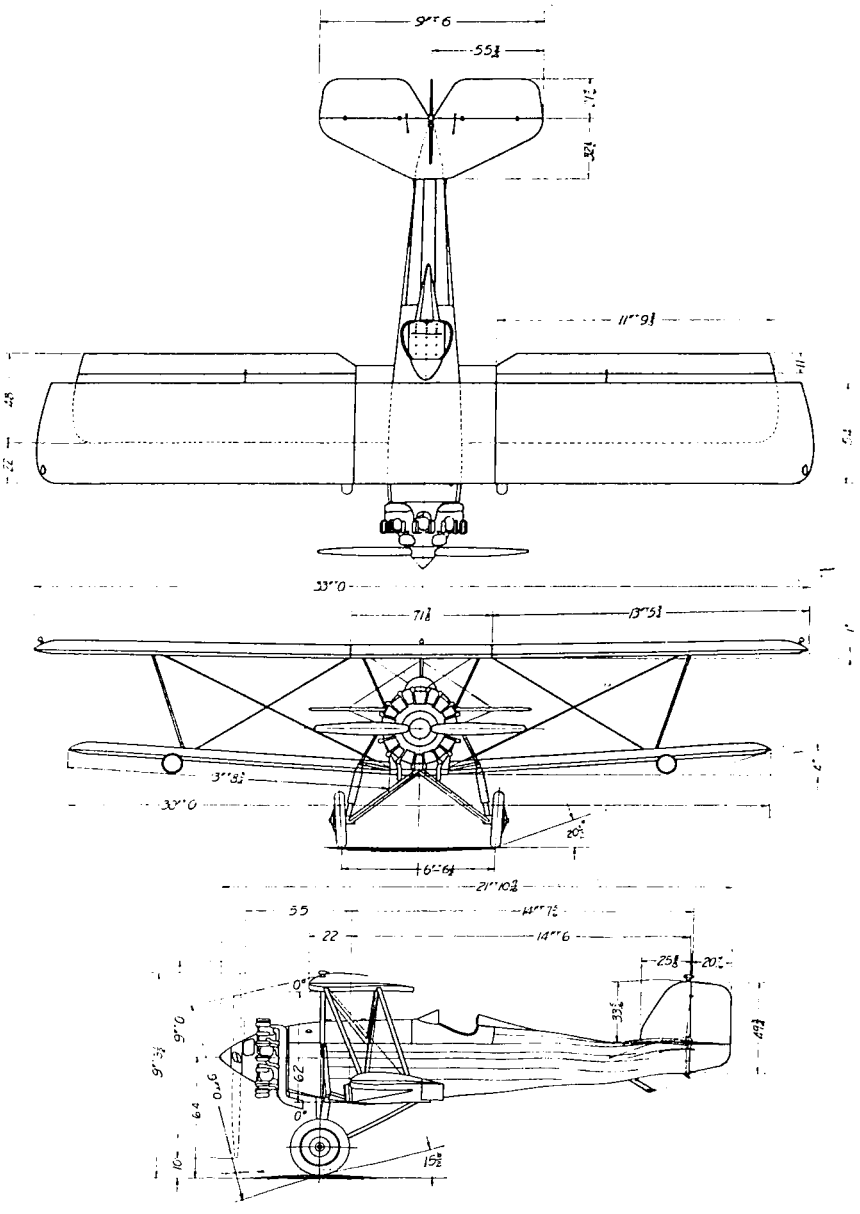


New Standard Aircraft Corporation

Paterson, N. J.

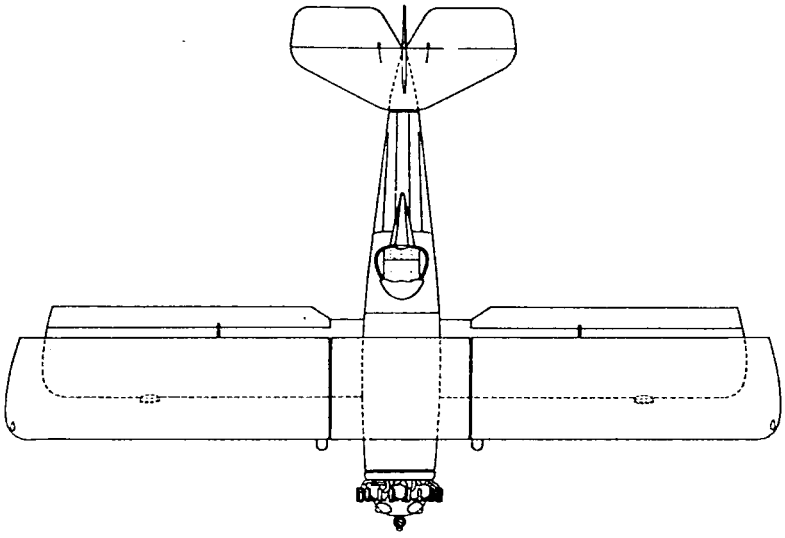
Model GD-24

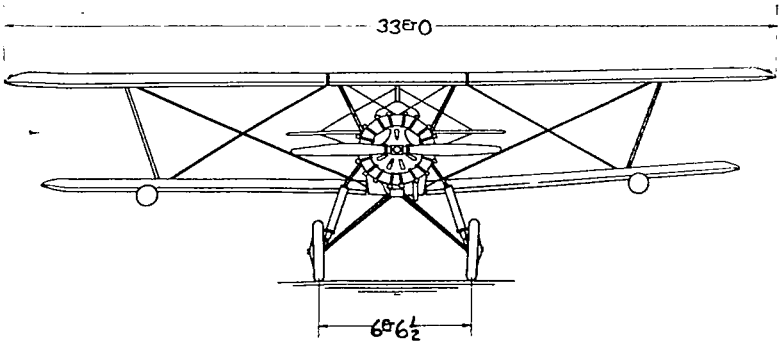
Engine—Wright "Whirlwind"

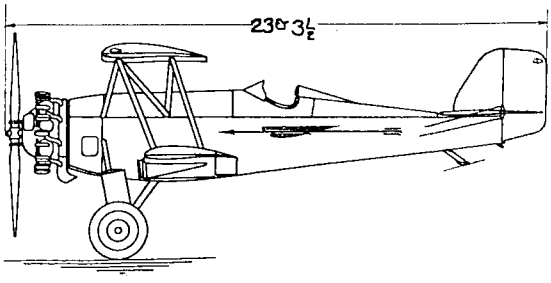


PITCAIRN AIRCRAFT, INC.
PHILADELPHIA, PA.

"MAILWING" MAIL CARRIER
ENGINE—WRIGHT "WHIRLWIND"

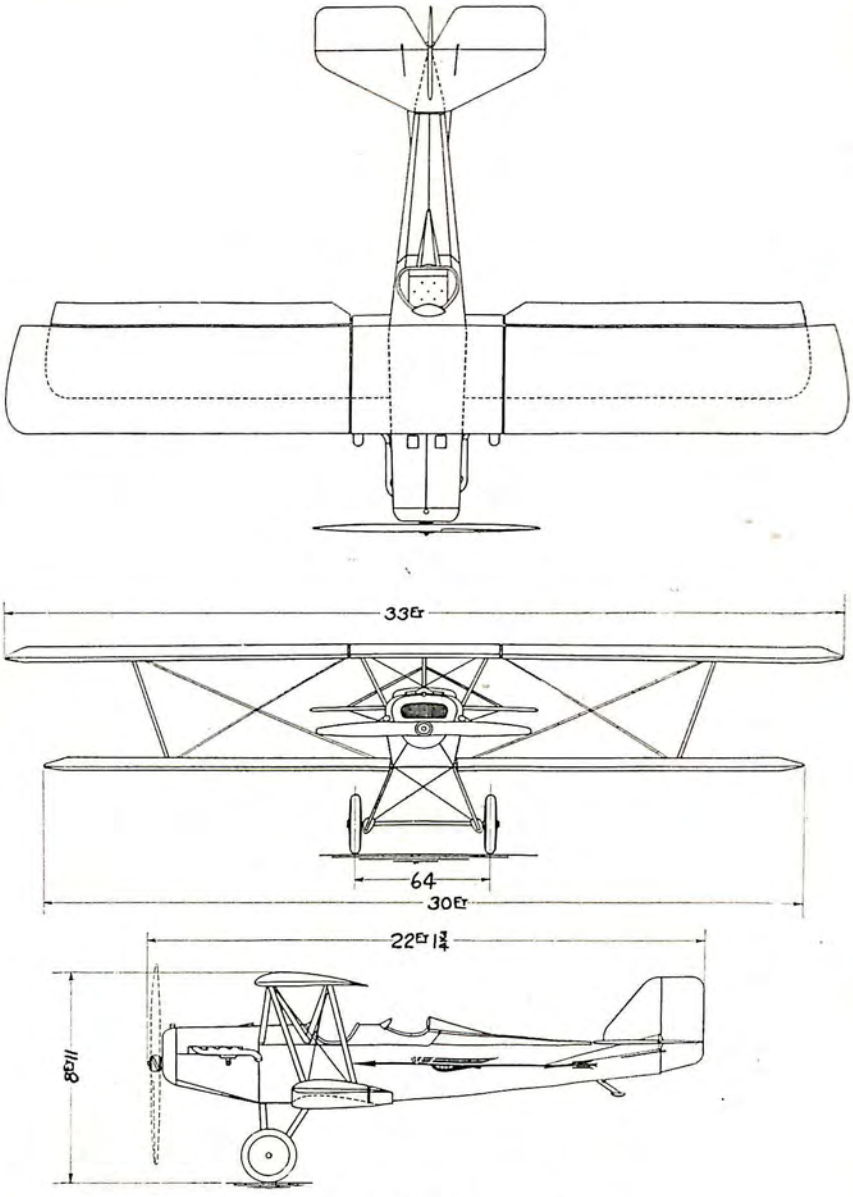






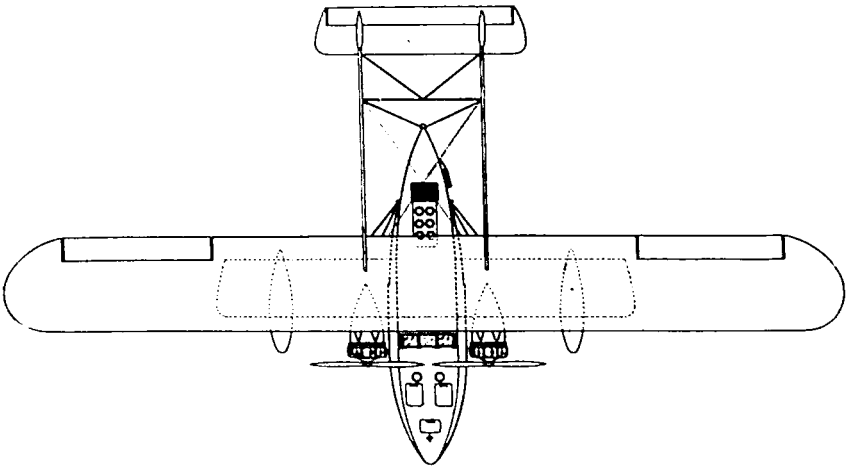
PITCAIRN AIRCRAFT, INC.
PHILADELPHIA, PA.

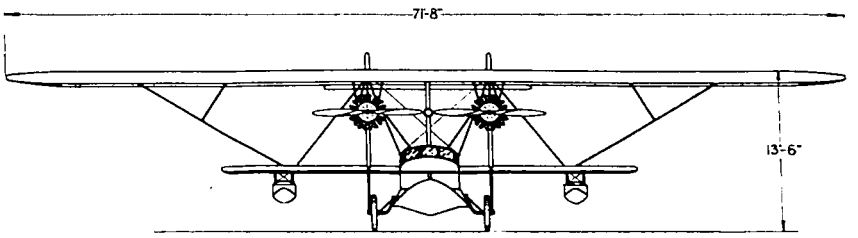
"SUPER-MAILWING"
ENGINE—WRIGHT "WHIRLWIND"

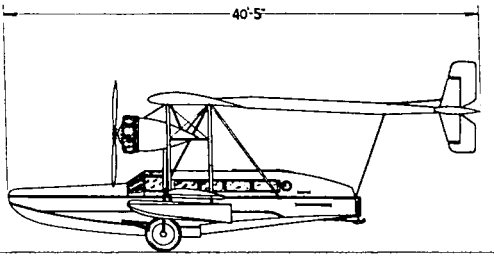


PITCAIRN AIRCRAFT, INC.
PHILADELPHIA, PA.

"FLEETWING II"
3-PLACE PASSENGER CARRIER
ENGINE—OX-5





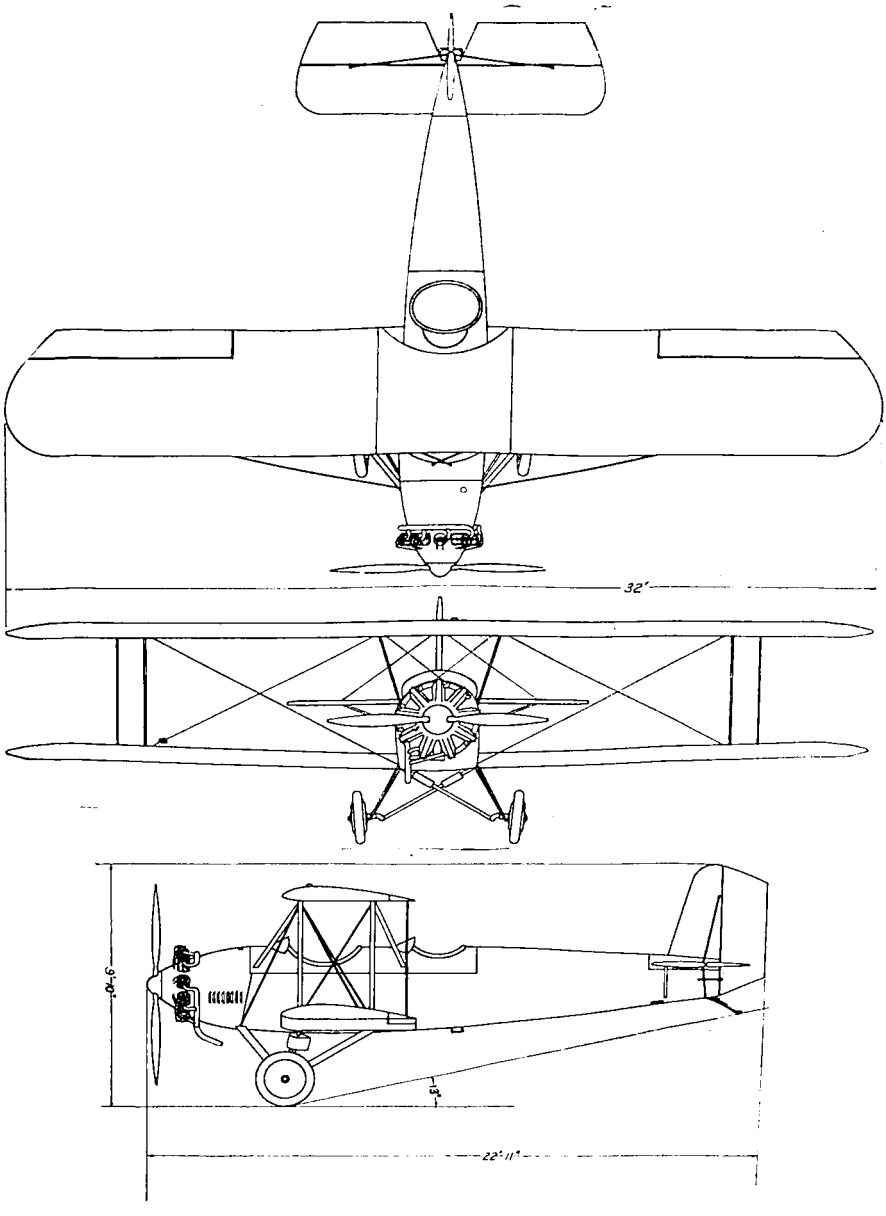


Sikorsky Aviation Corporation

College Point, Long Island, N. Y.

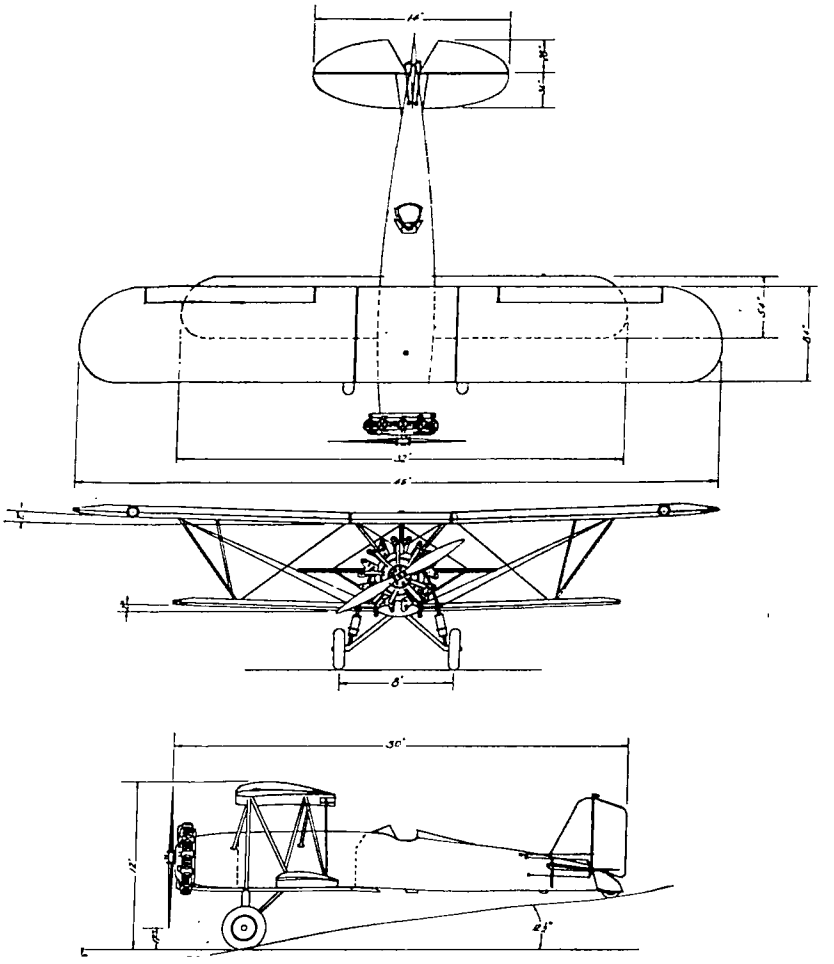
Amphibian 11-Place

2 Engines—Pratt & Whitney "Wasp"



SPARTAN AIRCRAFT COMPANY, INC.
TULSA, OKLA.

"SPARTAN C-3"
ENGINE—WALTER "N-Z"
308

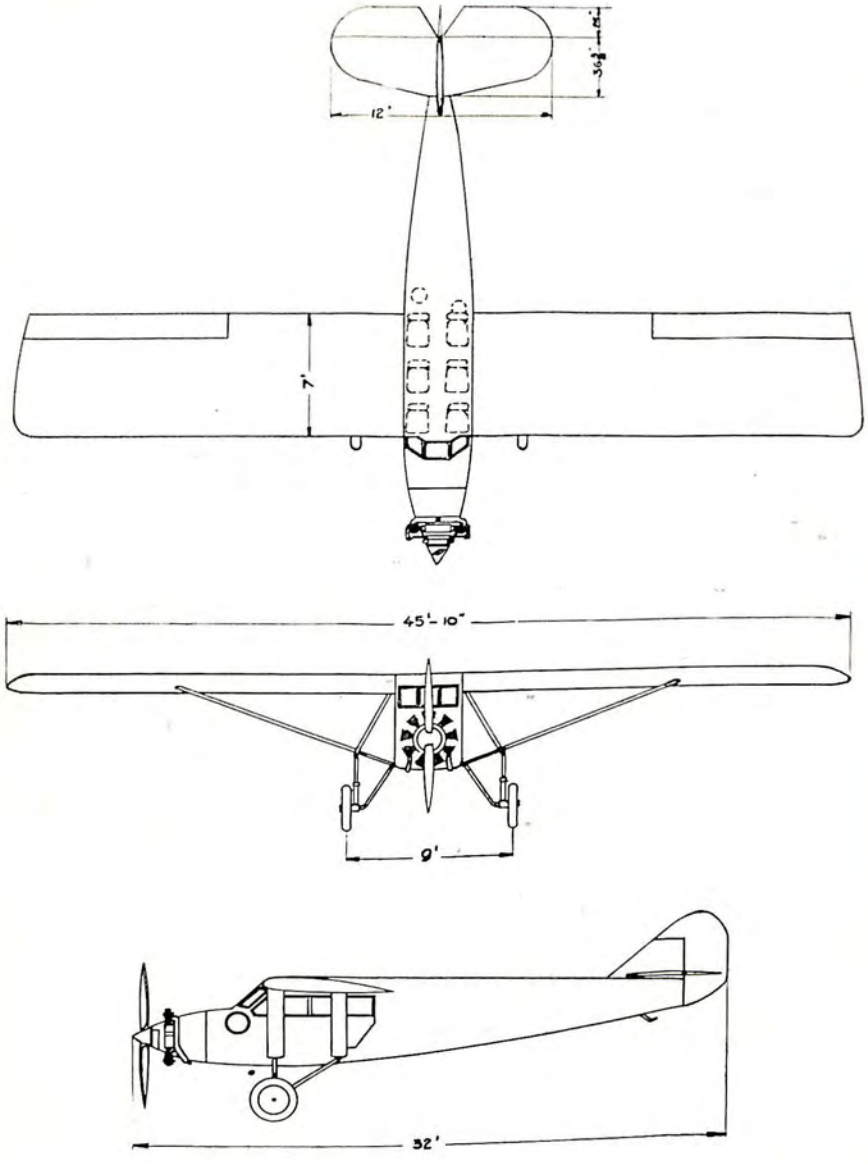


THE STEARMAN AIRCRAFT COMPANY

WICHITA, KAN.

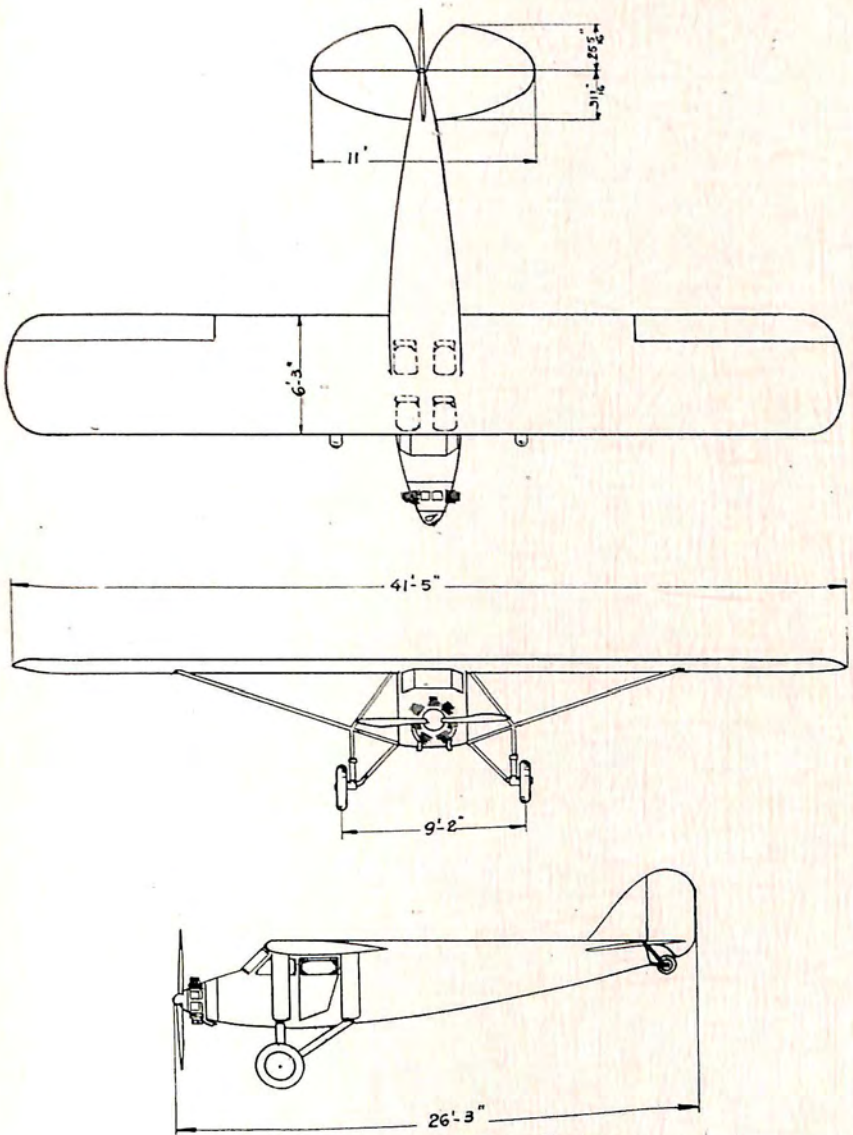
"SPEED MAIL"

ENGINE—WRIGHT "CYCLONE"



STINSON AIRCRAFT CORP.
NORTHVILLE, MICH.

"DETROITER"
6 PASSENGERS
ENGINE—WRIGHT "WHIRLWIND"

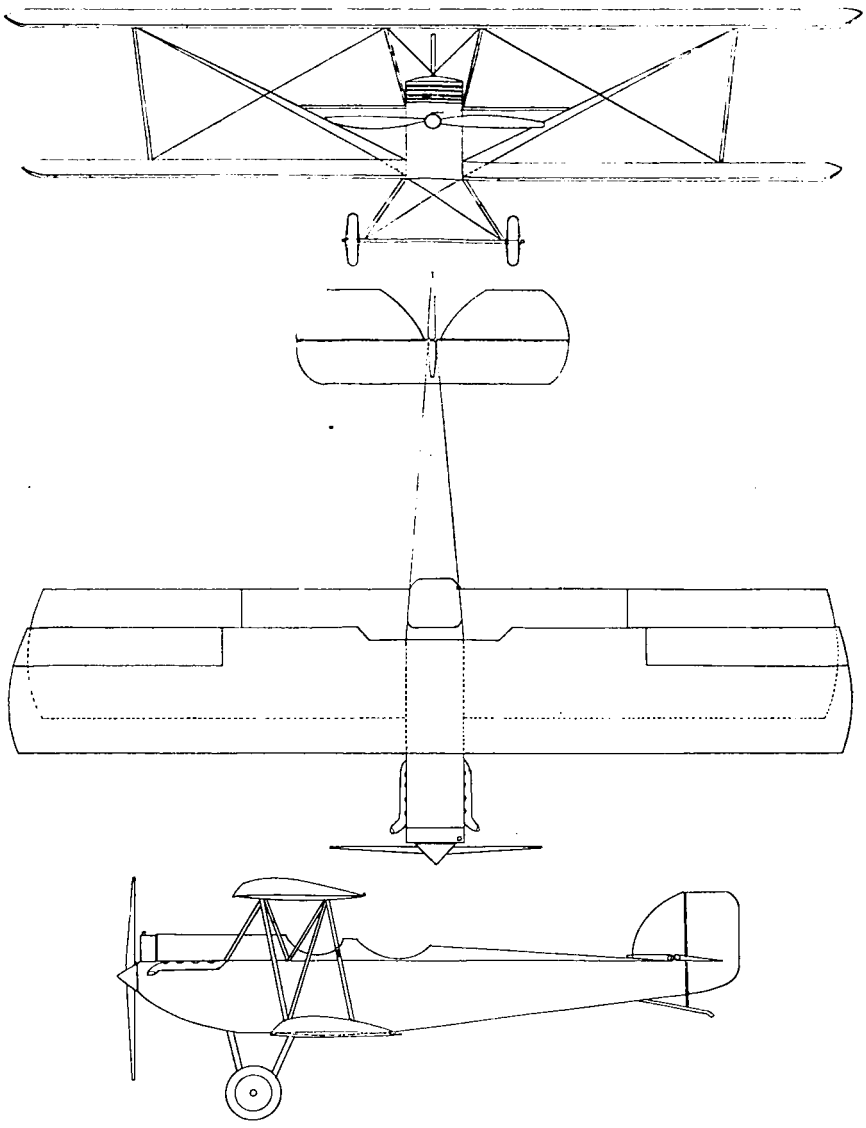


Stinson Aircraft Corp.

Northville, Mich.

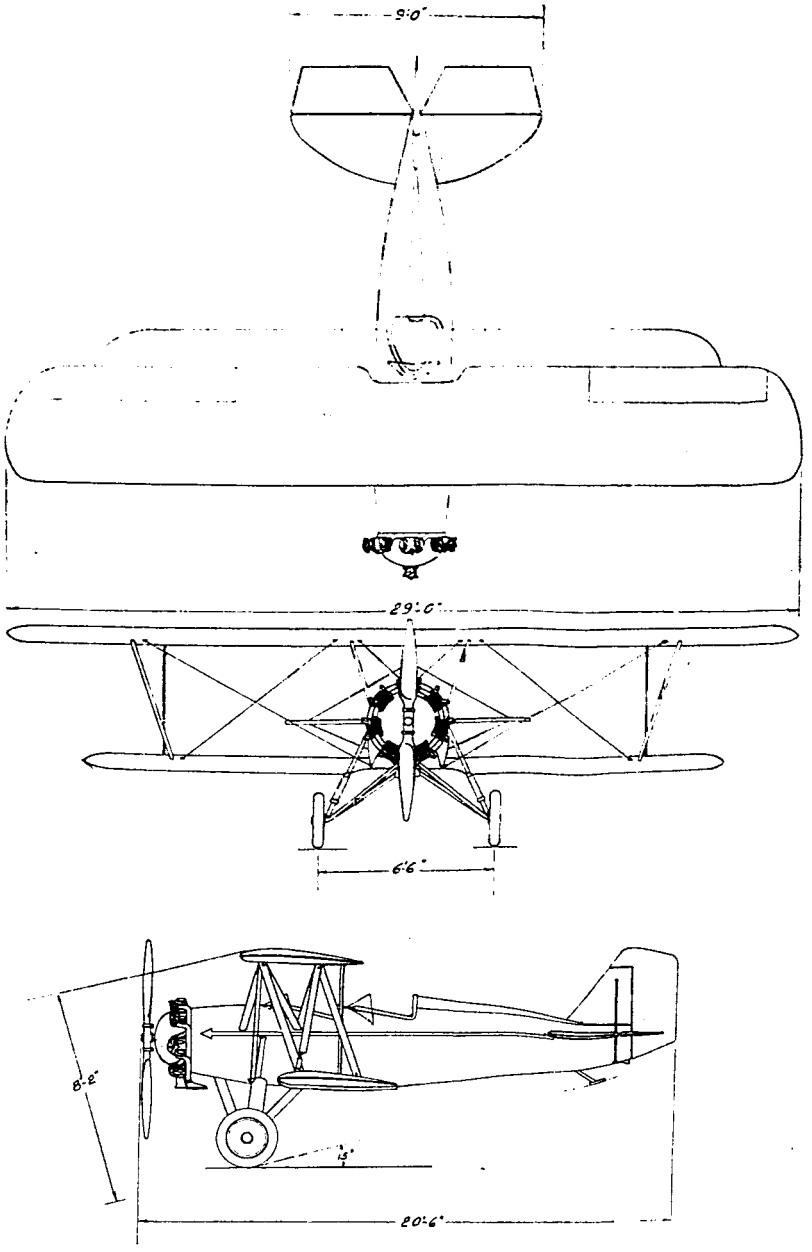
"Junior" 4 Passengers

Engine—Warner or Wright



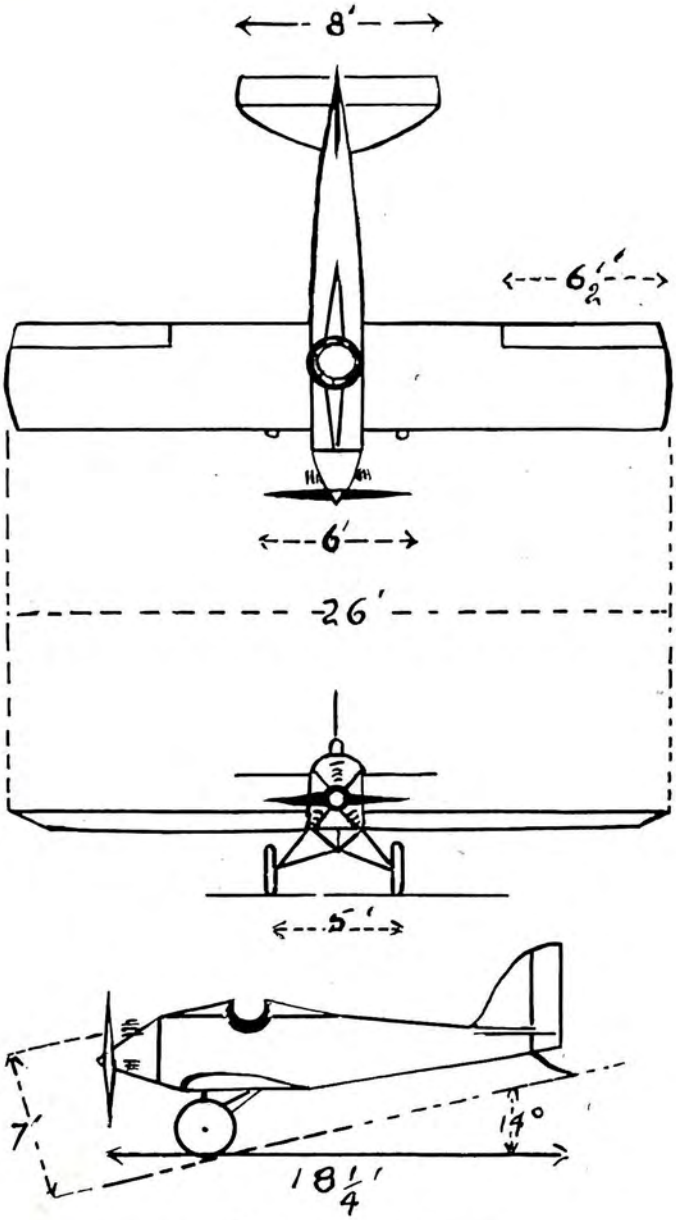
SWALLOW AIRPLANE COMPANY
WICHITA, KAN.

MODEL TP



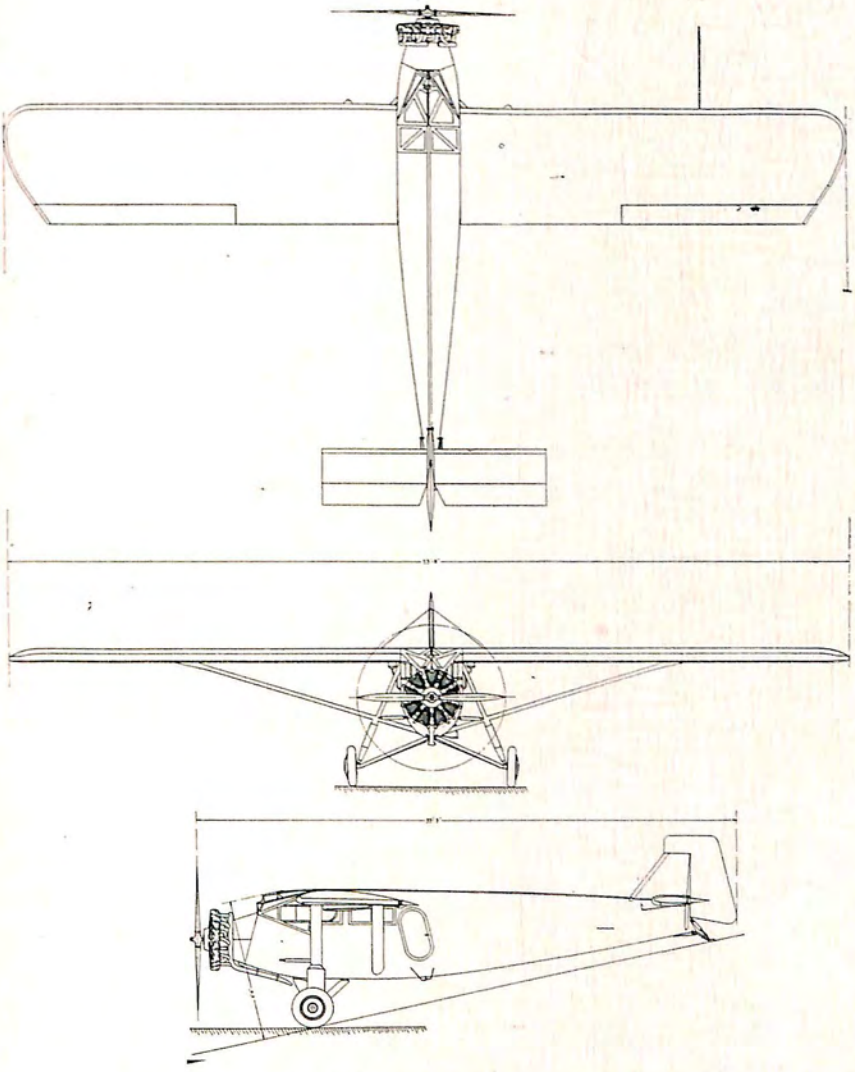
SWIFT AIRCRAFT CORPORATION
WICHITA, KAN.

BIPLANE



O. E. SZEKELY CORP.
HOLLAND, MICH.

"FLYING DUTCHMAN"
ENGINE—SZEKELY SR-3

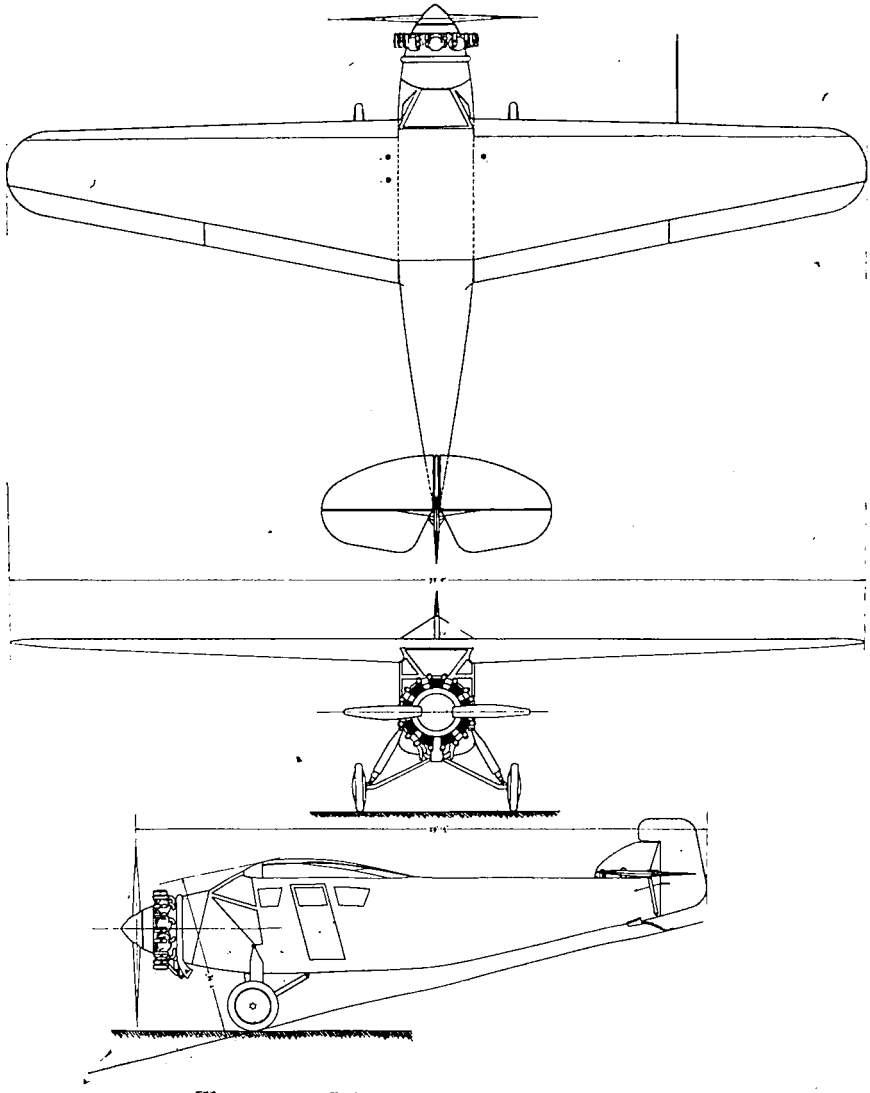


Thaden Metal Aircraft Corp.

San Francisco, Calif.

Type T-1 8-Place

Engine—Pratt & Whitney "Wasp"

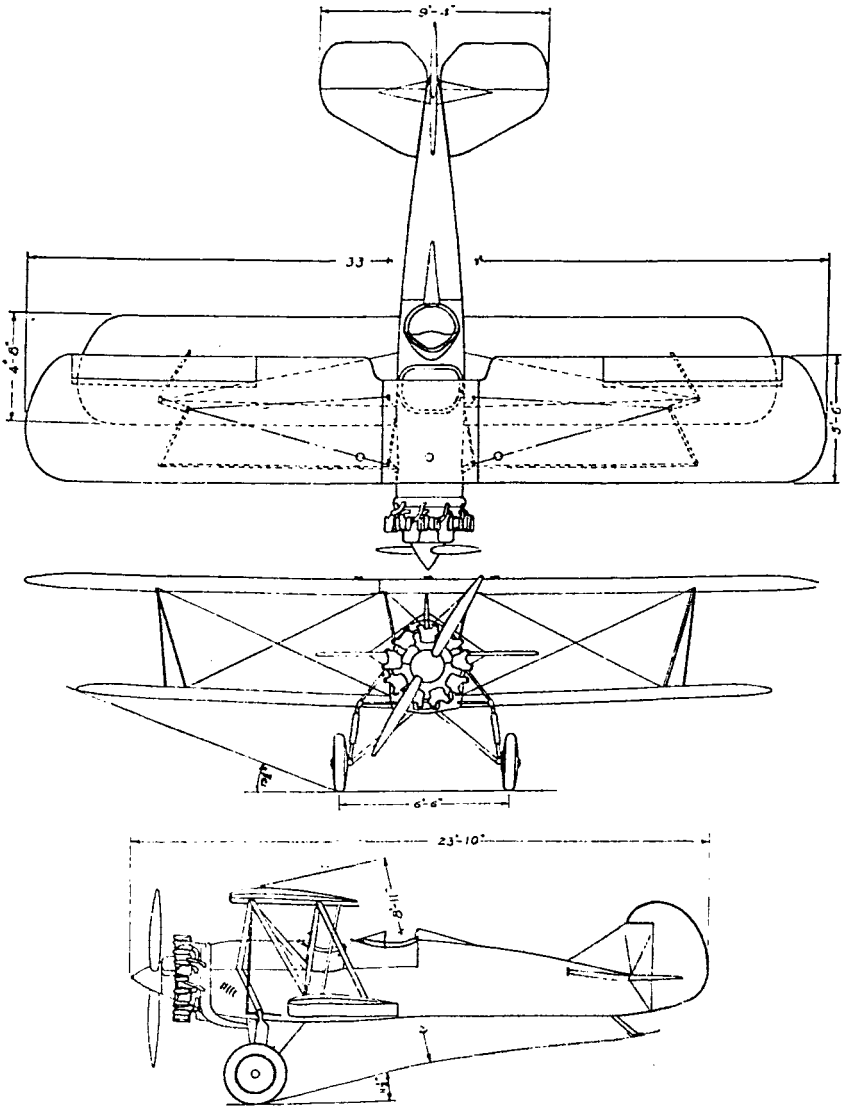


Thaden Metal Aircraft Corp.

San Francisco, Calif.

Type T-2 4-Place

Engine—Wright "Whirlwind" or
Aircraft Eng. Corp. "Comet"

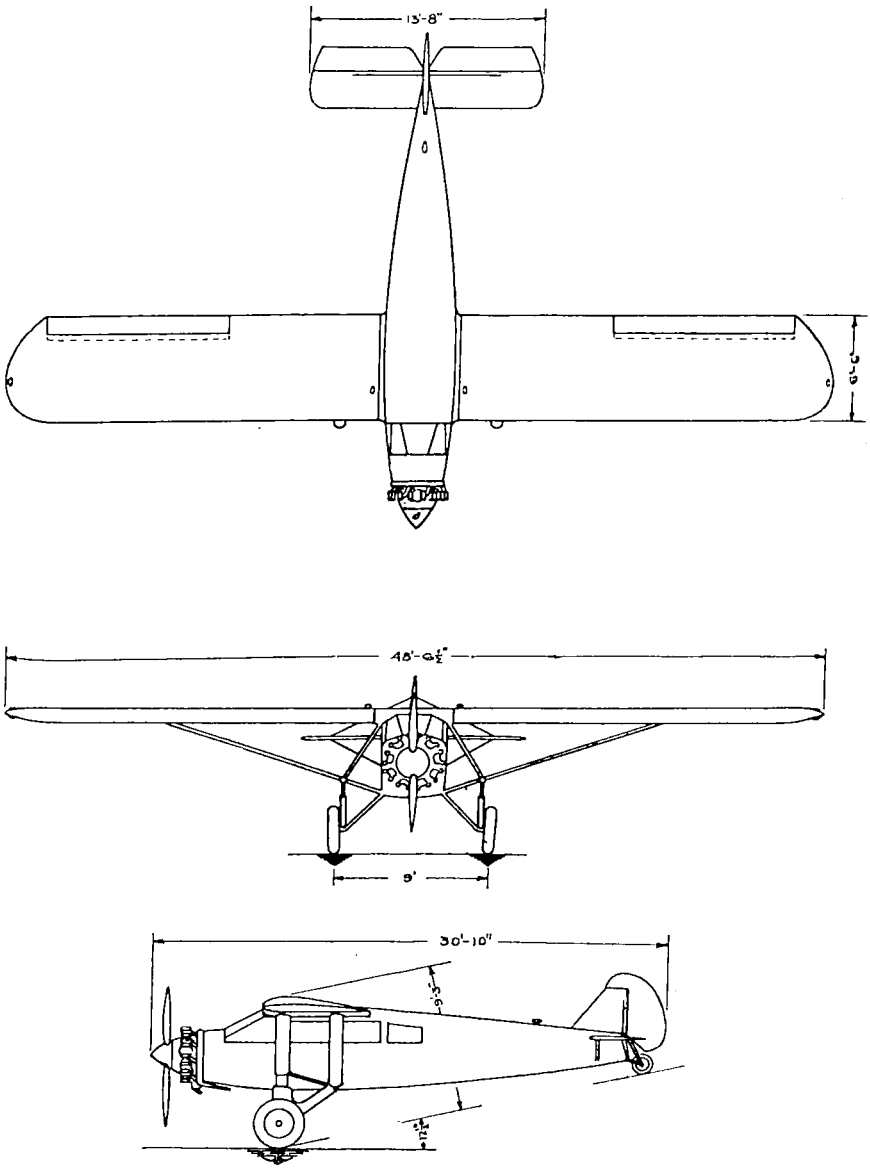


Travel Air Mfg. Co., Inc.

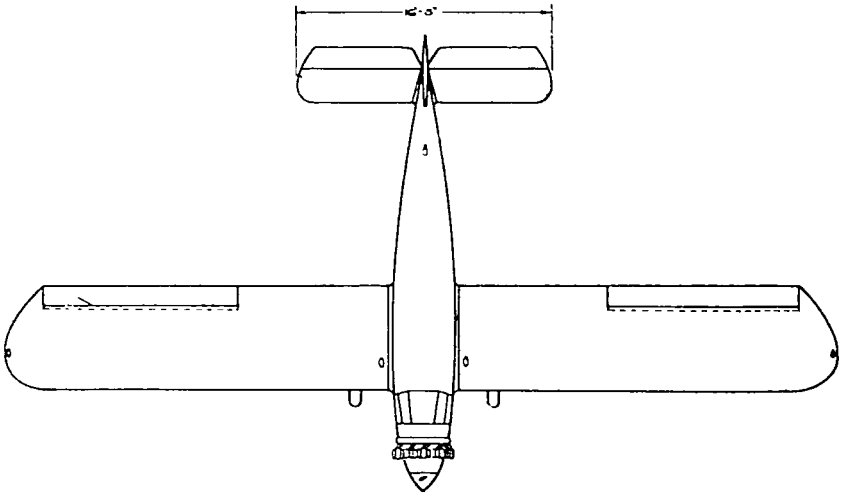
Wichita, Kan.

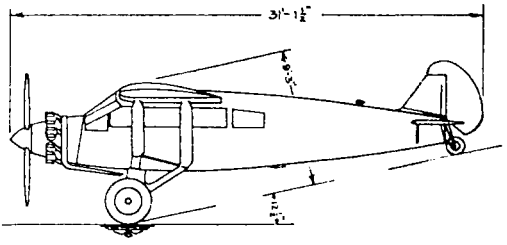
Type 4000

Engine—Wright "Whirlwind"

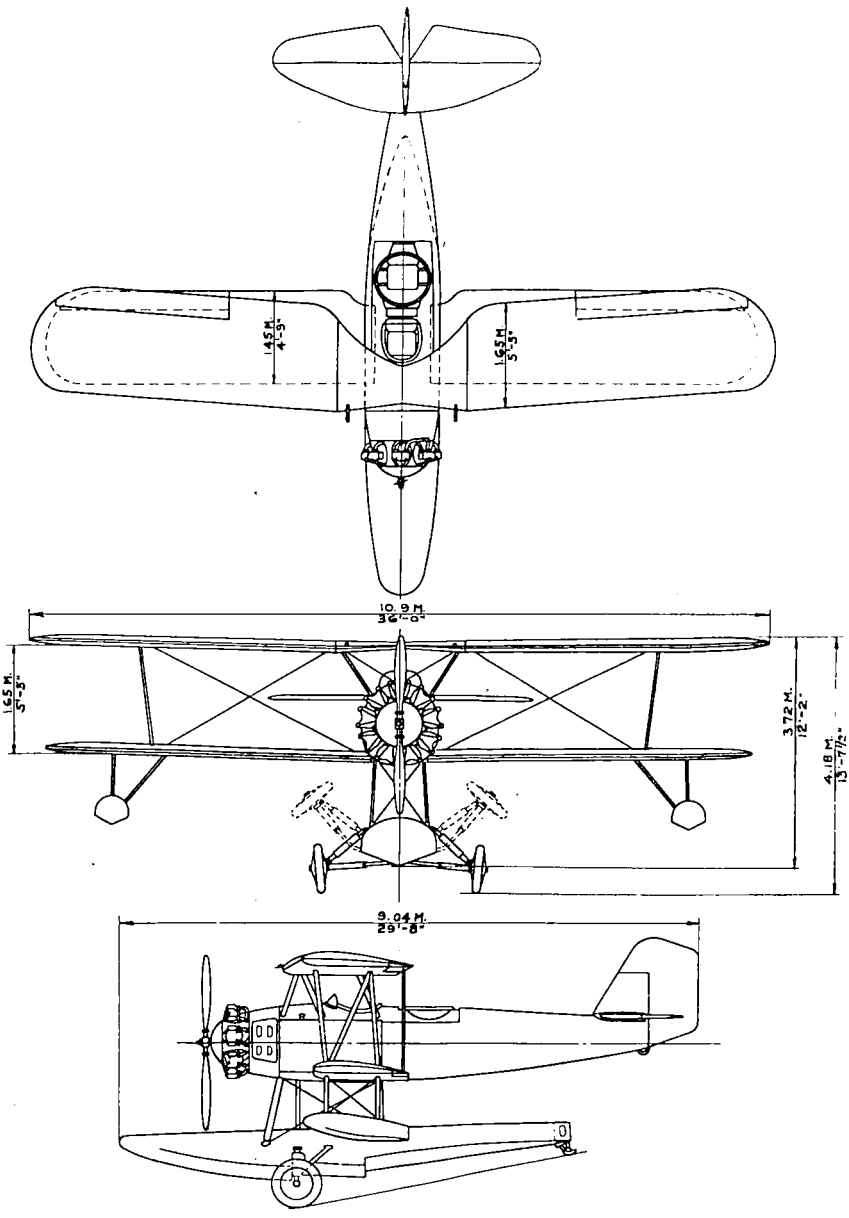


TRAVEL AIR MFG. CO., INC.
WICHITA, KAN.
TYPE 6000
ENGINE—WRIGHT "J-5"





TRAVEL AIR MFG. CO., INC.
WICHITA, KAN.
TYPE A-6000-A
ENGINE—PRATT & WHITNEY "WASP"

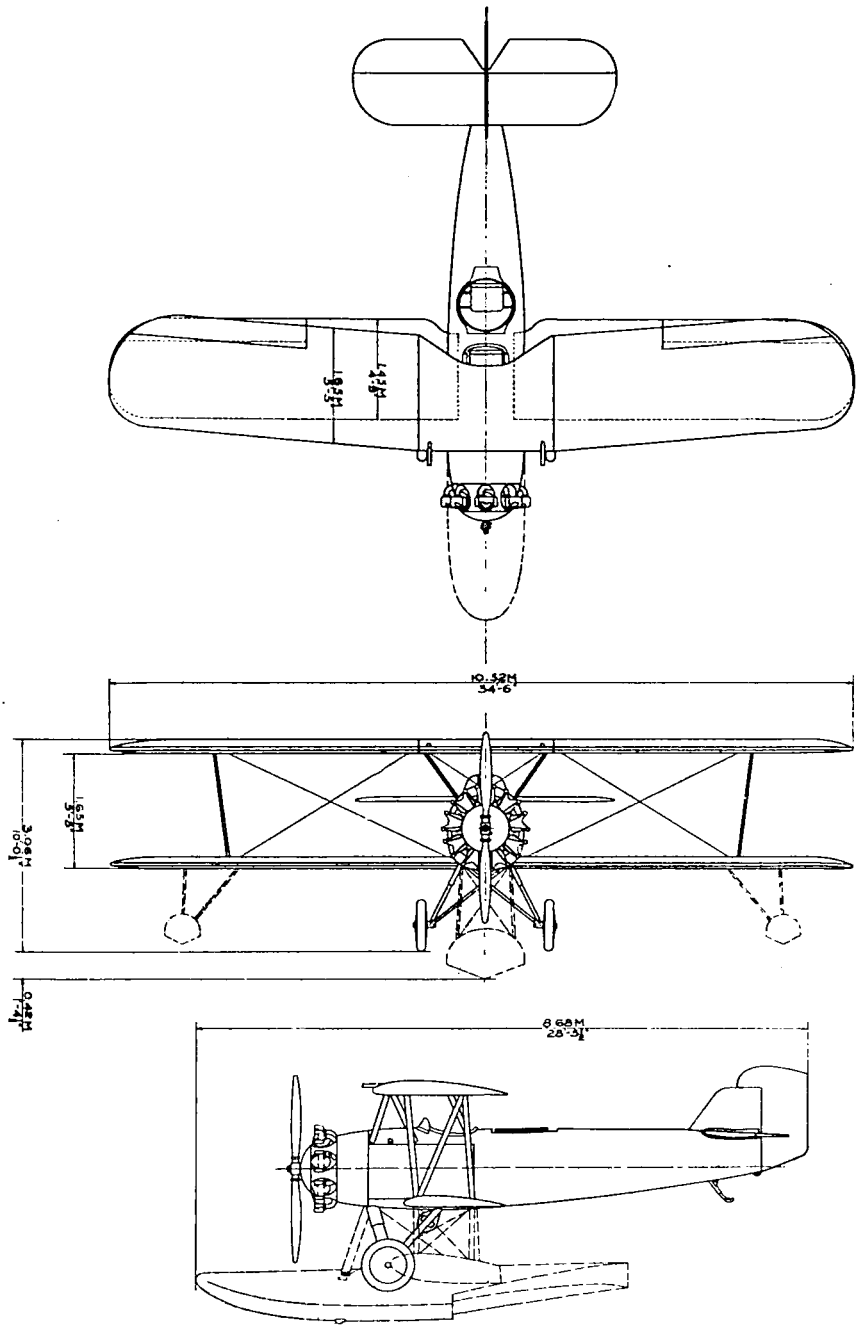


CHANCE VOUGHT CORPORATION

LONG ISLAND CITY, NEW YORK

"024-2" AMPHIBIAN

ENGINE—PRATT & WHITNEY "WASP"



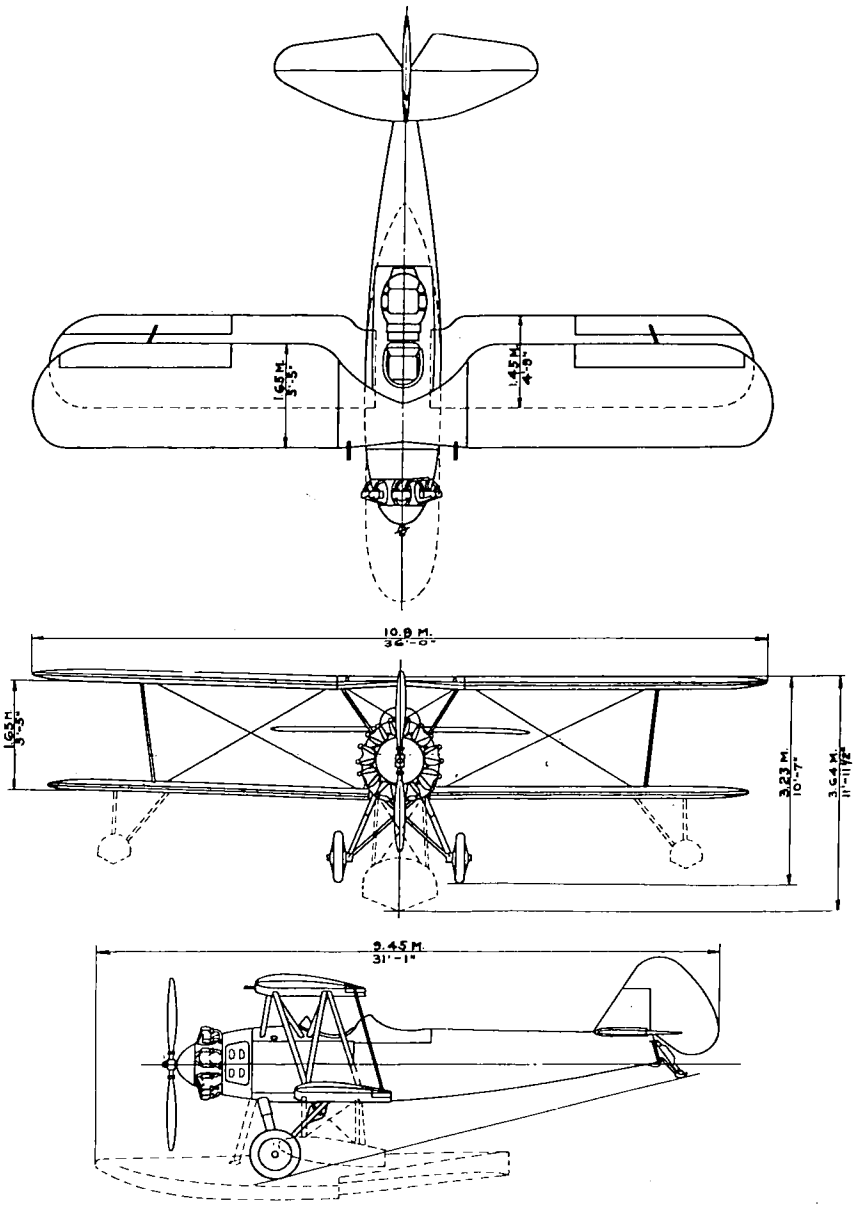
Chance Vought Corporation

Long Island City, N. Y.

"Corsair" Observation-Fighter

(Land or Seaplane)

Engine—Pratt & Whitney "Wasp"

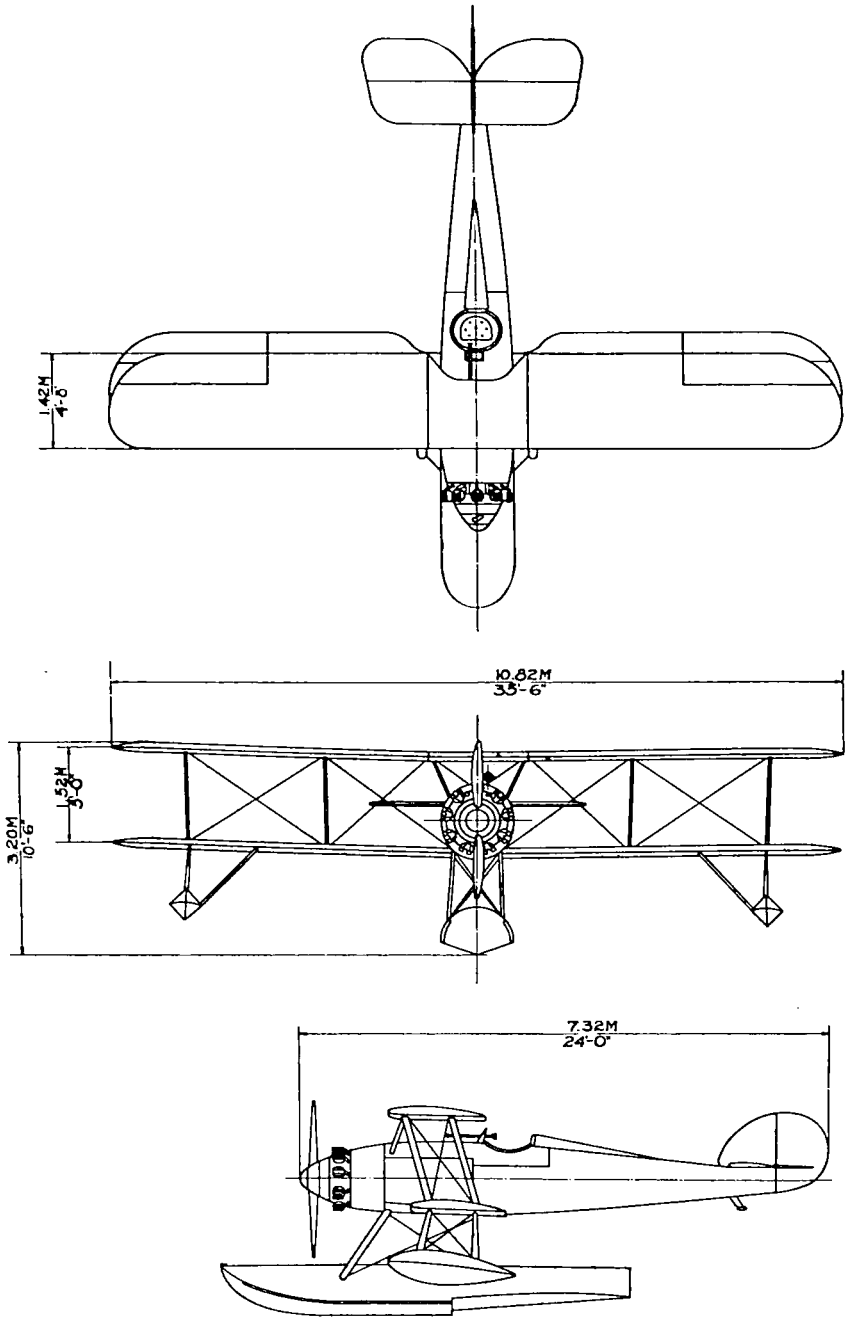


CHANCE VOUGHT CORPORATION

LONG ISLAND CITY, NEW YORK

"XF2U-1" 2-SEATER FIGHTER

ENGINE—PRATT & WHITNEY "WASP"

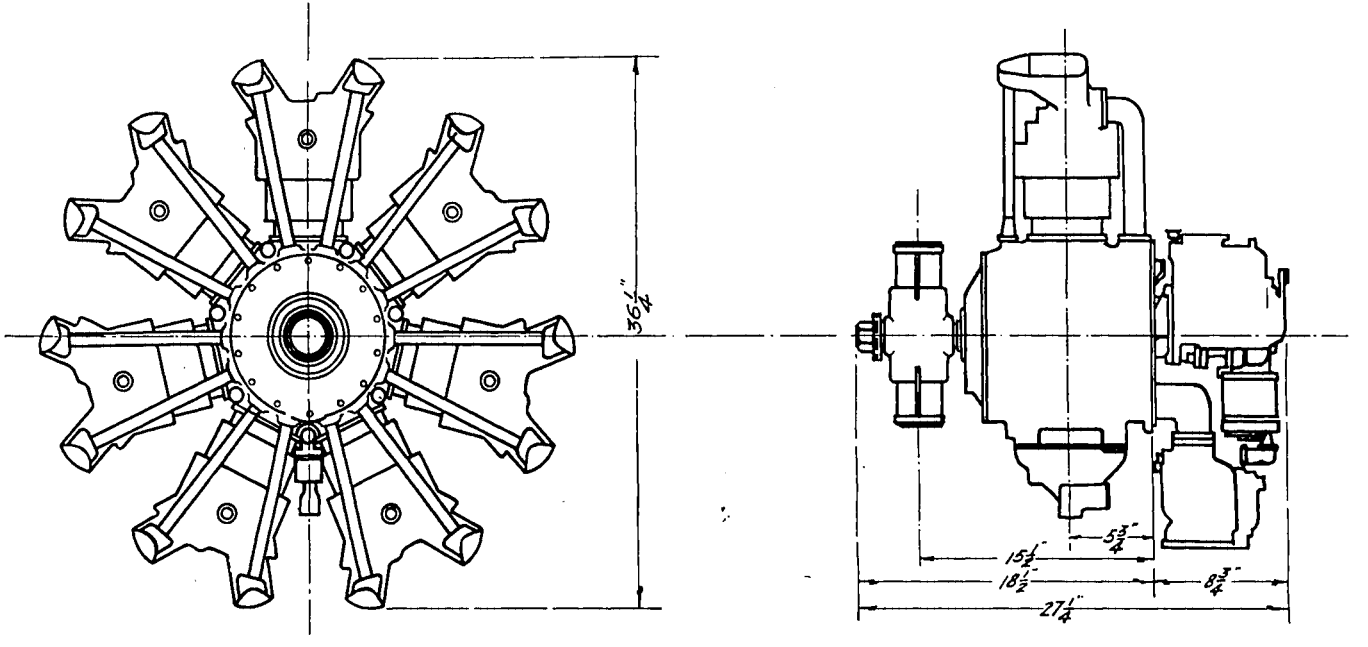


CHANCE VOUGHT CORPORATION

LONG ISLAND CITY, N. Y.

TYPE FU-1

ENGINE—WRIGHT "WHIRLWIND"

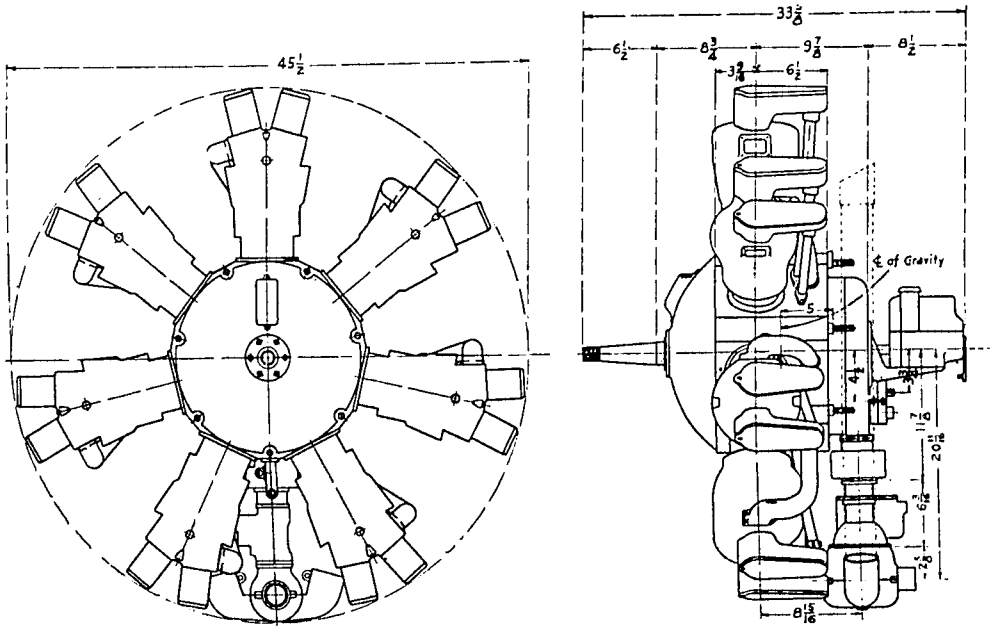


Alliance Aircraft Corp.

Alliance, Ohio

Hess "Warrior" 7 Cylinders Radial Aircooled

125 H.P. at 1800 R.P.M. Weight 300 Lbs.

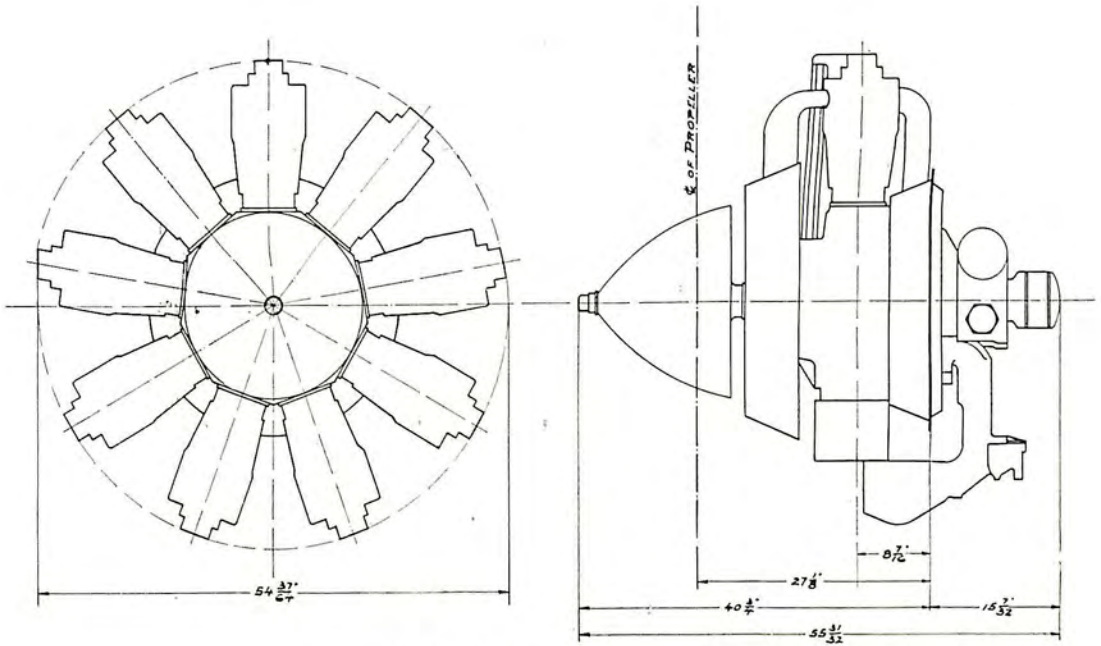


Axelson Machine Co.

Los Angeles, Calif.

Axelson Airplane Motor — 7 Cylinders

150 H.P.

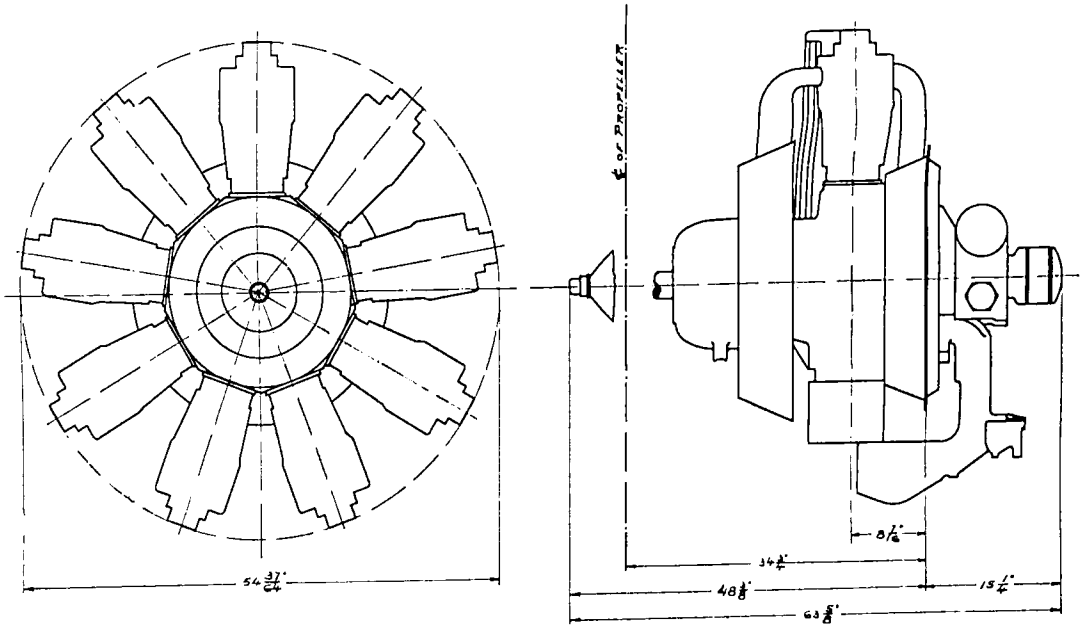


E. W. Bliss Company

Brooklyn, N. Y.

"Bliss-Jupiter" 9 Cylinders Aircooled

550 H.P. 1900 R.P.M. 760 Lbs.

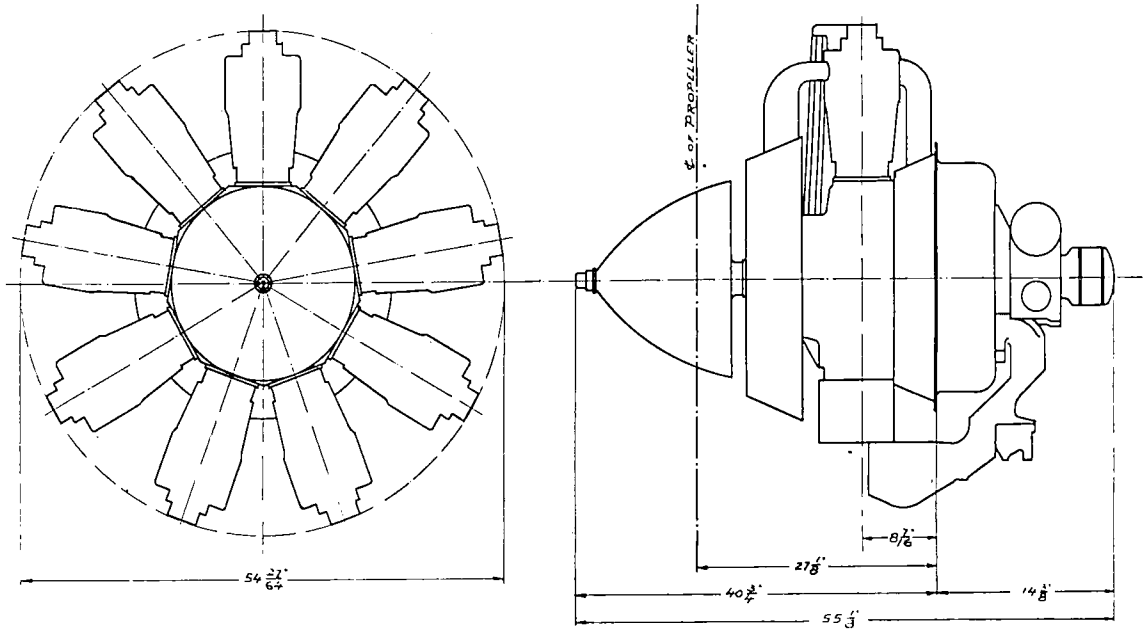


E. W. Bliss Company

Brooklyn, N. Y.

"Bliss-Jupiter" (Geared) 9 Cylinders Aircooled

550 H.P. 1900 R.P.M. 780 Lbs.

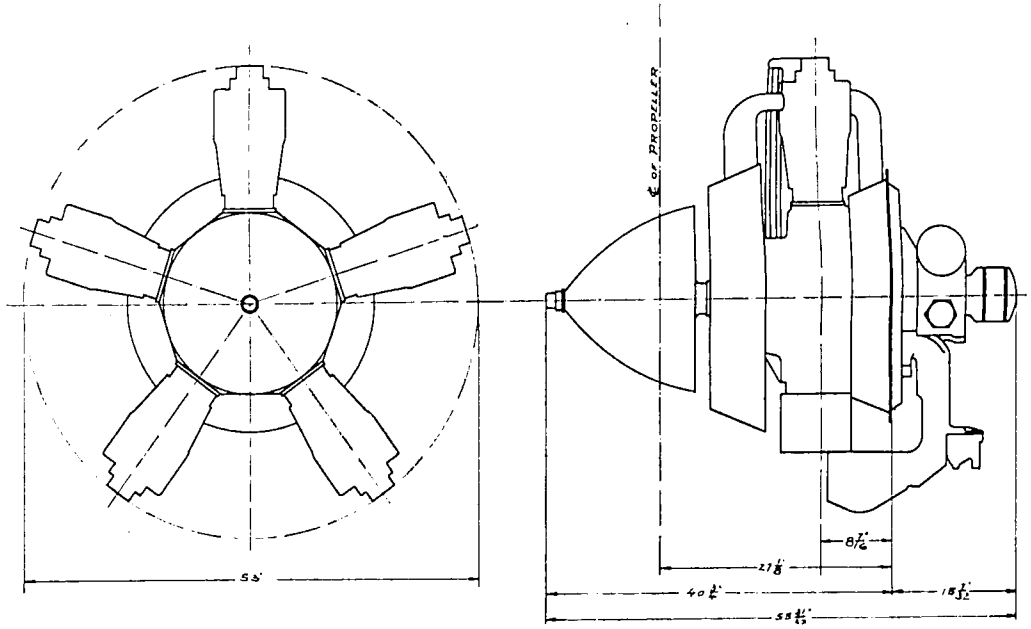


E. W. Bliss Company

Brooklyn, N. Y.

"Bliss-Jupiter" (Supercharged) 9 Cylinders Aircooled

550 H.P. 1900 R.P.M. 760 Lbs.

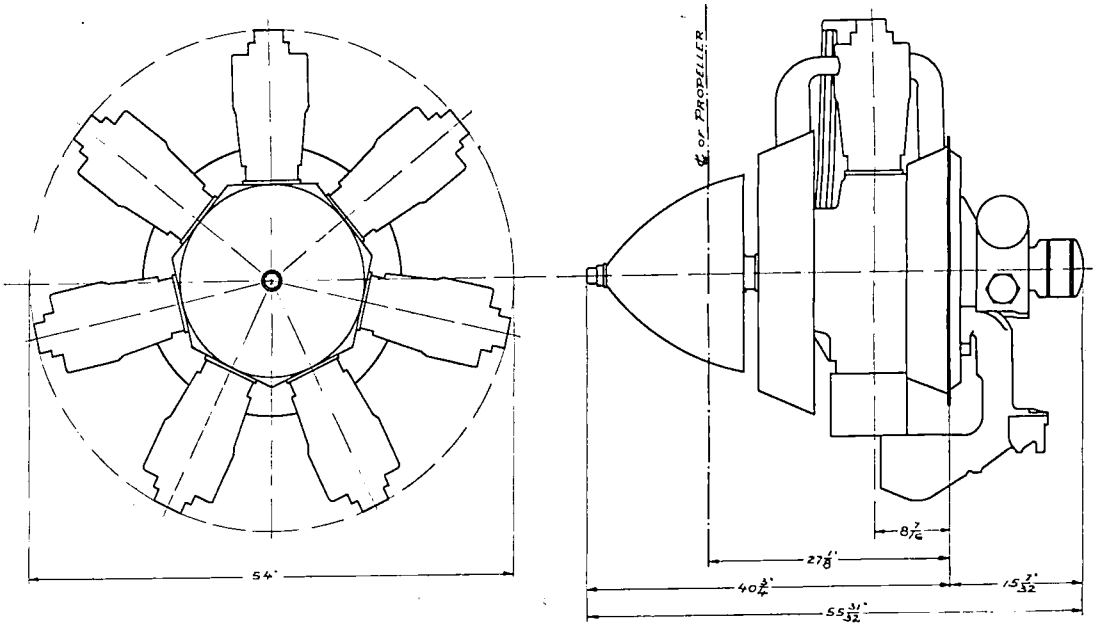


E. W. Bliss Company

Brooklyn, N. Y.

"Bliss-Titan" 5 Cylinders Aircooled

Commercial 250 H.P. 1900 R.P.M. 500 Lbs.

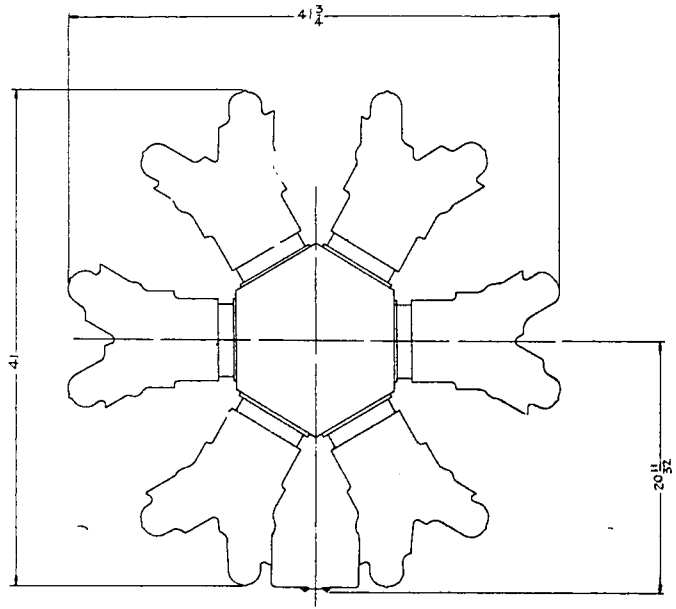


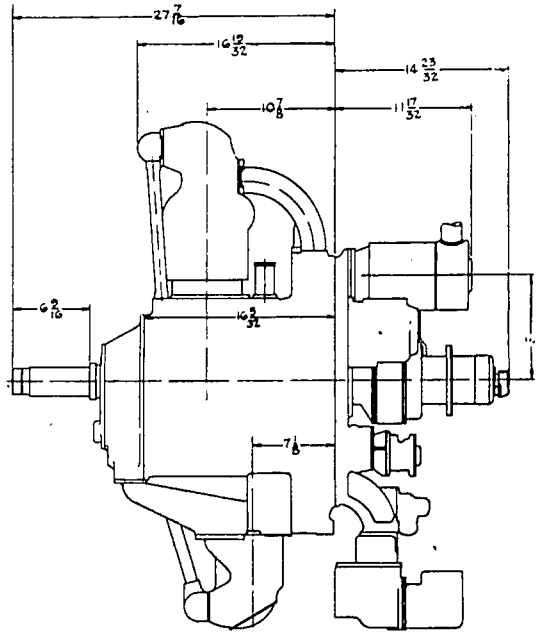
E. W. Bliss Company

Brooklyn, N. Y.

"Bliss-Neptune" 7 Cylinders Aircooled

400 H.P. 1900 R.P.M. 650 Lbs.



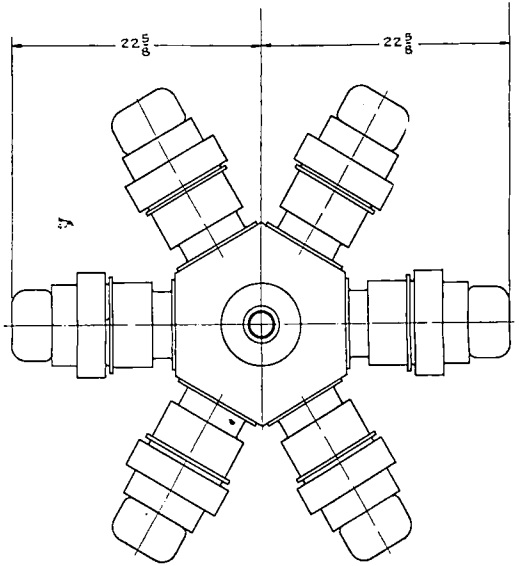


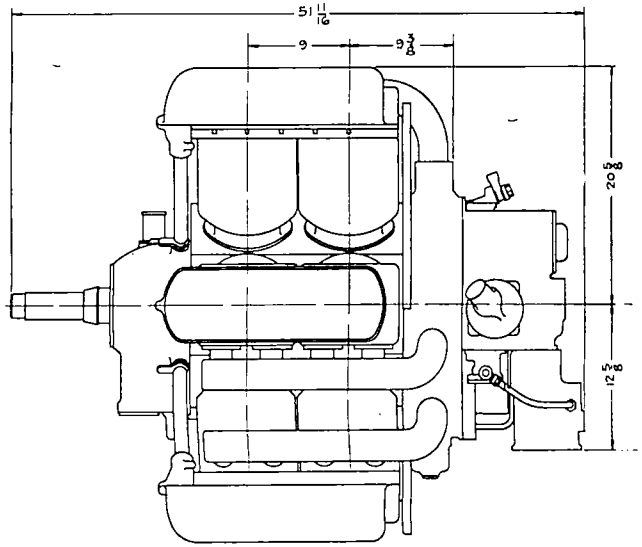
CURTISS AEROPLANE & MOTOR CO., INC.

GARDEN CITY AND BUFFALO, N. Y.

MODEL R-600 "CHALLENGER" 6 CYLINDERS AIRCOOLED

170 B.H.P. AT 1800 R.P.M. WEIGHT 420 LBS.



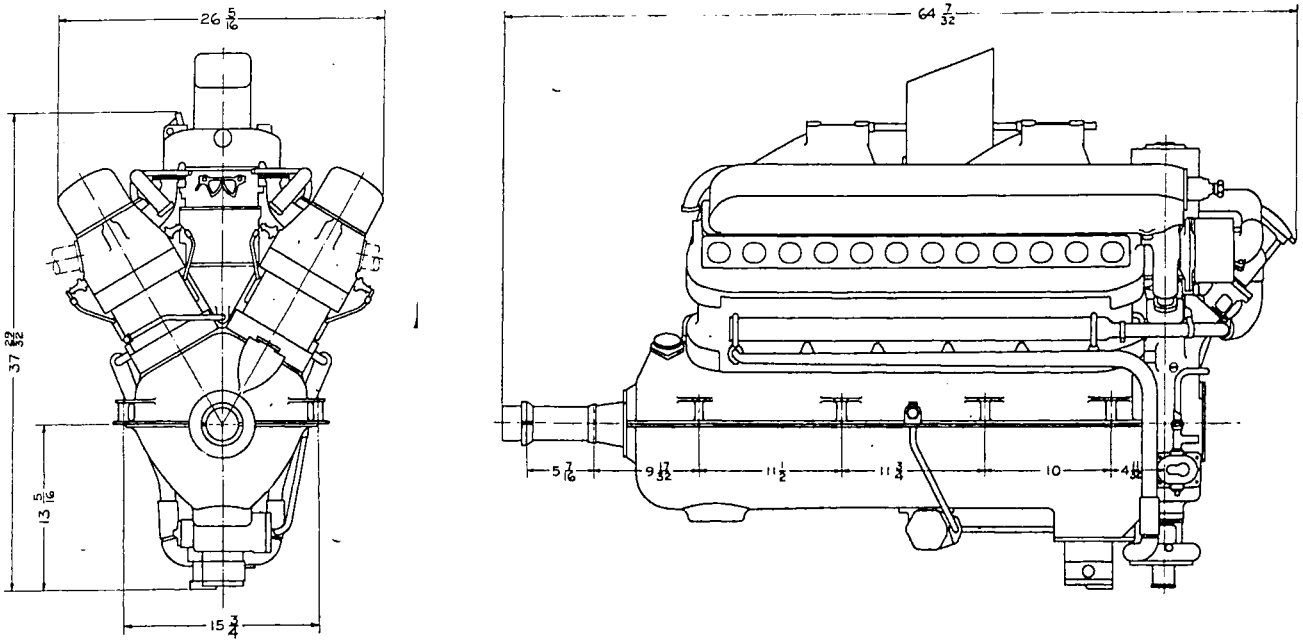


Curtiss Aeroplane & Motor Co., Inc.

Garden City and Buffalo, N. Y.

"Chieftain" 12 Cylinders Aircooled

600 B.H.P. at 2200 R.P.M. Weight 900 Lbs.

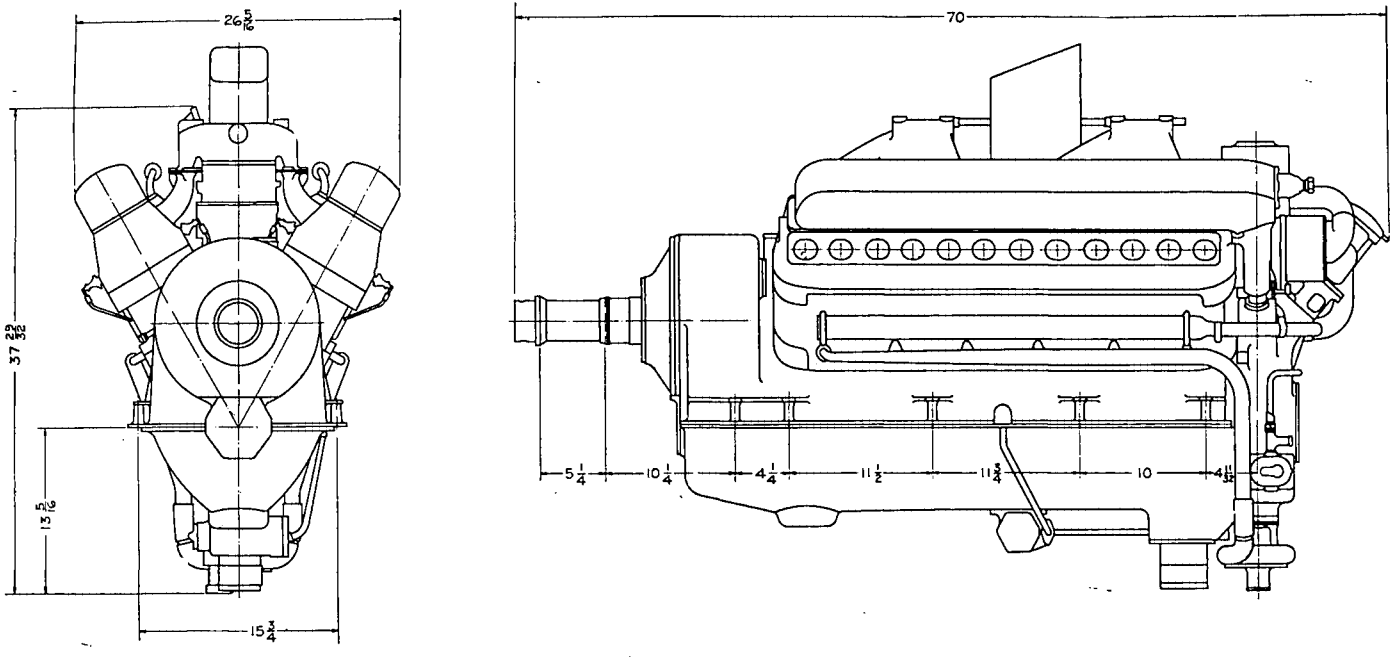


Curtiss Aeroplane & Motor Co., Inc.

Garden City and Buffalo, N. Y.

Model V-1570 "Conqueror" 12 Cylinders Watercooled

625 B.H.P. at 2400 R.P.M. Weight Dry 755 Lbs.

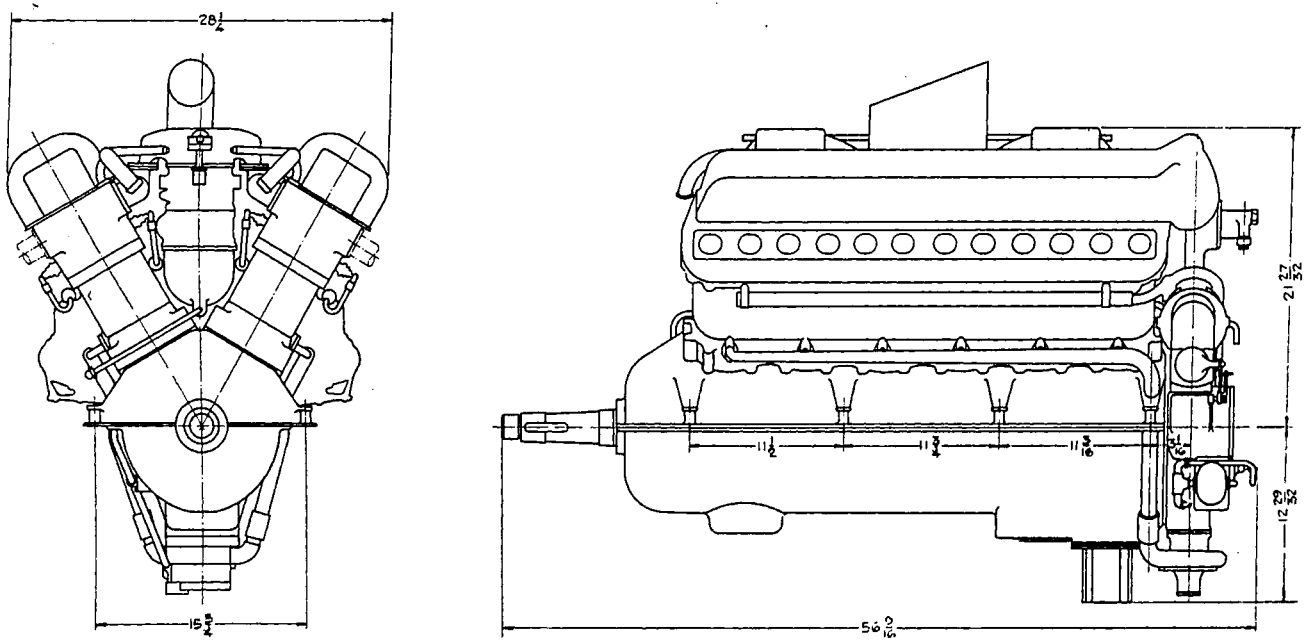


CURTISS AEROPLANE & MOTOR CO., INC.

GARDEN CITY AND BUFFALO, N. Y.

MODEL GV-1570 "CONQUEROR" 12 CYLINDERS GEARED 2-1 WATERCOOLED

600 B.H.P. AT 2400 R.P.M. WEIGHT DRY 845 LBS.

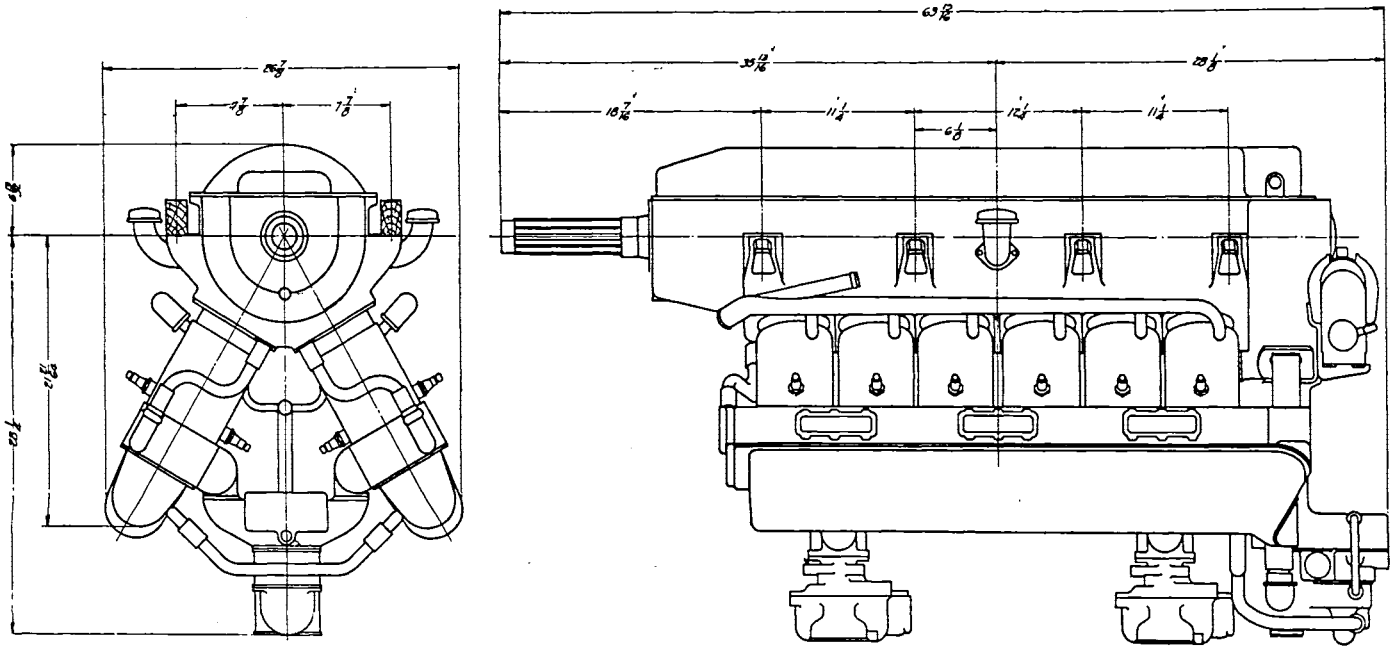


Curtiss Aeroplane & Motor Co., Inc.

Garden City and Buffalo, N. Y.

Model D-12 — 12 Cylinders — Watercooled

435 B.H.P. at 2300 R.P.M. — Weight Dry 680 Lbs.

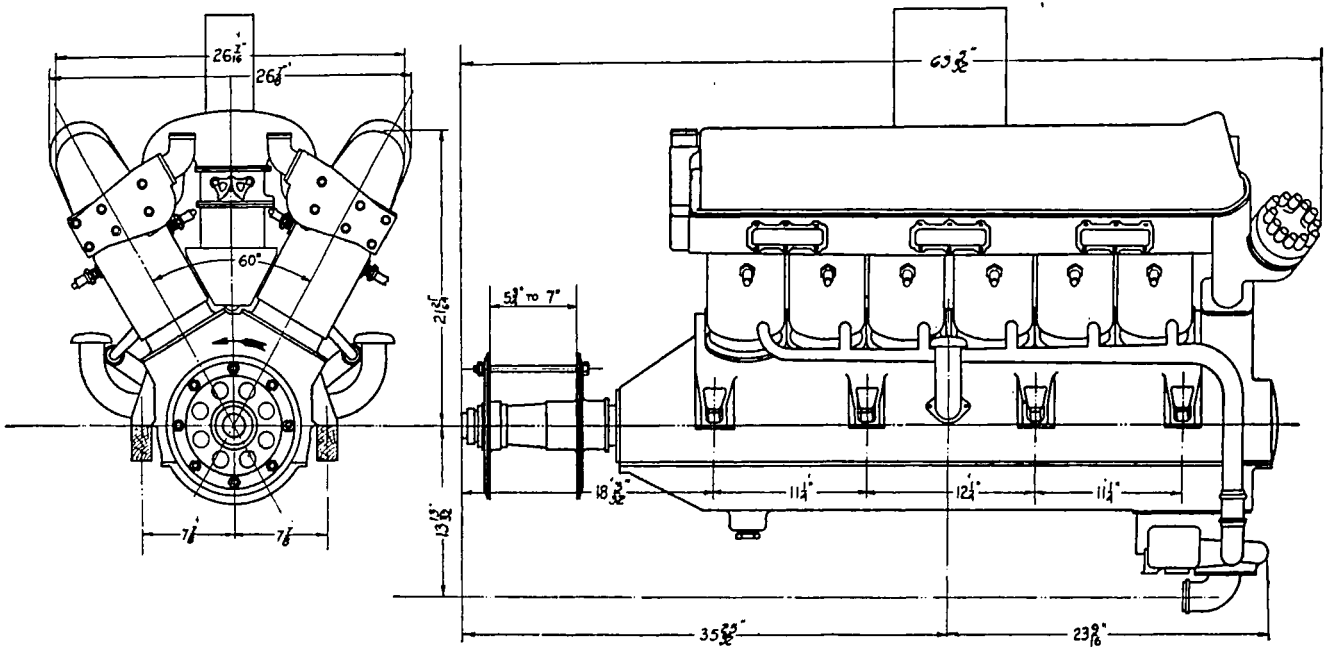


Packard Motor Car Company

Detroit, Mich.

Model 2A-1500 — 12 Cylinders — Water Cooled

600 B.H.P. at 2500 Engine R.P.M. — 750 Lbs. Dry — 30 Lbs. Water

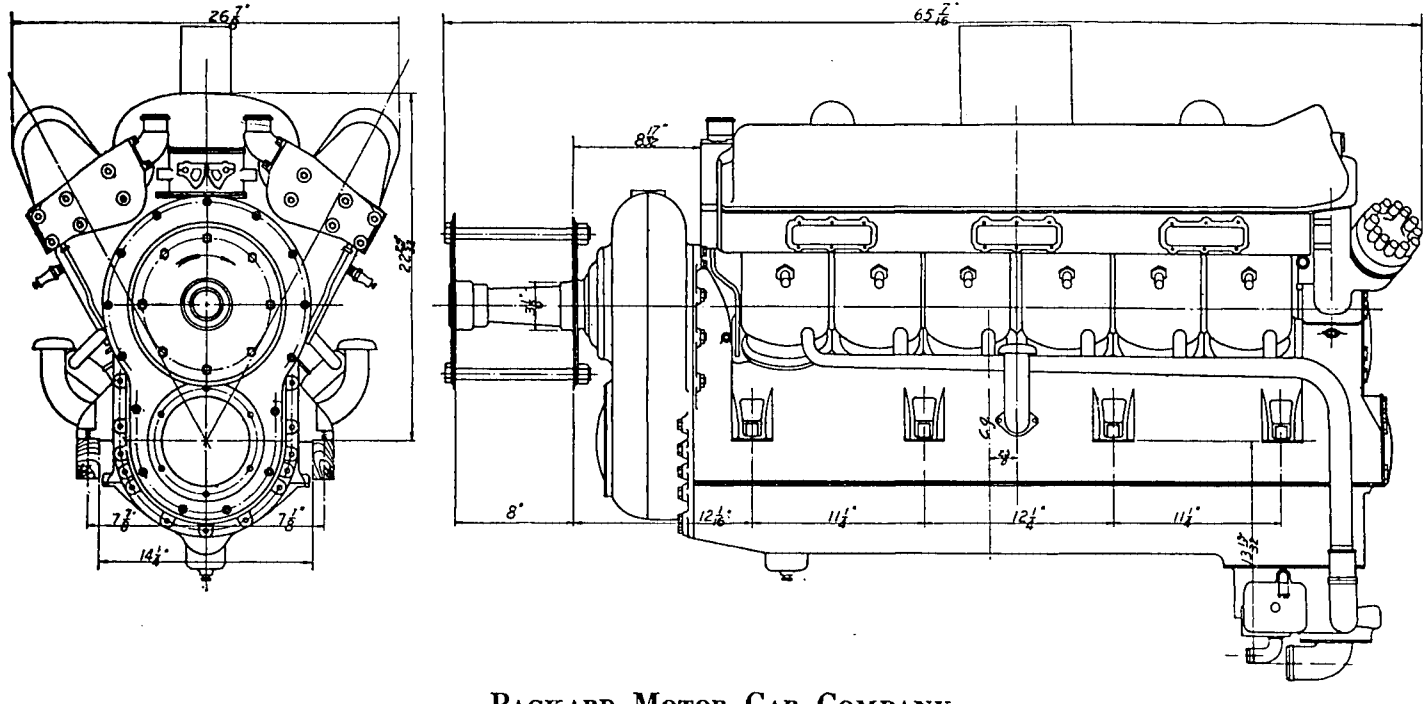


Packard Motor Car Company

Detroit, Mich.

Model 2A-1500 — 12 Cylinders — Water Cooled

600 B.H.P. at 2500 Engine R.P.M. — 730 Lbs. Dry — 30 Lbs. Water

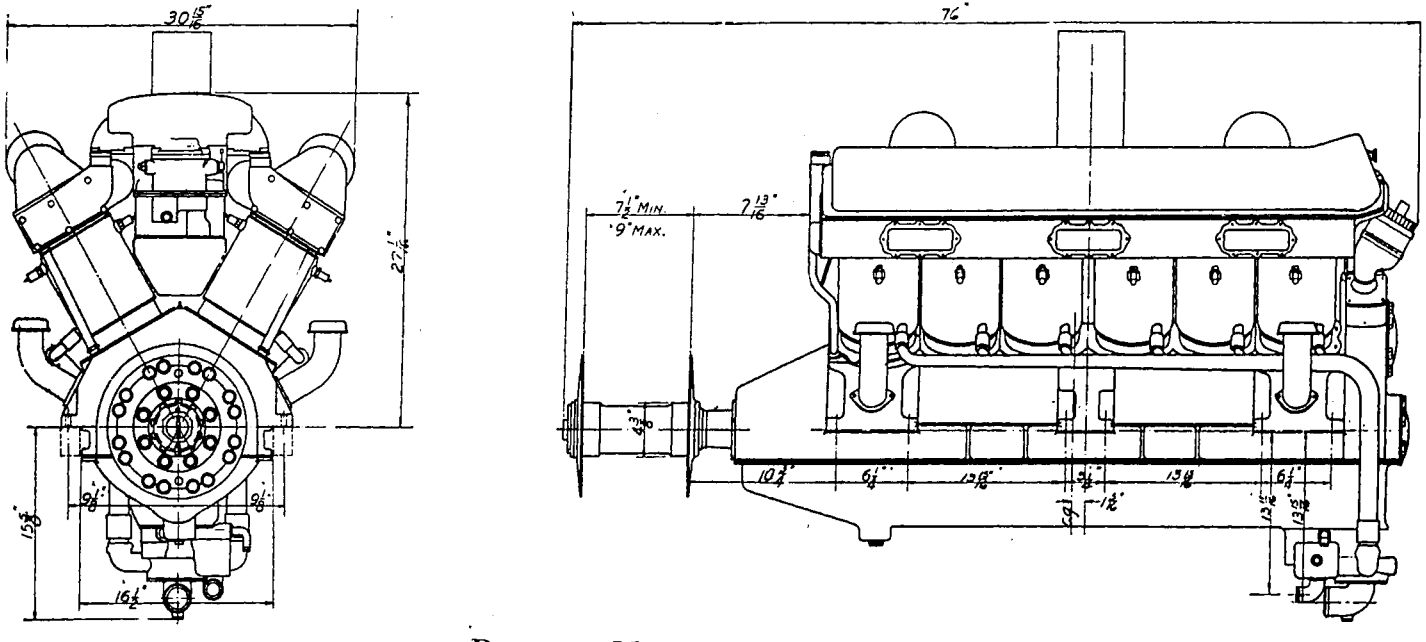


Packard Motor Car Company

Detroit, Mich.

Model 2A-1500 Geared 2:1 12 Cylinders Water Cooled

600 B.H.P. at 2500 Engine R.P.M. 850 Lbs. Dry 30 Lbs. Water

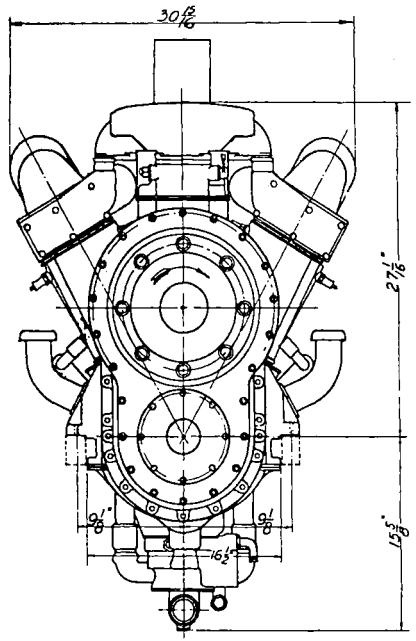


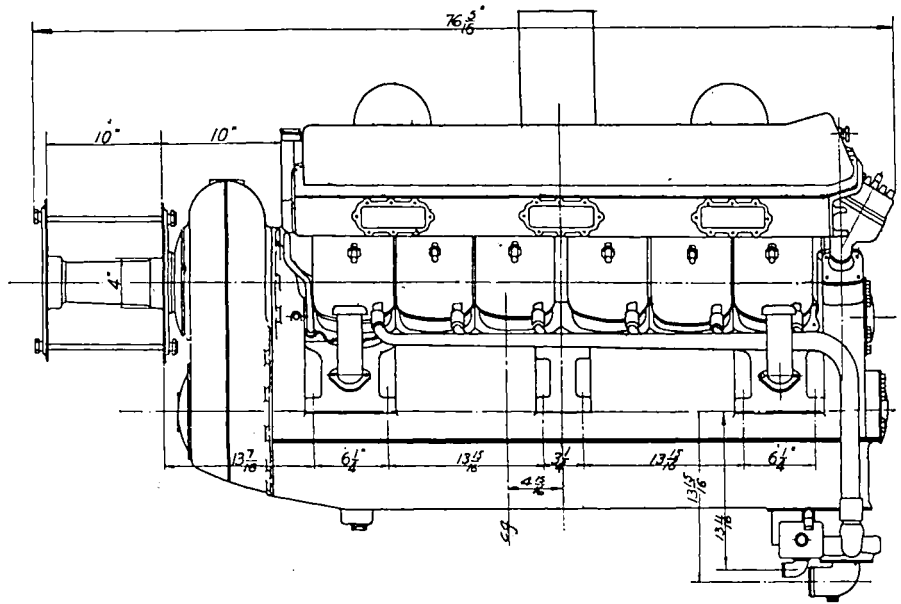
PACKARD MOTOR CAR COMPANY

DETROIT, MICH.

MODEL 2A-2500 — 12 CYLINDERS — WATER COOLED

800 B.H.P. AT 2000 ENGINE R.P.M. — 1146 LBS. DRY — 39 LBS. WATER



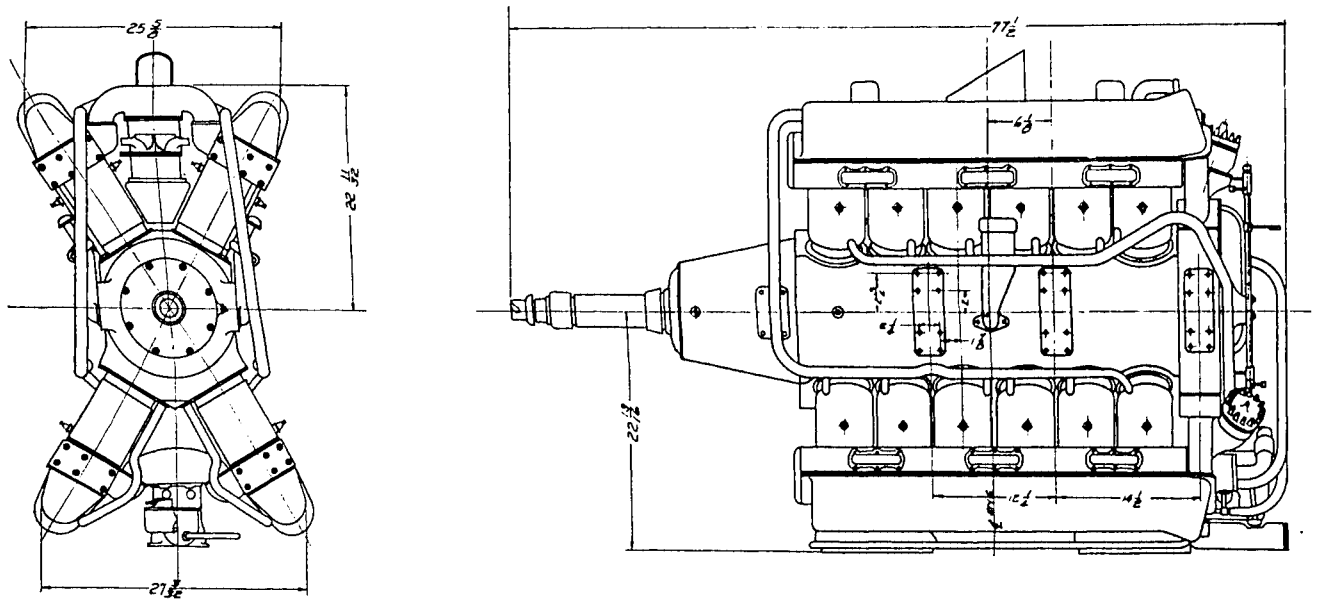


Packard Motor Car Company

Detroit, Mich.

Model 2A-2500 Geared 2:1 12 Cylinders Water Cooled

800 B.H.P. at 2000 Engine R.P.M. 1300 Lbs. Dry 39 Lbs. Water

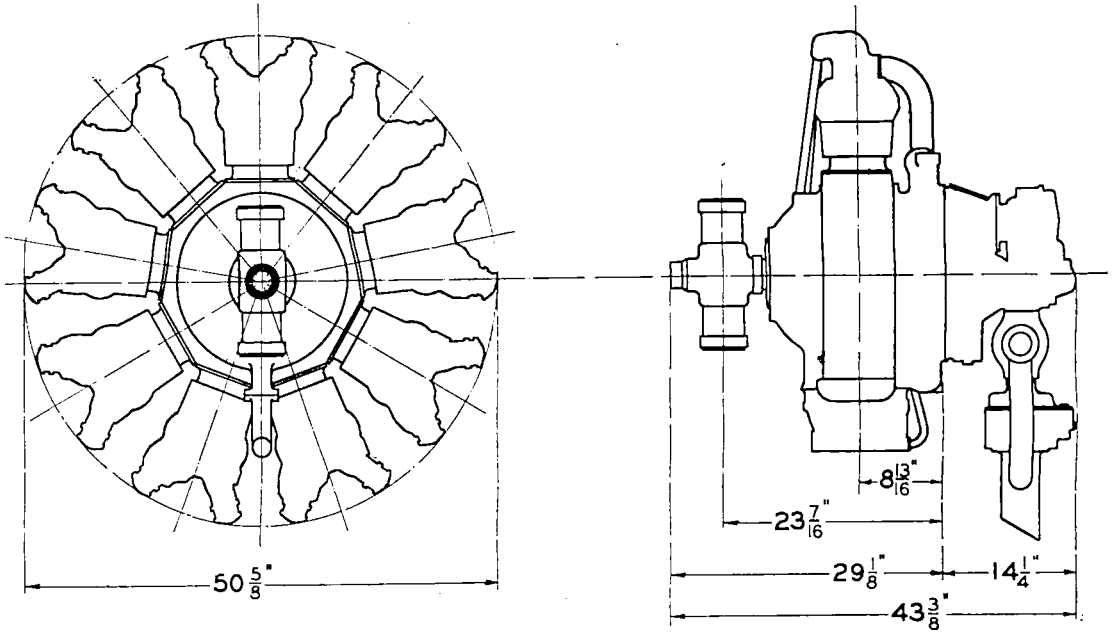


Packard Motor Car Company

Detroit, Mich.

Model 1A-2775 — **24 Cylinders** — **Water Cooled**

1250 B.H.P. at 2700 Engine R.P.M. — 1500 Lbs. Dry — 45 Lbs. Water



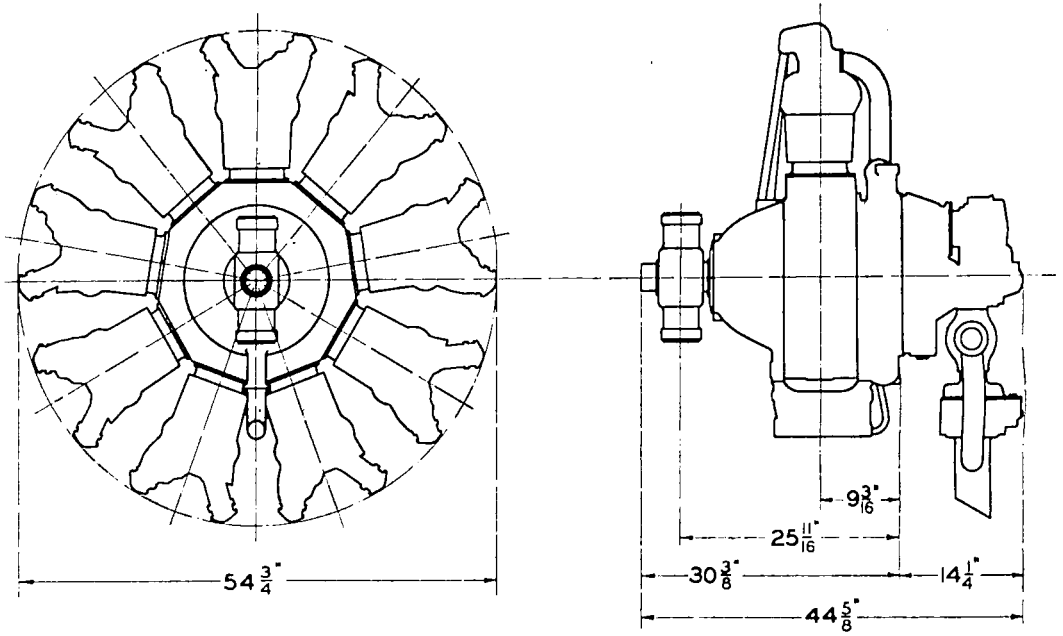
THE PRATT & WHITNEY AIRCRAFT COMPANY

HARTFORD, CONN.

"WASP" 9 CYLINDERS AIRCOOLED

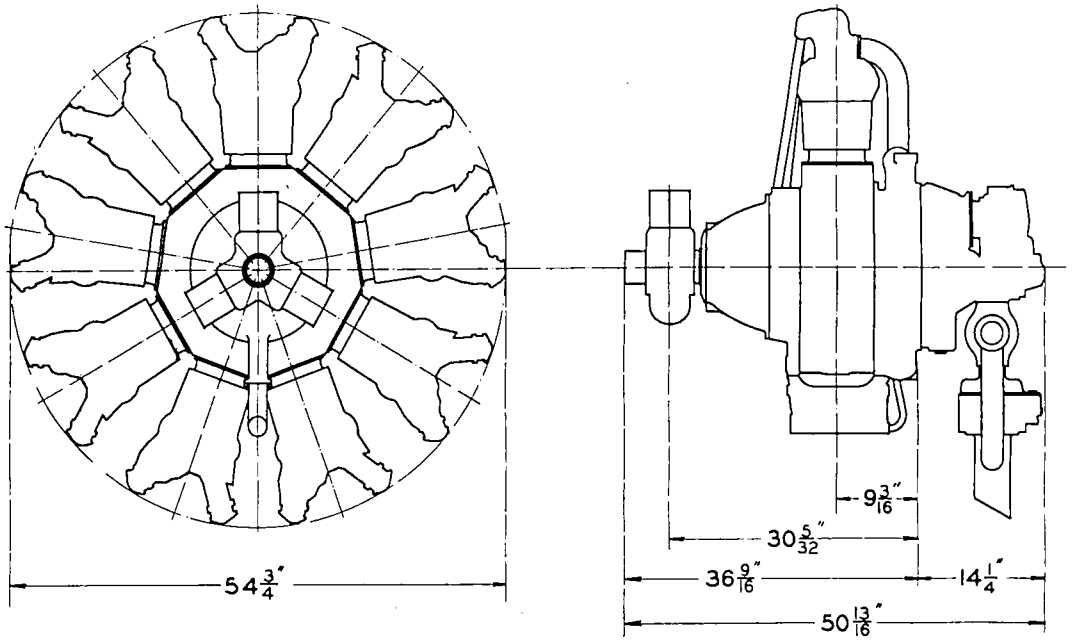
COMMERCIAL 400 B.H.P. AT 1900 R.P.M. 670 LBS.

MILITARY SERIES "B" 450 B.H.P. AT 2100 R.P.M.



THE PRATT & WHITNEY AIRCRAFT COMPANY
HARTFORD, CONN.

"HORNET" 9 CYLINDERS AIRCOOLED
525 B.H.P. AT 1900 R.P.M. 760 LBS.

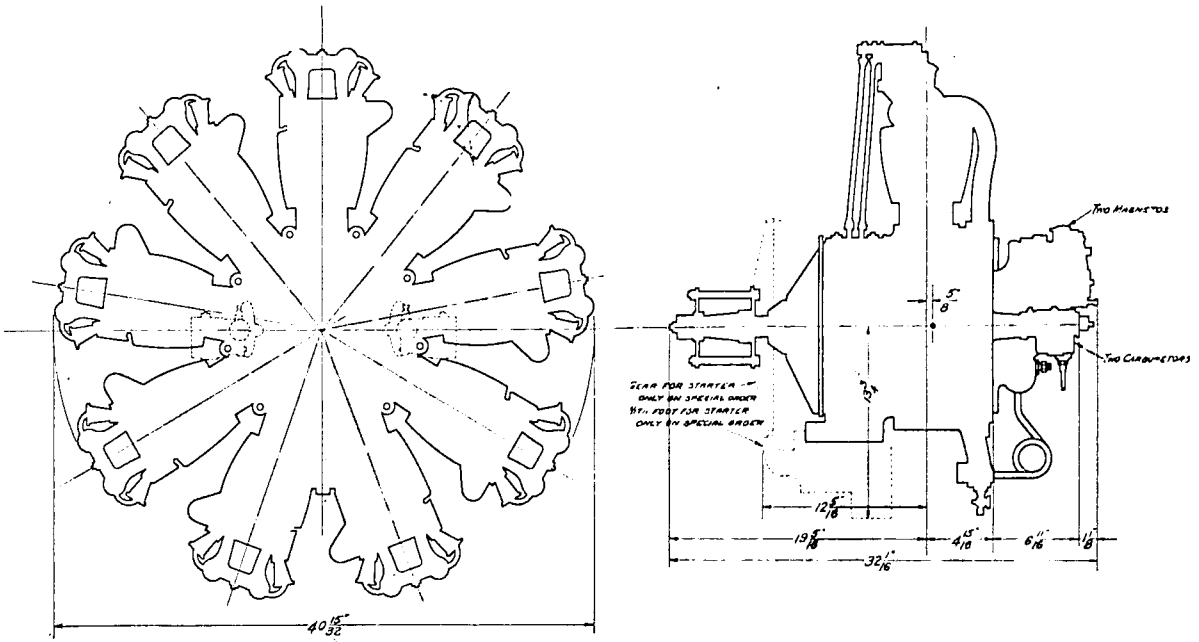


THE PRATT & WHITNEY AIRCRAFT COMPANY

HARTFORD, CONN.

"HORNET" GEARED 2:1 9 CYLINDERS AIRCOOLED

525 B. H. P. AT 1900 R.P.M. 835 LBS.

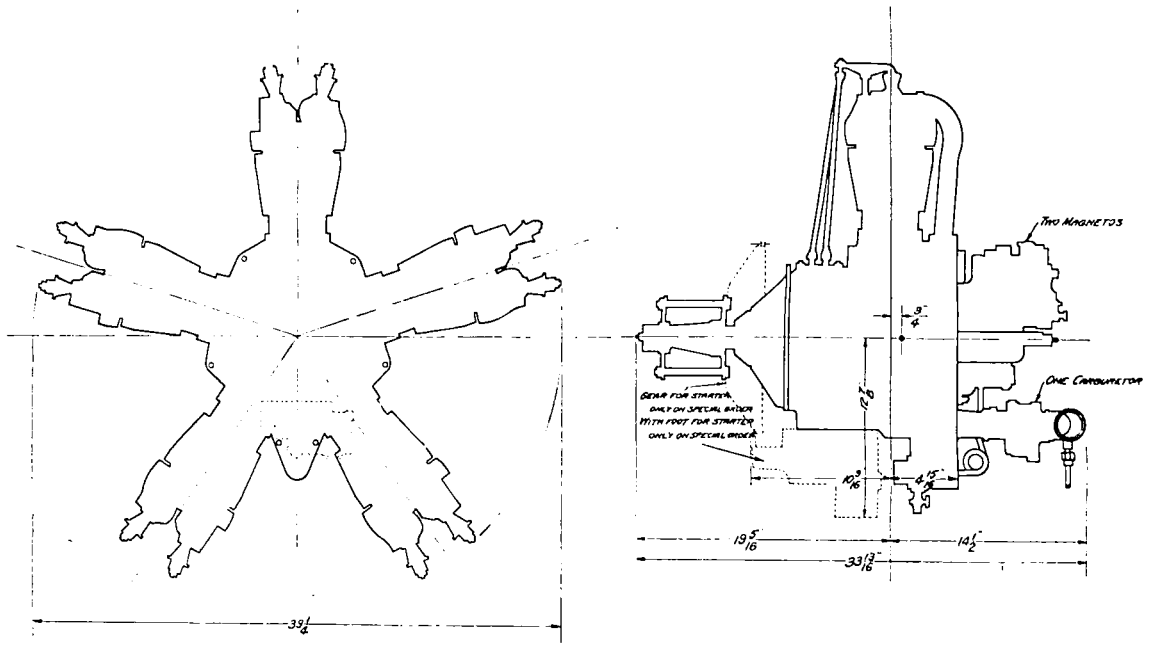


Siemens & Halske, A.G.

Represented in America by K. G. FRANK, Consulting Engineer,
75 West St., New York City

Type SH-12 9 Cylinders Aircooled

125 H.P. at 1800 R.P.M. Weight Dry 382 Lbs.

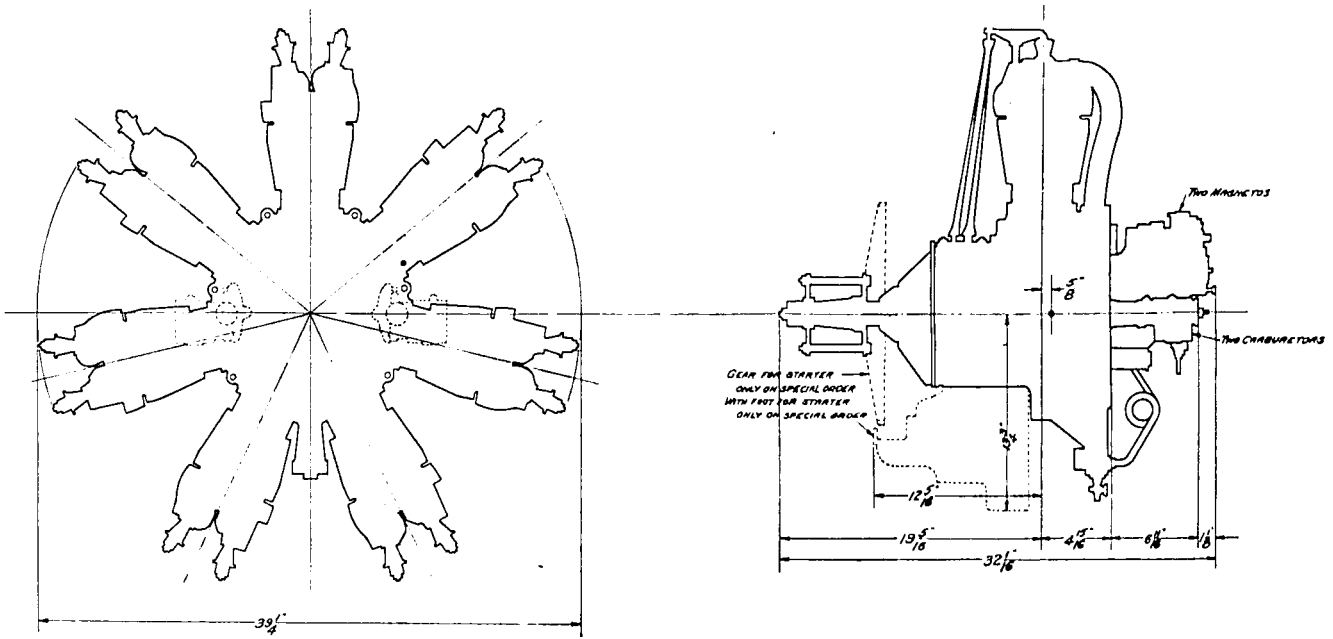


SIEMENS & HALSKE, A.G.

REPRESENTED IN AMERICA BY K. G. FRANK, CONSULTING ENGINEER,
75 WEST ST., NEW YORK CITY

TYPE SH-13 5 CYLINDERS AIRCOOLED

80 H.P. AT 1800 R.P.M. WEIGHT DRY 247 LBS.

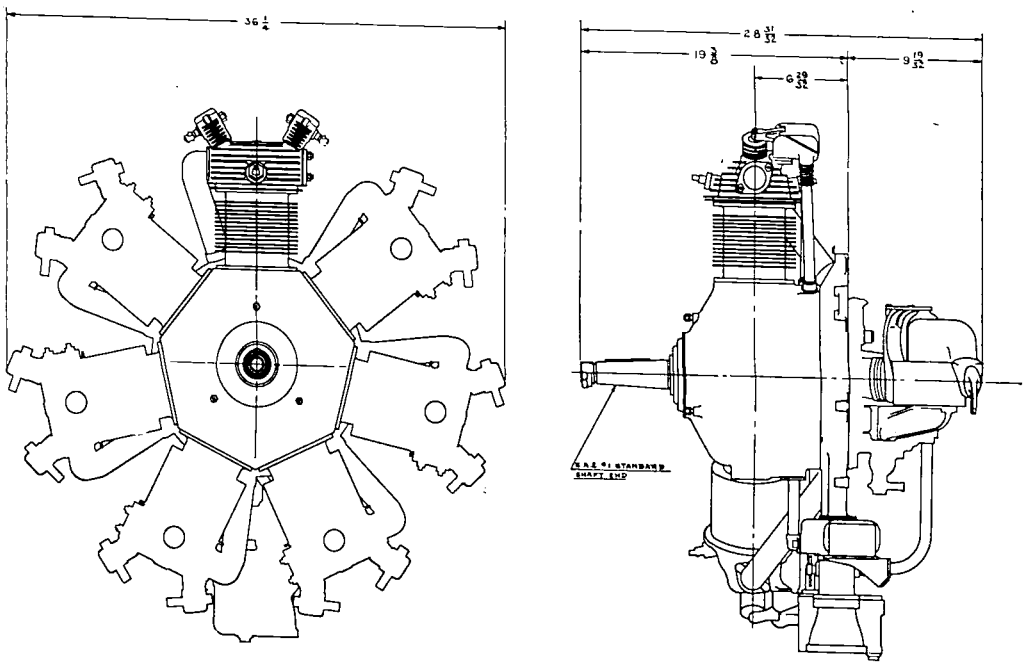


Siemens & Halske, A.G.

Represented in America by K. G. FRANK, Consulting Engineer,
75 West St., New York City

Type SH-14 7 Cylinders Aircooled

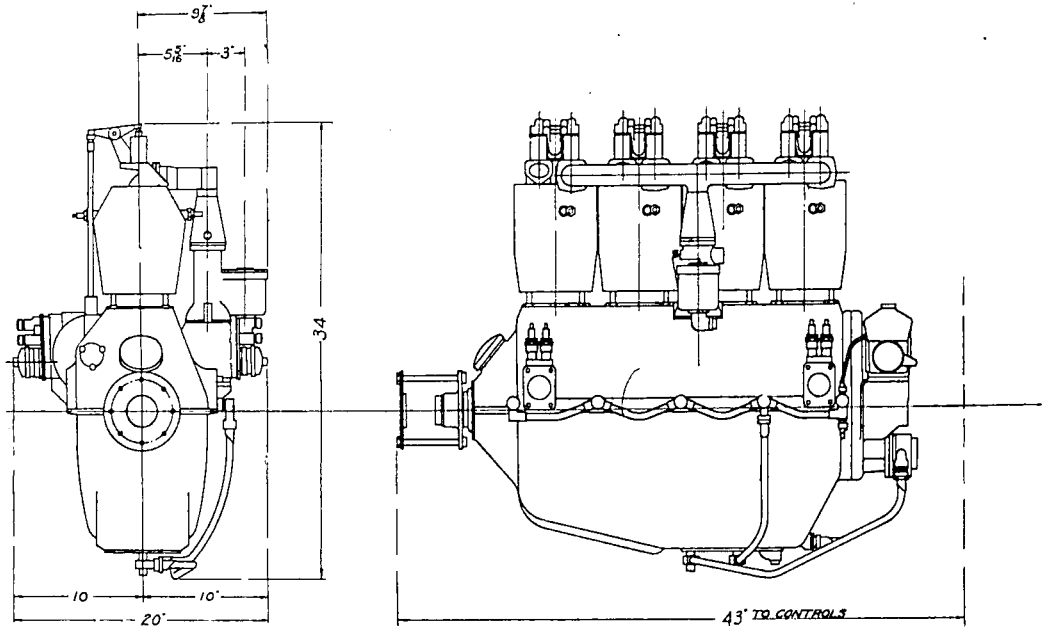
110 H.P. at 1800 R.P.M. Weight Dry 308 Lbs.



The Warner Aircraft Corp.

Detroit, Mich.

"Scarab"

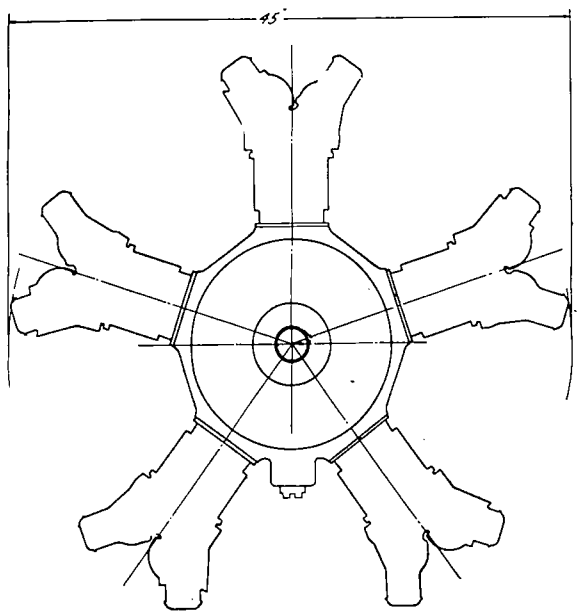


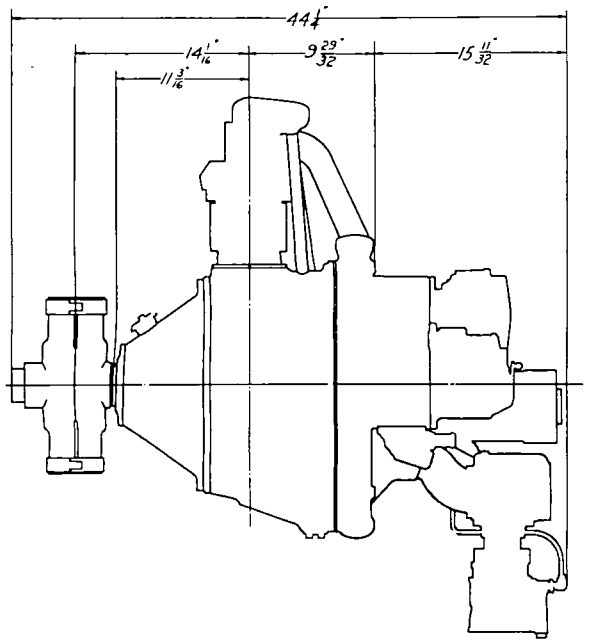
Wright Aeronautical Corporation

Paterson, N. J.

Wright-Gipsy 4 Cylinders Aircooled

Standard 85 B.H.P. at 1900 R.P.M. Weight Dry 277 Lbs.



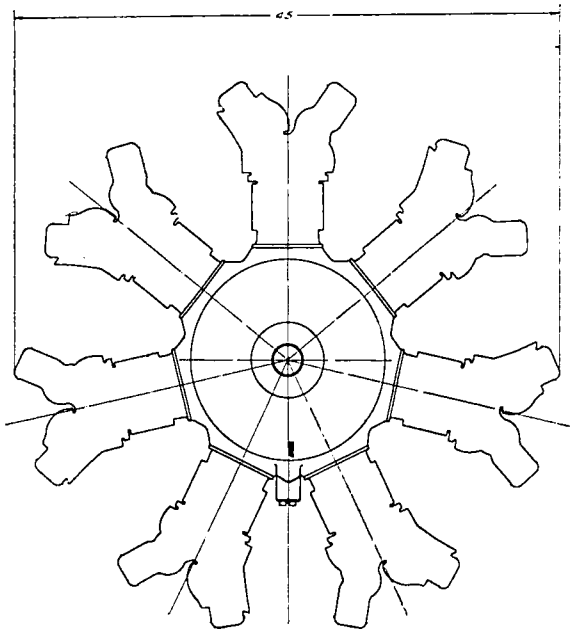


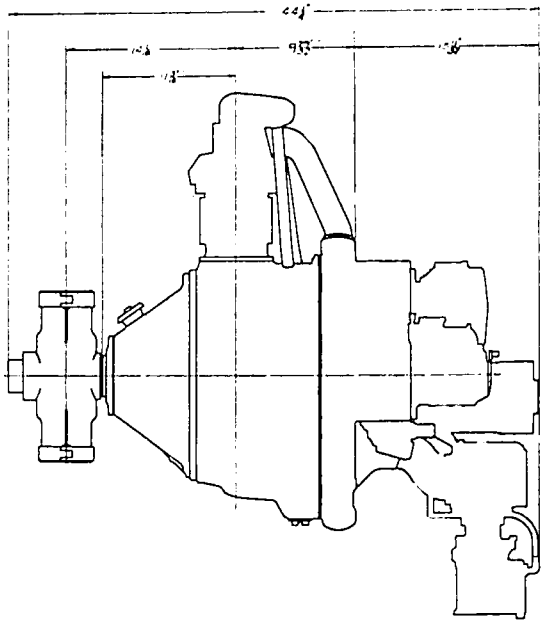
Wright Aeronautical Corporation

Paterson, N. J.

"Whirlwind" 5 Cylinders Aircooled

Standard 150 B.H.P. at 1800 R.P.M. Weight Dry 370 Lbs.



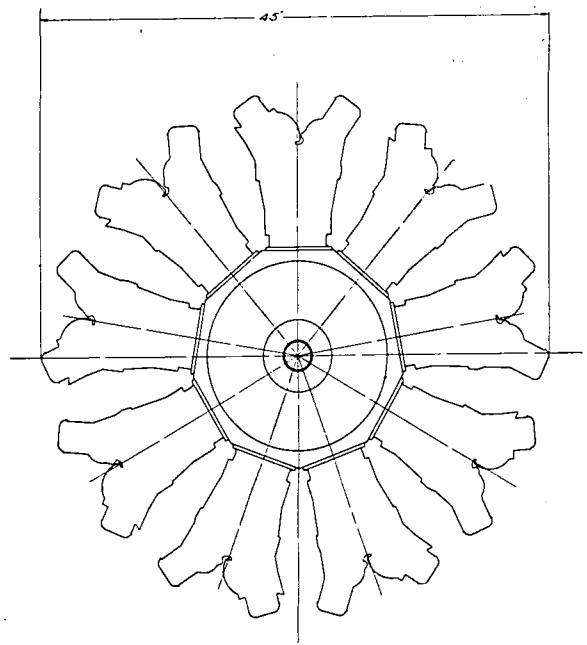


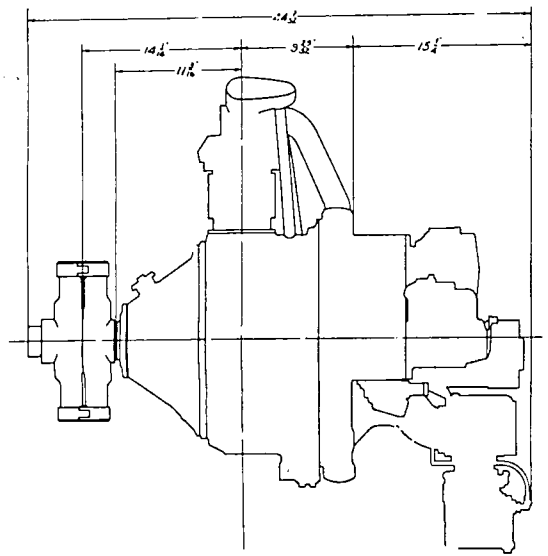
Wright Aeronautical Corporation

Paterson, N. J.

"Whirlwind" 7 Cylinders Aircooled

Standard 220 B.H.P. at 2000 R.P.M. Weight Dry 425 Lbs.



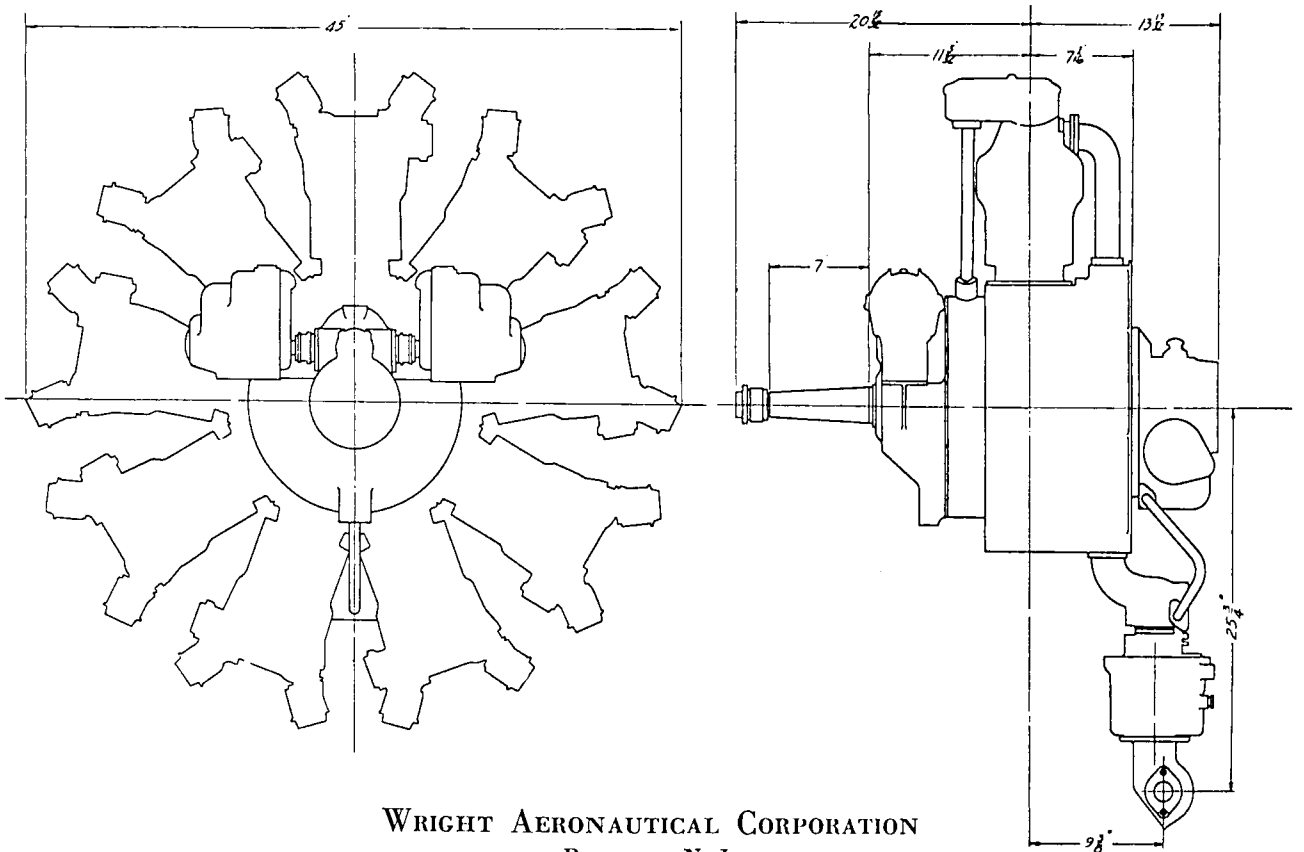


Wright Aeronautical Corporation

Paterson, N. J.

"Whirlwind" 9 Cylinders Aircooled

Standard 300 B.H.P. at 2000 R.P.M. Weight Dry 520 Lbs.

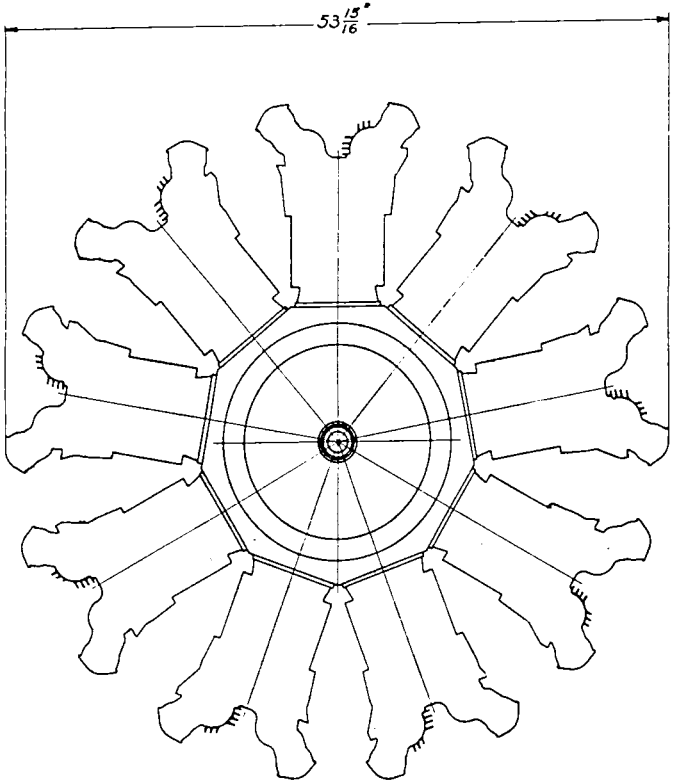


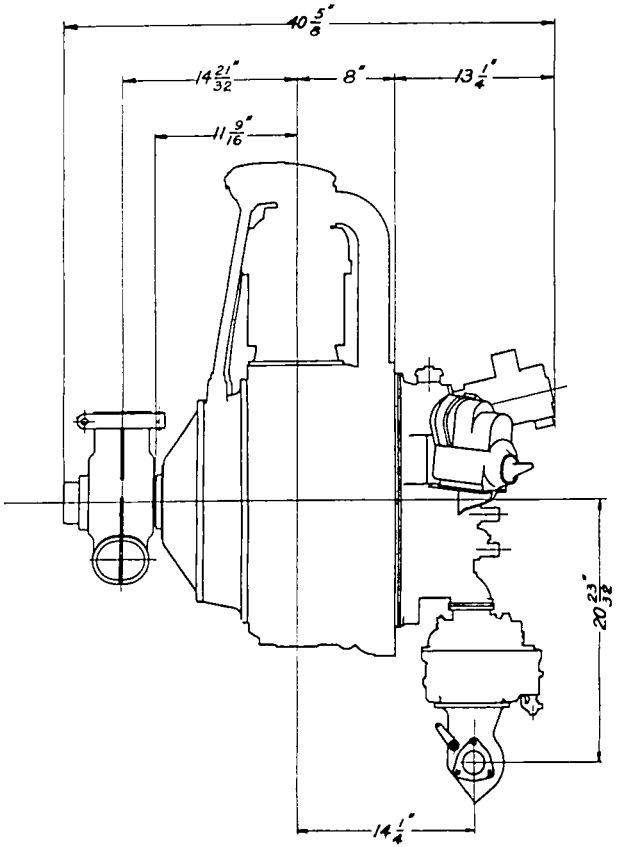
Wright Aeronautical Corporation

Paterson, N. J.

"Whirlwind" J-5 9 Cylinders Air Cooled

Standard 200 B.H.P. at 1800 R.P.M. Weight Dry 525 Lbs.



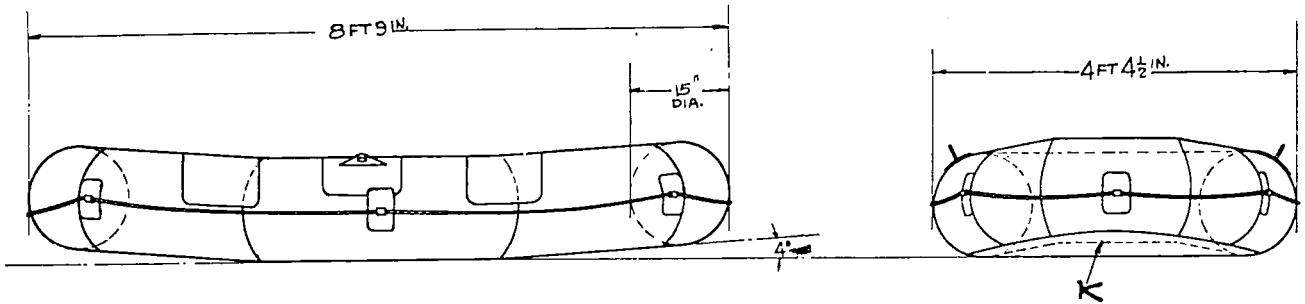


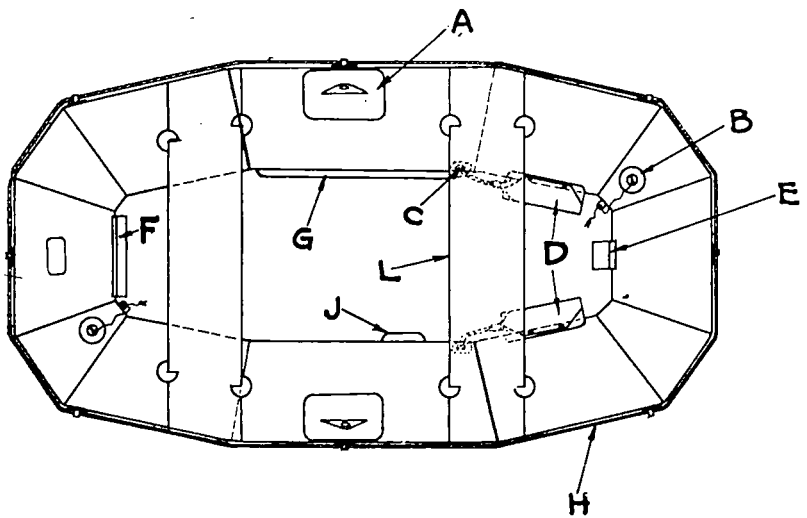
WRIGHT AERONAUTICAL CORPORATION

PATERSON, N. J.

"CYCLONE" R-1750 9 CYLINDERS AIR COOLED

STANDARD 525 B.H.P. AT 1900 R.P.M. WEIGHT DRY 760 LBS.





A—Oar Lock
B—Pump Valve
C—CO_2 Inflation Valve
D—1.5 # Bottle of CO_2
E—Canteen Pocket
F—Ration and Chart Pocket
G—Pump and Oar Pocket
H—Life Line
J—Watertight Repair Kit
K—Bottom
L—Seat

AIRSHIPS, INC.
HAMMONDSPORT, N. Y.
"AIRAFT"

APPENDIX

AERONAUTICAL CHAMBER OF COMMERCE OF AMERICA, Inc.

WHAT IT IS AND WHAT IT DOES

THE Aeronautical Chamber of Commerce of America, Inc., is the national trade organization for all the activities of the aircraft industry. Our purpose is to encourage the use of aircraft. This purpose is twofold: We work within the industry for the improvement of conditions and practices conducive to public appreciation and support; and we take the initiative, on behalf of the industry, in correcting or stimulating the public viewpoint.

Believing that air transport will contribute largely to the peaceful progress of the human race, we feel it is our privilege to co-ordinate the best that the industry offers, its proper aims and ambitions, with public policy, to the end that the industry may greatly prosper and thus assist our country in maintaining America's leadership in the air.

The Aeronautical Chamber of Commerce is unique. It is literally a federation of commercial aeronautical interests. It brings within one comprehensive movement, devoted to one common end, every element conceivably connected with the business of flying. We believe it fortunate that this is so, for the business of flying—like air navigation itself—is revolutionary. It introduces original and perplexing problems and yet each of these problems is in some way involved with other business activities and other means of transport on land and water.

On July 31, 1928, the members of the Chamber voted changes in the By-Laws to enable it to expand. Under the new set-up, there are three classes of membership: Organization, Associate and Sustaining. Organization membership is divided into three classes, A, B, and C, to which any reputable person, firm or corporation in the United States of America, having an outstanding interest in aeronautics may be eligible. Class A includes aircraft manufacturers; motor manufacturers; air transport operators; affiliated transport operation; financial institutions; insurance; fuels, lubricants and gases. Class B includes experimental manufacturers and designers; aircraft accessory manufacturers, etc.; airports and airways-designers, constructors, managers, operators, manufacturers; publishers; photography and survey; aerial advertisers, aeronautical engineers. Class C includes jobbers or dealers; aerial service; schools, specialized services; specialized manufacturing. Any municipality or reputable group, society, club or association interested in aeronautics, including any Chamber of Commerce, Board of Trade or Trade Association maintaining aviation committees or sections may be eligible for associate membership. Any individual, who through services or financial aid in promotion, research or experimentation has contributed to the development of the art, or any engineer, designer, pilot or owner of aircraft, or any person financially or professionally interested in aeronautics or in the employ of a member company, may be eligible for sustaining membership.

Our By-Laws provide for the appointment or recognition of Sectional Committees. Among such Sections or Committees now functioning, or in process of formation are: Commercial Airplane Manufacturers; Motor Manufacturers; Air Transport Operators; Airports and Airways; Parts, Material, Instrument, Accessory and Supply Manufacturers; Airship Manufacturers; Aeronautical Education; Accounting Standardization; Technical Standardization; Institutional Advertising; Fuels and Lubricants; Arbitration; Insurance; Aerial Photography and Survey; Government Relations; Publishers; Legislative; Jobbers and Dealers; Traffic, Shipping and Export; Shows; Aerial Service and Flying Schools; Public Policy and Information.

The hundreds of members of the Chamber are scattered throughout the United States. In the promotion of aviation by means of our trade organization, there is consequently a regional or geographical interest, as well as specialized. Thus far seven geographical divisions have been established, as follows:

Eastern centering upon New York
North Central centering upon Detroit
Great Lakes centering upon Chicago
South Central centering upon Wichita
Southwestern centering upon Los Angeles
Nortwestern centering upon Seattle
Southeastern

The Aeronautical Chamber of Commerce provides the legal and logical means for the collection, interpretation and dissemination of information for the promotion of aviation.

Our Bulletin Service embraces matters relating to the Government as well as phases of general application. Bulletins emanating from our Washington contacts embrace the following series: Bid-Information—(All Government aviation purchases—issued weekly); Patent Digest—(Issued weekly); Legislative Digest—(Fortnightly when Congress is in session); Aeronautics Branch, Department of Commerce—(Aircraft manufacturing); Aeronautics Branch, Department of Commerce—(Aircraft operation); Aeronautics Branch, Department of Commerce—(Airports and Airways); Aeronautics Branch, Department of Commerce—(Foreign); Post Office Department—(Contract Air Mail Operation). Bulletins regularly issued on general topics include: Library Bulletin (Index to aeronautical publications issued fortnightly), Sales Suggestions, Production Reports, Operation Reports, Miscellaneous Statistics, Publicity Suggestions.

We maintain a Washington Bureau, which, in addition to gathering facts for our Governmental bulletins, is also available for use by the members in obtaining or conveying information and in other ways.

Our library, which issues the Library Bulletin, has been functioning since the inception of the Chamber. Its collection of books, reports, pamphlets, charts, maps, photographs, magazines, etc., extends into the thousands. The *Aircraft Year Book* since 1919, has been the standard reference book on world aviation. Its publication by the Chamber represents a valuable asset to the industry.

Through the Chamber, a definite exposition policy has been evolved whereby the industry obtains maximum benefit from a limited number of national shows, and local ambitions and sales possibilities are realized in co-operation with jobbers and dealers. The Chamber has a subsidiary stock corporation—The Aeronautical Expositions Corporation—to which members may subscribe and thus share with the Chamber not only in the promotional benefits but also in the financial profits of shows held under the auspices of the trade association.

AERONAUTICAL CHAMBER OF COMMERCE OF AMERICA, Inc.

300 Madison Avenue, New York

Officers

July 1 to Dec. 31, 1928, Lester D. Gardner, President

1929

President	F. B. Rentschler.
Vice-President, Eastern Division	H. F. Pitcairn.
Vice-President, North Central Division	Edward S. Evans.
Vice-President, Great Lakes Division	Paul Henderson.
Vice-President, South Central Division	Clyde V. Cessna.
Secretary, South Central Division	Wilbur Neely.
Vice-President, Southwestern Division	H. M. Hanshue.
Vice-President, Northwestern Division	P. G. Johnson.
Vice-President, Commercial Airplane Manufacturers Section	J. Don Alexander.
Vice-President, Motor Manufacturers Section	F. H. Russell.
Vice-President, Airship Manufacturers Section	J. C. Hunsaker.
Vice-President, Airports Section	C. M. Knox.
Vice-President and General Manager	S. S. Bradley.
Secretary	Luther K. Bell.
Treasurer	Owen A. Shannon.

The Council

L. D. Gardner. C. L. Lawrance.
Paul Henderson. G. C. Loening.
I. M. Uppercu.

Governors

J. Don Alexander.
Walter Beech.
S. S. Bradley.
C. J. Brukner.
J. L. Callan.
John R. Cautley.
Clyde V. Cessna.
Charles H. Colvin.
Edward S. Evans.
T. Z. Fagan.
S. M. Fairchild.
E. N. Gott.
Harris M. Hanshue.
J. C. Hunsaker.
P. G. Johnson.
Clarence M. Knox.
C. T. Ludington.
H. F. Pitcairn.
F. B. Rentschler.
F. H. Russell.
J. M. Russell.

Committees

Executive

F. B. Rentschler, Chairman; C. L. Lawrance, F. H. Russell, C. H. Colvin, S. S. Bradley.

Policy and Operation

W. E. Metzger, Chairman; E. N. Gott, Lloyd Stearman, H. F. Pitcairn, H. M. Hanshue.

Commercial Airplane Manufacturers Section

J. Don Alexander, Chairman; R. H. Depew, Thomas Hamilton, C. J. Brukner, A. J. Edwards.

Technical Sub-Committee—R. B. C. Noorduyn, Chairman.

Purchasing Agents Sub-Committee—Roy Edwards, Chairman.

Motor Manufacturers Section

F. H. Russell, Chairman.

Motor Testing Sub-Committee—C. L. Lawrance, Chairman.

Air Transport Operators

L. D. Seymour, Chairman; Thorp Hiscock, L. H. Brittin, H. C. Leuteritz, H. A. Elliott, E. W. Proctor, Paul Goldsborough, Herbert Hoover, Jr.

Technical Radio Sub-Committee

Thorp Hiscock, Chairman.

Airship Manufacturers Section

J. C. Hunsaker, Chairman; Carl B. Fritsche, E. H. Courteney, J. L. Callan.

AERONAUTICAL CHAMBER OF COMMERCE OF AMERICA, Inc.

Committees (Continued)

Airport Section

C. M. Knox, Vice President in Charge; John Berry, Chairman; Tex Rankin, Cliff Henderson, H. B. Shaver, F. J. Geng, C. P. Newhouse, A. H. Heermance, C. L. Bredow, B. E. Fulton, Charles Dion.

Airport Fire Hazards Sub-Committee

W. J. Austin, Chairman; W. L. LePage, E. A. Johnson.

Flying School Section

P. R. Love, Chairman; C. S. Jones, Jack Stinson, O. L. Parks, Ted Braley, Tex Rankin, W. B. Haviland, D. P. Wardwell.

Fuel and Lubricants Section

Frank J. Shipman, Chairman; Vice-Chairman-at-large, E. E. Aldrin; Sidney S. Chadderton; Sidney Bevin, I. H. Shearer, D. P. Bernard, F. L. Foster, Dudley Steele, Emery Bronte.

Fuel Sub-Committee—E. E. Aldrin and F. L. Foster.

Lubrication Sub-Committee—R. H. Mozier and I. H. Shearer.

Arbitration Committee

Lester D. Gardner, Chairman; E. S. Evans, J. C. Hunsaker, C. M. Knox, J. R. Cautley.

Show Committee

C. L. Lawrance, Chairman; C. J. Brukner, C. V. Cessna, C. H. Colvin, T. Z. Fagan, E. N. Gott, G. B. Grosvenor, H. M. Hanshue, P. G. Johnson, H. P. Mamen, W. B. Mayo, H. C. Ritchie, F. H. Russell, A. A. Woodruff.

Insurance Underwriters

H. Barber, Chairman; R. H. Depew, J. B. B. Parker, R. M. Chambers.

Aeronautical Education

Prof. R. H. Spaulding, Chairman; H. Girard, B. G. Shackelford, A. D. Althouse, W. F. Frey.

Membership Committee

C. H. Colvin, Chairman; E. N. Gott, C. B. Fritsche, L. D. Seymour, Wilbur Neeley, Fred A. Worthey, P. G. Johnson.

Special Committee on Questionable Advertising

Frank Tichenor, Chairman; Earl D. Osborn, Ralph Duysters, P. R. Love, George S. Wheat.

Sub-Committee on Investigation — Ralph Duysters, Chairman; H. W. Mitchell, Vice-Chairman for Middle West; R. J. Pritchard, Vice-Chairman for Pacific Coast; L. A. Nixon and Harry Schwartzschild, members-at-large.

Members and Subscribers

Acme Aircraft Corporation, Rockford, Ill.
A. C. Spark Plug Co., Flint, Michigan.
Advance Aircraft Co., Troy, Ohio.
Aerial Service Corp., Hammondsport, N. Y.
Aero Guides, Inc., New York, N. Y.
Aeromarine Klemm Corp., Keyport, N. J.
Aero Model Co., Chicago, Ill.
Aeronautical Digest Pub. Corp., New York.
Aeronautical Industries, New York, N. Y.
Aeronautical Products Co., Naugatuck, Conn.
Aeronautical World, Los Angeles, Calif.
Aero Supply Mfg. Co., College Point, L. I.
Aerovane Utilities Corp., New York, N. Y.
Air Activities, Inc., Chicago, Ill.
Air Associates, Inc., New York, N. Y.
Aircraft Development Corp., Detroit, Mich.
Aircraft Holding Corp., Culver City, Calif.
Aircraft Products Corp. of America, Detroit, Mich.
Airports, Flushing, L. I.
Airport Development & Const. Co., Phila., Pa.
Airships, Inc., Hammondsport, N. Y.
Airstocks, Inc., Jersey City, N. J.
Air Transportation, Inc., New York, N. Y.
Akron Municipal Airport, Akron, O.
Alexander Aircraft Co., Colorado Springs, Colo.
Alliance Aircraft Corp., Alliance, Ohio.
Allison Engineering Co., Indianapolis, Ind.
Aluminum Co. of America, Pittsburgh, Pa.
Aluminum Industries, Inc., Cincinnati, Ohio.
American Aeronautical Corp., New York.
American Airports Corp., New York, N. Y.
American Cirrus Engines, Inc., New York.
American Eagle Airplane Co., Kansas City, Mo.
American Gas Accumulator Co., Elizabeth, N. J.
American Neon Light & Sign Co., New York, N. Y.
American Telephone & Telegraph Co., New York, N. Y.
Austin Co., Cleveland, Ohio.
Aviation Commission, Hartford, Conn.
Aviation Publishing Co., New York, N. Y.
Axelson Machine Co., Los Angeles, Calif.
Balsa Wood Co., Inc., New York, N. Y.
Barr Shipping Corp., New York.
B. B. T. Corp. of America, Phila., Pa.
The B. G. Corporation, New York, N. Y.
Bellanca Aircraft Corp., Newcastle, Del.
Bendix Brake Co., South Bend, Ind.
Berry Brothers, Inc., Detroit, Mich.
Binks Spray Equipment Co., Chicago, Ill.
Black & Bigelow, Inc., New York, N. Y.
Bliss Company, E. W., Brooklyn, N. Y.
Boeing Airplane Co., Seattle, Wash.
Bohn Aluminum & Brass Corp., Detroit, Mich.
Bonforte Airport Engineering Corp., New York, N. Y.

The Braley School of Flying Corp., Wichita, Kansas.
Brenack, Inc., Brooklyn, N. Y.
Brewster & Company, Long Island City.
The J. G. Brill Co., Phila., Pa.
Bryan Davis Pub. Co., Inc., New York.
Buhl Aircraft Co., Marysville, Mich.
Carpenter Steel Co., Reading, Pa.
Celluloid Corporation, Newark, N. J.
Cessna Airplane Co., Wichita, Kansas.
Champion Spark Plug Co., Toledo, Ohio.
Cleveland Pneumatic Tool Co., Cleveland, O.
Coastal Airways, New York, N. Y.
Colonial Air Transport, Inc., New York.
Command-Aire, Inc., Little Rock, Ark.
Commercial Investment Trust, Inc., New York, N. Y.
Consolidated Aircraft Corp., Buffalo, N. Y.
Consolidated Instrument Co., New York.
Crouse-Hinds Co., Syracuse, N. Y.
F. R. Cruikshank Co., New York, N. Y.
Cunningham-Hall Aircraft Corp., Rochester, N. Y.
Curtiss Aeroplane & Motor Co., Garden City, L. I.
Curtiss Flying Service, Inc., Garden City, L. I.
Curtiss Robertson Airplane Mfg. Co., Anglum, Mo.
Cutajar & Provost, Inc., New York, N. Y.
Harold J. Daly & Co., New York.
D'Arcy Advertising Co., St. Louis, Mo.
Davis Aircraft Corporation, Richmond, Ind.
Detroit Board of Commerce, Detroit, Mich.
Detroit Steel Products Co., Detroit, Mich.
Dupont de Nemours & Co., E. I., Wilmington, Del.
Eastman Kodak Co., Rochester, N. Y.
Eclipse Machine Co., Hoboken, N. J.
Edo Aircraft Corp., College Point, L. I.
Electric Storage Battery Co., Phila., Pa.
Elgin National Watch Co., Chicago, Ill.
Elias & Bro., G., Buffalo, N. Y.
Ex-Cell-O Tool & Mfg. Co., Detroit, Mich.
Fairchild Aviation Corp., New York, N. Y.
Firestone Tire & Rubber Co., Akron, O.
Fokker Aircraft Corp., Hasbrouck Heights, N. J.
Folmer Clogg & Co., Lancaster, Pa.
Dr. K. G. Frank (German Siemens Halske Co.), New York, N. Y.
Garrison Fire Detecting System, New York.
General Airplanes Corp., Buffalo, N. Y.
General Electric Co., Schenectady, N. Y.
Goodrich Rubber Co., B. F., Akron, Ohio.
Goodyear Tire & Rubber Co., Akron, Ohio.
Gray Goose Airplanes, Inc., Chicago, Ill.
Great Lakes Aircraft Corp., Cleveland, Ohio.
Gulf Refining Co., Pittsburgh, Pa.
Hall-Aluminum Aircraft Co., Buffalo, N. Y.
Hamilton Aero. Mfg. Co., Milwaukee, Wis.
Hamilton Metalplane Co., Milwaukee, Wis.
Hartol Refining Corp., New York, N. Y.
Hartshorn Co., Stewart, New York, N. Y.
Harwen Products Corp., New York, N. Y.
Haskelite Mfg. Co., Chicago, Ill.
Heywood Starter Corp., Detroit, Mich.
Huntington Aircraft Corp., Bridgeport, Conn.
Industrial Bureau of Columbus, Columbus, Ohio.
Inter-Allied Aeronautics, Inc., New York.
Interflash Signal Corp., New York, N. Y.
International Nickel Co., New York, N. Y.
Ireland Aircraft, Inc., Garden City, L. I.
Irving Airchute Co., Buffalo, N. Y.
Johnson Airplane & Supply Co., Dayton, Ohio.
Kelsey-Hayes Wheel Corp., Jackson, Mich.
Kendall Refining Co., Bradford, Pa.
Keystone Aircraft Corp., Bristol, Pa.
Walter Kidde & Co., Inc., New York, N. Y.
The Knoll Aircraft Corp., Wichita, Kan.
Kreider Reisner Aircraft Co., Hagerstown, Md.
Joseph Kreutzer, Inc., Los Angeles, Calif.
Leece Neville Co., Cleveland, Ohio.
Linde Air Products Co., New York, N. Y.
Lockheed Aircraft Co., Los Angeles, Calif.
Loening Aeronautical Engineering Corp., New York, N. Y.
Ludington-Philadelphia Flying Service, Philadelphia, Pa.
MacWhyte Co., Kenosha, Wis.
Manufacturers Aircraft Assn., New York.
Hamilton Maxwell, Inc., New York, N. Y.
Mahoney-Ryan Aircraft Corp., Anglum (St. Louis County), Mo.
Meisel Press Mfg. Co., Boston, Mass.
Metal Aircraft Corp., Cincinnati, O.
Mono Aircraft, Inc., Moline, Ill.
Moth Aircraft Corp., New York, N. Y.
Moto-Meter Co., Inc., Long Island City.
Murphy & Chapman, New York, N. Y.
National Air Transport, Inc., Chicago, Ill.
N. A. T. Flying Service, Chicago, Ill.
National Aviation Corp., New York, N. Y.
National Carbide Sales Corp., New York.
National Credit Office, Inc., Cleveland, Ohio.
National Standard Parts Assn., Detroit, Mich.
National Steel Products Co., Dayton, Ohio.
Naturaline Co. of America, Tulsa, Okla.
New York Rubber Co., New York, N. Y.
New Standard Aircraft Corporation, Paterson, N. J.
Nicholas-Beazley Airplane Co., Marshall, Mo.
Norma Hoffman Bearings Co., Stamford, Conn.
Northwest Airways, Inc., St. Paul, Minn.
Packard Electric Co., Warren, Ohio.
Packard Motor Car Co., Detroit, Mich.
Pan-American Airways, Inc., New York.
Park Drop Forge Co., Cleveland, Ohio.
Parks Aircraft, Inc., St. Louis, Mo.
Parks Air College, Inc., St. Louis, Mo.
Pennsylvania R. R. Co., Philadelphia, Pa.
Perry Austin Mfg. Co., Staten Island, N. Y.
Pioneer Instrument Co., Brooklyn, N. Y.
Pitcairn Aviation, Inc., Philadelphia, Pa.
Popular Aviation, Chicago, Ill.
Pratt & Whitney Aircraft Co., Hartford, Conn.
Prudden Aircraft Corp., San Diego, Calif.
Pyle-National Co., Chicago, Ill.
Radiomarine Corporation, New York, N. Y.
Rand McNally & Co., Chicago, Ill.
Rankin School of Flying, Portland, Ore.
Reed Propeller Co., New York, N. Y.
Richfield Oil Co., Los Angeles, Calif.
The Robbins Co., Attleboro, Mass.
Robertson Aircraft Corp., Anglum (St. Louis County), Mo.
H. H. Robertson Co., Pittsburgh, Pa.
Roebling's Sons Co., John A., Trenton, N. J.
Rome Wire Co., Rome, N. Y.
The Russell Mfg. Co., New York, N. Y.
Russell Parachute Co., San Diego, Calif.
Saginaw Airport Co., Saginaw, Mich.
Schlee-Brock Aircraft Corp., Detroit, Mich.
Scintilla Magneto Co., Sidney, N. Y.
B. Russell Shaw Co., Inc., St. Louis, Mo.
Shell Oil Co., San Francisco, Cal.

Sikorsky Manufacturing Corp., College Point, L. I.
Simmons Boardman Publishing Co., New York, N. Y.
The Simplex Aircraft Corp., Defiance, Ohio.
S. K. F. Industries, New York, N. Y.
Spartan Aircraft Co., Inc., Tulsa, Okla.
A. G. Spaulding & Bro., New York, N. Y.
Sperry Gyroscope Co., Brooklyn, N. Y.
Splitdorf Electrical Co., Newark, N. J.
The Sportsman Pilot, Inc., New York.
Standard Oil Co. of Indiana, Chicago, Ill.
Standard Oil Co. of N. J., New York.
Standard Oil Co. of N. Y., New York.
Standard Steel Propeller Co., Pittsburgh, Pa.
Stearman Aircraft Co., Wichita, Kansas.
Stinson Aircraft Corp., Northville, Mich.
Stromberg Motor Devices Co., Chicago, Ill.
Summerill Tubing Co., Bridgeport, Pa.
Supreme Propeller Co., Wichita, Kan.
Swallow Airplane Co., Wichita, Kansas.
The Swift Aircraft Corp., Wichita, Kansas.
Szekely Aircraft Corp., Holland, Mich.
Taylor Instrument Companies, Rochester.
Texas Air Transport, Inc., Fort Worth, Texas.
The Texas Co., New York, N. Y.
Texas Pacific Coal & Oil Co., Fort Worth, Texas.
Thomas-Morse Aircraft Corp., Ithaca, N. Y.
Thompson Products, Inc., Cleveland, Ohio.
Thurston Cutting Corp., New York, N. Y.
Tide Water Oil Sales Corp., New York.
Titanine, Inc., Union, N. J.
Transcontinental Air Transport, Inc., New York, N. Y.
Transcontinental Airport of Toledo, Inc., Toledo, Ohio.
Travel Air Mfg. Co., Wichita, Kansas.
Travelers Insurance Co., Hartford, Conn.
Twining & Co., E. S., New York, N. Y.
Universal Aviation Corporation, Minneapolis, Minn.
U. S. Air Services, Washington, D. C.
U. S. Aviation Underwriters, Inc., New York, N. Y.
U. S. Hammered Piston Ring Co., Irvington, N. Y.
U. S. Rubber Co., New York.
Utica Chamber of Commerce, Utica, N. Y.
Vacuum Oil Co., New York, N. Y.
Valentine & Co., New York, N. Y.
Van Schaack Bros. Chemical Works, Chicago, Ill.
Varney Aeroplanes, Walter T., San Francisco, Calif.
Velie Motors Corp., Moline, Ill.
Voice of the Sky, Inc., New York, N. Y.
Chance Vought Corp., Long Island City.
Welch Aircraft Co., Orin, Anderson, Ind.
Wellington Sears & Co., New York, N. Y.
Western Air Express, Inc., Los Angeles, Calif.
Western Electric Co., Inc., New York.
Western Flying Magazine, Los Angeles, Calif.
Westinghouse Elec. & Mfg. Co., South Bend, Ind.
Westinghouse Lamp Co., New York, N. Y.
White Dental Mfg. Co., S. S., New York.
Clarence Whitman & Sons, Inc., New York.
Whittelsey Mfg. Co., Inc., Bridgeport, Conn.
The Wichita Chamber of Commerce, Wichita, Kansas.
The Wise Birds, Inc., Detroit, Mich.
Wolverine Lubricants Co., New York, N. Y.
Wood & Spencer Co., Cleveland, O.
Wright Aeronautical Corp., Paterson, N. J.
Wyman-Gordon Co., Worcester, Mass.
Wyoming Airways Corp., Casper, Wyo.

Kesniel Acton.
Porter H. Adams.
Norman Allderdice.
Andrew D. Althouse.
A. Drew Arend.
E. R. Armstrong.
W. E. Arthur.
L. M. Atkinson.
Charles J. Ball.
H. Barber.
J. Stewart Barney.
J. B. Beadle.
David Beecroft.
A. T. Bell.
Luther K. Bell.
P. A. Bernard.
John Berry.
Anson A. Bigelow.
Bessie E. Bishop.
A. Black.
Eleanor Bloomfield.
Sumner N. Blossom.
James Henry Boles.
H. C. Boynton.
S. S. Bradley.
C. H. Briggs, M.D.
Anton F. Brotz, Sr.
Charles B. Brown.
C. Gordon Brown.
H. A. Bruno.
Mrs. Geo. DeForest Brush.
J. Lansing Callan.
Harold Caminez.
B. F. Castle.
Clarence Chamberlin.
C. deF. Chandler.
John B. Chevalier.
V. E. Clark.
N. W. Clements.
A. B. Coffman.
Walter A. Colman.
C. H. Colvin.
Fred H. Colvin.
Charlotte Cecil Cooley.
Frank G. Coon.
Henry M. Crane.
Glenn H. Curtiss.
Robert Cuse.
Chester W. Cuthell.
Richard H. Depew.
R. Henry Depew.
William H. Dey.
F. G. Diffin.
Albert W. Dold.
Joseph F. Dougherty.
W. H. Dunning.
Perley R. Eaton.
Abraham Lionel Edis.
H. F. Eggert.
F. B. Erickson.
J. A. Eubank.
Edward S. Evans.
Martha C. Evans.
Sherman M. Fairchild.
H. C. Ferguson.
Harry L. Finch.
Earl N. Findley.
Robert Foote.
William F. Frey.
William P. Gaffney.
L. D. Gardner.
Francis J. Geng.
Hubert Girard.
C. W. Glose.
Leopold Godowsky.
Leo Godowsky, Jr.
E. N. Gott.
Frank M. Granger.
Herbert L. Gregory.
Fred H. Grieme.
J. J. Gunther-Mohr.
Charles R. Hall.
W. L. Hamilton.
Stedman Hanks.
Clarence D. Hanscom.
John Harding, Jr.
Laura B. Harney.
Lucy M. Harrison.
Brent Hart.
H. R. Hart.
S. A. Hartwell, Jr.
Beckwith Havens.
C. R. Hays.
Lady James Heath.
Spencer Heath.
Stanley A. Hedberg.
Andrew H. Heermance.
Cliff Henderson.
J. Edgar Hilgendorf.
Thomas Hingsberg.
F. Wandy Hockaday.
W. Hodkinson.
Addison C. Hoof.
Bennett H. Horchler.
Iskander Hourwich.

George R. Houston.
Jerome C. Hunsaker.
G. S. Ireland.
Henry Arnold Jencks.
P. G. Johnson.
M. Magruder Jones.
Harry Karcher.
Victoria M. Karp.
W. W. Kellett.
Albert B. Kellogg.
Cadwallader W. Kelsey.
Robert Kemp.
Sherrill Kent.
H. A. Kenyon.
C. F. Kettering.
C. Roy Keys.
Prof. Alexander Klemin.
Howard C. Knotts.
John B. Kohler.
Harold Kondolf.
Andrew A. Kucher.
Agnew E. Larsen.
Charles L. Lawrance.
Robert E. Lenton.
W. Lawrence LePage.
F. J. Lisman.
Albert P. Loening.
Grover Loening.
Floyd J. Logan.
Philip R. Love.
Hans Lubig.
Ennis B. Mallette.
William H. Mallon.
Roscoe I. Markey.
R. D. Marshall.
C. H. Matthews, Jr.
L. D. Matthews.
William B. Mayo.
J. S. McDonnell, Jr.
Jos. H. McEvoy.
Marie T. McGrath.
Philip S. McLean.
Stephen J. McMahon.
George J. Meade.
Arthur V. Briesen Menken
A. C. Merriam.
William E. Metzger.
Danford Miller.
Elam Miller.
Stanley H. Miller.
Wendell P. Miller.
Helen M. C. Mitchell.
Rev. John R. Morrissey.
A. R. Mosler.
Rosemary F. Mullen.
Marcellus M. Murdock.
Wilbur Neely.
R. B. C. Noorduyn.
John F. O'Ryan.
E. D. Osborn.
Peter J. O'Toole.
Haven B. Page.
Albert F. Pardee.
J. Brooks B. Parker.
Charles Parker.
Gus. A. Parsons.
Philip H. Patchin.
R. H. Patchin.
Lyman S. Peck.
Alexander A. Pedu.
C. G. Peterson.
Herman Pfenniger.
Stephen H. Philbin.
Ethel M. Plumb.
Charles T. Porter.
Clarence O. Prest.
J. F. Prince.
Alexander Procofieff-Seversky.
Albert S. Reed.
F. B. Rentschler.
Victor A. Rickard.
J. K. Robinson, Jr.
Daniel Rochford.
Beta Rothholz.
Earl Rowland.
Arthur C. Roy.
Frank H. Russell.
Roy E. Russell.
R. Sanford Saltus.
Herbert C. Sampter.
Daniel deR. Scarritt.
Edward Schildhauer.
Howard A. Scholle.
Otto Schontz.
L. R. Seidell.
Janet R. Sencer.
L. S. Seymour.
Owen A. Shannon.
D. M. Sheaffer.
L. V. Smith.
W. W. Sowden.
Roland H. Spaulding.
Lorillard Spencer.
James D. Stein.
S. P. Stevens.
W. B. Stout.
Paul J. Strobach.
J. P. Tarbox.
Robert G. Thach.
Dora B. Thompson.
Milton Tibbetts.
G. P. Tidmarsh.
E. R. Tolfree.
Fred A. Toombs.
J. T. Trippe.
I. M. Uppercu.
Ralph Upson.
G. W. Vaughan.
J. G. Vincent.
Harry Vissering.
Chance M. Vought.
Henry Wacker.
Jas. A. Walsh.
Kenneth D. Walton.
Roswell H. Ward.
C. W. Webster.
James McB. Webster.
Howard F. Wehrle.
Raymond W. Welch.
Gerritt Weston.
George S. Wheat.
John E. Whitbeck.
Ernest M. White.
Reginald W. Whitney.
John G. Whytlaw.
George A. Wies, Jr.
William Robt. Wilson.
Benjamin F. Wood.
John Perry Wood.
Duncan A. Woodman.
Henry Price Wright.
Orville Wright.
Theodore P. Wright.
Benjamin F. Wyatt.
W. C. Young.
Jessie G. Young.
Walter F. Zeidler.
Paul G. Zimmermann.

AERONAUTICAL EXPOSITIONS CORPORATION

300 Madison Avenue, New York City

Officers

Paul Henderson.....President.
S. M. Fairchild.....Vice-President.
S. S. Bradley.....Vice-President and General Manager.
C. H. Colvin.....Treasurer.
H. F. Pitcairn.....Secretary.
Owen Shannon.....Assistant Secretary.

Directors

Paul Henderson.
S. M. Fairchild.
Chance M. Vought.
L. B. Valentine.
C. H. Colvin.
H. F. Pitcairn.
S. S. Bradley.
John F. O'Ryan.
E. N. Gott.
C. L. Lawrance.
J. L. Callan.
E. A. Johnson.
Geo. P. Tidmarsh.
F. H. Russell.
L. D. Gardner.

MANUFACTURERS' AIRCRAFT ASSOCIATION, Inc.

300 Madison Avenue, New York, N. Y.

Officers

President.....F. H. Russell.
Vice-President.....G. L. Martin.
Treasurer.....C. L. Lawrance.
Secretary.....C. M. Vought.
General Manager and Assistant Treasurer.....S. S. Bradley.

Directors

F. H. Russell.
G. L. Martin.
C. L. Lawrance.
C. M. Vought.
G. P. Tidmarsh.
A. J. Elias.
Donald Douglas.

Members

Aeromarine Plane & Motor Co., Keyport, N. J.
Boeing Airplane Co., Seattle, Wash.
Curtiss Aeroplane & Motor Co., Inc., Garden City, N. Y.
Curtiss Engineering Corp., Garden City, N. Y.
Dayton Wright Co., Dayton, Ohio.
Douglas Co., Santa Monica, Calif.
G. Elias & Bro., Inc., Buffalo, N. Y.
Fisher Body Corp., Detroit, Mich.
Gallaudet Aircraft Corp., East Greenwich, R. I.
L. W. F. Engineering Co., College Point, L. I.
Glenn L. Martin Co., Cleveland, Ohio.
Packard Motor Car Co., Detroit, Mich.
Sturtevant Aeroplane Co., Boston, Mass.
Thomas-Morse Aircraft Corp., Ithaca, N. Y.
Chance Vought Corp., Long Island City, N. Y.
West Virginia Aircraft Co., Wheeling, W. Va.
Wright Aeronautical Corp, Paterson, N. J.

Burgess Co., Marblehead, Mass; Engel Aircraft Corp., Niles, Ohio; Springfield Aircraft Corp., Springfield, Mass.; St. Louis Aircraft Corp., St. Louis, Mo.; Standard Aircraft Corp., Elizabeth, N. J.; Standard Aero Corp., Plainfield, N. J.; have ceased the manufacture of aircraft and withdrawn from the Association.

The Amended Cross-License Agreement of December 31, 1928

THIS AGREEMENT, made this 31st day of December, 1928, between the MANUFACTURERS AIRCRAFT ASSOCIATION, INC., a New York corporation (hereinafter called the "Company") party of the first part, and each person, firm, corporation or association (hereinafter called the "Subscriber" or "Subscribers") as are and shall become stockholders of the said "Company" in the manner and under the conditions provided in the By-Laws thereof (which for the purpose of this Agreement are made a part hereof), parties of the second part:

WHEREAS, an Agreement (hereinafter called the original Cross-License Agreement) dated the 24th day of July, 1917, was entered into between the "Company" and certain

"Subscribers," which Agreement was amended by a Supplemental Agreement dated the 19th day of April, 1918, between the same parties, and which Agreement was further amended by a second Supplemental Agreement dated the 12th day of January, 1923, between the same parties, and

WHEREAS, the parties hereto are interested in the manufacture, sale and use of airplanes, as hereinafter defined, and desire to promote and develop the industry in which they are engaged, and to encourage and advance the art applicable thereto; and

WHEREAS, the said development and advancement, prior to the execution of the original Cross-License Agreement was not capable of complete accomplishment because of the existence of certain United States patents claimed to be basic in their nature, upon which suits have been brought, or threatened, for alleged infringement and for the collection of royalties and damages in connection therewith; and

WHEREAS, it is desired to prevent and avoid such litigations or threatened litigations in the future and to give to all of the "Subscribers" the right to manufacture, sell and use airplanes embodying the inventions of each of the "Subscribers" and to that end it is desired that licenses be granted as herein expressed; and

WHEREAS, on account of conditions which did not exist and which were not anticipated at the date of execution of said original Cross-License Agreement, nor at the date of execution of the Supplemental Agreements of April 19, 1918, and January 12, 1923, respectively, and in an effort to better serve the art and industry as they now exist, it is desired to further modify and amend said original Cross-License Agreement as hereinafter set forth:

NOW, THEREFORE, THIS AGREEMENT WITNESSETH: That for and in consideration of the premises, covenants and conditions herein contained, and other good and valuable considerations moving between the "Company" and each of the "Subscribers" hereto, and between the "Subscribers" themselves:

IT IS COVENANTED AND AGREED: That the said original Cross-License Agreement as amended by the Supplemental Agreements of April 19, 1918, and January 12, 1923, anything therein contained to the contrary notwithstanding, shall from December 31st, 1928, which is fixed as the date of execution of this Agreement, be modified and amended to read henceforth as follows:

I. Definitions

The word "Airplane" as used in this agreement shall be understood to mean any form of heavier-than-air craft, using wing surfaces for sustaining it, and to include such indirect power plant appurtenances as radiators, oil-coolers, fuel and oil tanks, and motor controls; but not to include the engine and such engine accessories as propellers, propeller hubs, super-chargers, starters, magnetos, mufflers, carburetors and reduction gears.

The words "Airplane patent," as used in this agreement, shall be understood to mean any patent covering inventions for or capable of use in or in connection with airplanes, including such indirect power plant appurtenances as radiators, oil-coolers, fuel and oil tanks, and motor controls; but not including the engine and such engine accessories as propellers, propeller hubs, super-chargers, starters, magnetos, mufflers, carburetors and reduction gears.

The words "selling price," as used in this agreement, shall be understood to mean the manufacturer's regular selling price of an airplane, completely equipped according to contract, if and when delivered under formal written contract, or in the absence of such contract, a completely equipped airplane ready to operate, as above defined, minus the then prevailing selling price of the engine and such engine accessories as propellers, propeller hubs, super-chargers, starters, magnetos, mufflers, carburetors, and reduction gears, irrespective of any and all discounts and rebates of whatsoever character.

II. Licenses and Powers Granted

The "Subscribers" grant, agree to grant and cause to be granted to each other, licenses to make, use and sell airplanes—under all airplane patents of the United States now or hereafter owned or controlled by them or any of them, or by any firm, corporation or association owned or controlled by them or under which they or any of them, or any such firm, corporation or association, have or shall have the right to grant licenses—in and throughout the United States, its territories and dependencies, for use therein or abroad, except that no rights, express or implied, are hereby granted under any foreign patents, nor shall said rights or the license herein provided for, apply to or include the use of said patents in their application to other than airplanes.

All licenses provided for herein shall run to the full end of the term of the letters patent under which the license is or is to be granted and shall be personal, indivisible, non-assignable and irrevocable, except for the causes and in the manner hereinafter stated.

The "Subscribers" hereby designate, constitute and appoint the "Company" (and the "Company" hereby accepts the appointment) as their true, sufficient and lawful agent and attorney in fact, for them and in their respective names, to make and execute licenses in writing in the form hereto annexed, and to deliver the same to those of the "Subscribers" who, at the time, are stockholders of the "Company" not in default hereunder and who shall have executed an agreement in writing of like tenor to this; and to enforce said licenses and any and all other obligations (including the obligation to make payments) of the "Subscribers" under this Agreement and the "Subscribers" hereby give and grant unto said "Company" as full, complete and ample power and authority in the premises as the "Subscribers" themselves now have and possess.

The "Subscribers" hereby designate, constitute and appoint the "Company" (and the "Company" hereby accepts the appointment) as their true, sufficient and lawful agent and

attorney in fact, for them in their respective names, to make and execute licenses to the Government of the United States and/or the various branches, bureaus and departments thereof, for the use by the Government and/or the various branches, bureaus and departments thereof of the patents covered by this Agreement, upon the agreement by the Government of the United States and/or the various branches, bureaus and departments thereof, to pay to the "Company" the rates of royalty fixed in Paragraph VII hereof, and to demand and receive of the Government of the United States and/or the various branches, bureaus and departments thereof, royalties due the "Company" and to give the said Government of the United States and/or the various branches, bureaus and departments thereof, receipts for royalties so collected, and to disburse the royalties so received in the same manner as the "Company" is herein authorized to disburse the royalties received by it from the "Subscribers" hereto.

All licenses provided for herein, when made, executed and delivered in accordance with the provisions hereof, shall have the same force and effect as if they had been executed and delivered by the "Subscribers" themselves.

III. Covenants of Further Assurance

(a) Each "Subscriber" now or hereafter, having rights under any United States airplane patent or invention, of such character that it has legal right and power to procure the grant of rights thereunder to others, but is not itself empowered to grant such rights, covenants to procure the execution of such further instrument as may be necessary to empower the "Company" to grant rights under such patent, or with reference to such invention, to the extent and in the manner herein provided.

(b) Each "Subscriber" covenants that it will not contract for or obtain any rights under any such patent or invention in such manner that its owner would be prevented from granting to other "Subscribers" hereto similar rights on the same terms unless the "Subscriber" obtains, at the same time, the further privilege to grant rights under said patent or said invention, whereby the same may and will be brought under the operation of this instrument.

IV. Covenants Against Other Licenses

Each "Subscriber" covenants that it has not heretofore and will not hereafter enter into any contract or arrangement, whereby its privileges under United States airplane patents, issued or to be issued, inventions and rights, owned or controlled by it, have been or shall be diminished or surrendered so as to exclude or restrict the operation of this instrument in respect thereto. Each "Subscriber" further covenants that it will not grant licenses under any such patents for use in airplanes, with reference to which it is receiving royalties hereunder, to any other person, firm or corporation on more favorable, or lower terms of royalty, than those herein provided, or which may become more favorable or lower during the term of such license.

V. After Acquired Patents

When a "Subscriber" shall hereafter acquire a United States airplane patent, or any right thereunder, he shall be entitled to compensation for the use thereof if the patent or patent right covers an invention which secures the performance of a function not before known to the art or constitutes an adaptation for the first time to a commercial use of an invention known to the industry to be desirable of use but not used because of lack of adaptation, or is otherwise of striking character or constitutes a radical departure from previous practice, or if either the price paid therefor or the amount expended in developing the same is such as to justify such compensation, provided that at the time said patent or patent right is reported to the "Company" as required in subdivision (b) of Paragraph VI, the "Subscriber" claims such compensation and states the grounds on which such claim is based. Such report and claims shall be submitted to a Board of Arbitration to be selected in the manner provided for in Paragraph XIV hereof, which Board shall determine whether such compensation shall be paid, and if so, the total amount thereof and the rate of royalty, or other payments which shall be paid (toward such compensation) by each "Subscriber" upon the issuance of a license under said patent and the use by any "Subscriber" of the subject matter covered by said patent, and shall also fix the time or times when said royalties or other amounts shall be paid. Licenses shall be issued to each "Subscriber" as a matter of course, through the offices of the "Company" within thirty days (30 days) after the rendition by such Board of Arbitration of its final report, whether or not compensation, under such after acquired patent, is or is not required to be paid.

VI. Reports to the "Company"

The following reports in writing shall be rendered to the "Company" by each "Subscriber" at the time or times hereinafter set forth:

(a) At the time of the execution of this Agreement each "Subscriber" shall report all United States airplane patents and inventions together with serial numbers and filing dates of all pending applications for such patents and all rights under such patents and inventions then owned or controlled by it, but no omission from such report shall exclude the patent, application or right so omitted from the operation of this Agreement.

(b) Within thirty days after the acquisition by any "Subscriber" of any United States patent (other than patents to be issued upon inventions now owned by it) or right within the scope of this Agreement, each such "Subscriber" shall report such acquisition together with all the facts known to it as to such patent or right and its manner of acquisition.

If such "Subscriber" claims that additional compensation should be paid to it for licenses under such patent or right, it shall so claim in its report.

(c) On the 10th days of January, April, July and October, in each year, each "Subscriber" shall report the number of airplanes (with or without engines) sold and delivered by it, together with the names of the purchasers, the selling price of each airplane, and the dates of delivery, or the number of airplanes put into use for other than experimental or development purposes, and the number of airplanes (with or without engines) shipped out of the United States, during the preceding three calendar months.

(d) Each License to other than "Subscribers" as provided in Paragraph IV hereof, shall be reported within thirty days after its delivery.

(e) Each suit instituted against infringers of the patents licensed hereunder shall be reported in a reasonable time.

The first report under sub-division (c) hereof shall be made by each "Subscriber" on the tenth day of January, April, July or October first occurring after it has become a "Subscriber" hereto and shall cover the period from December 31, 1928, to the first day of the month in which the report is due.

Each of the "Subscribers" hereto shall keep separate books of account showing all business done under or subject to the operation of this Agreement. The "Company" may at any time have a New York Certified Public Accountant to be designated by it, audit such books of account of the "Subscribers" together with such other accounts as the accountant may deem necessary, in order to verify or correct the report herein provided for, and the "Company" shall have such audit made when any "Subscriber" so demands. Such audit, however, shall be limited to ascertaining whether the reports herein provided for are properly made and to correcting the same, if necessity for correction shall appear. No information obtained from any such audit shall be reported by the accountant or given to any of the parties hereto, except as it directly applies to the reports required by this Agreement.

VII. Payments to the "Company"

Each "Subscriber" agrees to pay into the treasury of the "Company" on the 10th days of January, April, July and October in each year the following sums of money, to wit:

(a) On each airplane, with or without engine, required to be reported as provided, in sub-division (c) of Paragraph VI hereof, the sum of two per cent (2%) of the selling price of such airplane, with a maximum of Two Hundred Dollars ($200) on any one airplane regardless of its cost or selling price until such time as the Curtiss Airplane & Motor Company, Inc., shall have been paid the aggregate sums provided for in Paragraph VIII hereof, or until United States Patent No. 1,203,550 issued October 31, 1916, shall have expired.

(b) On each airplane, with or without engine, required to be reported as provided for in sub-division (c) of Paragraph VI hereof, such sum not to exceed one-quarter of one per cent of the selling price of such airplane, but in no case to exceed twenty-five dollars ($25.00) per airplane, as the Board of Directors of the "Company" may, from time to time, fix and determine as payable after October 31, 1933, or after the above mentioned aggregate sums shall have been paid to the Curtiss Airplane & Motor Company, Inc.

(c) Such amount or amounts as the Board of Arbitration may specify as special compensation for after acquired patents as provided in Paragraph V hereof, and required to be reported in sub-division (b) of Paragraph VI.

(d) All royalties received under Licenses referred to in sub-division (d) of Paragraph VI.

(e) All monies received as the result of suits reported under sub-division (e) of Paragraph VI less deductions for actual cost to the Subscriber of such suit.

Each "Subscriber" who shall become a party hereto after the thirty-first day of December, 1928 shall on the 10th days of January, April, July or October next thereafter occurring pay to the "Company" those amounts which it would have been obliged to pay in accordance with the foregoing if it had been a "Subscriber" on December 31, 1928.

Monies paid into the treasury of the "Company" pursuant to any provisions hereof shall not be or constitute or be deemed to be or constitute the assets, property or profits of said "Company" but shall be received and disbursed by it as the agent and the attorney in fact of the "Subscriber" in the manner and for the purposes herein mentioned.

VIII. Payments by the "Company"

Out of the monies paid into the treasury of the "Company" pursuant to the provisions hereof and of the predecessor agreements hereinabove mentioned, the following payments shall be made by the Company on the 20th days of January, April, July and October in each year, to wit:

(a) To the Curtiss Aeroplane & Motor Company, Inc., eighty-seven and one-half percent (87½%) of all sums received on account of each of said airplanes with reference to which payments have been or shall be made in accordance with sub-divisions (a) and (d) of Paragraph VII hereof, until the payments so made to Curtiss Airplane & Motor Company, Inc., under the original Cross-License Agreement, when increased by the payments made after the execution of this Amended Agreement, shall aggregate the sum of Two Million Dollars ($2,000,000) or until the United States Patent No. 1,203,550 issued October 31, 1916, shall have expired, when all payments to it hereunder shall cease, except as hereinafter provided.

(b) To each of the "Subscribers" entitled thereto such amounts as may have been paid to the "Company" with relation to the use of after acquired patents in accordance

with sub-division (c) of Paragraph VII, subject to the reservation in sub-division (a) of Paragraph IX.

(c) To any "Subscriber" who shall have granted licenses to other than subscribers, as provided in Paragraph IV, the royalties received under such licenses which are not required for payments provided for in sub-division (a) of this Paragraph VIII, subject to the reservation of sub-division (b) of Paragraph IX.

IX. Moneys Retained by the Company

(a) The "Company" may retain and use, for the purposes set forth in sub-division (c) of this Paragraph IX up to twelve and one-half per cent (12½%) of such amounts as may be paid to the "Company" with relation to the use of after acquired patents in accordance with sub-division (c) of Paragraph VII.

(b) The "Company" may retain and use for the purposes set forth in sub-division (c) of this Paragraph IX, up to twelve and one-half per cent (12½%) of that part of any amount paid to the "Company" on account of direct licenses given and reported in accordance with sub-division (d) of Paragraph VI.

(c) Out of the balance of said moneys paid into the treasury of the "Company" under sub-division (a) of Paragraph VII of this Agreement, and not paid out by the "Company" under sub-division (a) of Paragraph VIII, the "Company" may retain and use sufficient to cover its operating expenses and to create such fund as, in the judgment of the Board of Directors of said "Company" shall be necessary and proper for the further development of the airplane art and industry, and the purchase of patents and rights for the benefit of the "Subscribers" hereto.

X. Disposition of Surplus

If, after making the payments and reservations herein provided for, any surplus or balance remains out of the funds so paid into the treasury of the "Company" the same shall be distributed by the "Company" from time to time, among those "Subscribers" who have contributed to said moneys, in proportion to their respective contributions under sub-divisions (a) and (b) of Paragraph VII other than those required for payments under this Paragraph X.

XI. Breach of Agreement

In the event that any "Subscriber" is claimed by the "Company" or any other "Subscriber" to be in default in the performance of any of its obligations hereunder, and such claimed default continues after thirty days' notice in writing, by the "Company" or any "Subscriber" claiming the default, then the Board of Arbitration, hereinafter provided for, shall determine whether there has been such specified default and if such default is found to exist, shall fix the time within which it must be repaired, and shall assess such damages and impose upon the "Subscriber" in default such other requirements (including the forfeiture of its stock and license) as may seem to the said Board of Arbitration to be proper under the circumstances. Each "Subscriber" covenants and agrees that it will pay such damages and comply with such requirements as may be specified by the said Board of Arbitration.

Nothing contained in this paragraph shall deprive the "Company" of the power to make, execute and deliver licenses under the patents or patent rights owned and controlled by any defaulting "Subscriber" or to which the "Subscriber" may be entitled at the time to cease to be a stockholder or "Subscriber," nor deprive other than defaulting "Subscribers" of any right which they may have received to the use of the said patents or patent rights.

XII. Withdrawal From Agreement

Any "Subscriber" may withdraw from this Agreement at any time after one (1) year after executing and delivering it, providing that written notice of its election to do so shall be given to the "Company" at least thirty (30) days in advance of the date when the next quarterly report is required to be filed under sub-division (c) of Paragraph VI hereof and on fulfilling all of its obligations up to the date of such withdrawal, but no withdrawal shall relieve the other parties and other "Subscribers" from their obligations to each other hereunder, nor deprive them of their rights acquired under the patents and patent rights owned or controlled by the withdrawing "Subscriber" at the time of withdrawal, all of said patents and patent rights remaining under this Agreement, but such withdrawing "Subscriber" shall cease to have any rights under the patents of the other "Subscribers" hereto, or any other right under this Agreement, from and after such withdrawal.

XIII. Repurchase of Stock

In the event of the death of any person who is a stockholder in the "Company" or in the event of the dissolution of any corporation or firm which is a stockholder therein, or in the event of the bankruptcy or insolvency of any such stockholders, or in the event of withdrawal under Paragraph XII hereof, the "Company" shall have the right to purchase for the benefit of the other "Subscribers" the stock held by such person, firm or corporation at a sum not to exceed the distributive share or shares of such stockholder in the funds held by the "Company" and the license or licenses issued to such stockholder shall be surrendered to the "Company" and cancelled.

XIV. Arbitration of Claims and Disputes

In case of any dispute or controversy between the "Subscribers" hereto, or between the "Subscribers" and the "Company" or in case of a claim by a "Subscriber" for special compensation for license under patents or rights hereafter acquired by it, or in case of breach of this Agreement, the said dispute, controversy, claim or breach shall, within thirty days after a "Subscriber" or "Subscribers" shall have given notice in writing to the "Company" or the "Company" shall have given notice in writing to the "Subscribers" hereof, be referred to a board of disinterested arbitrators consisting of three persons, for determination.

In the case of a claim for special compensation, one member of such Board of Arbitration shall be appointed by the Board of Directors of the "Company," another by the "Subscriber" making the claim and the third by the other two arbitrators.

In the case of any dispute between the "Company" and a "Subscriber" or "Subscribers" one member of the Board of Arbitration shall be appointed by the Board of Directors of the "Company," another by the "Subscriber" (or if more than one "Subscriber" is involved in the same dispute, then by a majority of those so involved) and the third by the other two arbitrators.

In case of a breach of this Agreement asserted by the "Company" or a "Subscriber" against another "Subscriber," one member of the Board of Arbitration shall be appointed by the Board of Directors of the "Company" another by the "Subscriber" against whom the assertion of breach is made and the third by the other two arbitrators.

If either the Board of Directors or the "Subscribers" fail to appoint a member of the Board of Arbitration within the time specified the other party or parties may appoint such member or fill such vacancy.

The decision of a majority of the members of said Board upon all matters submitted to them for adjudication shall be final and binding upon all the parties hereto.

XV. Release to "Subscribers"

The "Subscribers" hereby waive and release any and all claims which they or any of them may have had against each other for damages and profits on account of any infringement or alleged infringement prior to December 31, 1928, of any patent included within this instrument in the manufacture, sale or use of airplanes.

XVI. Binding Upon Parties, Controlled Companies, Legal Representatives, Etc.

This Agreement is binding upon the parties hereto and their several successors, legal representatives and assigns, but shall inure to the benefit of only their several successors in business. Each "Subscriber" agrees that all persons, firms and corporations now or hereafter controlled by it and engaged in the manufacture of airplanes, or owning or controlling United States airplane patents, shall be caused to execute this Agreement.

XVII. Execution of Agreement

Nothing herein contained shall be construed to relieve either the "Company" or any "Subscriber" hereto of any act or obligation to be performed or any duty to be fulfilled under the terms and conditions of the original Cross-License Agreement as amended April 19, 1918, and January 12, 1923, respectively, which act, obligation or duty, as and of December 31, 1928, shall remain at such time unperformed or unfulfilled.

This Agreement may be executed by the "Subscriber" in any number of counterparts, but when so executed shall constitute but one and the same Agreement, and shall be as binding, and of the same force and effect as if all the "Subscribers" had executed but one and the same instrument, and as if all executions had been dated December 31, 1928, which date shall be the date on which this Agreement becomes effective.

This Agreement of December 31, 1928, amending the original Cross-License Agreement of July 24, 1917, in turn amended by the Supplemental Agreements of 1918 and January 12, 1923, respectively, shall, for convenience, be referred to as

"THE AMENDED CROSS-LICENSE AGREEMENT OF DECEMBER 31, 1928."

NATIONAL AERONAUTIC ASSOCIATION OF U. S. A., INC.

National Headquarters, 910 Seventeenth St. N. W., Washington, D. C.

The Representative in U. S. A. of the Fédération Aéronautique Internationale

Hiram Bingham.....President
Roscoe Vaughan.....Vice-President
B. F. Castle.....Treasurer
Valentine Gephart.....Secretary
Frederick R. Neely.....General Manager

Governors-at-Large

Orville Wright

Godfrey L. Cabot — Glenn L. Martin
Porter Adams — J. Carroll Cone

Governors

James A. Meissner.....Ala.
Claude C. Ramsay.....Alaska
J. Parker Van Zandt.....Ariz.
Felix G. Smart, Jr.....Ark.
D. E. McDaneld.....Calif.
J. Don Alexander.....Colo.
L. S. Horner.....Conn.
Henry B. du Pont.....Dela.
Geo. W. Lewis.....D. C.
Henderson Hallman.....Ga.
Walter F. Dillingham.....Hawaii
Cyril C. Thompson.....Idaho
William G. Herron.....Ill.
Richard F. Taylor.....Ind.
George Yates.....Iowa
A. E. Merriam.....Kan.
A. H. Bowman.....Ky.
John L. Henning.....La.
W. H. Gannett.....Me.
Temple N. Joyce.....Md.
Theo. G. Holcombe.....Mass.
Ray Cooper.....Mich.
Edward T. Chapman, Jr.....Minn.
Morgan M. Ferrell.....Miss.
Harry Block.....Mo.
Loy J. Molumby.....Mont.
Gould Dietz.....Nebr.
Robert S. Fogg.....N. H.
Charles L. Lawrence.....N. J.
Edwin B. Lyon.....N. M.
H. Ralph Badger.....N. Y.
Lloyd O. Yost.....N. C.
Floyd J. Logan.....Ohio
M. H. Kotzebue.....Okla.
Lawrence Therkleson.....Ore.
C. T. Ludington.....Pa.
Elliott Springs.....S. C.
Henry W. Harms.....S. D.
Robert B. Snowden, Jr.....Tenn.
W. F. Long.....Texas
Thomas Carroll.....Va.
Thomas D. Stimson.....Wash.
Thos. F. Hamilton.....Wis.
George W. Scales.....Wyo.

Contest Committee

Orville Wright, Chairman — Geo. W. Lewis, Vice-Chairman
Carl F. Schory, Secretary

Porter Adams
Ray Cooper
F. P. Lahm
A. B. Lambert
Lester J. Maitland
Glenn L. Martin
J. Robert Moulthrop
John H. Towers
Edward P. Warner
Clarence M. Young

Chairman of Other Committees—Executive, Porter Adams; Finance, Godfrey L. Cabot; Foreign Relations, Sidney B. Veit; Contest, Orville Wright; Legislative, M. J. Talbot Freeman; Membership, Maj. General J. E. Fechet; Publicity, Col. C. de F. Chandler; Honorary Membership, Governor J. R. Trumbull; Publications, H. Ralph Badger; Airways and Landing Fields, Harold F. Pitcairn; Civic Organization, Theo. G. Holcombe.

The Policy of the National Aeronautic Association

Contests of the air are in most respects similar to contests between man-operated machines on the ground. Unscrupulous promoters and over-enthusiastic local managers develop air meets either for personal gain or to bring attention on their community or through sheer delight in developing and managing contests. Those promotions for personal gain do not fail to provide the stipulated prizes through oversight, for this is part of their well laid plans. However, the inexperienced local committees allow their meets to fall into this plight because such details have not been considered. Many events cause dissatisfaction and distrust, rather than enthusiasm and anticipation of future events, simply because the program and all of its details have not been fully developed at the very beginning and carefully followed throughout the meet.

To overcome this situation the National Aeronautic Association has assumed the responsibility of sanctioning meets under the rules of the Federation Aeronautique Internationale and has devised a system which will insure the proper handling of any sanctioned meet.

A standard sanction application form is now in printed form, which application requires the compliance with the accepted rules, the deposit of all prize money in a bank

or trust company, a certification of the course by a civil engineer, a full outline of all details and an announced program of events with the number of events, schedule of prizes, entrance requirements, closing dates, fees, method of starting, timing, rules of race, protests, pilots' meeting and when the prizes will be awarded—all in accordance with Chapter IV, F. A. I. Regulations. After provisions have been satisfactorily fulfilled, the N. A. A. issues a sanction certificate.

Events Sanctioned by N. A. A. in 1928

1. April 2.....Kansas Air Tour, from Wichita, Kan.
2. May 19.....Curtiss Marine Trophy Race, Washington, D. C.
3. May 30.....National Balloon Race, Pittsburgh, Pa.
4. June 29-30.....Stout and Mulvihill Model Contests, Detroit, Mich.
5. June 30-July 28.....National Air Tour started from Detroit, Mich.
6. June 30.....Gordon Bennett Race, Detroit, Mich.
7. Aug. 10-12.....Colorado Springs, Colo., Air Meet
8. Sept. 3.....Altoona, Pa., Balloon Race
9. Sept. 8-16.....National Air Races, Mines Field, Los Angeles, Cal.
10. Sept. 20-22.....Los Angeles-Cincinnati Air Race
11. Sept. 29.....Idaho Air Races and Circus, Boise, Idaho
12. Oct. 6.....Wilmington Air Meet, Wilmington, Del.
13. Nov. 9-10.....Jackson, Miss., Air Meet

THE DANIEL GUGGENHEIM FUND FOR THE PROMOTION OF AERONAUTICS, Inc.

598 Madison Ave., New York

DANIEL GUGGENHEIM, Founder

Officers

HARRY F. GUGGENHEIM, President.
EMORY S. LAND, Vice-President.
J. W. MILLER, Secretary.

Trustees

H. I. Cone.
F. Trubee Davison.
W. F. Durand.
Charles A. Lindbergh.
A. A. Michelson.
Robert A. Millikan.
Dwight W. Morrow.
Elihu Root, Jr.
John D. Ryan.
Orville Wright.
Emory S. Land.
Harry F. Guggenheim.

FLYING IN THE UNITED STATES

Calendar Year 1928

Air Transport Summary

	1926	*1927*	*1928*
Operators	19	24	32
Planes in service	95	144	294
Miles flown	4,608,880a	5,242,839b	10,472,024
Passengers	5,782	12,594	52,934
Express, lbs.	1,733,092c	2,307,579c	2,148,981
Mail, lbs.	433,649	1,222,843d	3,632,059e

a—Includes 2,583,056 miles flown on Government operated mail routes.
b—Includes 1,320,535 miles flown on Government operated mail routes.
c—Includes miscellaneous freight flown by special order.
d—Includes 121,439 pounds mail flown on Government operated routes.
e—Includes 631,541 pounds mail flown on F.A.M. routes.

New Mileage Added to Air Lines in United States During 1928

Passenger	6,451 miles
Mail	5,928 miles
Express	2,151 miles

Aerial Service Summary

	1926	*1927*	*1928*
Operators reporting	420	357	168
Planes in service	969	768	489
Miles flown	7,656,492	8,341,517	8,411,889
Passengers carried	380,201	476,724	526,203

Flying in Privately Owned Aircraft

(Corporate and Personal)

Estimated

	1928
Planes	3,000
Passengers	180,000
Miles flown	12,000,000

Flying in Chartered Aircraft

Estimated

	1928
Passengers	12,000
Miles flown	120,000

Governmental Operations

	1926 Miles	*1927 Miles*	*1928 Miles*
U. S. Army	16,764,540	14,871,870	19,546,450a
U. S. Navy	8,352,800	10,452,720	14,135,490b
U. S. Coast Guard	16,300	28,960	83,083
U. S. Department of Commerce	.....	.....	900,000

a—Includes National Guard.
b—Includes Marine Corps and Naval Reserve.

General Summary

Civilian and Commercial	31,003,913 miles
Government	34,655,023 miles

Airplane Accidents in the United States

The following table of airplane accidents in the United States during the calendar year 1928 was compiled from statistics supplied by the Aeronautics Branch of the Department of Commerce. In order to interpret the figures properly, certain facts should first be noted.

For the first time official reports for the year enable us to record every accident of whatever minor character, even a broken wheel or strut. Including these, they totaled 1062 in number. In 755 of the 1062 accidents no person was injured. Therefore seven-tenths of the so-called accidents were trivial in character.

The number of accidents reported for the latter half of the year was greater than that for the first half, the reason being that the number of new pilots had increased at a rapid rate.

It should be noted further that the fatalities were confined principally to student and miscellaneous flying.

In 10,472,024 miles of scheduled flying with 52,934 passengers (more than five hundred and twenty million pilot-passenger miles) on the air transport routes in 1928, fatalities were limited to 9 pilots and 13 passengers. Of these, the majority were attributed to lack of proper navigational facilities both in the planes and on the surface, which imposed forced landings in bad weather. Storms and fog at night, or by day, obliterated the landmarks and forced the planes to land off their regular routes. In 55 of the total 85 accidents on the transport lines there were no injuries.

While 11 pilots and 8 others were killed in experimental flying there were no injuries in 25 of the total 49 accidents in that field. Experimental work involves tests of new theories and newly designed equipment, and should not be cited as a criterion of safety in ordinary commercial flying.

Twenty-nine per cent of all the accidents were attributed to poor technique. Poor technique connotes improper instruction. If only the private owners, the recent students and the pilots engaged in test flying or other hazardous work were considered, the percentage of accidents attributed to poor technique would be much higher.

The inadequately trained pilot may have a good ship and he may have been able to pass the required examination for a license, but his judgment may fail in an emergency which to the skilled aviator would mean nothing more than proper guidance of his machine.

The Department of Commerce in analyzing each accident found that the number caused by faulty equipment was steadily decreasing, due largely to the responsibility assumed by a growing number of manufacturers and operators who carefully provide against structural failure and produce or maintain their machines in first class condition. A second reason for the falling off in equipment failures is the increased facilities with which the Department of Commerce is able to exercise official control.

If that appears to put the majority of accidents squarely up to the deficiencies in pilot instruction, one will find in that quarter several factors which promise much for the immediate future.

The Aeronautical Chamber of Commerce is establishing an approved list of flying schools having certain definite and efficient standards of teaching and training. The Department of Commerce is gradually exercising the degree of control and discipline permitted under existing law. And there is reason for belief that the power and authority of the Department shall soon be enlarged by Act of Congress.

Again, while 29 per cent of the accidents were attributed to poor technique the pilots were blamed for more than that. Forty-nine per cent of the total were found to have used bad judgment with poor technique, they disobeyed orders or were negligent and reckless. It will also be noted that a large number of the accidents occurred to unlicensed planes in the hands of unlicensed pilots.

Accident Summary

Calendar Year 1928

Kind of Flying	*Number of Accidents*	*Persons Killed*		*Severely Injured*	
		Pilots	*Passengers*	*Pilots*	*Passengers*
Scheduled	85	9	13	7	1
Student Instruction	134	28	19	26	25
Experimental	49	11	8	4	1
Miscellaneous	794	105	175	117	141
Total	1062	153	215	154	168

Principal Contributing Causes

Collision in air with other machines	8
Collision on or near the surface with other than aircraft	85
Forced landings due to failure of power plant	54
Forced landings without failure of power plant	242
Other landing accidents	194
Take-off accidents	122
Taxying accidents	27
Fire in the air	9
Miscellaneous	83
Unknown	12
Total	1,062

Federal Status of Aircraft and Pilots

	Airplanes	*Pilots*
Licensed	503	556
Temporary number for plane	369	...
Letter of authority for pilot	...	157
Unlicensed	190	349
	1,062	1,062

U. S. AIR CORPS, WAR DEPARTMENT

Chief of the Air Corps.....Major General James E. Fechet.

ASSISTANT CHIEFS OF THE AIR CORPS

Brigadier General Frank P. Lahm, commanding Training Center, San Antonio, Texas.
Brigadier General William E. Gillmore, in charge of Material Division, Dayton, Ohio.
Brigadier General Benjamin D. Foulois, in charge of Training and Operations Division, Washington, D. C.

Organization

In the office of the Chief of the Air Corps is the Executive Officer, Major L. W. McIntosh, under whom comes the Finance Section, the Buildings and Grounds Section and the following Divisions:

Training and Operations Division in Washington, under which comes the War Plans, Schools, Operations and Medical Sections.

Material Division at Dayton, Ohio, under which come the Experimental Engineering, Procurement, Field Service, Repair and Maintenance, Administration and Industrial War Plans Sections.

Information Division which is composed of the Intelligence, Press Relations, Publications and Photographic Sections. This Division is located in Washington.

Personnel Division, which is in Washington, and is composed of the Commissioned, Enlisted and Reserve Sections.

Inspection Division which is in Washington, D. C., under which comes the Development, Installation, Supervision and Test Sections.

Officers on Duty in Washington

Major General James E. Fechet, Chief of the Air Corps.
Brigadier General Benjamin D. Foulois, Assistant Chief of the Air Corps.
Colonel C. G. Hall, Colonel L. M. Hathaway, M. C., Lt. Colonel R. C. Kirtland.
Majors—Ira Loganecker, L. W. McIntosh, J. C. McDonnell, D. B. Netherwood, F. M. Kennedy, F. L. Martin, T. D. Milling, Carl Spatz, E. B. Lyons, H. W. Harms, D. C. Emmons, R. F. Longacre, M. C., J. B. Brooks, H. A. Dargue, R. B. Lincoln, J. T. McNarney, H. M. Hickam, A. H. Hobley, D. Johnson, B. Q. Jones, W. C. McChord.
Captains—C. B. B. Bubb, E. E. Adler, W. E. Farthing, W. H. Hale, T. W. Hastey, D. B. Howard, R. G. Hoyt, F. O'D. Hunter, L. B. Jacobs, W. F. Kraus, H. M. McClelland, P. J. Mathis, C. T. Phillips, W. J. Reed.
Lieutenants—C. E. Archer, J. D. Barker, H. L. Clark, H. A. Craig, A. I. Ennis, Guy Kirksey, N. Longfellow, A. K. Ladd, H. A. McGinnis, L. J. Maitland, L. W. Miller, D. B. Phillips, C. P. Prime, E. R. Quesada, R. E. Selff, C. W. Sullivan, J. E. Upston, E. H. Wood, M. R. Wood, F. M. McKee.

Air Corps Posts, etc.

AKRON, OHIO—Balloon Production and Inspection. Procurement Section, District Office, (Chief of the Air Corps), P. O. % Goodyear Tire & Rubber Company, Akron, Ohio.
ARMSTRONG, FT.—(H. Dept.). P. O. Honolulu, T. H. Air Depot.
BIGGS FIELD—(Eighth Corps Area). P. O. Ft. Bliss, Texas. Intermediate Landing Field.
BOLLING FIELD—(Chief of the Air Corps). P. O. Anacostia, D. C. Air Corps Detachment. Flying Field.
BOSTON AIRPORT—(First Corps Area). P. O. Boston, Mass. Corps Area Hdqr. Flight Intermediate Landing Field. Reserve Flying. Reserve Airdrome.
BOWMAN FIELD—(Fifth Corps Area). P. O. Taylorsville Road, Louisville, Ky. Intermediate Landing Field. Reserve Airdrome.
BRISTOL, PA.—(Chief of the Air Corps). P. O. Bristol, Pa. Air Corps Representative Keystone Aircraft Corp.
BROOKS FIELD—(Chief of the Air Corps). P. O. San Antonio, Texas. 11th School Group. Hdqr. 46th School Sq. 62d Service Sq., 51st, 52d School Sqs. 20th Photo Section. Flying Cadet Detachment. School of Aviation Medicine. Primary Flying School. Border Patrol Station, Airdrome. Intermediate Landing Field.
BUFFALO, N. Y.—(Chief of the Air Corps). P. O. 398 Ellicott Square, Buffalo, N. Y. Procurement Planning Representative. Air Corps Rep. Curtiss Aeroplane & Motor Corp.
BURGESS FIELD—(Chief of the Air Corps). P. O. Uniontown, Pa. Intermediate Landing Field.
CHANUTE FIELD—(Chief of the Air Corps). P. O. Rantoul, Ill. Technical School, School Troops. Air Corps Band.
CHICAGO, ILL.—(Chief of the Air Corps). P. O. 1819 W. Pershing Road, Chicago, Ill. Procurement Planning Representative.
CLARK FIELD—(P. Dept. C) P. O. Camp Stotsenburg, P. I. 3rd Pursuit Sq.
CLARK, FT.—(Eighth Corps Area). P. O. Brackettville, Texas. Airdrome. Intermediate Landing Field.
CLOVER FIELD—(Ninth Corps Area). P. O. Santa Monica, Cal. Intermediate Landing Field. Reserve Airdrome.

CRISSY FIELD—(Ninth Corps Area). P. O. Presidio of San Francisco, Cal. 91st Obs. Sq. 15th Photo Section.
CROCKETT, FT.—(Eighth Corps Area). P. O. Galveston, Texas. Hdqr. 3d Attack Gp., 8th, 90th Attack Sqs. 60th Service Sq.
CROOK, FT.—(Seventh Corps Area). P. O. Ft. Crook, Nebraska. Corps Area Hdqr. Flight. Intermediate Landing Field. Reserve Flying.
CUMBERLAND LANDING FIELD—(Chief of the Air Corps). P. O. Cumberland, Md. Intermediate Landing Field.
DETROIT, MICH.—(Chief of the Air Corps). P. O. 802 Farwell Bldg., Detroit, Mich. Procurement Planning Representative.
DODD FIELD—(Eighth Corps Area).—P. O. Ft. Sam Houston, Texas. Airdrome. 12th Obs. Sq. 1st Photo Section.
DOUGLAS, ARIZONA—(Eighth Corps Area). P. O. Douglas, Arizona. Airdrome. Intermediate Landing Field.
DRYDEN, TEXAS—(Eighth Corps Area). P. O. Dryden, Texas. Border Patrol Station. Airdrome. Intermediate Landing Field.
DUNCAN FIELD—(Chief of the Air Corps). P. O. San Antonio, Texas. Air Corps Training Center. Supply and Repair depot.
EDGEWOOD ARSENAL—P. O. Edgewood, Md. Air Corps Detachment.
FAIRFIELD AIR DEPOT—(Chief of the Air Corps). P. O. Fairfield, Ohio. Supply and Repair Depot. Field Service Station.
FRANCE FIELD—(P. C. Depot). P. O. France Field, Canal Zone. 6th Composite Group Hdqr. 7th Obs. Sq. 12th Photo Sec. 63d Service Sq. 24th Pursuit Sq. 25th Bomb. Sq. Aerial Coast Defense. Air Corps Band.
GARDEN CITY—(Chief of the Air Corps). P. O. Long Island, N. Y. Air Corps Representative Curtiss Aeroplane & Motor Corp.
HATBOX FIELD—(Eighth Corps Area). P. O. Muskogee, Oklahoma. Intermediate Landing Field.
HOUSTON, FT. SAM—(Eighth Corps Area). P. O. Ft. Sam Houston, Texas. Airway Control Officer. (See Dodd Field).
KELLY FIELD—(Chief of the Air Corps). P. O. Kelly Field, Texas. Advanced Flying School. 10th School Group Hq. 24th School Wing Hq. 40th, 41st, 42d, 43d School Sqs. 68th Service Sq. 22d Photo Sec. 39th, 48th, School Sqs. Flying Cadet Detachment. Air Corps Band.
KINDLEY FIELD—(P. Dept.) P. O. Ft. Mills, Corregidor, P. I. 2d Obs. Sq.
LANGLEY FIELD—(Chief of the Air Corps). P. O. Hampton, Va. Hq. 2d Wing. 19th Airship Co. Hq. 2d Bomb. Group. 20th, 49th, 96th Bomb. Sqs., 58th, 59th Service Sqs. 2d Photo Sec. Tactical School. Flying Field.
LEAVENWORTH, FT.—P. O. Ft. Leavenworth, Kansas. Air Corps Det. Intermediate Landing Field.
LITTLE ROCK AIR DEPOT—(Chief of the Air Corps). P. O. Little Rock, Ark. Supply Depot. Flying Field.
LOGAN FIELD—(Third Corps Area). P. O. Dundalk, Md. Intermediate Landing Field. Flying Field for 104th Obs. Sq., Md. Nat. Guard.
LORDSBURG—(Eighth Corps Area). P. O. Lordsburg, N. M. Airdrome. Intermediate Landing Field.
LOVE FIELD—(Eighth Corps Area). P. O. Dallas, Texas. Intermediate Landing Field.
LUKE FIELD—(H. Dept.) P. O. Honolulu, Hawaii. Hq. 5th Composite Group. 4th Obs. Sq. 23d, 72d Bomb. Sqs. 65th Service Sq. 11th Photo Sec. Aerial Coast Defense.
LUNKEN AIRPORT—(Fifth Corps Area). P. O. Cincinnati, Ohio. (Station C.) Airdrome. Intermediate Landing Field. Reserve Airdrome.
MCINTOSH, FT.—(Eighth Corps Area). P. O. Ft. McIntosh, Texas. Intermediate Landing Field.
MARCH FIELD—(Chief of the Air Corps). P. O. Riverside, Cal. Primary Flying School. 13th School Group Hq. 70th Service Sq. 23d Photo Section. 47th School Sq. 53d, 54th School Sqs. Flying Cadet Det.
MARFA, CAMP—(Eighth Corps Area). P. O. Marfa, Texas. Airdrome. Intermediate Landing Field.
MARSHALL FIELD—(Seventh Corps Area). P. O. Ft. Riley, Kansas. 16th Obs. Sq. 9th Photo Section.
MAXWELL FIELD—(Fourth Corps Area). P. O. Montgomery, Ala. 22d Obs. Sq. (less det. at Ft. Bragg). 4th Photo Section.
MIDDLETOWN AIR DEPOT—(Chief of the Air Corps). P. O. Middletown, Pa. Repair and Supply Depot. Flying Field.
MITCHEL FIELD—(Second Corps Area). P. O. Mitchel Field, L. I., N. Y. Hq. 9th Obs. Group. 8th, 14th Photo Sections. 1st, 5th Obs. Secs. 61st Service Sq.
NEW YORK—(Chief of the Air Corps). P. O. 39 Whitehall St., New York City, N. Y. District Property and Survey Officer. District Office Procurement Section (Material Division). Procurement Planning Representative.
NICHOLS, CAMP—(P. Dept.) P. O. Maricaban, Rizal, P. I. Hq. 4th Composite Group. 66th Service Sq. 6th Photo Section. 28th Bomb. Sq. Philippine Air Depot.
NORTON FIELD—(Fifth Corps Area). P. O. Columbus, Ohio. Corps Area Hq. Flight. Intermediate Landing Field. Reserve Airdrome.
OFFUTT FIELD—(Seventh Corps Area). P. O. Ft. Crook, Nebr. Corps Area Hq. Flight. Intermediate Landing Field. Reserve Flying.
PEARSON FIELD—(Ninth Corps Area). P. O. Vancouver, Wash. Intermediate Landing Field.
PHILLIPS FIELD—P. O. Aberdeen Proving Ground, Md. Det. 49th Bomb. Sq.

PITTSBURGH AIRPORT—(Third Corps Area). P. O. Pittsburgh, Pa. Airport. Intermediate Landing Field. Reserve Airdrome.
POPE FIELD—(Fourth Corps Area). P. O. Ft. Bragg, N. C. Det. 22d Obs. Sq. Flying Field.
POST FIELD—P. O. Ft. Sill, Oklahoma. 88th Obs. Sq. Flying Field.
RICHARDS FIELD—(Seventh Corps Area). P. O. Kansas City, Mo. Intermediate Landing Field. Reserve Airdrome. (Part of Kansas City Municipal Airport.)
ROCKWELL FIELD—(Chief of the Air Corps). P. O. Rockwell Field, Coronado, Cal. Supply and Repair Depot. Flying Field. 7th Bomb. Group Hq. 11th Bomb. Sq. 95th Pursuit Sq.
ROSS FIELD—(Ninth Corps Area). P. O. Arcadia, Cal. Det. 91st Obs. Sq. Intermediate Landing Field.
SAN ANTONIO AIR DEPOT—(Chief of the Air Corps). P. O. Duncan Field, San Antonio, Texas. Supply and Repair Depot.
SAND POINT—(Ninth Corps Area). P. O. Seattle, Wash. Intermediate Landing Field. Reserve Airdrome.
SAN FRANCISCO—(Chief of the Air Corps). P. O. Room 624 Exchange Block, 369 Pine Street, San Francisco, Cal. Procurement Planning Representative.
SANTA MONICA—(Chief of the Air Corps). P. O. 2435 Wilshire Blvd., Santa Monica, Cal. District Procurement Office. Production Manager. Air Corps Representative Douglas Aircraft Co.
SCHOEN FIELD—(Fifth Corps Area). P. O. Ft. Benjamin Harrison, Ind. Intermediate Landing Field. Reserve Airdrome.
SCOTT FIELD—(Chief of the Air Corps). P. O. Scott Field, Belleville, Ill. 8th, 9th, 12th Airship Cos. 21st Airship Group Hq. 21st Photo Sec. 24th Airship Service Co. Balloon and Airship School. Air Depot. Cadet Det. Flying Field.
SEATTLE—(Chief of the Air Corps.) P. O. % Boeing Airplane Co., Georgetown Station, Seattle, Wash. District Procurement Office. Air Corps Rep. Boeing Airplane Co.
SELFRIDGE FIELD—(Sixth Corps Area). P. O. Mt. Clemens, Mich. Hq. 1st Pursuit Group. 57th Service Sq. 17th, 27th, 94th Pursuit Sqs. Flying Field. 5th Photo Section. 15th Observation Sq.
SHERIDAN, FT.—(Sixth Corps Area). P. O. Ft. Sheridan, Ill. Corps Area Hq. Flight. Intermediate Landing Field.
TUCSON—(Eighth Corps Area). P. O. Tucson, Ariz. Airdrome. Intermediate Landing Field.
WHEELER FIELD—(H. Dept.) P. O. Schofield Barracks, Honolulu, Hawaii. 18th Pursuit Group. 6th, 19th Pursuit Sqs. Flying Field.
WOODWARD FIELD—(Ninth Corps Area). P. O. Salt Lake City, Utah. Intermediate Landing Field. Reserve Airdrome.
WRIGHT FIELD—(Chief of the Air Corps). P. O. Dayton, Ohio. Materiel Division. Engineering School. Experimental Engineering Section. Procurement Planning Representative. Repair and Maintenance Section. Industrial War Plans. Field Service Section Procurement Sec.

Special Service Schools—Advanced Flying School, Kelly Field, Texas; Primary Flying School, Brooks Field, Texas; Primary Flying School, March Field, Cal.; Tactical School, Langley Field, Hampton, Va.; Technical School, Chanute Field, Rantoul, Ill.; Engineering School, Wright Field, Dayton, Ohio; School of Aviation Medicine, Brooks Field, San Antonio, Texas; Balloon and Airship School, Scott Field, Bellville, Ill.

Matériel Division

Wright Field, Dayton, Ohio

Brig. General William E. Gillmore.

Lieut. Colonel—Harry Graham.

Majors—Alfred H. Hobley, Jacob H. Rudolph, Leslie MacDill, Harold S. Martin, Jacob E. Fickel, C. W. Howard, R. M. Jones.

Captains—William H. Crom, Gerald E. Brower, Oliver P. Echols, Morris Berman, William F. Volandt, William B. Mayer, Theose E. Tillinghast, Oliver S. Ferson, Albert W. Stevens, Robert Kauch, Shiras A. Blair, Robert G. Breene, C. V. Finter, H. V. Hopkins, Edgar P. Sorensen.

Lieutenants—Ernest W. Dichman, Edwin E. Aldrin, Alonzo M. Drake, Lewis R. P. Reese, Carl F. Greene, Grandison Gardner, John P. Richter, Harry A. Sutton, Edwin E. Page, Franklin O. Carroll, Alfred J. Lyon, Eugene L. Eubank, Lawrence A. Lawson, Bayard Johnson, Albert C. Foulk, James H. Doolittle, Harry A. Johnson, Albert F. Hegenberger, Malcolm S. Lawton, Cortlandt S. Johnson, Eugene C. Batten, Raymond C. Zettel, Bennett E. Myers, Barney M. Giles, Donald D. FitzGerald, George P. Tourtellot, Clarence E. Crumrine, William N. Amis, James T. Hutchinson, Ivan G. Moorman, Leroy M. Wolfe, Reuben C. Moffat, Harry G. Montgomery, Edward M. Powers, Ennis C. Whitehead, John A. Laird, Jr., Howard Z. Bogert, Samuel P. Mills, Glenn T. Lampton, Austin W. Martenstein, Donald F. Stace.

Air Corps National Guard Units

101st Obs. Sqdn. & Photo Sec.,	Mass. Nat'l Gd.	Boston Airport, Boston, Mass.
102d Obs. Sqdn. & Photo Sec.,	N. Y. Nat'l Gd.	Miller Field, Staten Island, N. Y.
103d Obs. Sqdn.,	Penna. Nat'l Gd.	Philadelphia, Pa.
104th Obs. Sqdn. & Photo Sec.,	Md. Nat'l Gd.	Logan Field, Baltimore, Md.
105th Obs. Sqdn. & Photo Sec.,	Tenn. Nat'l Gd.	McConnell Field, Nashville, Tenn.
106th Obs. Sqdn. & Photo Sec.,	Ala. Nat'l Gd.	Roberts Field, Birmingham, Ala.
107th Obs. Sqdn. & Photo Sec.,	Mich. Nat'l Gd.	Route 9, Box 453, Detroit, Mich.
108th Obs. Sqdn.,	Illinois Nat'l Gd.	Chicago, Ill.
109th Obs. Sqdn. & Photo Sec.,	Minn. Nat'l Gd.	Chamberlain-Wold Field, St. Paul, Minn.
110th Obs. Sqdn. & Photo Sec.,	Mo. Nat'l Gd.	Anglum Field, St. Louis, Mo.
111th Obs. Sqdn. & Photo Sec.,	Texas Nat'l Gd.	Ellington Field, Houston, Texas.
112th Obs. Sqdn.,	Ohio Nat'l Gd.	Cleveland, Ohio.
113th Obs. Sqdn. & Photo Sec.,	Ind. Nat'l Gd.	Indianapolis, Ind.
115th Obs. Sqdn. & Photo Sec.,	Cal. Nat'l Gd.	Los Angeles Airport, Griffith Park, Cal.
116th Obs. Sqdn. & Photo Sec.,	Wash. Nat'l Gd.	Parkwater Aviation Field, Spokane, Wash.
118th Obs. Sqdn. & Photo Sec.,	Conn. Nat'l Gd.	Municipal Airdrome, Hartford, Conn.
120th Obs. Sqdn. & Photo Sec.,	Colo. Nat'l Gd.	Lowry Field, Denver, Colo.
154th Obs. Sqdn.,	Arkansas Nat'l Gd.	Little Rock, Ark.

Corps Area and Department Air Officers

First Corps Area	Army Base, South Boston, Mass.	Captain C. W. Ford
Second Corps Area	Governors Island, N. Y.	Col. T. A. Baldwin, Jr.
Third Corps Area	Standard Oil Bldg., Baltimore, Md.	Lt. Col. Harry Graham
Fourth Corps Area	Oakland City Station, Atlanta, Ga.	(None)
Fifth Corps Area	Ft. Hayes, Columbus, Ohio	Maj. H. C. K. Muhlenberg
Sixth Corps Area	1819 W. Pershing Road, Chicago, Ill.	Capt. E. E. W. Duncan
Seventh Corps Area	Ft. Omaha, Nebr.	Maj. H. J. Houghland
Eighth Corps Area	Ft. Sam Houston, Texas	Maj. W. N. Hensley, Jr.
Ninth Corps Area	Presidio of San Francisco, Cal.	Maj. H. B. Clagett
The Philippine Dept.	Manila, P. I.	Maj. W. G. Kilner
The Hawaiian Dept.	Ft. Shafter, T. H.	Lt. Col. A. G. Fisher
The Panama Dept.	Quarry Heights, Balboa Heights, C. Z	Lt. Col. J. H. Howard

Strength of the Army Air Corps

Dec. 31, 1928

Commissioned Officers		1086
Student Officers	104	
Pilots	957	
Enlisted men		10311
Cadets	280	
Civilians	2983	

Air Equipment

Attack Airplanes	69
Bombardment Airplanes	61
Observation Airplanes	459
Pursuit Airplanes	190
Training Airplanes	302
Cargo Airplanes	30

Strength of Air Corps Organized Reserves

Officers	6605
Pilots	3545

Number of Civilian Employees, Dec. 31, 1928

Fairfield Air Depot	396
Little Rock Air Depot	8
Middletown Air Depot	269
San Antonio Air Depot	467
Rockwell Air Depot	219

Army Flying Time and Distances

Calendar Year 1928

Heavier-than-air	213,204 hours
Lighter-than-air	3,074 hours
Total flying time	216,279 hours
Miles flown	19,546,450 miles

ARMY PURCHASES OF AERONAUTICAL EQUIPMENT

Fiscal Year 1928

Aircraft

No.	*Types*	*Cost*
	Lighter than air equipment	$ 274,501.00
	Heavier than air equipment:	
	1. Airplanes and Spares:	
130	Primary Training Airplanes and Spares	1,951,629.94
31	Advanced Training Airplanes and Spares	735,217.74
16	Pursuit Airplanes and Spares	552,404.94
62	Observation Airplanes and Spares	1,021,472.73
10	Amphibian Airplanes and Spares	284,078.12
25	Bombardment Airplanes and Spares—Model LB-5A	818,621.66
2	Bombardment Airplanes and Spares—Model B-2	338,571.46
21	Airplanes and Spares—Model C-11	380,061.32
8	Bombardment Airplanes and Spares—Model LB-7	731,636.76
36	Attack Airplanes and Spares	1,292,405.49
8	Cargo Airplanes and Spares	622,837.97
	Modification of 110 DH-4M1 and M-2 Observation Airplanes	29,560.92
1	Advanced type Airplane for M.A., Berlin, Germany	15,000.00
1	Model RO-1 Airplane for M.A., Italy	14,700.00
1	Boeing Design "66" Airplane	15,000.00
5	Pursuit Airplanes, Model P-3A	58,964.91
4	Thomas-Morse Observation Airplanes	133,500.00
1	Ford Cargo Airplane	32,727.00
	2. Engines and Spares:	
100	Curtiss D-12 Engines (See airplanes)	937,897.27
310	Wright J-5 Engines " "	1,622,686.50
167	Liberty Engines—Remodelled " "	123,078.00
32	Pratt & Whitney R-1690 " "	299,275.77
8	Curtiss G. V. 1570 Engines " "	97,520.00
	(These engines are initial equipment for above airplanes)	
2	Curtiss V-1550 Engines	30,000.00
4	Wright Air-cooled "V" Engines	110,000.00
6	Curtiss Air-cooled "Hex" Engines	130,352.49
3	7-cylinder 200 h.p. Air-cooled Engines	30,000.00
558	Liberty Engines Remodelled	397,527.00
	3. Miscellaneous:	
1025	Parachutes, Seat type	324,277.00
500	Flying suits—Winter	54,175.00
1004	Flying Suits—Summer	4,590.00
1800	Pairs goggles	23,464.50
950	Pairs lenses	4,804.54
1000	Aviators' Winter Helmets	7,350.00
1300	Aviators' Jackets	9,746.09
12	Cameras, Type K-6	18,000.00
10	Cameras, Type T-2 and Printer	45,575.00
1	Camera, Type T-3A and Printer	18,400.00
6	Cameras, Type T-4A	15,000.00
15	Turbo-Superchargers	40,500.00
478	Engine Generators	90,164.00
	Airplane Equipment and accessories	178,145.00
	Photographic Equipment	6,206.54
	Power Plant Equipment and accessories	142,111.86
	Life Saving Equipment	7,710.40
	Flying Equipment, Goggles, Clothing, etc	11,087.37
	Armament Equipment	23,767.78
	Miscellaneous Equipment	1,414.56
	Transportation and Crating for Overseas shipment	131,558.50

AIRPLANES DELIVERED TO U. S. ARMY IN 1928

Calendar Year

No.	*Type and Model*	*Contractor*
120	Training, Model PT-3A	Consolidated Aircraft Corporation.
28	Special Training, Model O-17 "Courier" (for National Guard)	Consolidated Aircraft Corporation.
1	Pursuit, Model XP-9	The Boeing Co.

1	Pursuit, Model XP-10	Curtiss Aeroplane & Motor Co., Inc.
3	Pursuit, Model P-11	Curtiss Aeroplane & Motor Co., Inc.
18	Pursuit, Model P-6	Curtiss Aeroplane & Motor Co., Inc.
33	Pursuit, Model P-1-C	Curtiss Aeroplane & Motor Co., Inc.
10	Pursuit, Model P-12	The Boeing Co.
50	Observation, Model O2-H (for National Guard)	The Douglas Co.
7	Observation, Models OX-19, O-19, O-19A, O-20, O-21, O-23	Thomas-Morse Aircraft Co.
1	Observation, Model O-22	The Douglas Co.
21	Observation, Model O2-H	The Douglas Co.
40	Observation, Model O2-K	The Douglas Co.
8	Observation, Amphibian OA-2	Leoning Aeronautical Engineering Corporation.
12	Bombardment, Model B-2	Curtiss Aeroplane & Motor Co., Inc.
35	Bombardment, Models LB-6 and LB-7	Keystone Aircraft Corporation.
8	Cargo, Model C3-A	Stout Metal Airplane Co.
396		

AIRCRAFT ENGINES DELIVERED TO U. S. ARMY IN 1928

Calendar Year

No.	*Type and Model*	*Contractor*
8	Curtiss "Hex," Model H-1640	Curtiss Aeroplane & Motor Co., Inc.
48	Curtiss, Model GV-1570	Curtiss Aeroplane & Motor Co., Inc.
43	Curtiss, Model V-1570	Curtiss Aeroplane & Motor Co., Inc.
120	Curtiss, Model D-12-E	Curtiss Aeroplane & Motor Co., Inc.
3	Wright, Model R-760	Wright Aeronautical Corporation.
17	Wright, Model V-1460	Wright Aeronautical Corporation.
147	Wright, Model R-790-A	Wright Aeronautical Corporation.
68	Wright "Cyclone," Model R-1750	Wright Aeronautical Corporation.
72	Pratt & Whitney "Hornet," R-1690	The Pratt & Whitney Aircraft Co.
20	Pratt & Whitney "Wasp," R-1340	The Pratt & Whitney Aircraft Co.
546	Total new types	
678	Reconditioned Liberties	Steel Products Engineering Co.
1,422	Reconditioned Liberties	Allison Engineering Co.

BUREAU OF AERONAUTICS, NAVY DEPARTMENT

Chief of Bureau.....Rear Admiral William A. Moffett
Assistant Chief of Bureau.....Captain E. J. King

Organization

The following divisions assist in carrying on the duties of the Bureau of Aeronautics:

Administration .....Lt. Comdr. A. H. Gray.
Financial .....Comdr. E. A. Cobey.
Plans .....Comdr. John H. Towers, Lt. Comdr. G. F. Chapline, Lt. Comdr. V. H. Ragsdale.
Flight .....Lt. Comdr. G. A. Smith, Lt. Comdr. C. Morgan.
Maintenance .....Comdr. S. M. Kraus, Comdr. S. J. Zeigler, Lt. Comdr. R. H. Clifford.
Design .....Captain H. C. Richardson, Comdr. Garland Fulton, Lt. Comdr. A. C. Miles, Lt. Comdr. H. R. Oster, Lt. Comdr. C. H. Havill, Lt. Comdr. A. I. Price, Lt. Comdr. L. C. Stevens, Lt. Comdr. J. E. Ostrander, Lt. Comdr. J. M. Shoemaker.
Information Section .....Captain H. C. Major, U.S.M.C.

Naval Air Stations

Pensacola, Fla., Training—Commandant, Rear Admiral J. J. Raby; Captain of the Yard, Comdr. W. G. Child.

San Diego, Calif., Fleet Base—Commanding Officer, Captain F. R. McCrary; Executive Officer, Lt. Comdr. E. W. Spencer.

Hampton Roads, Va., Fleet Base—Commanding Officer, Commander A. C. Read; Executive Officer, Lt. Comdr. H. T. Bartlett.

Lakehurst, N. J., Lighter-than-Air—Commanding Officer, Captain E. S. Jackson; Executive Officer, Comdr. M. R. Pierce, N.A.

Pearl Harbor, T. H., Fleet Base—Commanding Officer, Commander V. D. Herbster; Executive Officer, Lt. Comdr. C. T. S. Gladden.

Coco Solo, C. Z., Fleet Base—Commanding Officer, Lieut. Comdr. F. M. Maile; Executive Officer, Lieut. W. N. Updegraff.

Anacostia, D. C., Experimental—Commanding Officer, Lieut. Comdr. D. C. Watson; Executive Officer, Lieut. J. J. Clark.

Rockaway, L. I., N. Y., Naval Aviation Reserve Unit—Commanding Officer, Lieut. Lucian A. Moebus.

Sand Point, Washington, Naval Aviation Reserve Unit—Commanding Officer, Lieut. Comdr. J. D. Price.

Great Lakes, Illinois, N.A.R.U—Commanding Officer, Lieut. Comdr. O. W. Erickson.

Squantum, Massachusetts, N.A.R.U.—Commanding Officer, Lieut. George C. Haeberle.

Aircraft Squadrons

Aircraft Squadrons, Scouting Fleet—Commander, Rear Admiral A. W. Marshall; Senior Aide, Commander Elmer W. Todd.

Observation Plane Squadron Three—Squadron Commander, Lt. Comdr. H. C. Frazier; Executive Officer, Lieut. H. E. Halland.

Scouting Squadron Five—Squadron Commander, Lt. Comdr. C. G. Halpine; Executive Officer, Lt. Comdr. M. B. Stonestreet.

Torpedo and Bombing Squadron Nine—Squadron Commander, Lt. Comdr. W. Capehart; Executive Officer, Lieut. G. D. Townsend.

Utility Squadron Two—Squadron Commander, Lt. Comdr. J. F. Moloney; Executive Officer, Lieut. G. T. Owen.

Utility Squadron Three—Squadron Commander, Lieut. C. H. Schildhauer; Executive Officer, Lieut. T. T. Tucker.

U. S. S. *Wright* (Tender) (Flagship)—Commanding Officer, Commander E. D. McWhorter; Executive Officer, Lt. Comdr. H. B. Cecil.

U. S. S. *Patoka*—Commanding Officer, Captain A. Claude.

U. S. S. *Sandpiper* (Tender)—Commanding Officer, Lieut. Arthur B. Dorsey.

U. S. S. *Teal* (Tender)—Commanding Officer, Lieut. F. J. Legere.

Aircraft Squadrons, Battle Fleet—Commander, Rear Admiral Joseph M. Reeves; Senior Aide, Commander Eugene E. Wilson.

Observation Plane Squadron Three—Squadron Commander, Lieut. J. G. Farrell; Executive Officer, Lieut. W. D. Sample.

Observation Plane Squadron Four—Squadron Commander, Lt. Comdr. D. B. Duncan; Executive Officer, Lieut. R. L. Fuller.

Observation Plane Squadron Five—Squadron Commander, Lt. Comdr. C. T. Durgin; Executive Officer, Lieut. H. C. Rodd.

Fighting Plane Squadron One—Squadron Commander, Lt. Comdr. H. C. Wick; Executive Officer, Lieut. C. W. Wieber.

Fighting Plane Squadron Two—Squadron Commander, Lieut. H. M. Martin; Executive Officer, Lieut. Austin K. Doyle.

Fighting Plane Squadron Three—Squadron Commander, Lieut. G. T. Cuddihy; Executive Officer, Lieut. G. R. Henderson.

Light Bombing Squadron One—Squadron Commander, Lt. Comdr. O. B. Hardison; Executive Officer, Lieut. W. M. Dillon.

Light Bombing Squadron Two—Squadron Commander, Lt. Comdr. Arthur C. Davis; Executive Officer, Lieut. T. P. Jeter.

Torpedo and Bombing Squadron One—Squadron Commander, Lt. Comdr. H. S. Sease; Executive Officer, Lieut. Henry S. Kendall.

Torpedo and Bombing Squadron Two—Squadron Commander, Lt. Comdr. Harry R. Bogusch; Executive Officer, Lieut. M. F. Schoeffel.

Scouting Plane Squadron One—Squadron Commander, Lt. Comdr. A. P. Schneider; Executive Officer, Lieut. B. J. Connell.

Scouting Plane Squadron Two—Squadron Commander, Lt. Comdr. V. C. Griffin; Executive Officer, Lieut. F. P. Sherman.

Scouting Plane Squadron Three—Squadron Commander, Lt. Comdr. George S. Gillespie; Executive Officer, Lieut. A. S. Marley.

Scouting Plane Squadron Four—Squadron Commander, Lieut. R. S. Taylor; Executive Officer, Lieut. (jg) Rufus C. Young.

Utility Squadron One—Squadron Commander, Lt. Comdr. R. F. Wood; Executive Officer, Lieut. Richard F. Whitehead.

U. S. S. *Saratoga* (Aircraft Carrier) (Flagship)—Commanding Officer, Captain John Halligan; Executive Officer, Comdr. Kenneth Whiting.

U. S. S. *Lexington* (Aircraft Carrier)—Commanding Officer, Captain Frank D. Berrien; Executive Officer, Comdr. N. H. White.

U. S. S. *Langley* (Aircraft Carrier)—Commanding Officer, Captain A. B. Cook; Executive Officer, Comdr. R. R. Paunack.

U. S. S. *Aroostook* (Tender)—Commanding Officer, Commander A. D. Bernhard; Executive Officer, Lt. Comdr. Roy Pfaff.

U. S. S. *Gannet* (Tender)—Commanding Officer, Lieut. Thomas Macklin.

Aircraft Squadrons, Asiatic Fleet—Commander, Commander R. K. Turner.

Torpedo and Bombing Plane Squadron Five—Squadron Commander, Lt. Comdr. R. S. Parr; Executive Officer, Lt. Comdr. R. Wyman.

Airship

U. S. S. *Los Angeles*—Commanding Officer, Lt. Comdr. C. E. Rosendahl; Executive Officer, Lt. Comdr. Herbert V. Wiley.

Aviation Duty Other Than Department Stations and Squadrons

Naval Torpedo Station, Newport, R. I.—Lieut. J. F. Bolger

Naval Aircraft Factory, U. S. Navy Yard, Philadelphia, Pa.—Manager, Commander R. D. Weyerbacher; Assistant Manager, Commander W. W. Webster.

Naval Air Detail, Dahlgren, Va.—Officer-in-Charge, Lieut. J. J. Ballentine.

Aviation Mechanics' School, Naval Training Station, Great Lakes, Ill.—Lieut. M. C. Faber.

Aide to Assistant Secretary of the Navy for Aeronautics, Navy Department, Washington, D. C.—Lt. Comdr. W. K. Harrill.

Bureau of Navigation, Navy Department, Washington, D. C.—Lt. Comdr. F. W. Neilson.

Hydrographic Office, Navy Department, Washington, D. C.—Lieut. E. F. Burkett.

Bureau of Ordnance, Navy Department, Washington, D. C.—Lt. Comdr. S. Picking.

Bureau of Engineering, Navy Department, Washington, D. C.—Lieut. S. L. LaHache.

Aide to C-in-C, U. S. Fleet, Staff—Lt. Comdr. D. C. Ramsey.

Aide to C-in-C, Battle Fleet, Staff—Lt. Comdr. G. D. Murray.

Office of Naval Operations, Navy Department, Washington, D. C.—Lt. Comdr. A. R. Simpson (Board of Inspection and Survey); Lt. Comdr. R. E. Davison (Operations); Lieut. R. P. McConnell (Fleet Training).

U. S. Marine Corps Aviation, Washington, D. C.

Officer in Charge.....Major Edwin H. Brainard.
Personnel Officer.....Captain L. E. Woods.
Matériel Officer.....Captain F. O. Rogers.
Reserve Personnel Officer.....Captain T. R. Shearer.

Aircraft Squadrons, ECEF, Quantico, Va.

Commanding Officer.....Lt. Col. T. C. Turner

Squadron Commanders

Observation Squadron Six-M.....Captain R. A. Presley.
Fighting Squadron Four-M.....Lieut. W. O. Brice.
Fighting Squadron Five-M.....Lieut. F. D. Weir.
Service Company One-M.....Captain W. E. McCaughtry.
Kite Balloon Squadron One-M.....Captain J. B. Neill, Jr.

Aircraft Squadrons, WCEF, NAS, San Diego, Calif.

Commanding Officer.....Captain R. J. Mitchell

Squadron Commanders

Observation Squadron Eight-M.....Lieut. T. J. Cushman.
Observation Squadron Ten-M.....Lieut. W. J. Wallace.
Fighting Squadron Six-M.....Lieut. C. C. Jerome.

Aircraft Squadrons, 2nd Brigade Marines, Nicaragua

Commanding Officer.....Major L. M. Bourne

Observation Squadron Seven-M.....Captain E. D. Howard.
Utility Squadron Six-M.....Lieut. V. M. Guymon.

1st Brigade Marines, Haiti

Observation Squadron Nine-M.....Commanding Officer, Major F. T. Evans

Naval Station, Guam

Patrol Squadron Three-M.....Commanding Officer, Captain W. G. Farrell

Strength of Naval Aviation

Dec. 31, 1928

OFFICERS			
Navy			
Commissioned Officers	738		
Warrant Officers	67	805	
Marine Corps			
Commissioned Officers	99		
Warrant Officers	10	109	
Grand Total Officers		914	
PILOTS—*Navy*			
Qualified Aviators			
Commissioned Officers	446		
Warrant Officers	23	469	
Naval Aviation Pilots			
(Enlisted Men)	159		
Total Pilots, Navy	628	628	628
PILOTS—*Marine Corps*			
Qualified Aviators			
Commissioned Officers	57		
Warrant Officers	2	59	
Naval Aviation Pilots			
(Enlisted Men)		25	
Total Pilots, Marine Corps		84	84
Grand Total Pilots			712
STUDENTS	197		
ENLISTED MEN—Navy	10,864		
Marine Corps	976		
Total	11,840		

Number of Naval Airplanes in Service

Dec. 31, 1928

Fighting Planes	194
Observation planes	220
Torpedo and Bombing planes	262
Patrol and Scouting planes	8
Total	684

Naval Flying Time and Distances

Calendar Year 1928

At airdromes	*At sea (with fleets)*	*Cross country or cross water*
95,102 hours	42,184 hours	19,775 hours
8,559,180 miles	3,796,560 miles	1,779,750 miles

Types and Number of Planes, U. S. Marine Corps

Dec. 31, 1928

Observation	57
Fighting	36
Transports	5
Training	1
Total	99

NAVY PURCHASES OF AERONAUTICAL EQUIPMENT

Fiscal Year 1928

Aircraft

No.		*Cost*
25	Fighters	$ 317,361.00
	Spares	79,307.00
61	Observation	909,236.00
	Spares	305,330.85
19	Training	161,870.00
	Spares	14,829.00
26	Patrol	1,374,107.00
	Spares	265,351.17
8	Experimental	310,129.00

Engines

157	Wright Aircooled	$ 881,923.15
1	Fairchild-Caminez	2,510.00
346	Wasp T	2,517,615.60
	Spares	629,455.00
50	N-1300	364,374.00
	Spares	91,093.50
96	R-1690	847,080.00
	Spares	211,770.00

Miscellaneous

1213	Propellers	$ 191,594.00
226	Inertia Starters	105,465.00
	Parts	19,087.00
	Parachutes	146,935.00
	Lift Rafts	10,308.70
	Instruments	200,000.00

AIRPLANES DELIVERED TO U. S. NAVY IN 1928

Calendar Year

Model	*No. Deliv.*	*Contractor*
F7C-1	1	Curtiss Aeroplane and Motor Co., Inc.
F2B-1	30	Boeing Airplane Co.
F3B-1	73	Boeing Airplane Co.
F8C-1	6	Curtiss Aeroplane and Motor Co., Inc.
F8C-3	14	Curtiss Aeroplane and Motor Co., Inc.
O2U-1	121	Chance Vought Corp.
O2U-2	30	Chance Vought Corp.
OL-8	20	Loening Aeronautical Eng. Corp.
OC-2	7	Curtiss Aeroplane and Motor Co., Inc.
TA-2	3	Atlantic Aircraft Corp.
T2D-1	8	The Douglas Co.
T4M-1	102	Glenn L. Martin Co.
PN-11	1	Naval Aircraft Factory.
PN-12	1	Naval Aircraft Factory.
NY-2	7	Consolidated Aircraft Corp.
XN2C-1	3	Consolidated Aircraft Corp.
XN2B-1	1	Boeing Airplane Co.
XNK-1	2	Keystone Aircraft Corp.
XJO-1	1	Fairchild Aircraft Mfg. Co.
XPS-1	1	Sikorsky Aircraft Mfg. Co.
Total	432	

Incl. Marine Corps planes.

AIRCRAFT ENGINES DELIVERED TO U. S. NAVY IN 1928

Calendar Year

Model	*No. Deliv.*	*Contractor*
3A-2500	48	Packard Motor Car Co.
J-5	81	Wright Aeronautical Corp.
R-1700	2	Pratt & Whitney.
R-1300	39	Pratt & Whitney.
R-1700	81	Pratt & Whitney.
R-1750	45	Wright Aeronautical Corp.
VL-2	1	Maybeach Motor Co.
R-1340-B	274	Pratt & Whitney.
R-790-A	138	Wright Aeronautical Corp.
Caminez	2	Fairchild-Caminez.
R-1750-A	32	Wright Aeronautical Corp.
R-1690	37	Pratt & Whitney.
R-1200	1	Wright Aeronautical Corp.
Total	781	

Incl. Marine Corps planes.

DEPARTMENT OF COMMERCE

Aeronautics Branch

Washington, D. C.

William P. MacCracken, Jr., Assistant Secretary of Commerce for Aeronautics.

Director of Aeronautics ..... Clarence M. Young.
Chief of Administrative Section ..... Stanley W. Crosthwait.

Air Regulations Division:

Edward P. Howard ..... Chief, Air Regulations Division.
Gilbert G. Budwig ..... Chief, Inspection Section.
Jesse W. Lankford ..... Chief, Licensing Section.
Louis H. Bauer ..... Chief, Medical Section.
Lawrence V. Kerber ..... Chief, Engineering Section.
Elmer McD. Kintz ..... Chief, Enforcement Section.

10 Supervising Inspectors.
5 Engineering Inspectors.
6 Aeronautical Engineers.
8 Airplane Inspectors, Factory.
28 Airplane and Engine Inspectors.

Division of Airports and Aeronautic Information:

Harry H. Blee ..... Chief, Division of Airports and Aeronautic Information.
A. P. Taliaferro, Jr. ..... Chief, Field Service Section.
John Groves ..... Chief, Airway Bulletin Section.
Fred J. Martel ..... Chief, Statistics and Distribution Section.
Ernest L. Jones ..... Chief, Editorial Section.

Airways Division:

F. C. Hingsburg ..... Chief Engineer.
C. I. Stanton ..... Airways Engineer.
Thomas A. Lee ..... Administrative Officer.
W. T. Miller ..... Principal Airways Extension Supt.
H. J. Walls ..... Radio Engineer.
Eugene Sibley ..... Chief, Communication Section.
T. H. Chapman ..... Chief, Weather Section.
A. J. LaBaie ..... Chief, Construction Section.

14 Airways Extension Superintendents.
13 Inspectors of Airways Construction.
7 Airways Engineers and Assistants.
5 Associate and Assistant Radio Engineers.
42 Airways Mechanicians.
76 Radio Operators.
5 Airplane Mechanicians.
226 Weather Observers.
3 Assistant Airways Traffic Supervisors.
544 Caretakers.

Air Mapping Section, Coast and Geodetic Survey:

Raymond S. Patton ..... Chief, Air Mapping Section.

Aeronautical Research Division, Bureau of Standards:

J. H. Dellinger ..... Chief, Aeronautical Research Division.

AIRPLANES HAVING APPROVED TYPE CERTIFICATES

Dec. 31, 1928

KEY: P—Place; O—Open; C—Closed; L—Landplane; Am—Amphibian; Conv—Convertible; Fb—Flying boat; B—Biplane; M—Monoplane.

A.T.C. No.	*Date Issued 1927*	*Airplane*	*Weight Empty*	*Useful Load*	*Gross Weight*
1	3-29	Buhl Airster, 3POLB, J4 200 h.p.	1686	1383	3069
2	7-26	Boeing 40A (Mail), 3PCLB, Wasp 400 h.p.	3531	2469	6000
3	3-29	Johnson Twin 60, 2POLB, 2 Bristol Cherub 36 h.p.	800	520	1320
4	6- 8	Douglas O2, 2POLB, Liberty 12 400 h.p.	2885	1870	4755
5	6- 8	Douglas M2, 3POLB, Liberty 12 400 h.p.	2885	1870	4755
6	6- 8	Douglas M4, 3POLB, Liberty 12 400 h.p.	3400	1455	4855
7	4- 7	Alexander Com. Wing, 3POLB, OX5 90 h.p. or OXX6 100 h.p.	1470	760	2230

A.T.C. No.	Date Issued	Airplane	Weight Empty	Useful Load	Gross Weight
8	4- 7	Alexander Long Wing, 3POLB, OX5 90 h.p. or OXX6 100 h.p.	1470	760	2230
9	6-17	Atlantic Universal, 7PCConvM, WW 200 h.p. Landplane	2192	1808	4000
		(Hamilton Pontoons) Seaplane	2653	1347	4000
10	7- 2	Fairchild Fc2, 5PCConv 200 h.p. Landplane	2160	1440	3600
		(Fairchild Pontoons) Seaplane	2427	1573	4000
11	7-19	Advance Waco 9, 3POLB, OX5 90 h.p. or OXX6 100 h.p.	1320	780	2100
12	9-27	Buhl Airsedan 10, 5PCLB, J5, 200 h.p.	2073	1628	3700
13	10- 6	Advance Waco 10, 3POLB, OX5 90 h.p. or OXX6 100 h.p.	1200	825	2025
14	10- 6	Douglas C1 Transport, 10PCLB, Liberty 12 400 h.p.	3800	3600	7400
15		Cancelled			
16	11- 1	Stinson SM1, 6PCLM, J5 200 h.p.	1970	1515	3485
17	11-10	American Eagle, 3POLB, OX5 90 h.p. or OXX6 100 h.p.	1227	814	2041
18	11-15	Pitcairn PA5, 1POLB, J5C 200 h.p.	1742	1070	2812
19	12- 1	Kreider-Reisner Challenger, 3POLB, OX5 90 h.p. or OXX6 100 h.p.	1236	764	2000
20	12- 1	Fairchild FC2W, 5PCConv. Wasp 400 h.p. (Fairchild Pontoons) Seaplane	2770	1830	4600
		Landplane	2418	2182	4600
		Skiplane	3030	1570	4600
21	12- 8	Swallow, 3POLB, OX5 90 h.p. or OXX6 100 h.p.	1447	753	2200
	1928				
22	1- 4	Central States Monocoupe, 2PCLM, Anzani 60-80 h.p.	700	475	1175
		(Mono-Aircraft Co.) Siemens 70 h.p.	749	426	1175
23	4-30	Boeing B1D, 4PCFbB, WW 200 h.p.	2588	1155	3743
24	1- 6	Stinson SB1, 5PCLB, J5 200 h.p.	1815	1465	3280
25	1-27	Mahoney Ryan B1, 5PCLM, J5 200 h.p.	1870	1430	3300
26	2- 8	Advance Waco-10, 3POLB, Siemens 90-125 h.p.	1349	676	2025
27	2-25	Boeing 40B, 3PCLB, Hornet 525 h.p.	3506	2573	6079
28	3-12	Lincoln Page 1928, 3POLB, OX5 90 h.p. or OXX6 100 h.p.	1250	950	2200
29	4- 2	National Airways Air King, 3POLB, OX5 90 h.p.	1380	755	2135
30	3-22	Travel Air Model 2000, 3POLB, OX5 90 h.p. OXX6 100 h.p.	1347	833	2180
31	3-22	Travel Air Model 3000, 3POLB, Hisso 150-180 h.p.	1664	926	2590
32	3-22	Travel Air Model 4000, 3POLB, WW 200 h.p.	1660	740	2400
33	4- 3	Buhl CA5A, 5PCLB, WW 200 h.p.	2100	1600	3700
34	4- 4	Loening 7PCAmB, Wasp 400 h.p.	3730	2170	5900
35	4- 4	Internat'l F17, 3POLB, OX5 90 h.p. or OXX6 100 h.p.	1480	620	2100
36	4- 7	Pheasant, 3POLB, OX5 90 h.p.	1351	675	2026
37	4-11	Travel Air Model 8000, 3POLB, Caminez 120 h.p.	1475	825	2300
38	4-11	Travel Air Model 9000, 3POLB, Ryan-Siemens 125 h.p.	1475	825	2300
39	5- 9	Berliner CM-4, 3POLM, OX5 90 h.p.	1490	810	2300
40	5-28	Curtis Robin, 3PCLM, OX5 90 h.p.	1480	728	2217
41	6-18	Advance Waco-10, 3POLB, WW 200 h.p.	1411	899	2310
42	6-18	Advance Waco-10, 3POLB, Hisso 150-180 h.p.	1508	896	2404
43	6-14	Simplex Red Arrow, 2POLM, Kinner 75 h.p.	1020	572	1592
44	6-14	Simplex Red Arrow, 2PCLM, Kinner 75 h.p.	1020	572	1592
45	6-23	Texas Temple, 1POLM, WW 200 h.p.	1350	900	2250
46	6-16	Buhl CA-3C, 8PCLM, WW 200 h.p.	1760	1440	3200
47	6-18	Bellanca CH, 3PCLB, WW 200 h.p.	2190	1860	4050
48	8-28	Stinson SM-2, 3PCLM, Warner 110 h.p.	1516	984	2500
49	7- 9	Lockheed Vega, 5PCLM, WW 200 h.p.	1875	1595	3470
50	7- 9	Swallow, 3POLB, Hisso 150-180 h.p.	1728	972	2700
51	7- 9	Swallow, 3POLB, WW 200 h.p.	1716	984	2700
52	7- 9	Atlantic Super Universal, 7PCConvM, Wasp 400 h.p. Landplane	3000	2150	5150
		(Hamilton Pontoons) Seaplane	3550	1600	5150
53	7-14	Arkansas 3C3 Commandaire, 3POLB, OX5 90 h.p. or OXX6 100 h.p.	1410	790	2200
54	7-14	Boeing 40C, 5PCLB, Wasp 400 h.p.	3522	2553	6075
55	7-27	Stearman C-3B, 3POLB, WW 200 h.p.	1625	1025	2650
56	7-30	Atlantic FX, 14PCLM, 3 Wasps @ 400 h.p.	7390	5110	12500
57	8- 6	Alexander A1, 3POLB, WW 200 h.p.	1705	786	2491
58	8- 6	Alexander A2, 3POLB, OX5 90 h.p. or OXX6 100 h.p.	1459	982	2441
59	8- 6	Alexander A3 & A4, 3POLB, Hisso 150-180 h.p.	1877	741	2618
60	8- 8	Sikorsky S38A, 11PCAmB, 2 Wasps @ 400 h.p.	6000	4480	10480
61	8- 9	Fairchild FC2W2, 5PCConvM, Wasp 400 h.p. Landplane	2732	2768	5500
		(Fairchild Pontoons) Seaplane	3072	2428	5500
62	8-15	Stearman C3C, 3POLB, Hisso 150-180 h.p.	1790	960	2750

A.T.C. No.	*Date Issued*	*Airplane*	*Weight Empty*	*Useful Load*	*Gross Weight*
63	8-15	Curtiss Robin, 3PCLM, Challenger 170 h.p.	1576	864	2440
64	8-24	Boeing B1E, 4PCFbB, Wasp 400 h.p.	2090	1510	4500
65	8-27	Cessna A, 4PCLM, Anzani 120 h.p.	1304	956	2260
66	8-27	Loening, 5PCAmB, Hornet 500 h.p.	3867	2033	5900
67	8-27	Loening, 6PCAmB, Cyclone 500 h.p.	3849	2051	5900
68	8-29	Curtiss-Robertson Robin, 3PCLM, OX5 90 h.p.	1489	728	2217
69	8-29	Curtiss-Robertson Robin, 3PCLM Challenger 170 h.p.	1576	864	2440
70	9- 5	Mono-Aircraft Monocoupe, 2PCLM, Velie 45 h.p.	795	555	1350
71	9- 6	Spartan C-3, 3POLB, Ryan-Siemens 120 h.p.	1355	795	2150
72	9- 7	Cessna AW, 4PCLM, Warner 110 h.p.	1225	1035	2260
73	10-12	Spartan C-3, 3POLB, Walter 120 h.p.	1310	840	2150
74	10-16	Stinson SM-1DA, 6PCLM, WW 200 h.p.	2432	2068	4500
75	10-24	Fairchild FC2, 5PCLM, Challenger 170 h.p.	2239	1361	3600
76	10-29	Stinson SM-1DB, 6PCLM, WW 200 h.p.	2522	1978	4500
77	10-29	Stinson SM-1DC, 2PCLM, WW 200 h.p.	2514	1986	4500
78	10-29	Stinson SM-1DD, 2PCLM, DD 200 h.p.	2280	2220	4500
79	11- 7	Consolidated PT-1, 2POLB, Hispano 150-180 h.p.	1805	713	2518
80	11- 7	Consolidated NY-1, 2POLB, WW 200 h.p.	1773	722	2495
81	11- 7	Consolidated NY-2, 2POConvB, WW 200 h.p. Landplane	1800	698	2498
		Seaplane	2145	698	2843
82	11- 7	Consolidated O-17, 2POLB, WW 200 h.p.	1881	842	2723
83	11- 7	Consolidated PT-3 and Pt-3a, 2POLB, WW 200 h.p.	1747	698	2445
84	11-10	Consolidated Model 14, 2POLB, Scarab 110 h.p.	976	474	1450
85	11-13	Hamilton H-45, 8PCLM, Wasp 400 h.p.	3342	2408	5750
86	11-17	Laird LC-B, 3POLB, WW 200 h.p.	1812	1038	2850
87	11-19	Ford 4-AT, 14PCLM, 3 WW @ 200 h.p.	6169	3961	10130
88	11-23	Kreider-Reisner C-4, 3POLB, Comet 115 h.p.	1331	1069	2400
89	11-24	Fairchild 71, 7PCL-SM, Wasp 400 h.p. Landplane	2930	2570	5500
		Seaplane	3270	2230	5500
90	11-24	Loening C2-C, 6 PcAmB, Cyclone 500 h.p.	3894	2006	5900
91	11-24	Loening C2-H, 6PCAmB, Hornet 500 h.p.	3894	2006	5900
92	12- 1	Pitcairn Pa-6, 1POLB, WW 200 h.p.	1892	1158	3050
93	12- 1	Lockheed Vega, 5PCLM, Wasp 400 h.p.	2492	1541	4033
94	12- 1	Hamilton H-47, 8PCLM, Hornet 500 h.p.	3450	2300	5750
95	12- 4	Mohawk Pinto, MLV, 2POLM, Velie 55 h.p.	858	474	1332
96	12-14	Atlantic FXA, 14PCLM, 3 Wasps @ 400 h.p.	8134	4966	13100
97	12-28	Kreider-Reisner C-3, 3POLB, Warner 110 h.p.	1165	835	2000
	1929				
98	1- 3	Buhl CA-8A, 8PCLB, Cyclone 525 h.p.	3542	2558	6100
99	1- 3	Buhl CA-8B, 8PCLB, Hornet 525 h.p.	3542	2558	6100
100	1- 3	Travel Air Model 6000, 6PCLM, WW 225 h.p.	2430	1670	4100
101	1- 5	Brunner-Winkle Model A, 3POLB, OX5 90 h.p.	1319	831	2150
102	1-11	Lockheed-Air Express, 5PCLM, Wasp 425 h.p.	2533	1842	4375

ENGINES HAVING APPROVED TYPE CERTIFICATES

Dec. 31, 1928

KEY: 4—Number of cylinders; R—Radial (arrangement); V—Vee (arrangement); L—In line (arrangement); A—Air cooled; W—Water cooled; G—Gear drive.

Date 1928	*A.T.C. No.*	*Description*	*Rated H.P.*	*Rated R.P.M.*
6- 1	1	Fairchild Caminez 447-C	4RA	120	960
4- 2	2	Warner	7RA	110	1850
6-18	3	Kinner K-5	5RA	90	1810
6-22	4	Velie	5RA	55	1815
7-26	5	Curtiss Challenger R-600	6RA	170	1800
8-31	6	Curtiss Conqueror V-1550	12VW	600	2400
9-13	6	Curtiss Conqueror GV-1570	12VW	600	2400
9-13	8	Curtiss Chieftain H-1640	12RA	600	2200
9-18	9	Aircraft Comet	7RA	130	1825
10-11	10	Curtiss D-12	12VW	435	2300
11-24	11	Dayton Bear	4LA	76	1425
11-30	12	LeBlond 60	5RA	65	1950
12-17	13	Wright J-5 Whirlwind	9RA	225	1800
12-19	14	Pratt & Whitney Wasp	9RA	425	1900
12-19	15	Pratt & Whitney Hornet	9RA	525	1900

ENGINES APPROVED FOR LICENSE WITHOUT APPROVED TYPE CERTIFICATES

Dec. 31, 1928

Name	*Model*	*Description*	*Rated H.P.*	*Rated R.P.M.*
Curtiss	OX-5	8VW	90	1400
Curtiss	OXX	8VW	102	1400
Curtiss	C-6	6LW	160	1750
DeHaviland	Gypsy	4LA	85	1900
Hall-Scott	L4	4LW	125	1650
Liberty	12A	12VW	400	1700
Siemens-Halske	SH-10	5RA	70	1557
Siemens-Halske	SH-11	7RA	100	1584
Siemens-Halske	SH-12	9RA	122	1575
Siemens-Halske	SH-4	5RA	60	1540
Walter	NZ	9RA	120	1600
Wright-Hispano	A	8VW	150	1450
Wright-Hispano	E	8VW	180	1800
Wright-Hispano	I	8VW	150	1450

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

3841 Navy Building, Washington, D. C.

Joseph S. Ames, Ph.D., Chairman; Provost, Johns Hopkins University, Baltimore, Md.

David W. Taylor, D. Eng., Vice Chairman; Washington, D. C.

Charles G. Abbot, Sc.D., Secretary, Smithsonian Institution, Washington, D. C.

George K. Burgess, Sc.D., Director, Bureau of Standards, Washington, D. C.

William F. Durand, Ph.D., Professor Emeritus of Mechanical Engineering, Stanford University, California.

James E. Fechet, Major General, United States Army, Chief of the Air Corps, War Department, Washington, D. C.

William E. Gillmore, Brigadier General, United States Army, Chief, Materiel Division, Air Corps, Wright Field, Dayton, Ohio.

Emory S. Land, Captain, United States Navy, Bureau of Aeronautics, Navy Department, Washington, D. C.

Charles F. Marvin, M.E., Chief, United States Weather Bureau, Washington, D. C.

William A. Moffett, Rear Admiral, United States Navy, Chief, Bureau of Aeronautics, Navy Department, Washington, D. C.

S. W. Stratton, Sc.D., President, Massachusetts Institute of Technology, Cambridge, Mass.

Orville Wright, Sc.D., Dayton, Ohio.

George W. Lewis, Director of Aeronautical Research.
John F. Victory, Secretary.

Henry J. E. Reid, Engineer-in-Charge, Langley Memorial Aeronautical Laboratory, Langley Field, Virginia.

John Jay Ide, Technical Assistant in Europe, Paris, France.

Executive Committee

Joseph S. Ames, Chairman.
David W. Taylor, Vice Chairman.

Charles G. Abbot.
George K. Burgess.
James E. Fechet.
William E. Gillmore.
Emory S. Land.
Charles F. Marvin.
William A. Moffett.
S. W. Stratton.
Orville Wright.

John F. Victory, Secretary.

For the fiscal year 1928 the Committee had available $537,000, of which amount $529,144.54 was expended.

The Office of Aeronautical Intelligence during the year distributed 70,663 technical reports and documents, the heaviest distribution by classes being to aircraft manufacturers and to educational institutions. This was an increase of 17,782 documents distributed on request alone and represented an overall increase of 27% over the preceding year.

Technical investigations undertaken by the Committee included the following:

For the Air Corps of the Army

Investigation of the flat spin of the Douglas O-2 airplane.
Full-scale investigation of different wings on the Sperry messenger airplane.
Investigation of the behavior of an airplane in landing and in taking off.
Investigation of pressure distribution and accelerations in pursuit-type airplane.
Acceleration readings on the PW-9 airplane.
Wind-tunnel investigation of biplane cellules.
Investigation of pressure distribution on observation-type airplane.
Study of mutual interference of propeller and fuselage with geared engine.
Study of comparative performance with various types of superchargers.
Tests in special wind tunnel and in flight of atmospheric conditions causing ice formation.
Determination of moment coefficients and hinge moment coefficients for different tail surfaces.
Determination of aileron hinge moments versus rolling moments for various types of ailerons and wings.
Investigation of wing flutter.

For the Bureau of Aeronautics of the Navy

Investigation of pressure distribution on vertical tail surfaces fitted with balanced rudders.
Investigation of methods of improving wing characteristics by control of the boundary layer.
Development of a solid-injection type of aeronautical engine.
Investigation of NY training airplane with Handley Page automatic slot.
Determination of radii of gyration of O2U-1 airplane.
Investigation of windshields and fairings for protection from air currents.
Investigation of comparative aerodynamic resistance of rivited and bolted construction.
Investigation of parasite resistance and propeller efficiencies of PB-2.
Investigation of method of improvement in visibility in an airplane.
Investigation of maximum tail loads in dives.
Investigation of the forces on seaplane floats under landing conditions.
Investigation of water pressure distribution on seaplane hulls.
Study of design factors for metal propellers.
Investigation of application of compression ignition to air-cooled engine cylinders.
Investigation of flight path characteristics.
Effect of varying the aspect ratio and area of wings on performance of fighter airplane with supercharged air-cooled engine.
Investigation of aerodynamic loads on the U. S. S. *Los Angeles*.
Investigation of autorotation.
Investigation of spoiler aileron control.
Development of aircraft engine supercharger.
Effect of various forms of cowling on performance and engine operation of fighter airplane with supercharged air-cooled engine.
Prevention of ice formation in flight.
Comparative tests of rubber and Oleo type landing gears.
Investigation of the drag of a wing radiator.
Wind-tunnel tests of racing wing sections.

National Advisory Committee for Aeronautics—Technical Reports

No.

283. A Preliminary Investigation of Supercharging an Air-Cooled Engine in Flight. By Marsden Ware and Oscar W. Schey.
284. The Comparative Performance of Roots Type Aircraft Engine Superchargers as Affected by Change in Impeller Speed and Displacement. By Marsden Ware and Ernest E. Wilson.
285. A Study of Wing Flutter. By A. F. Zahm and R. M. Bear.
286. Aerodynamic Characteristics of Airfoils—V. By the National Advisory Committee for Aeronautics.
287. Theories of Flow Similitude. By A. F. Zahm.
288. Pressure Distribution Over a Rectangular Monoplane Wing Model up to 90° Angle of Attack. By Montgomery Knight and Oscar Loeser, Jr.
289. Forces on Elliptic Cylinder in Uniform Air Stream. By A. F. Zahm, R. H. Smith, and F. A. Louden.
290. Water Pressure Distribution on UO-1 Seaplane Float. By F. L. Thompson.
291. Drag of C-Class Airship Hulls of Various Fineness Ratios. By A. F. Zahm, R. H. Smith, and F. A. Louden.
292. Characteristics of Five Propellers in Flight. By J. W. Crowley, Jr., and R. E. Mixson.
293. Two Practical Methods for the Calculation of the Horizontal Tail Area Necessary for a Statically Stable Airplane. By Walter S. Diehl.
294. The Measurement of Maximum Cylinder Pressures. By Chester W. Hicks.

295. The Variation in Engine Power with Altitude Determined from Measurements in Flight with a Hub Dynamometer. By W. D. Grove.
296. Pressure Distribution Tests on PW-9 Wing Models from -18° Through 90° Angle of Attack. By Oscar E. Loeser, Jr.
297. The Reduction of Observed Airplane Performance to Standard Conditions. By Walter S. Diehl.
298. Effect of Chord and Span of Ailerons on Rolling and Yawing Moments in Level Flight. By R. H. Heald and D. L. Strother.
299. Investigation of Damping Liquids for Aircraft Instruments. By G. H. Keulegan.
300. The Twenty-Foot Propeller Research Tunnel of the National Advisory Committee for Aeronautics. By Fred E. Weick and Donald H. Wood.
301. Full-Scale Tests of Wood Propellers on a VE-7 Airplane in the Propeller Research Tunnel. By Fred E. Weick.
302. Full-Scale Tests on a Thin Metal Propeller at Various Tip Speeds. By Fred E. Weick.
303. An Investigation of the Use of Discharge Valves and an Intake Control for Improving the Performance of N. A. C. A. Roots Type Supercharger. By Oscar Schey and Ernest Wilson.
304. An Investigation of the Aerodynamic Characteristics of an Airplane Equipped with Several Different Sets of Wings. By J. W. Crowley and M. W. Green.
305. The Gaseous Explosive Reaction—A Study of the Kinetics of Composite Fuels. By F. W. Stevens.
306. Full-Scale Wind Tunnel Tests of a Series of Metal Propellers on a VE-7 Airplane. By Fred E. Weick.
307. The Pressure Distribution over the Horizontal and Vertical Tail Surfaces of the F6C-4 Pursuit Airplane in Violent Maneuvers. By Richard V. Rhode.
308. Aircraft Accidents—Method of Analysis. By the Special Committee on the Nomenclature, Subdivision, and Classification of Aircraft Accidents.

National Advisory Committee for Aeronautics—List of Technical Notes Issued During the Past Year

No.

267. Pressure Distribution on Wing Ribs of the VE-7 and TS Airplanes in Flight. By R. V. Rhode. Part I: Level Flight.
268. Mass Distribution and Performance of Free Flight Models. By Max Scherberg and R. V. Rhode.
269. The Distribution of Loads Between the Wings of a Biplane Having Decalage. By Richard M. Mock.
270. The Characteristics of the N. A. C. A. 97, Clark Y, and N. A. C. A.-M6 Airfoils with Particular Reference to the Angle of Attack. By George J. Higgins.
271. Full Scale Drag Tests on Various Parts of Sperry Messenger Airplane. By Fred E. Weick.
272. Special Propeller Protractor. By A. L. Heim.
273. The Effect on Performance of a Cutaway Center Section. By Thomas Carroll.
274. The Effect of the Sperry Messenger Fuselage on the Air Flow at the Propeller Plane. By Fred E. Weick.
275. Determination of Propeller Deflection by Means of Static Load Tests on Models. By Fred E. Weick.
276. Helium Tables. By Lieut. Commander Clinton H. Havill, U. S. N.
277. Pressure Distribution on Wing Ribs of the VE-7 and TS Airplanes in Flight. Part II: Pull-Ups. By R. V. Rhode.
278. An Automatic Speed Control for Wind Tunnels. By A. F. Zahm.
279. Resistance of Streamline Wires. By George L. DeFoe.
280. Drag of Exposed Fittings and Surface Irregularities on Airplane Fuselages. By Donald H. Wood.
281. A Comparison of Propeller and Centrifugal Fans for Circulating the Air in a Wind Tunnel. By Fred E. Weick.
282. Corrosion Embrittlement of Duralumin. I. Practical Aspects of the Problem. By Henry S. Rawdon.
283. Corrosion Embrittlement of Duralumin. II. Accelerated Corrosion Tests and the Behavior of High-Strength Aluminum Alloys of Different Compositions. By Henry S. Rawdon.
284. Corrosion Embrittlement of Duralumin. III. Effect of the Previous Treatment of Sheet Material on the Susceptibility to This Type of Corrosion. By Henry S. Rawdon.
285. Corrosion Embrittlement of Duralumin. IV. The Use of Protective Coatings. By Henry S. Rawdon.
286. Preliminary Investigation on Boundary Layer Control by Means of Suction and Pressure with the U. S. A. 27 Airfoil. By E. G. Reid and M. J. Bamber.
287. A Dangerous Seaplane Landing Condition. By Thomas Carroll.
288. The Reaction on a Float Bottom When Making Contact with Water at High Speeds. By H. C. Richardson.
289. Preliminary Biplane Tests in the Variable Density Wind Tunnel. By James M. Shoemaker.
290. Welding High Chromium Steels. By W. B. Miller.
291. Gluing Practice at Aircraft Manufacturing Plants and Repair Stations. By T. R. Truax.

292. The Drag of a J-5 Radial Air-Cooled Engine. By Fred E. Weick.
293. The Formation of Ice Upon Exposed Parts of an Airplane in Flight. By Thomas Carroll and William H. McAvoy.
294. Wind Tunnel Force Tests in Wing Systems Through Large Angles of Attack. By Carl J. Wenzinger and Thomas A. Harris.
295. The Effect of Tip Shields on a Horizontal Tail Surface. By Paul V. Dronin, Earl I. Ramsden, and George J. Higgins.
297. Preliminary Report on the Flat-Top Lift Curve as a Factor in Control at Low Speed. By Montgomery Knight and Millard J. Bamber.
298. The Determination of Several Spray Characteristics of a High-Speed Oil Engine Injection System with an Oscilloscope. By Chester W. Hicks and Charles S. Moore.
432. Slotted-Wing Airplanes. By E. Everling. Translation from "Zeitschrift des Vereines deutscher Ingenieure," May 7, 1927.
433. Some German Gliders of 1920–1923. By Alfred Gymnich. Translation from "Der Gleit- und Segelflugzeugbau" (ch. 3). Published by Richard Carl Schmidt & Co., Berlin, 1925.
434. Glider Construction and Design. By Alfred Gymnich. Translation from "Der Gleit- und Segelflugzeugbau" (ch. 4, secs. 1-3), 1925.
435. Turbulent Flow. By L. Prandtl. Lecture delivered before the International Congress for Applied Mechanics, Zurich, September, 1926.
436. Approximation Method for Determining the Static Stability of a Monoplane Glider. By A. Lippisch. Translation from "Zeitschrift für Flugtechnik und Motorluftschiffahrt," June 14, 1927.
437. Experiments on Airfoils with Aileron and Slot. By A. Betz. Translation from Report III, "Ergebnisse der Aerodynamischen Versuchsanstalt zu Gottingen" (Aerodynamic Institute).
438. Safety in Airplane Flight. By H. Brunat. Communication by H. Brunat, of the "Service de la Navigation Aérienne," to the "Société Française de Navigation Aérienne," November 10, 1927.
439. Structural Details of German Gliders. By Alfred Gymnich. Translation from "Der Gleit- und Segelflugzeugbau" (ch. 4, secs. 6–9), 1925.
440. Metal Aircraft Construction at Vickers. Some Interesting New Forms Developed. From Flight, September 15, 1927.
441. Increasing Lift by Releasing Compressed Air on Suction Side of Airfoil. By F. Seewald. Translation from "Zeitschrift für Flugtechnik und Motorluftschiffahrt," August 16, 1927.
442. "Gloster" High-Lift Biplane Wings. By H. E. Preston. From The Gloster, Volume II, No. 5, January-February, 1927.
443. Duralumin—Defects and Failures. By Lieut. Commander William Nelson (C. C.), United States Navy. From "Aviation," August 29, 1927.
444. Calculating Thrust Distribution and Efficiency of Air Propellers. By Theodor Bienen. Translation from "Zeitschrift für Flugtechnik und Motorluftschiffahrt," November 27, 1926.
445. Tensile Strength of Welded Steel Tubes. First Series of Experiments. By A. Rechtlich. Translation from "Zeitschrift für Flugtechnik und Motorluftschiffahrt." September 14, 1927.
446. Crank Case Scavenging of a Two-Stroke-Cycle Engine. By Otto Holm. Translation from "Zeitschrift des Vereines deutscher Ingenieure," June 11, 1927.
447. Stressed Coverings in Naval and Aeronautic Construction. By L. L. Kahn. Translation from "Association Technique Maritime et Aéronautique," May-June, 1927.
448. Mechanical Properties of Some Materials Used in Airplane Construction. By E. B. Wolff and L. J. G. Van Ewijk. Translation from Report M-219 of the "Rijks-Studiedienst voor de Luchtvaart," reprinted from "De Ingenieur," August 7, 1926.
449. Results of Aerodynamic Tests on Slotted Airfoils in the Aerotechnical Laboratory (S. T. Aé.) of Rhode St. Genese, Brussels. By Paul Puvrez. Translation from Bulletins Nos. 1 and 4, April and July, 1927, of the "Service Technique de L'Aéronautique Belge."
450. Parachutes for Aircraft. By Waldemar Müller. Translation from "Zeitschrift für Flugtechnik und Motorluftschiffahrt," October 28, 1927.
451. Aviation Fuels (with Special Reference to "White Spirit"). By P. Dumanois. Translation from "La Technique Aeronautique," April 15, 1927.
452. Motion of Fluids with Very Little Viscosity. By L. Prandtl. Translation from "Vier Abhandlungen zur Hydrodynamik und Aerodynamik," Göttingen, 1927.
453. Welding in Airplane Construction. By A. Rechtlich and M. Schrenk. Translation from the 1927 Yearbook of the "Deutsche Versuchsanstalt für Luftfahrt."
454. The 1926 German Seaplane Contest. Part I: Lessons Taught. By F. Seewald. Part II: Method of Rating. By H. Blenk and F. Liebers. Translation from the 1927 Yearbook of the "Deutsche Versuchsanstalt für Luftfahrt."
455. Note on Research Work by Helmholtz and Wein Relating to the Form of Waves Propagated Along the Surface of Separation of Two Liquids. By J. M. Burgers. Translation from a reprint from "Rendiconti della R. Accademia Nazionale dei Lincei," Volume V, No. 5.
456. Calculation of Airplane Performances Without the Aid of Polar Diagrams. By Martin Schrenk. Translation from the 1927 Yearbook of the "Deutsche Versuchsanstalt für Luftfahrt."

457. A Few More Mechanical-Flight Formulas Without the Aid of Polar Diagrams. By Martin Schrenk. Translation from the 1927 Yearbook of the "Deutsche Versuchsanstalt für Luftfahrt." (Supplement to Technical Memorandum No. 456.)
458. Steel Spars. By Brian L. Martin. From "The Gloster," September-December, 1927.
459. Variable Pitch Propellers. By H. L. Milner. From "The Gloster," September-December, 1927.
460. Take-Off of Heavily Loaded Airplanes. By A. Pröll. Translation from "Zeitschrift für Flugtechnik und Motorluftschiffahrt," January 28, 1928.
461. Contribution to the Systematic Investigation of Joukowsky Profiles. By Göttfried Loew. Translation from "Zeitschrift für Flugtechnik und Motorluftschiffahrt," November 28, 1927.
462. Comments on Crankless Engine Types. Translation from "Der Motorwagen," November 20, 1927.
463. Prospective Development of Giant Airplanes. By B. Von Romer. Translation from "Luftfahrt," October 22, 1927.
464. Discussion of Problems Relating to the Safety of Aviation. By J. Sabatier. Part I. Translation from "Bulletin Technique" No. 42, of the "Service Technique et Industriel de l'Aeronautique," June 18, 1927.
465. Discussion of Problems Relating to the Safety of Aviation. By J. Sabatier. Part II. Translation from "Bulletin Technique" No. 42, of the "Service Technique et Industriel de l'Aeronautique," June 18, 1927.
466. Wheel Brakes and Their Application to Aircraft. By G. H. Dowty. From *Flight*, November 24 and December 29, 1927, and January 26, 1928.
467. The Diesel as a Vehicle Engine. By Kurt Neumann. Translation from "Zeitschrift des Vereines deutscher Ingenieure," May 28, 1927.
468. Choice of Profile for the Wings of an Airplane. Part I. By A. Toussaint and E. Carafoli. Translation from "L'Aeronautique," December, 1927.
469. Choice of Profile for the Wings of an Airplane. Part II. By A. Toussaint and E. Carafoli. Translation from "L'Aeronautique," January, 1928.
470. On Improvement of Air Flow in Wind Tunnels. By C. Wieselsberger. From Journal, Society of Mechanical Engineers (of Japan), June, 1925, volume 29, No. 98.
471. Technical Progress Shown in the 1927 Rhön Soaring-Flight Contest. By W. Hübner. Translation from "Zeitschrift des Vereines deutscher Ingenieure," December 3, 1927.
472. Experiments with a Wing from Which the Boundary Layer Is Removed by Pressure or Suction. By K. Wieland. Translation from "Zeitschrift für Flugtechnik und Motorluftschiffahrt," August 16, 1927.
473. (I) The Problem of Noise in Civil Aircraft and the Possibilities of Its Elimination. By W. S. Tucker. From Journal of the Royal Aeronautical Society, March, 1928, volume 32, No. 207.
473. (II) The Problem of Noise in Civil Aircraft and the Possibilities of Its Elimination. By W. S. Tucker. From Journal of the Royal Aeronautical Society, March, 1928, volume 32, No. 207.
474. Windmills in the Light of Modern Research. By A. Betz. Translation from "Die Naturwissenschaften," November 18, 1927, volume 15, No. 46.
475. Recent Researches on the Air Resistance of Spheres. By O. Flachsbart. Translation from "Physikalische Zeitschrift," volume 28, 1927.
476. Synopsis of French Aeronautic Equipment—Aeronautic Instruments. Translation from "L'Aeronautique," September, 1927, No. 100.
477. Contribution to the Design and Calculation of Fuel Cams and Fuel Valves for Diesel Engines. By Jatindra Nath Basu. Translation from "Der Motorwagen," May 10 and July 31, 1927.
478. The Cells of Giant Airplanes. By E. Offermann. From Offermann's "Riesenflugzeuge," 1927.
479. The Span as a Fundamental Factor in Airplane Design. By G. Lachmann. Translation from "Zeitschrift für Flugtechnik und Motorluftschiffahrt," May 14, 1928.
480. Airplane Strength Calculations and Static Tests in Russia. (An Attempt at Standardization.) Translation from "L'Aeronautique," February, 1928.
481. Considerations on Propeller Efficiency. By A. Betz. Translation from "Zeitschrift für Flugtechnik und Motorluftschiffahrt," April 28, 1928.

List of Aircraft Circulars Issued During the Past Year

No.

57. The DeHaviland *Tiger Moth*—A Low-Wing Monoplane. From "Flight," September 22, 1927.
58. The Fairchild *All-Purpose* Cabin Monoplane. From a circular issued by the Fairchild Airplane Manufacturing Corporation.
59. The Focke-Wulf F. 19 *Ente* Tail-First Airplane. From "Flight," September 29, 1927.
60. Stinson Commercial Airplane, type SM-1—A Semicantilever Monoplane. Prepared by the Stinson Aircraft Corporation.
61. Lockheed *Vega* Airplane—A Commercial Cabin Monoplane. Prepared by the Lockheed Aircraft Co.
62. The Pitcairn *Mailwing* PA-5—A Single-Seat Commercial Biplane. Prepared by Pitcairn Aviation (Inc.).

63. *Avimeta*—Three-Engine Commercial Monoplane, type A. V. M. 132. From a circular issued by the Avimeta Co.
64. The Heinkel Commercial Airplane *H. D. 40.* From a circular issued by the Ernst Heinkel Airplane Co.
65. The De Haviland 61 *Canberra* (British)—A Six to Eight Passenger Airplane. From "Flight," December 29, 1927.
66. Focke-Wulf A. 17 Commercial Airplane *Moewe* (German). From a circular issued by the Focke-Wulf Airplane Construction Co.
67. Supermarine *S-5* Seaplane (British)—Winner of the 1927 Schneider Cup Race. From "Flight," February 16, 1928.
68. The Short *Calcutta*—First British All-Metal Commercial Seaplane. From "Flight," February 23, 1928.
69. The *Gloster IV* Seaplane (British). From "Flight," March 1, 1928.
70. The Avro *Avian III* Airplane (British). From "Flight," March 8, 1928.
71. The Boulton and Paul *Sidestrand I* Bomber Airplane (British). From "Flight," March 29, 1928.
72. The Parnall *Imp*—A New British Light Airplane. From "Flight," April 12, 1928.
73. The Fokker *Universal* Commercial Airplane. From a circular issued by the Atlantic Aircraft Corporation.
74. The Bleriot *Spad 91* Airplane—Pursuit Single-Seater "Jockey" type. Translation from Les Ailes, April 19, 1928.
75. Morane-Saulnier 121 Single-Seat Pursuit Airplane (French). By J. Serryer. Translation from Les Ailes, October 20, 1927.
76. The Fokker *Trimotor F VII* Commercial Transport Monoplane. From a circular issued by the Atlantic Aircraft Corporation.
77. René Couzinet Monoplane (French). By J. Serryer. Translation from "Les Ailes," March 29, 1928.
78. Savoia Marchetti *S 64* Airplane. By Maurice Victor. Translation from "Les Ailes," June 14, 1928.
79. The Sikorsky Twin-Engined Amphibian, type S-38, Model 1928. Prepared by Sikorsky Manufacturing Corporation.
80. C. A. M. S. *54 G. R.* Transatlantic Seaplane (French). Prepared by Paris Office, N. A. C. A.
81. Westland *Wapiti* (British). Prepared by the Westland Aircraft Works, England.
82. The Armstrong Whitworth *Starling* (British)—Single-Seat Fighter. From "Flight," August, 1928.

AIR MAIL SERVICE

POST OFFICE DEPARTMENT

Washington, D. C.

Postmaster General ..... Harry S. New.
Second Assistant Postmaster General ..... W. Irving Glover.
Deputy Second Assistant Postmaster General ..... Chase C. Gove.
Superintendent ..... E. B. Wadsworth.
Assistant Superintendent ..... J. W. Sutherin.

B. F. Myers, Assistant Superintendent ..... Chicago, Ill.
Joseph Menth, Assistant Superintendent ..... New York, N. Y.
A. O. Willoughby, Assistant Superintendent ..... San Francisco, Calif.

E. R. White, Director ..... Division of International Postal Service.

Contract Air Mail Routes in the United States in 1928

CAM- 1 Boston to New York.
2 Chicago to St. Louis.
3 Chicago to Dallas.
4 Salt Lake City to Los Angeles.
5 Salt Lake City to Pasco.
6 Detroit to Cleveland. (Discontinued July 19, 1928.)
7 Chicago to Detroit. (Discontinued July 16, 1928.)
8 Seattle to Los Angeles.
9 Chicago to St. Paul and Minneapolis.
11 Cleveland to Pittsburgh.
12 Cheyenne to Pueblo.
16 Cleveland to Louisville.
17 New York to Chicago.
18 Chicago to San Francisco.
19 New York to Atlanta.
20 Albany to Cleveland.
21 Dallas to Galveston.
22 Dallas to Laredo.
23 Atlanta to New Orleans.
24 Chicago to Cincinnati.
25 Atlanta to Miami.
26 Great Falls to Salt Lake City.
27 Bay City to Chicago.
30 Chicago to Atlanta.

Contracts awarded on the following routes to start in 1929:

CAM-28 St. Louis, Mo., to Omaha, Nebr., and return.
29 New Orleans, La., via Houston to either San Antonio, Laredo or Brownsville, Tex., and return.

Air Mail Operations by Routes During Calendar Year 1928

Route	*Route Miles*	*Pounds of Mail*	*Compensation*	*Miles of Service Scheduled*	*Flown*
1. Boston-New York	192	47,453	$ 142,354.67	107,904	90,569
2. Chicago-St. Louis	278	56,300	142,506.50	135,664	133,721
3. Chicago-Dallas	1,059	196,161	588,468.95	968,972	899,106
4. Salt Lake City-Los Angeles	600	319,910	958,608.72	426,000	404,771
5. Salt Lake City-Pasco	530	112,838	338,503.47	360,520	338,894
6. Detroit-Cleveland	91	1,170	1,259.63	30,216	26,598
7. Chicago-Detroit	237	9,758	10,499.63	78,684	71,348
8. Seattle-Los Angeles	1,099	117,653	333,079.32	596,050	570,137
9. Chicago-Minneapolis	503	57,104	157,034.45	206,054	194,219
11. Cleveland-Pittsburgh	123	54,852	164,556.84	85,140	80,769
12. Cheyenne-Pueblo	199	54,718	45,416.98	134,718	129,866
16. Cleveland-Louisville	339	21,354	26,050.06	85,455	81,797
17. New York-Chicago	772	781,803	801,570.83	1,047,553	948,946
18. Chicago-San Francisco	1,918	837,211	1,716,734.95	1,473,792	1,433,740
19. New York-Atlanta	763	85,153	255,456.73	288,314	261,192
20. Albany-Cleveland	443	45,309	50,291.45	187,974	163,334
21. Dallas-Galveston	320	25,370	73,322.05	187,990	180,480
22. Dallas-Laredo	417	36,121	104,346.52	18,811	183,104
23. Atlanta-New Orleans	479	23,325	40,816.77	174,018	170,860
24. Chicago-Cincinnati	270	35,667	52,417.80	180,900	163,906
26. Great Falls-Salt Lake City	493	18,752	46,412.60	125,961	116,834
27. Bay City-Chicago	522	61,460	54,699.27	135,383	129,403
30. Chicago-Atlanta	790	1,076	839.47	6,744	5,881
Total		3,000,518	$6,105,247.66	7,042,817	6,779,475

Additions and Changes:

CAM-18 Chicago, Ill., to San Francisco, Calif.—established July 1, 1927. (This route previously part of Government-operated route.)
17 New York, N. Y., to Chicago, Ill.—established Sept. 1, 1927. (This route previously part of Government-operated route.)
20 Cleveland, Ohio., to Buffalo, N. Y.—established Dec. 17, 1927—and Buffalo to Albany, N. Y.—established June 1, 1928.
24 Chicago, Ill., to Cincinnati, Ohio—established Dec. 17, 1927.
21 Dallas to Galveston, Texas—established Feb. 6, 1928.
22 Dallas to San Antonio, Texas—established Feb. 6, 1928.
19 New York, N. Y., to Atlanta, Ga.—established May 1, 1928.
23 Atlanta, Ga., to New Orleans, La.—established May 1, 1928.
26 Great Falls, Mont., to Salt Lake City, Utah—established June 30, 1928 (service suspended to August 1, 1928).

Contract Air Mail Operators on December 31, 1928

CAM-1 Boston, Mass., by Hartford, Conn., to New York., N. Y., 192 miles.

Contractor: **Colonial Air Transport, Inc., 270 Madison Ave., New York, N. Y.**
Compensation: $3.00 per pound.

Schedule:

Leave Boston	6:15 p. m.	Arrive New York	9:15 p. m.
Leave New York	5:00 a. m.	Arrive Boston	7:50 a. m.

(Daily except Sundays and holidays.)
Service began July 1, 1926.

CAM-2 Chicago, Ill., via Peoria and Springfield, Ill., to St. Louis, Mo., 278 miles.

Contractor: **Robertson Aircraft Corporation, Anglum, Mo.**
Compensation: $2.53125 per pound.

Schedule:

Leave Chicago	5:50 a. m.	Leave: St. Louis	4:15 p. m.
Leave Peoria	7:25 a. m.	Leave Springfield	5:20 p. m.
Leave Springfield	8:15 a. m.	Leave Peoria	6:10 p. m.
Arrive: St. Louis	9:15 a. m.	Arrive Chicago	7:30 p. m.

(Daily.)
Service began April 15, 1926.

CAM-3 Chicago, Ill., via Moline, Ill., St. Joseph and Kansas City, Mo., Wichita, Ponca City, Tulsa and Oklahoma City, Okla., to Fort Worth and Dallas, Texas, 1,059 miles.

Contractor: **National Air Transport, Inc., Chicago, Ill.**
Compensation: $3.00 per pound.

Schedule:

	(Night)	(Day)		(Night)	(Day)
Lv. Chicago	8:00 p. m.	7:30 a. m.	Lv. Dallas	7:00 p. m.	
Lv. Moline	9:50 p. m.	9:30 a. m.	Lv. Ft. Worth	7:30 p. m.	
Lv. St. Joseph		12:30 p. m.	Lv. Okla. City	9:20 p. m.	
Lv. Kansas City	1:10 a. m.	1:00 p. m.	Lv. Tulsa	5:15 p. m.	
Lv. Wichita	3:15 a. m.		Lv. Ponca City	10:20 p. m.	
Lv. Ponca City	4:10 a. m.		Lv. Wichita	11:10 p. m.	
Ar. Tulsa	5:20 a. m.		Lv. Kansas City	1:10 a. m.	2:05 p. m.
Lv. Okla. City	5:25 a. m.		Lv. St. Joseph		2:40 p. m.
Lv. Ft. Worth	7:35 a. m.		Lv. Moline	4:20 a. m.	5:30 p. m.
Ar. Dallas	8:00 a. m.		Ar. Chicago	5:40 a. m.	7:20 p. m.

(Daily.)
Service began May 12, 1926.

CAM-4 Salt Lake City, Utah, via Las Vegas, Nev., to Los Angeles, Calif., 600 miles.

Contractor: **Western Air Express, Inc., Los Angeles, Calif.**
Compensation: $3.00 per pound.

Schedule:

Leave Salt Lake City	9:10 a. m.	Leave Los Angeles	7:35 a. m.
Leave Las Vegas	2:25 p. m.	Leave Las Vegas	10:40 a. m.
Arrive Los Angeles	5:25 p. m.	Arrive Salt Lake City	1:45 p. m.

(Daily.)
Service began April 17, 1926.

CAM-5 Salt Lake City, Utah, via Boise, Idaho, to Pasco, Wash., 530 miles.

Contractor: **Walter T. Varney, Boise, Idaho.**
Compensation: $3.00 per pound.

Schedule:

Leave Salt Lake City	9:45 a. m.	Leave Pasco	6:00 a. m.
Leave Boise	1:15 p. m.	Leave Boise	9:20 a. m.
Arrive Pasco	4:35 p. m.	Arrive Salt Lake City	12:50 p. m.

(Daily.)

Service began April 6, 1926.

CAM-6 and 7 discontinued.

CAM-8 Seattle, Wash., via Tacoma, Vancouver, Wash., Portland and Medford, Ore., San Francisco, San Jose, Fresno and Bakersfield, Calif., to Los Angeles, Calif., 1,099 miles.

Contractor: **Pacific Air Transport, Inc., San Francisco, Calif.**
Compensation: $2.8125 per pound.

Schedule:

Leave Seattle	*11:45 p. m.	Leave Los Angeles	12:01 a. m.
Leave Tacoma	1:30 a. m.	Leave Bakersfield	1:30 a. m.
Leave Vancouver, Wash., Portland, Ore.	7:10 a. m.	Leave Fresno	3:00 a. m.
Leave Medford	9:30 a. m.	Leave San Francisco	5:00 a. m.
Leave San Francisco	1:15 p. m.	Leave Medford	9:00 a. m.
Leave Fresno	3:15 p. m.	Leave (Portland), (Vancouver)	11:30 a. m.
Leave Bakersfield	4:45 p. m.	Leave Tacoma	1:30 p. m.
Arrive Los Angeles	6:15 p. m.	Arrive Seattle	2:00 p. m.
Leave San Francisco	4:45 p. m.	Leave San Jose	6:15 a. m.
Arrive San Jose	5:10 p. m.	Arrive San Francisco	6:40 a. m.

*Dispatch is by train to Portland Field.

(Daily.)

Service began Sept. 15, 1926.

CAM-9 Chicago, Ill., via Milwaukee, Madison and LaCrosse, Wis., to St. Paul and Minneapolis, Minn., with a spur line from Milwaukee, Wis., via Fond du Lac, Oshkosh and Appleton, to Green Bay, Wis., 503 miles.

Contractor: **Northwest Airways, Inc., St. Paul, Minn.**
Compensation: $2.75 per pound.

Schedule:

Lv. Chicago	2:00 p. m.	5:50 a. m.	Lv. Minneapolis	8:30 a. m.	2:30 p. m.
Ar. Milwaukee		6:40 a. m.	Lv. St. Paul	8:40 a. m.	2:40 p. m.
Lv. Milwaukee		7:30 a. m.	Lv. LaCrosse		4:00 p. m.
Lv. Fond du Lac		8:10 a. m.	Lv. Madison		5:30 p. m.
Lv. Oshkosh		8:25 a. m.	Ar. Milwaukee		6:25 p. m.
Lv. Appleton		8:40 a. m.	Lv. Green Bay		3:45 p. m.
Ar. Green Bay		9:00 a. m.	Lv. Appleton		4:05 p. m.
Lv. Milwaukee		6:50 a. m.	Lv. Oshkosh		4:20 p. m.
Lv. Madison		7:40 a. m.	Lv. Fond du Lac		4:35 p. m.
Lv. LaCrosse		9:30 a. m.	Ar. Milwaukee		5:10 p. m.
Lv. St. Paul		11:30 a. m.	Lv. Milwaukee		6:35 p. m.
Ar. Minneapolis	6:10 p. m.	11:40 a. m.	Ar. Chicago	12:10 p. m.	7:30 p. m.

(Daily.)

Service began June 7, 1926.

CAM-11 Cleveland, Ohio, via Youngstown, Ohio, and McKeesport, Pa., to Pittsburgh, Pa., 123 miles.

Contractor: **Clifford Ball, McKeesport, Pa.**
Compensation: $3.00 per pound.

Schedule:

Leave Cleveland	12:15 p. m.	Leave Pittsburgh / Leave McKeesport	2:30 p. m.
Leave Youngstown	1:00 p. m.	Leave Youngstown	3:15 p. m.
Arrive McKeesport / Arrive Pittsburgh	1:45 p. m.	Arrive Cleveland	4:00 p. m.

(Daily.)

Service began April 21, 1927.

CAM-12 Cheyenne, Wyo., via Denver and Colorado Springs, Colo., to Pueblo, Colo., 199 miles.

Contractor: **Western Air Express, Inc., Los Angeles, Calif.**
Compensation: $0.83 per pound.

Schedule:

Leave Cheyenne	5:00 a. m.	Leave Pueblo	4:15 p. m.
Leave Denver	6:20 a. m.	Leave Colorado Springs .	4:50 p. m.
Leave Colorado Springs.	7:20 a. m.	Leave Denver	6:00 p. m.
Arrive Pueblo	7:45 a. m.	Arrive Cheyenne	7:00 p. m.

(Daily.)

Service began May 31, 1926.

CAM-16 Cleveland, via Akron, Columbus, Dayton and Cincinnati, Ohio, to Louisville, Ky., 339 miles.

Contractor: **Continental Air Lines, Inc., Cincinnati, Ohio.**
Compensation: $1.22 per pound.

Schedule:

Lv. Cleveland.	†12:45 p.m.	2:45 a.m.ET	Lv. Louisville .		6:00 p.m.CT
Lv. Akron	1:10 p.m.	3:20 a.m.ET	Lv. Cincinnati..		8:20 p.m.ET
Lv. Columbus .		4:40 a.m.ET	Lv. Dayton ...		9:00 p.m.ET
Lv. Dayton ...		5:25 a.m.ET	Lv. Columbus .		9:45 p.m.ET
Lv. Cincinnati.		6:05 a.m.ET	Lv. Akron ...	†3:45 p.m.	*11:05 p.m.ET
Ar. Louisville .		6:15 a.m.CT	Ar. Cleveland .	4:10 p.m.	11:30 p.m.ET

*Daily. †Daily except Sunday and holidays.

Service began August 1, 1928.

CAM-17 New York, N. Y., via Cleveland and Toledo, Ohio (Detroit, Mich.), to Chicago, Ill., 772 miles.

Contractor: **National Air Transport, Inc., Chicago, Ill.**
Compensation: $1.24 per pound.

Schedule:

Lv. New York (P.R.R. Sta.)	8:00 p. m.	11:00 a. m.	Lv. Chicago.	8:00 p. m.	8:00 a. m.
Lv. New Brunswick ..... (Hadley Field)	9:35 p. m.	12:15 p. m.	Lv. Detroit .	*10:05 p. m.	
Ar. Cleveland	2:15 a. m.	4:20 p. m.	Lv. Toledo .	10:50 p. m.	10:50 a. m.
Lv. Cleveland	2:30 a. m.	4:35 p. m.	Ar. Cleveland	12 Mid.	12 Noon
Lv. Toledo ..	3:20 a. m.	5:20 p. m.	Lv. Cleveland	12:15 a. m.	12:15 p. m.
Ar. Detroit ..	*5:30 a. m.		Ar. New Brunswick (Hadley Fld.)	4:45 a. m.	4:45 p. m.
Ar. Chicago .	5:35 a. m.	7:00 p. m.	Ar. New York (P.R.R.Sta.)	6:43 a. m.	6:40 p. m.

Daily. *Daily except Sunday.

Service began September 1, 1927.

CAM-18 Chicago, Ill., via Cedar Rapids, Iowa City and Des Moines, Iowa; Omaha, Lincoln and North Platte, Nebr.; Cheyenne and Rock Springs, Wyo.; Salt Lake City, Utah; Elko and Reno, Nev.; and Sacramento, to San Francisco, Calif., 1,918 miles.

Contractor: **Boeing Air Transport, Inc., Seattle, Wash.**
Compensation: $1.50 per pound.

Schedule:

	‡	*		†	*
Lv. Chicago .	5:45 a. m.	7:50 p. m.	Lv. San Francisco		7:00 a. m.
Lv. Iowa City		9:40 p. m.	Lv. Sacramento		7:45 a. m.
Lv. Cedar Rapids	8:00 a. m.		Ar. Reno		8:45 a. m.
Lv. Des Moines ...	9:00 a. m.		Lv. Reno		9:00 a. m.
Ar. Omaha ..	10:10 a. m.	12:20 a. m.	Lv. Elko		11:00 a. m.
Lv. Omaha ..	10:15 a. m.	12:35 a. m.	Ar. Salt Lake City		1:45 p. m.
Ar. Lincoln ..	10:45 a. m.		Lv. (Mt. Time)		3:00 p. m.
Ar. North Platte		2:50 a. m.	Lv. Rock Springs		
Lv. (Mt. Time)		2:00 a. m.	Ar. Cheyenne .		7:15 p. m.
Ar. Cheyenne .		4:30 a. m.	Lv. Cheyenne . (Central Time)		7:30 p. m.
Lv. Cheyenne .		4:45 a. m.	Lv. Lincoln ..	2:45 p. m.	
Lv. Rock Springs		7:05 a. m.	Ar. Omaha ..	3:10 p. m.	12:15 a. m.
Ar. Salt Lake City		10:00 a. m.	Lv. Omaha ..	3:15 p. m.	12:30 a. m.
Lv. (Pac. Time)		9:20 a. m.	Lv. Des Moines ...	4:30 p. m.	1:30 a. m.
Lv. Elko		11:15 a. m.	Lv. Cedar Rapids	5:30 p. m.	
Ar. Reno		1:30 p. m.	Lv. Iowa City..		
Lv. Reno		1:45 p. m.	Ar. Chicago .	7:30 p. m.	5:45 a. m.
Ar. Sacramento		2:45 p. m.			
Ar. San Francisco		4:30 p. m.			

‡Daily except Sunday, Monday, holidays and days after holidays.
*Daily.
†Daily except Saturday, Sunday, holidays, and days before holidays.

Service began July 1, 1927.

CAM-19 New York, N. Y., via Philadelphia, Pa., Washington, D. C., Richmond, Va., Greensboro, N. C., and Spartanburg, S. C., to Atlanta, Ga., 763 miles.

Contractor: **Pitcairn Aviation, Inc., Philadelphia, Pa.**
Compensation: $3.00 per pound.

Schedule:

Lv. New York	5:00 a. m.	9:40 p. m.	Lv. Atlanta ..	8:00 p. m.	
Lv. Philadelphia	5:35 a. m.	10:24 p. m.	Lv. Spartanburg	9:50 p. m.	
Lv. Washington		11:45 p. m.	Lv. Winston-Salem, Greensboro	11:21 p. m.	
Lv. Richmond .		1:02 a. m.	Lv. Richmond	1:28 a. m.	
Lv. Winston-Salem, Greensboro		2:59 a. m.	Lv. Washington	2:35 a. m.	
Lv. Spartanburg		4:32 a. m.	Lv. Philadelphia	3:56 a. m.	8:30 p.m.
Ar. Atlanta ..		6:17 a. m.	Ar. New York	4:35 a. m.	9:05 p. m.

(Daily except Sundays and holidays.)
Service began May 1, 1928.

CAM-20 Albany, N. Y., via Schenectady, Utica, Rome, Syracuse, Rochester, Buffalo, N. Y., to Cleveland, Ohio, 443 miles.

Contractor: **Colonial Western Airways, Inc., New York, N. Y.**
Compensation: $1.11 per pound.

Schedule:

Lv. Albany	10:10 a. m.	Lv. Cleveland	12:20 p. m.
Lv. Schenectady	10:25 a. m.	Lv. Buffalo	2:50 p. m.
Lv. Utica-Rome	11:20 a. m.	Lv. Rochester	3:40 p. m.
Lv. Syracuse	11:50 a. m.	Lv. Syracuse	4:35 p. m.
Lv. Rochester	12:55 p. m.	Lv. Rome-Utica	5:15 p. m.
Lv. Buffalo	1:55 p. m.	Lv. Schenectady	6:05 p. m.
Ar. Cleveland	4:15 p. m.	Ar. Albany	6:15 p. m.

(Daily except Sunday.)
Service began December 17, 1927.

CAM-21 Dallas, via Fort Worth, Waco, Houston, to Galveston, Texas, 320 miles.

Contractor: **Texas Air Transport, Inc., Fort Worth, Texas.**
Compensation: $2.89 per pound.

Schedule:

Lv. Dallas	7:45 a. m.	Lv. Galveston	4:00 p. m.
Lv. Fort Worth	8:15 a. m.	Lv. Houston	4:45 p. m.
Lv. Waco	9:20 a. m.	Lv. Waco	6:15 p. m.
Lv. Houston	10:50 a. m.	Lv. Fort Worth	7:15 p. m.
Ar. Galveston	11:30 a. m.	Ar. Dallas	7:37 p. m.

(Daily.)
Service began February 6, 1928.

CAM-22 Dallas, via Fort Worth, Waco, Austin, to San Antonio and Laredo, Texas, 417 miles.

Contractor: **Texas Air Transport, Inc., Fort Worth, Texas.**
Compensation: $2.89 per pound.

Schedule:

Lv. Dallas	7:45 a. m.	Lv. Laredo	2:35 p. m.
Lv. Fort Worth	8:15 a. m.	Lv. San Antonio	4:15 p. m.
Lv. Waco	9:20 a. m.	Lv. Austin	5:10 p. m.
Lv. Austin	10:25 a. m.	Lv. Waco	6:15 p. m.
Lv. San Antonio	11:20 a. m.	Lv. Fort Worth	7:15 p. m.
Ar. Laredo	12:55 p. m.	Ar. Dallas	7:35 p. m.

(Daily.)
Service began February 6, 1928.

CAM-23 Atlanta, Ga., via Birmingham and Mobile, Ala., to New Orleans, La., 479 miles.

Contractor: **St. Tammany Gulf Coast Airways, Inc., New Orleans, La.**
Compensation: $1.75 per pound.

Schedule:

Lv. Atlanta	*5:30 a. m.	Lv. New Orleans	†1:00 p. m.
Lv. Birmingham	7:10 a. m.	Lv. Mobile	2:35 p. m.
Lv. Mobile	9:30 a. m.	Lv. Birmingham	4:55 p. m.
Ar. New Orleans	11:00 a. m.	Ar. Atlanta	6:30 p. m.

*Daily except Mondays and days after holidays.
†Daily except Sunday and holidays.

Service began May 1, 1928.

CAM-24 Chicago, Ill., via Indianapolis, Ind., to Cincinnati, Ohio, 270 miles.

Contractor: **Embry-Riddle Company, Cincinnati, Ohio.**
Compensation: $1.47 per pound.

Schedule:

Lv. Chicago	6:00 a. m. CT	Lv. Cincinnati	3:45 p. m. ET
Lv. Indianapolis	7:55 a. m. CT	Lv. Indianapolis	4:00 p. m. CT
Ar. Cincinnati	10:00 a. m. ET	Ar. Chicago	5:45 p. m. CT

(Daily.)

Service began December 17, 1927.

CAM-25 Atlanta, Ga., via Jacksonville, to Miami, Fla., 595 miles.

Contractor: **Pitcairn Aviation, Inc., Philadelphia, Pa.**
Compensation: $1.46 per pound.

Schedule:

Lv. Atlanta	*6:45 a. m.	Lv. Miami	†11:05 a. m.
Lv. Jacksonville	9:55 a. m.	Lv. Jacksonville	2:50 p. m.
Ar. Miami	1:30 p. m.	Ar. Atlanta	5:30 p. m.

*Daily except Monday and days after holidays.
†Daily except Sunday and holidays.

Service began December 1, 1928.

CAM-26 Great Falls, via Helena and Butte, Mont., Pocatello, Idaho, and Ogden, Utah, to Salt Lake City, Utah, 493 miles.

Contractor: **National Parks Airways, Inc., Salt Lake City, Utah.**
Compensation: $2.475 per pound.

Schedule:

Lv. Great Falls	8:30 a. m.	Lv. Salt Lake City	10:20 a. m.
Lv. Helena	9:25 a. m.	Lv. Ogden	10:50 a. m.
Lv. Butte	10:10 a. m.	Lv. Pocatello	12:40 p. m.
Lv. Pocatello	12:45 p. m.	Lv. Butte	3:00 p. m.
Lv. Ogden	2:05 p. m.	Lv. Helena	3:45 p. m.
Ar. Salt Lake City	2:25 p. m.	Ar. Great Falls	4:30 p. m.

(Daily.)

Service began June 30, 1928.

CAM-27 Bay City, via Saginaw, Flint and Lansing, to Kalamazoo, Mich.; Pontiac, via Detroit, Ann Arbor, Jackson and Battle Creek to Kalamazoo, Mich.; Muskegon, via Grand Rapids, to Kalamazoo, Mich.; and from Kalamazoo, Mich., via South Bend, Ind., to Chicago, Ill., 522 miles.

Contractor: **Thompson Aeronautical Corporation, Kalamazoo, Mich.**
Compensation: $0.89 per pound.

Schedule:

Lv. Bay City	3:50 p. m. ET	Lv. Chicago	7:15 a. m. CT
Lv. Saginaw	4:00 p. m. ET	Lv. South Bend	8:10 a. m. CT
Lv. Flint	4:30 p. m. ET	Ar. Kalamazoo	8:50 a. m. CT
Lv. Lansing	5:10 p. m. ET		
Ar. Kalamazoo	5:00 p. m. CT	Lv. Kalamazoo	8.55 a. m. CT
		Lv. Grand Rapids	9:35 a. m. CT
Lv. Pontiac	3:45 p. m. ET	Ar. Muskegon	9:55 a. m. CT
Lv. Detroit / Lv. Dearborn	4:05 p. m. ET	Lv. Kalamazoo	8:55 a. m. CT
		Lv. Battle Creek	10:15 a. m. ET
Lv. Ann Arbor	4:30 p. m. ET	Lv. Jackson	10:45 a. m. ET
Lv. Jackson	5:10 p. m. ET	Lv. Ann Arbor	11:15 a. m. ET
Lv. Battle Creek	5:40 p. m. ET	Lv. Detroit / Lv. Dearborn	11:40 a. m. ET
Ar. Kalamazoo	5:00 p. m. CT	Ar. Pontiac	12:00 m. ET
Lv. Muskegon	4:05 p. m. CT		
Lv. Grand Rapids	4:25 p. m. CT	Lv. Kalamazoo	8:55 a. m. CT
Ar. Kalamazoo	5:00 p. m. CT	Lv. Lansing	10:40 a. m. ET
		Lv. Flint	11:25 a. m. ET
Lv. Kalamazoo	5:05 p. m. CT	Lv. Saginaw	11:55 a. m. ET
Lv. South Bend	6:25 p. m. CT	Ar. Bay City	12:05 p. m. ET
Ar. Chicago	7:20 p. m. CT		

(Daily.)

Service began July 17, 1928.

CAM-30 Chicago, Ill., via Terra Haute and Evansville, Ind.; Nashville and Chattanooga, Tenn.; to Atlanta, Ga., and with a spur line, Evansville, Ind., to St. Louis, Mo., 790 miles.

Contractor: **Interstate Air Lines, Inc., Chicago, Ill.**
Compensation: $0.78 per pound.

Schedule:

Lv. Chicago	9:00 a. m.	Lv. Atlanta	9:25 a. m.
Lv. Terre Haute	11:05 a. m.	Lv. Chattanooga	10:30 a. m.
Ar. Evansville	12:05 p. m.	Lv. Nashville	11:35 a. m.
Lv. St. Louis	10:30 a. m.	Ar. Evansville	1:00 p. m.
Ar. Evansville	12:05 p. m.	Lv. Evansville	1:10 p. m.
Lv. Evansville	12:20 p. m.	Ar. St. Louis	3:00 p. m.
Lv. Nashville	1:50 p. m.	Lv. Evansville	1:30 p. m.
Lv. Chattanooga	3:15 p. m.	Lv. Terre Haute	2:20 p. m.
Ar. Atlanta	4:30 p. m.	Ar. Chicago	4:30 p. m.

(Daily.)

Service began November 19, 1928.

Operators Under Contract and Scheduled to Begin Operations in 1929

CAM-28 St. Louis, via Kansas City, Mo., to Omaha, Nebr., 395 miles.

Contractor: **Robertson Aircraft Corp., Anglum, Mo.**
Compensation: $0.785 per pound.

Schedule: (Not yet worked out but will connect at Omaha with transcontinental route.)

CAM 29 New Orleans, La., via Houston, to either San Antonio, Laredo, or Brownsville, Texas, 550 miles. (Operating from New Orleans, La., via Beaumont, Texas, to Houston, Texas, effective January 23, 1929.)

Contractor: **St. Tammany Gulf Coast Airways, Inc., New Orleans, La.**
Compensation: $1.00 per pound.

Schedule: (From New Orleans to Houston only.)

Lv. New Orleans	*11:30 a. m.	Lv. Houston	†8:45 a. m.
Lv. Beaumont	2:25 p. m.	Lv. Beaumont	9:40 a. m.
Ar. Houston	3:15 p. m.	Ar. New Orleans	12:30 p. m.

*Daily except Monday and days after holidays.
†Daily except Sunday and holidays.

Service began January 23, 1929.

U. S. Air Mail Service to Foreign Countries During 1928

At the beginning of the year 1928 three Foreign Air Mail Routes were in operation. Two of these were for connection with incoming and outgoing steamers at New Orleans, La., and Seattle, Wash. The other was from Key West, Fla., to Havana, Cuba. Effective September 15, the terminus of the last named route was changed to Miami, Fla., and mails dispatched from both Key West and Miami until December 4, after which date all dispatches were made from Miami. One new foreign air mail route was put into operation during the year, from New York, via Albany, to Montreal, Canada. Service started October 1, 1928.

F. A. M. Routes in Operation in 1928

Seattle, Wash., to Victoria, B. C.
New Orleans, La., to Pilottown, La.
Miami and Key West, Fla., to Havana, Cuba.
(January 1 to September 15 operated from Key West.)
New York via Albany to Montreal, Canada.
(Began operations October 1, 1928.)

F. A. M. Routes Under Contract to Begin in 1929

Miami to Nassau, Bahamas.
Miami via Havana, Cuba; Merida, Mexico; Belize, British Honduras; Tegucigalpa, Honduras; Managua, Nicaragua; San Jose, Costa Rica; to Cristobal, Canal Zone, and return.
Miami via Havana, Santa Clara, Camaguey and Santiago, Cuba; Port au Prince, Haiti; Santo Domingo, D. R. to San Juan, P. R., and return.
(Pan-American Airways, Inc., contractor on all three routes. Rate, $2.00 per mile.)

F. A. M. Routes Projected for 1929

From Brownsville, Texas, to Vera Cruz or Mexico City, Mexico.
From Cristobal, Canal Zone, via Buenaventura and Tumaco, Colombia; Esmeraldas and Guayaquil, Equador; Talara, Truxillo, Lima; Lomas and Mollendo, Peru; Caldera, Iquique, Antofagasta and Coquimbo to Santiago, Chile.

Total Weight of Air Mail on F. A. M. Routes in 1928

	Lbs.		*Lbs.*
January	34,777	July	37,184
February	31,755	August	36,900
March	42,483	September	38,779
April	39,670	October	59,824
May	38,419	November	55,768
June	38,739	December	62,953

F. A. M. Routes in Operation in 1928

ROUTE NO. F. A. M. 2

Seattle, Washington, to Victoria, B. C., and Return
Length of Route, 84 Miles One Way

Month	*Contractor*	*No. of trips per month Round trips*	*Weight of mails carried lbs.*	*Contract rate of payment per round trip*	*Compensation*
January	Northwest Air Service, Inc.	11	3,511	$190.00	$2,090.00
February	Northwest Air Service, Inc.	10	4,681	190.00	1,900.00
March	Northwest Air Service, Inc.	15	5,905	190.00	2,850.00
April	Northwest Air Service, Inc.	9	4,305	190.00	1,710.00
May	Northwest Air Service, Inc.	14	5,100	190.00	2,660.00
June	Northwest Air Service, Inc.	13	5,619	190.00	2,470.00
July	Barnes & Gorst Air Lines, Inc.	14	3,949	142.50	1,995.00
August	Barnes & Gorst Air Lines, Inc.	11	3,536	142.50	1,567.50
September	Barnes & Gorst Air Lines, Inc.	12½	4,603	142.50	1,781.25
October	Barnes & Gorst Air Lines, Inc.	10	4,793	142.50	1,425.00
November	Barnes & Gorst Air Lines, Inc.	14	6,182	142.50	1,995.00
December	Barnes & Gorst Air Lines, Inc.	14	6,442	142.50	1,995.00

No regular schedule.
Planes dispatched by postmaster at Seattle to connect with incoming and outgoing steamers.

New Orleans to Pilottown, Louisiana, and Return
Length of Route, 75 Miles One Way

Month	*Contractor*	*No. of trips per month Round trips*	*Weight of mails carried lbs.*	*Contract rate of payment per round trip*	*Compensation*
January	Arthur E. Cambas	29	7,873	$110.00	$3,190.00
February	Arthur E. Cambas	20	4,569	110.00	2,200.00
March	Arthur E. Cambas	27	7,272	110.00	2,970.00
April	Arthur E. Cambas	26	5,069	110.00	2,860.00
May	Arthur E. Cambas	28	5,645	110.00	3,080.00
June	Arthur E. Cambas	34	7,154	110.00	3,740.00
July	Arthur E. Cambas	32	6,700	75.00	2,400 00
August	Arthur E. Cambas	36	7,103	75.00	2,700.00
September	Arthur E. Cambas	29	6,055	75.00	2,175.00
October	Arthur E. Cambas	43	10,001	75.00	3,225.00
November	Arthur E. Cambas	35	6,637	75.00	2,625.00
December	Arthur E. Cambas	31½	6,628	75.00	2,384.00

No regular schedule.
Planes dispatched by postmaster at New Orleans to connect with incoming and outgoing steamers.

Miami and Key West to Havana—One Way

Prior to September 15th this route operated from Key West to Havana. Length of route from Key West, 113.5 miles; from Miami, 261 miles.

Month	*Contractor*	*No. of trips per month Round trips*	*Weight of mails carried lbs.*	*Contract rate of payment per pound*	*Compensation*
January	Pan-American Airways, Inc.	31	23,393	$.405	$ 9,474.17
February	Pan-American Airways, Inc.	29	22,505	.405	9,114.53
March	Pan-American Airways, Inc.	31	29,306	.405	11,868.93
April	Pan-American Airways, Inc.	30	30,296	.405	12,269.88
May	Pan-American Airways, Inc.	31	27,674	.405	11,207.97
June	Pan-American Airways, Inc.	30	25,966	.405	10,516.23
				Per mile	
July	Pan-American Airways, Inc.	31	26,535	$2.00	7,037.00
August	Pan-American Airways, Inc.	31	26,261	2.00	7,037.00
September	Pan-American Airways, Inc.	29	28,031	2.00	10,418.00
October	Pan-American Airways, Inc.	31	34,610	2.00	16,182.00
November	Pan-American Airways, Inc.	30	33,340	2.00	15,660.00
December	Pan-American Airways, Inc.	49	37,809	2.00	25,578.00

Daily.

New York Via Albany to Montreal, Canada
Service Began Oct. 1, 1928

Length of route, 346 miles.

Month	*Contractor*	*No. of trips per month Round trips*	*Weight of mails carried lbs.*	*Contract rate of payment per pound Per mile*	*Compensation*
October	Canadian Colonial Airways, Inc.	26	10,420	96c	$8,605.44
November	Canadian Colonial Airways, Inc.	21	9,609	96c	6,975.36
December	Canadian Colonial Airways, Inc.	25	12,074	96c	7,480.32

Daily except Sunday.

AMENDMENT TO AIR MAIL ACT

(Public—No. 410—70th Congress) (H. R. 8337)

An Act to amend the Air Mail Act of Feb. 2, 1925, as amended by the Act of June 3, 1926.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section 3 of the Air Mail Act of Feb. 2, 1925 (United States Code, Title 39, section 463), as amended by the Act of June 3, 1926, is hereby amended to read as follows:

"Sec. 3. That the rates of postage on air mail shall not be less than 5 cents for each ounce or fraction thereof."

Sec. 2. That after section 5 of said Act (United States Code, Title 39, section 465) a new section shall be added as follows:

"Sec. 6. That the Postmaster General may by negotiation with an air mail contractor who has satisfactorily operated under the authority of this Act for a period of two years or more, arrange, with the consent of the surety for the contractor and the continuation of the obligation of the surety during the existence or life of the certificate provided for hereinafter, for the surrender of the contract and the substitution therefore of an air mail route certificate, which shall be issued by the Postmaster General in the name of such air mail contractor, and which shall provide that the holder shall have the right of carriage of air mail over the route set out in the certificate so long as he complies with such rules, regulations, and orders as shall from time to time be issued by the Postmaster General for meeting the needs of the Postal Service and adjusting air mail operations to the advances in the art of flying: Provided, That such certificate shall be for a period not exceeding ten years from the beginning of carrying mail under the contract. Said certificate may be canceled at any time for willful neglect on the part of the holder to carry out such rules, regulations, or orders; notice of such intended cancelation to be given in writing by the Postmaster General and sixty days provided to the holder in which to answer such written notice of the Postmaster General. The rate of compensation to the holder of such an air mail route certificate shall be determined by periodical negotiation between the certificate holder and the Postmaster General, but shall never exceed the rate of compensation provided for in the original contract of the air mail route certificate holder."

Approved May 17, 1928.

AIRCRAFT APPROPRIATIONS, UNITED STATES

1922-1929

			Total	Increase or Decrease	Net
1922–23	Army	12,895,000		†6,305,000	
	Navy	14,683,590		*1,270,159	
	Air Mail	1,900,000		*650,000	
	N.A.C.A.	210,000	29,688,590	*10,000	
1923–24	Army	12,426,000		†469,000	†4,347,841
	Navy	14,647,174		†36,416	
	Air Mail	1,500,000		†400,000	
	N.A.C.A.	283,000	28,856,174	*73,000	
1924–25	Army	14,113,043.80		*1,687,043.80	†832,416
	Navy	15,150,000		*502,826	
	Air Mail	2,750,000		*1,250,000	
	N.A.C.A.	470,000	32,483,043.80	*187,000	
1925–26	Army	14,700,000**		*586,956.20	*3,626,869.80
	Navy	14,790,000‡		†360,000	
	Air Mail	2,810,000††		†150,000	
	N.A.C.A.	534,000	32,624,000	*64,000	
1926–27	Army	15,050,000		*350,000	*350,956.20
	Navy	18,505,288		*3,715,288	
	Air Mail	2,650,000††		†160,000	
	N.A.C.A.	513,000	36,718,288***	†21,000	
1927–28	Army	20,396,300		*5,346,300	*3,884,288
	Navy	20,100,000		*1,594,712	
	N.A.C.A.	513,000			
	Commerce	3,791,500	44,787,800	*3,291,500	*10,219,512
1928–29	Army	24,848,562(1)		*4,452,262	[illegible]
	Navy	32,189,560(2)		*12,089,560	
	N.A.C.A.	600,000		*87,000	
	Commerce	4,361,850	61,999,972	*570,350	*17,199,172

(1) And contract authorization of $5,000,000.
(2) And contract authorization of $10,000,000.
*Increase over preceding year.
†Decrease from preceding year.
**Plus $2,150,000 "contract authorizations" for additional purchases of aircraft.
‡Plus $4,100,000 "contract authorizations" for additional purchases of aircraft.
***Plus $6,250,000 "contract authorizations" for additional purchases of aircraft.
††For the contract Air Mail Service $500,000 was appropriated for 1926 and $2,000,000 was allowed for 1927.

Note—Budget estimates for the fiscal year 1929-30 recommended for the Army, $33,578,683; Navy, $31,645,420 [and contract authorization of $10,000,000] National Advisory Committee for Aeronautics $1,292,200; and Department of Commerce $6,393,620. Total estimated amount $72,909,923.

AIR TRANSPORT ROUTES IN THE UNITED STATES

Dec. 31, 1928

Airway	Route Miles	Service†	Schedule	Commenced	Operator
New York-Boston*	219	MPE	6 d. a wk.	7/ 1/26	Colonial Air Trans.
St. Louis-Chicago*	268	MPE	5 t. wkly (d & n)	4/15/26	Robertson Aero. Corp.
Dallas-Chicago*	995	ME	Nightly	5/ 2/26	National Air Trans.
Kansas City - Chicago (454 m.)*	...	ME	Daily	2/ 1/28	National Air Trans.
Kansas City - Wichita (173 m.)	...	P	Daily	.....	Wichita A. S. Prov. Co.
Tulsa-Ponca City*	72	ME	Daily	7/ 5/28	National Air Trans.
Tulsa-Ponca City (72 m.)	...	P	Daily	.....	Paul R. Braniff, Inc.
Los Angeles-Salt Lake City*	633	MPE	Daily	4/17/26	Western Air Express
Salt Lake City-Pasco	540	M	Daily	4/ 6/26	Walter T. Varney
Los Angeles-Seattle*	1,080	MPE	Daily	9/15/26	Pacific Air Trans.
Los Angeles - Oakland (378 m.)	...	PE	Daily	6/../28	Mutual Aero. Corp.
Los Angeles-S. Fran. (378 m.)	...	P	Daily	4/14/28	Maddux Air Lines

Airway	*Route Miles*	*Service†*	*Schedule*	*Commenced*	*Operator*
Los Angeles-S. Fran. (378 m.)*	...	PE	Daily	5/26/28	Western Air Express
Sacramento-San Fran. (88 m.)	...	P	Daily	.....	Union Air Lines
S. Francisco-Portland (549 m.)	...	PE	3 d. a wk.	3/ 5/28	Union Air Lines
Portland-Seattle (153 m.)	...	PE	2 t. dly.	3/ 5/28	Union Air Lines
Oakland-San Jose	38	MPE	Daily	12/ 3/28	Pacific Air Transport
Chicago-Mpls./St. Paul*	399	MPE	2 t. dly.	6 /7/26	Northwest Awys.
Chgo.-Mpls./St. Paul (399 m.)	...	P	Daily	7/ 1/28	Universal Air Lines
Chicago-Madison (120 m.)	...	P	Daily	7/19/28	Royal Airways
Milwaukee-Green Bay..	120	MPE	Daily	12/15/28	Northwest Aways.
Pittsburgh-Cleveland* ..	121	MPE	Daily	4/21/27	Clifford Ball
Pueblo Cheyenne*	200	MPE	Daily	5/31/26	Western Air Express
Louisville-Cleveland ...	345	MP	Nightly	8/ 1/28	Continental Air Lines
Chicago-New York*....	723	ME	Dly & Nly	7/ 1/19	National Air Trans.
Chgo.-Cleve. (313 m.)	...	P	Daily	9/15/28	Universal Air Trans.
Toledo-Detroit	54	ME	Nightly	8/ 1/28	National Air Trans.
San Fran.-Chicago*.....	1,949	MPE	Daily	9/ 8/20	Boeing Air Trans.
Lincoln-Chgo. (482 m.)*	353	MPE	Daily	7/10/28	Boeing Air Trans.
Atlanta-New York	763	M	Dly ex Sun.	5/ 1/28	Pitcairn Aviation
Wash.-New York ...	201	P	Daily	6/15/28	U. S. Air Trans.
Cleveland-Albany	445	MP	Daily ex Sun.	12/17/27	Colonial Wn. Aways.
Laredo-Dallas	423	MP	Daily	2/ 6/28	Texas Air Trans.
Galveston-Dallas	308	MP	Daily	2/ 6/28	Texas Air Trans.
New Orleans-Atlanta...	483	MP	Daily ex Sun.	5/ 1/28	St. Tam. Gulf Coast
Cincinnati-Chicago*	267	MPE	Daily	12/17/27	Embry-Riddle Co.
Salt Lake City-Gt. Falls	489	MP	Daily	8/ 1/28	National Parks Awys.
Chgo.-M'kegon-Bay City-Pontiac	521	M	Daily	7/17/28	Thompson Aerial Corp.
Miami-Atlanta	622	M	Daily	12/ 1/28	Pitcairn Aviation
Atlanta-Chicago	623	M	Daily	12/ 1/28	Interstate Air Lines
Agua Caliente-San Diego	14	P	Daily	7/ 4/28	Maddux Air Lines
San Bernardino - Palm Springs	47	P	Daily	11/15/28	Maddux Air Lines
Detroit-Cleveland	155	P	Dly ex Sun.	9/ 1/27	Stout Air Service
Detroit-Chicago	252	E	6 d. a wk.	2/15/26	Ford Motor Co.
Detr't-Chgo. (252 m.)	...	P	Dly ex Sun.	11/ 1/28	Stout Air Services
Detroit-Buffalo	218	E	6 d. a wk.	3/28/27	Ford Motor Co.
San Diego-Los Angeles.	115	P	Daily	11/ 1/27	Maddux Air Lines
Los Angeles-Tucson....	440	PE	3 d. a wk.	11/28/27	Standard Air Lines
Wilmington-Avalon	32	PE	2 t. dly.	6/../22	Western Air Express
Minneapolis-Fargo	218	P	Daily	8/ 1/28	Universal Air Lines
Minneapolis-Duluth	138	P	Daily	8/ 1/28	Universal Air Lines
Tulsa-Oklahoma City...	98	P	Daily	6/../28	Paul Braniff
Tulsa-Okmulgee	37	P	Daily	6/../28	Paul Braniff
Portland-Yakima	108	PE	Dly ex Sun.	.....	Rankin Flying Service
Evansville-St. Louis....	145	MP	Daily	12/ 1/28	Interstate Air Lines
St. Louis-Kansas City..	225	P	Daily	.....	Robertson Airo. Corp.
Seattle-Victoria	77	MP	Variable	10/15/20	Barnes & Gorst
Pilottown-New Orleans.	75	M	Variable	4/ 9/23	N. O. Air Lines
Havana-Miami	261	MP	Daily	10/28/27	Pan Am. Airways
New York-Montreal ...	334	MP	6 t. wkly.	10/ 1/28	Can. Colonial A. T.
Miami-Nassau	187	MP	3 t. wkly.	11/ 9/28	Pan Amer. Airways
Seattle-Vancouver	143	P	Daily	.....	Commercial A. T.
K. West-S. Juan, P. R..	1,260	MP	3 t. wkly.	1/ 9/29	Pan American Airways
Cristobal, C. Z.-K. West.	1,640	M	2 t. mthly.	1/11/29	Pan American Airways

*These routes carry express under contract with the American Railway Express Co.
†M=Mail, P=Passengers, E=Express.

Routes Scheduled

Airway	*Miles*	*Service*	*Operator*
Laredo-New Orleans	615	M	St. Tam. Gulf Coast Awys.
St. Louis-Omaha	401	M	Robertson Aero. Corp.
Columbus-Los. Ang. (1,744 m.)	1,331	P	Transcontinental A. T.

Miles of Airways Operating Dec. 31st, 1928	19,254
Miles of Mail Airways Operating	17,055
Miles or Mail Airways Scheduled for early operation	1,016
Miles All Airways Operating or Scheduled	21,331
Miles Scheduled Daily with Mail, average	29,164
Miles Scheduled Daily. All Services, average	40,061

AIRWAY MARKING AND LIGHTING IN 1928

Compiled by Aeronautics Branch, Department of Commerce

	Miles	Fields Lighted	Boundry Lights		Obstruction Lights		Acreage		Beacons		Private Aero. Lights	Weather Stations			Radio Stations		Caretakers & Attendants		Telephones	Mechanicians	Service Trucks
			Total	Per Field	Total	Per Field	Total	Per Field	24" Revolving Number	Flashing Number		Upper A W.E.A. B.	Airways W.E.A. B.C.	Airways AIR DIV.	Comm. Station	Beacon	Field	Beacon			
New York—Boston	219	3	65	21.7	56	18.7	110	36.7	20	4	1	2	1	1	1	1	3	2	17	1	1
Atlanta—New York	769	20	453	22.6	222	11.1	1045	52.3	78	3	7	3	10	5	2	1	19	55	54	5	5
Chicago—New York	713	39	770	20.	91	2.3	2031	47.2	86	35	5	4	..	11	5	1	33	24	32	4	4
Cleveland—Detroit	134	1	30	30.0	3	3.0	107	107.	8	..	..	1	..	..	1	..	..	..	..	1	1
St. Louis—Chicago	268	9	198	22.0	..	..	360	40.	24	1	..	2	..	..	1	..	9	15	18	2	2
Dallas—Kansas City	541	14	306	21.9	67	4.8	659	47.1	47	30	..	1	5	4	..	..	14	33	14	3	3
Kansas City—Chicago	454	8	197	24.6	58	7.2	291	36.4	28	5	..	3	1	4	1	..	8	20	18	2	2
Omaha—Chicago	430	16	296	18.5	26	1.6	887	55.4	32	167	..	2	1	5	3	..	16	16	32	2	2
Chicago—Twin Cities (Chicago-LaCrosse Sec.)	357	6	158	26.3	28	4.7	323	35.9	30	2	..	2	..	..	1	..	6	24	27	2	2
Pueblo—Cheyenne	200	6	151	25.2	48	8.0	650	108.3	16	9	..	..	3	..	1	..	3	14	1	1	1
Salt Lake City—Omaha	898	33	543	16.5	0	0.0	2746	83.2	59	226	..	2	1	15	5	..	28	18	33	5	5
Salt Lake City—Pasco (Boise—Pasco Sec.)	240	7	117	16.7	68	9.7	370	52.9	24	20	..	1	6	..	3	..	..	1	5	1	1
Los Angeles—Salt Lake City (Los Angeles—Apex Sec.)	278	7	140	20.0	29	4.1	679	97.	21	7	3	2	4	1	1	..	6	9	1	1	1
Los Angeles—San Francisco	378	8	169	22.9	31	3.9	701	87.6	31	4	3	2	4	3	1	..	7	5	3	2	2
Tulsa—Ponca City	76	2	..	..	..	..	141	70.5	2	20	..	..	..	..	..	..	..	..	..	..	..
Louisville—Cleveland	345	9	..	..	..	..	440	48.8	30	1	..	..	..	..	..	..	..	..	..	..	..
San Francisco—Salt Lake City	690	22	..	..	..	..	2475	..	54	74	..	..	..	..	..	..	..	..	..	..	..
(Parron ————)	150	1	..	..	..		115	...	1	27	..	..	..	..	..	..	..	..	..	..	..
San Francisco—Redding	210	3	..	..	..	..	244	81.3	17	..	..	..	..	..	..	..	..	..	..	..	..
Los Angeles—Salt Lake City	386	13	..	..	..	..	2218	170.6	20	75	..	..	..	..	..	..	..	..	..	..	..
New Orleans—Atlanta	216	6	..	..	..	..	243	40.5	21	5	..	..	..	..	..	..	..	..	..	..	..
Cincinnati—Chicago	272	6	..	..	..	..	..	..	26	..	..	..	..	..	..	..	..	..	..	..	..
Kansas City—Omaha	159	3	..	..	..	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..
S. Bend—Kalamazoo	46	1	..	..	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..
La Crosse—Twin Cities	124	3	..	..	..	..	..	..	11	3	..	..	..	..	..	..	..	..	..	..	..
Cleveland—Buffalo	198	5	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..
Buffalo—Albany	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Jacksonville—Atlanta	281	7	..	..	..	..	..	..	28	..	..	..	..	..	..	..	..	..	..	..	..
Burley—Boise	150	3	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..
Salt Lake City—Burley	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kansas City—St. Louis	228	7	..	..	..	..	..	..	21	..	..	..	..	..	..	..	..	..	..	..	..
St. Louis—Evansville	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Portland—Seattle	157	1	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..
Roseburg—Portland	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Redding—Roseburg	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Atlanta—Evansville	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Evansville—Chicago	337	5	..	..	..	..	..	..	15	1	..	..	..	..	..	..	..	..	..	..	..
New York—Albany	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

AIRPORTS AND LANDING FIELDS IN THE UNITED STATES ON DEC. 31, 1928

Listed by Aeronautics Branch, Department of Commerce

The following is a list of airports, Department of Commerce intermediate and marked auxiliary landing fields in the United States, with their classification. There are included only those sites which are marked and have more or less facilities or which have been marked and reserved as landing fields without facilities.

Fields marked (*) are intermediate fields along airways, marked and lighted by the Department of Commerce.

Airports marked (†) are equipped with beacon lights or partial or full equipment of flood lights for landing, flood-lighted buildings, boundary lights, danger lights, etc.

There are of record more than 4,000 other fields in the United States on which landings may be made—owned by the States, municipalities, corporations, clubs, commissions, and individuals. Many of these are constantly changing in character with the alternation of crops and for other reasons which make a permanent record of variable value.

Alabama

*Anniston, intermediate.
Anniston, Reilly Field, Air Corps.
Atmore, commercial.
Birmingham, Roberts Field, municipal.
Birmingham, commercial.
Citronelle, commercial.
*Cropwell, intermediate.
Gulfcrest, commercial.
Mobile, Mobile Airport, municipal.
Montgomery, Maxwell Field, Air Corps.
*Plantersville, intermediate.
*Tallapoosa, intermediate.
Tuscaloosa, municipal.

Arizona

Ajo, auxiliary.
Apache Pass, auxiliary.
Bellemont, auxiliary.
Benson, municipal.
Casa Grande, municipal.
Cochise, municipal.
Douglas, auxiliary.
Eloy, municipal.
Flagstaff, municipal.
Fort Huachuca, auxiliary.
Gila Bend, municipal.
Grand Canyon, commercial.
Holbrook, municipal.
Kingman, municipal.
Marana, municipal.
Maricopa, municipal.
Mobile, auxiliary.
Nogales, municipal.
Phoenix, municipal.
Phoenix, State Fairgrounds, auxiliary.
Prescott, municipal.
Quartzite, commercial.
Salome, auxiliary.
San Simon, municipal.
Seligman, auxiliary.
Stoval, municipal.
†Tucson, municipal.
Vail, municipal.
Wellton, municipal.
Williams, municipal.
Winslow, Berrigen Field, municipal.
Winslow, race track, auxiliary.
Yuma, municipal.

Arkansas

Bentonville, municipal.
Conway, commercial.
El Dorado, auxiliary.
Fort Smith, commercial.
Hot Springs, municipal.
Lake Village, commercial.
†Little Rock, Army.
Little Rock, commercial.
Lonoke, auxiliary.
Monticello, municipal.
Newport, auxiliary.
Ogden, auxiliary.
Paragould, auxiliary.
Pine Bluff, auxiliary.
Pine Bluff, Toney Field, commercial.

California

Alameda, auxiliary.
Alturas, auxiliary.
Amboy, municipal.
Antelope Valley, intermediate.
Arcadia, Ross Field, Air Corps.
*Baker, intermediate.
†Bakersfield, municipal.
*Bakersfield, intermediate.
Banning, municipal.
Banning, commercial.
Barstow, commercial.
Beresford, commercial.
Brawley, municipal.
Brea, municipal.
Bridgeport, municipal.
Burbank, commercial.
Calipatria, municipal.
Camp Kearney, Army.
Campo, municipal.
Chico, municipal.
Chowchilla, municipal.
*Chowchilla, intermediate.
Chula Vista, commercial.
Coalinga, municipal.
Concord, municipal.
Corning, commercial.
Corona, auxiliary.
Culver City, commercial.
Delano, auxiliary.
*Earlimart, intermediate.
Edgewood, commercial.
El Monte, commercial.
Elsinore, municipal.
Encinitas, auxiliary.
Fresno, auxiliary.
Fresno, municipal.
Galt, commercial.
Glendale, auxiliary.
Glendale, municipal.
Grass Valley, auxiliary.
Grays Well, municipal.
Gridley, commercial.
Hanford, municipal.
*Harvard, intermediate.
Hawthorne, Kelly Airport, commercial.
Hayward, auxiliary.
*Hesperia, intermediate.
Hollister, commercial.
Hollywood, DeMille Field, commercial.

Imperial, municipal.
Indio, commercial.
Jacumba Hot Springs, auxiliary.
Laguna Beach, commercial.
Lancaster, municipal.
Lakeport, municipal.
*Lenwood, intermediate.
*Livermore, intermediate.
*Livingston, intermediate.
†Long Beach, municipal.
Los Angeles, Aero Corporation Field, commercial.
Los Angeles, American Airport, commercial.
Los Angeles, Burdette Airport, commercial.
Los Angeles, Daugherty Field, commercial.
Los Angeles, Dyer Field, commercial.
Los Angeles, Griffith Park Airport, municipal.
Los Angeles, Kinner Airport, commercial.
Los Angeles, Metropolitan Airport, commercial.
Los Angeles, Rogers Airport, commercial.
Los Angeles, Ryan Airport, commercial.
Los Angeles, seaplane anchorage, Navy.
Los Angeles, Short Airport, commercial.
Los Angeles, Vail Field, commercial.
McKittrick, auxiliary.
Mare Island, Navy Yard, Navy.
Maricopa, municipal.
Marysville, auxiliary.
Maxwell, auxiliary.
Merced, commercial.
Mineral, auxiliary.
Modesto, municipal.
*Mohawk, intermediate.
Mojave, commercial.
Montague, municipal.
Montebello, auxiliary.
Monterey, polo field, auxiliary.
Mount Shasta, auxiliary.
Natoma, auxiliary.
†Oakland, Oakland Airport, municipal.
Ontario, municipal.
Oroville, auxiliary.
Palmdale, municipal.
Palo Alto, commercial.
Parris, auxiliary.
Petaluma, commercial.
Pomona (see Spadra).
Porterville, commercial.
Ramona, auxiliary.
Redwood, commercial.
†Riverside, March Field, Air Corps.
Riverside, commercial.
Riverside, municipal.
†Sacramento, Mather Field, Air Corps.
Sacramento, municipal.
San Carlos, commercial.
San Diego, Mahoney Field, commercial.
San Diego, North Island, Navy.
San Diego, Rockwell Field, Army.
San Francisco, Crissy Field, Army.
†San Francisco, Mills Field, municipal.
San Juan, auxiliary.
San Leandro, commercial.
San Mateo, Johnson Field, commercial.
San Simeon, private.
Santa Ana, Eddie Martins Airport, commercial.
Santa Barbara, Ovington Airport, commercial.
Santa Clara, commercial.
Santa Maria, municipal.
Santa Monica, Clover Field, municipal.
*Saugus, site 3A, intermediate.
Seal Beach, commercial.
†Selma, municipal.
Sebastapol, municipal.
Sonora, auxiliary.
Spadra, municipal.
†Stockton, municipal.
Stockton, Farris Field, commercial.
Tallac, auxiliary.
Trona, auxiliary.
Truckee, auxiliary.
*Tulare, intermediate.
†Tulare, municipal.
*Turlock, intermediate.
Universal City, commercial.
Venice, municipal.
Ventura, auxiliary.
*Verdemonte, intermediate.
†Visalia, municipal.
Warm Springs, auxiliary.
*Westley, intermediate.
Wilmington, auxiliary.
Woodland, municipal.
Yreka, Yreka Airport, municipal.
Yuba City, commercial.

Colorado

Canyon City, auxiliary.
*Castle Rock, intermediate.
†Cheyenne, municipal.
Colorado Springs, municipal.
Cortez, auxiliary.
Creede, auxiliary.
De Beque, commercial.
Denver, Alexander Airport, commercial.
†Denver, Denver Post Airdrome, commercial.
Denver, Lowry Field National Guard, Air Corps.
Denver, Denver Union Airport, commercial.
*Dover, intermediate.
Estes Park, commercial.
*Fort Lupton, intermediate.
Grand Junction, municipal.
*Greeley, intermediate.
Lamar, municipal.
Leadville, Bingham Field, municipal.
*Monument, intermediate.
Pueblo, municipal.
Trinidad, commercial.
*Wigwam, intermediate.

Connecticut

*Bethany, intermediate.
Danbury, municipal.
†Hartford, Brainard Field, municipal.
Meriden, municipal.
New London, auxiliary.
New Milford, auxiliary.
Niantic, auxiliary.
Torrington, commercial.
Wallingford, municipal.

Delaware

Lewes, auxiliary.
Newark, auxiliary.
New Castle, auxiliary.
†New Castle, commercial.
Wilmington, Biggs Field, auxiliary.
†Wilmington, Du Pont Field, private.

District of Columbia

†Anacostia, Bolling Field, Air Corps.
†Anacostia, Naval Air Station, Navy.
Arlington (Va.), Hoover Field, commercial.
Arlington (Va.), Capital Airport, commercial.

Florida

Arcadia, auxiliary.
Arcadia, Carlstrom Field, auxiliary.
Avon Park, auxiliary.
Bartow, auxiliary.
Clearwater, municipal.
Fort Meyers, municipal.
Hialeah, municipal.
Inverness, commercial.
Jacksonville, Camp Johnson, Army.
†Jacksonville, municipal.
Jacksonville, Paxon Field, commercial.
Key West, commercial.
Key West, Naval Air Station, Navy.
Lakeland, municipal.
Miami, commercial.
†Miami, municipal.
North La Belle, auxiliary.
Ocala, commercial.
Okeechobee, commercial.
Orlando, commercial.
Orlando, municipal.
Palmdale, auxiliary.
Pensacola, Naval Air Station, Navy.
St. Augustine, auxiliary.
St. Petersburgh, municipal.
Sanford, commercial.
Sebring, municipal.
Stuart, municipal.
Tallahassee, municipal.
Tampa, commercial.
Tampa, municipal.
Titusville, municipal.
West Palm Beach, commercial.

Georgia

Albany, municipal.
Americus, Souther Field, Air Corps.
Athens, Epps Field, municipal.
†Atlanta, Candler Field, municipal.
†Augusta, Daniel Field, municipal.
Brunswick, commercial.
Columbus, municipal.
Douglas, municipal.
Fort Benning, auxiliary, Army.
*Jefferson, intermediate.
*Lawrenceville, intermediate.
Macon, Miller Airport, municipal.
Macon, race track, auxiliary.
Madison, auxiliary.
Pelham, commercial.
Rome, auxiliary.
Rome, municipal.
*Royston, intermediate.
Savannah, Daffing Park, municipal.
Tifton, auxiliary.
Valdosta, auxiliary.
*Villa Rica, intermediate.

Idaho

*Bliss, intermediate.
Boise, Boise Barracks, auxiliary.
Boise, municipal.
Cœur d'Alene, municipal.
Idahome, auxiliary.
Lewiston, auxiliary.
*Mountain Home, intermediate.
Pocatello, municipal.

Illinois

*Ashburn, intermediate.
*Aurora, commercial.
Belleville, Scott Field, Air Corps.
Bloomington, municipal.
Carlinville, auxiliary.
*Chesterfield, intermediate.
†Chicago, Aero Club Field, commercial.
Chicago, Yackey Airport, commercial.
†Chicago, Chicago Airport, municipal.
Chicago, Fort Sheridan, auxiliary.
Chicago, Lincoln Park Field, municipal.
Chicago, River Road Field, commercial.
Chicago, Schiller Park, Cook County Airport, commercial.
Chicago, Schiller Park, Wilson Flying Field, commercial.
Chicago, Southtown Airport, commercial.
Chicago, Wallace Airport, commercial.
*Cordova, intermediate.
Des Plaines Heath Flying Field, commercial.
Des Plaines, Pal-Waukee Airport, commercial.
Elmhurst, Pioneer Flying Field, commercial.
Elmhurst, Eagle Field, commercial.
Fairfield, auxiliary.
*Fenton, intermediate.
*Franklin Grove, intermediate.
Galena, commercial.
Galesburg, municipal.
*Godfrey, intermediate.
Great Lakes, Naval Air Station, Navy.
Greenville, auxiliary.
*Harvey, intermediate.
Hinckley, Eagle Airport, commercial.
Kawanee, Machesney Field, commercial.
Lansing, Ford Airport, commercial.
*La Rose, intermediate.
Litchfield, auxiliary.
Lomax, commercial.
*Lowder, intermediate.
McCook, commercial.
*McGirr, intermediate.
Marion, commercial.
*Mason City, intermediate.
†Moline, Moline Airport, commercial.
Monmouth, commercial.
*Morris, intermediate.
*North Aurora, intermediate.
*Pekin, intermediate.
†Peoria, municipal.
Pinckneyville, auxiliary.
*Plainfield, intermediate.
Rantoul, Chanute Field, Air Corps.
*Rocks Falls, intermediate.
Rockford, Black Hawk Airport, commercial.
Rockford, Rockford Airport, commercial.
Rushville, municipal.
St. Elmo, Smith Field, commercial.
†Springfield, Conkling Field, municipal.
Sterling, commercial.
Stockton, commercial.
Tonica, auxiliary,
Waterman, commercial.

Indiana

*Ashley, intermediate.
Bedford, commercial.
Brazil, municipal.
Cedar Lake, auxiliary.
Fort Wayne, Baer Field, municipal (temporary).
Fort Wayne, commercial.
Gary, commercial.
*Goshen, intermediate.
Indianapolis, Fort Benjamin Harrison, Schoen Field, Air Corps.
Indianapolis Capital Airways, commercial.
Indianapolis, Hoosier Airport, commercial.
Indianapolis, Stout Field, municipal.
Knox, commercial.
Kokomo, Shockley Field, commercial.

La Fayette, commercial.
*Lakeville, intermediate.
*La Porte, intermediate.
*McCool, intermediate.
Muncie, Wall Field, municipal.
Peru, commercial.
Richmond, Berry Field, commercial.
Richmond, Richmond Airport, commercial.
*Rising Sun, intermediate.
Seymour, commercial.
Shelbyville, auxiliary.
South Bend, commercial.
*South Bend, municipal.
Terre Haute, auxiliary.
Terre Haute, Dresser Field, municipal.
Vincennes, commercial.
Vincennes, municipal.
Wabash, commercial.
*Wolcottville, intermediate.

Iowa

*Adel, intermediate.
Ames, Gerbracht Airport, commercial.
*Atalissa, intermediate.
*Atlantic, intermediate.
Battle Creek, commercial.
Belle Plaine, commercial.
*Bloomfield, intermediate.
Burlington, commercial.
Burlington, municipal.
*Casey, intermediate.
†Cedar Rapids, municipal.
Centerville, municipal.
Council Bluffs, commercial.
Davenport, commercial.
Des Moines, Camp Dodge, Army.
Des Moines, Herring Field, commercial.
†Des Moines, municipal.
*Dixon, intermediate.
*Earlham, intermediate.
*Fairfield, intermediate.
Fort Dodge, commercial.
†Iowa City, municipal.
*Libertyville, intermediate.
*McCausland, intermediate.
Mason City, municipal.
Milford, Donaldson Field, commercial.
*Montezuma, intermediate.
*Muscatine, intermediate.
*Oakland, intermediate.
Ottumwa, commercial.
*Reasnor, intermediate.
Rockwell City, municipal.
Scranton, auxiliary.
Shenandoah, municipal.
Sioux City, Kari-Keen Airport, commercial.
Sioux City, Rickenbacker Airport, commercial.
†Waterloo, municipal.
*Williamsburg, intermediate.

Kansas

Arkansas City, commercial.
Caney, commercial.
*Cassody, intermediate.
Chanute, municipal.
Coffeyville, municipal.
El Dorado, municipal.
Fort Leavenworth, Army.
†Fort Riley, Marshall Field, Air Corps.
Fort Scott, municipal.
†Garden City, municipal.
Hutchinson, Albright Field, commercial.
Independence, municipal.
Kansas City, Fairfax Field, municipal.
Kansas City, Sweeney Airport, commercial.
Lawrence, commercial.
Liberal, Baughman Field, auxiliary.
Newton, municipal.
*Olathe, intermediate.
*Olivet, intermediate.
*Olpe, intermediate.
*Ottawa, intermediate.
*Oxford, intermediate.
Parsons, municipal.
Plainville, auxiliary.
Pratt, commercial.
Topeka, auxiliary.
†Wichita, Wichita Airport, municipal.
Wichita, Laird Field, commercial.
Winfield, municipal.

Kentucky

*Carrollton, intermediate.
Covington, municipal.
Danville, commercial.
Hopkinsville, commercial.
Lexington, municipal.
†Louisville, Bowman Field, municipal.
Louisville, Louisville Airport, commercial.
Owensboro, commercial.

Louisiana

Alexandria, Camp Beauregard, auxiliary.
Baton Rouge, Dougherty Field, municipal.
Chalmette, commercial.
Crowley, municipal.
Lafayette, municipal.
Mansfield, Herndon Field, municipal.
†Monroe, Selman Field, municipal.
Natchitoches, commercial.
†New Orleans, Alvin Callendar Field, municipal.
New Orleans, Gentilly Field, auxiliary.
New Orleans, Maison Blanche, auxiliary.
New Orleans, Menefee Airport, commercial.
Shreveport, municipal.
Shreveport, commercial.
Shreveport, Texico Airport, commercial.
Tallulah, Department of Agriculture.
Wisner, auxiliary.

Maine

Augusta, auxiliary.
Bangor, auxiliary.
Bangor, Bangor Airport, commercial.
Caribou, commercial.
Caribou, municipal.
Portland, Portland Airport, municipal.
†Portland, Stroudwater Field, commercial.

Maryland

†Aberdeen, Phillips Field, Air Corps.
Baltimore, Logan Field, Air Corps.
Bowie, race track, auxiliary.
Camp Meade, Army auxiliary.
Chesapeake City, auxiliary.
College Park, Department of Commerce.
Cumberland, Army.
Edgewood Arsenal, Army, auxiliary.
Elk Mills, auxiliary.
Frederick, fairgrounds, auxiliary.
Frostburg, auxiliary.
Grantsville, auxiliary.
Hagerstown, commercial.
Havre de Grace, race track, auxiliary.
Hebron, commercial.
Laurel, race track, auxiliary.
Old Town, auxiliary.

Massachusetts

Atlantic, commercial.
Auburndale, Riverside Park, auxiliary.
Ayer, Camp Devens, Army, auxiliary.
Beverly, auxiliary.
†Boston, municipal.
Brockton, commercial.
*Dudley, intermediate.
*Framingham, intermediate.
Gardner, municipal.
Holyoke, auxiliary.
Hyannis, commercial.
Lawrence, commercial.
Lowell, commercial.
Mendon, commercial.
North Attleboro, commercial.
Readville, race track, auxiliary.
Revere, commercial.
Saugus, Groah Field, auxiliary.
Seekonk, commercial.
South Dartmouth, Round Hill Airport, private.
South Sudbury, commercial.
Taunton, King Field, commercial.
Wareham, commercial.
Westfield, municipal.
†Worcester, commercial.

Michigan

Adrian, auxiliary.
Albion, municipal.
Alma, commercial.
Anchor Bay Beach, Colony Airport, commercial.
Augusta, Camp Custer, Army.
Bad Axe, auxiliary.
Battle Creek, municipal.
Bay City, race track, auxiliary.
Benton Harbor, commercial.
Cadillac, auxiliary.
Charlevoix, commercial.
†Dearborn, Ford Airport, commercial.
Detroit, commercial.
Detroit, fairgrounds, auxiliary.
Detroit, municipal.
Gaylord, municipal.
Grand Rapids, commercial.
Grand Rapids, fairgrounds, auxiliary.
Grand Rapids, municipal.
Grayling, auxiliary.
Iron Mountain, commercial.
Jackson, Sparks Field, municipal.
Jackson, Reynolds Field, municipal.
Kalamazoo, municipal.
†Lansing, municipal.
Marysville, Marysville Airport, municipal.
Menominee, municipal.
*Monroe, intermediate.
†Mount Clemens, Selfridge Field, Air Corps.
Munising, auxiliary.
Muskegon, municipal.
Niles, municipal.
Northville, Stinson-Northville Field, commercial.
Pontiac, municipal.
Saginaw, municipal.
Standish, fairgrounds, auxiliary.
Ypsilanti, municipal.

Minnesota

Brainerd, commercial.
Crookston, auxiliary.
Fergus Falls, municipal.
Lake City, State Camp Ground, auxiliary.
Little Falls, auxiliary.
Mankato, auxiliary.
Mankato, commercial.
Maynard, commercial.
Minneapolis, commercial.
Minneapolis, Robbindale Airport, commercial.
Minneapolis, Minneapolis Airport (Wold-Chamberlain Field), municipal.
†St. Paul, municipal.
Sleepy Eye, Berkner Field, commercial.
Virginia, commercial.
*Wabasha, intermediate.
White Bear Lake, commercial.
*Winona, intermediate.

Mississippi

Clarksdale, auxiliary.
Greenville, race track, auxiliary.
Jackson, commercial.
Natchez, auxiliary.

Missouri

†Anglum, Lambert-St. Louis Field, municipal.
Bucklin, Van Osdee Field, commercial.
Carthage, commercial.
Jefferson City, municipal.
Joplin, municipal.
†Kansas City, municipal.
†Kansas City, Richards Field, commercial.
Kirksville, auxiliary.
Kirksville, commercial.
Marshall, commercial.
Memphis, municipal.
Queen City, baseball park, auxiliary.
Richland, fairgrounds, auxiliary.
†St. Joseph, municipal.
†St. Louis, Parks Airport, commercial.
†St. Louis. (See Anglum.)
Sedalia, municipal.
Springfield, McClure Field, municipal.
Springfield, National Guard Airport, municipal.
Sullivan, fairgrounds, auxiliary.
*Unionville, intermediate.

Montana

Bigtimber, Budd Field, auxiliary.
Butte, Butte National Airport, commercial.
Chinook, fairgrounds, auxiliary.
Dillon, commercial.
Forid, municipal.
Fort Missoula, Army, auxiliary.
Glendive, auxiliary.
Great Falls, commercial.
Harlowton, auxiliary.
Helena, municipal.
Kalispell, municipal.
Livingston, municipal.
Manhattan, auxiliary.
Manhattan, municipal.
Miles City, municipal.
Missoula, municipal.
Sidney, commercial.

Nebraska

Alliance, commercial.
*Benedict, intermediate.
*Big Springs, intermediate.
Chadron, fairgrounds, auxiliary.
*Chappell, intermediate.
*Dix, intermediate.
*Elm Creek, intermediate.
*Gothenburg, intermediate.

†Grand Island, municipal.
Hastings, municipal.
*Kearney, intermediate.
*Lexington, intermediate.
Lincoln, Lincoln Airport, commercial.
*Marquette, intermediate.
Mason City, auxiliary.
†North Platte, municipal.
Ogallala, commercial.
*Ogallala, intermediate.
Omaha, municipal.
Omaha, commercial.
Omaha (Fort Crook), Offutt Field, Army.
*Paxton, intermediate.
*Pershing, auxiliary.
Scottsbluff, commercial.
*Shelton, intermediate.
*Sidney, intermediate.
*Ulysses, intermediate.
*Valparaiso, intermediate.
*Wann, intermediate.

Nevada

Battle Mountain, auxiliary.
*Beowawe, intermediate.
Caliente, municipal.
†Elko, municipal.
Ely, municipal.
Hazen, auxiliary.
Hawthorne, municipal.
*Jean, intermediate.
†Las Vegas, municipal.
Lovelock, municipal.
Owyhee, Department of Interior.
Parran, auxiliary.
Reno, municipal.
Tonopah, auxiliary.
Wells, race track, auxiliary.
Winnemucca, municipal.
Yerington, municipal.

New Hampshire

Claremont, municipal.
Concord, municipal.
Greenfield, auxiliary.
Keene, municipal.
Manchester, municipal.
Whitefield, municipal.

New Jersey

Arcola, commercial.
Asbury Park, municipal.
Atlantic City, commercial.
Atlantic City, municipal.
Auburn, auxiliary.
Avalon, commercial.
Camden, commercial.
Cape May, Coast Guard.
Dover, commercial.
Freehold, Patten Field, commercial.
†Hasbrouck Heights, Teterboro Airport, commercial.
Kenvil, commercial.
Keyport, commercial.
Lakehurst, Naval Air Station, Navy.
Lakehurst, commercial.
Little Silver, Fort Monmouth, Army.
Lyons, commercial.
Medford, auxiliary.
Moorestown, municipal.
†New Brunswick, Hadley Field, commercial.
New Brunswick, municipal.
Oceanport (Fort Monmouth), Army.
Paterson, commercial.
Perth Amboy, commercial.
Pine Valley, Ireland Field, commercial.
Princeton, auxiliary.
Redbank, commercial.
Seagirt, Camp Edwards, auxiliary.
*Stewartsville, intermediate.
*Trenton, intermediate.
*White House, intermediate.
Wrightstown, Camp Dix, Army.

New Mexico

Albuquerque, commercial.
Alamogordo, auxiliary.
Cambray, municipal.
Carlsbad, municipal.
Carrizozo, auxiliary.
Clayton, auxiliary.
Deming, municipal.
Gage, municipal.
Gallup, auxiliary.
Gallup, Moses Field, municipal.
Hachita, auxiliary.
Las Vegas, auxiliary.
†Lordsburg, Army.
Lordsburg, municipal.
Roswell, commercial.
Rutter, auxiliary.
Santa Rosa, municipal.
Sepas, municipal.
Silver City, auxiliary.
Steins, municipal.
Taiban, municipal.
Tucumcari, auxiliary.

New York

Albany, Quentin Roosevelt Field, municipal.
Albany, Albany Airport, municipal.
Angola, commercial.
Armonk, commercial.
Batavia, fairgrounds, auxiliary.
Beacon, commercial.
Belrose, race track, auxiliary.
Binghamton, commercial.
†Buffalo, Buffalo Airport, municipal.
Buffalo, Becher's Airport, commercial.
Dansville, municipal.
Elmira, municipal.
Endicott, commercial.
Farmingdale, commercial.
Fisher Island, Fort H. G. Wright, Army, auxiliary.
Fort Terry, Plum Island, Army, auxiliary.
†Garden City, Curtiss Field, commercial.
Garden City, Roosevelt Field, commercial.
Geneva, Finger Lakes Airport, commercial.
Glens Falls, municipal.
Hammondsport, Mercury Field, commercial.
Ithaca, municipal.
Jamaica, race track, auxiliary.
Jamestown, commercial.
Lake Placid, municipal.
Le Roy, D. W. Flying Field, commercial.
Little Falls, auxiliary.
Mohawk, auxiliary.
†Mineola, Mitchell Field, Air Corps.
New Dorp, Miller Field, Air Corps.
Norwich, commercial.
Pittsford, commercial.
Plattsburg, Army.
Rochester, Rochester Airport, municipal.
†Rochester, commercial.
Rochester, Naval Air Station, Navy.
†Schenectady, commercial.
Syracuse, municipal.
Utica, municipal.

Watertown, municipal.
Watkins Glen, auxiliary.
West Point, parade grounds, auxiliary.
Yaphank, Camp Upton, Army, auxiliary.

North Carolina

Asheville, municipal.
Charlotte, municipal.
Fayetteville, Pope Field, Air Corps.
*Gastonia, intermediate.
Goldsboro, municipal.
†Greensboro, municipal.
Henderson, fairgrounds, auxiliary.
*Lexington, intermediate.
*Milton, intermediate.
Monroe, commercial.
*Mooresville, intermediate.
New Berne, Acme Field, commercial.
Pinehurst, auxiliary.
Pinehurst, commercial.
Raleigh, municipal.
Raleigh, commercial.
Reidsville, commercial.
*Reidsville, intermediate.
Rockingham, commercial.
Rocky Mount, commercial.
Shelby, municipal.
*Stanley, intermediate.
Tarboro, Baker Field, municipal.
Wilmington, municipal.
†Winston-Salem, municipal.

North Dakota

Bismarck, municipal.
Fargo, Hector Airport, municipal.
Fargo, State College, auxiliary.
Grand Forks, auxiliary.
Linton, Seeman Park, commercial.
Minot, municipal.
Towner, commercial.

Ohio

Ada, auxiliary.
Alliance, commercial.
Akron, Fulton Field, commercial.
†Blue Ash, Watson Field, commercial.
Bryan, Bryan Air Park, commercial.
†Bryan, municipal.
*Bryan, intermediate.
Cambridge, auxiliary.
Camp Perry, State Camp, auxiliary.
Canton, commercial.
†Cincinnati, Lunken Airport, municipal.
†Cleveland, Cleveland Airport, municipal.
Cleveland, Martin Field, commercial.
†Columbus, Norton Field, Air Corps.
Columbus, commercial.
Dayton, Dayton Airport, commercial.
Dayton, Moraine Field, commercial.
†Dayton, Wilbur Wright Field, Air Corps.
Defiance, commercial.
Elyria, commercial.
Gallipolis, municipal.
†Gerald, intermediate.
Hamilton, commercial.
*Hartford, intermediate.
Hebron, Harbor Hills Golf Course, auxiliary.
*Huron, intermediate.
Kent, commercial.
Kenton, auxiliary.
*Lebanon, intermediate.
Lima, commercial.
London, auxiliary.
*Loudonville, intermediate.
Mansfield, municipal.
Marietta, municipal.
Martins Ferry, commercial.
Massilon, commercial.
*Medina, intermediate.
Middletown, Middletown Airport Park, Municipal.
*Mount Vernon, intermediate.
North Madison, auxiliary.
*Parkman, intermediate.
Portsmouth, municipal.
St. Paris, auxiliary.
Steubenville, commercial.
*Solon, intermediate.
Springfield, municipal.
Toledo, auxiliary.
Toledo, commercial.
Toledo, municipal (temporary).
Troy, commercial.
Van Wert, municipal.
*Vickery, intermediate.
*Watersville, intermediate.
*West Jefferson, intermediate.
Willoughby, commercial.
*Woodville, intermediate.
*Wooster, intermediate.
Wooster, fairgrounds, auxiliary.
Youngstown, Lansdowne Field, municipal.
Youngstown, Bernard Field, commercial.
Zanesville, auxiliary.
Zanesville, commercial.

Oklahoma

Altus, commercial.
Ardmore, commercial.
Bartlesville, commercial.
*Blackwell, intermediate.
Blanchard, Davis Field, auxiliary.
Bristow, commercial.
Chandler, rifle range, auxiliary.
Chickasha, race track, auxiliary.
Cleveland, auxiliary.
Clinton, municipal.
Coalgate, commercial.
*Criner, intermediate.
Drumright, Cooks Field, auxiliary.
Duncan, Halliburton Field, municipal.
*Edmond, intermediate.
Elk City, municipal.
El Reno, municipal.
Enid, municipal.
Fort Sill, Air Corps.
Guthrie, commercial.
*Healdton, intermediate.
Hennessey, auxiliary.
Henryetta, auxiliary.
Holdenville, race track, auxiliary.
*Hominy, intermediate.
Kingfisher, race track, auxiliary.
McAlester, Legion Field, commercial.
McLoud, auxiliary.
Miami, commercial.
Muskogee, Hatbox Field, municipal.
Newkirk, auxiliary.
Norman, commercial.
†Oklahoma City, municipal.
Okmulgee, municipal.
Pauls Valley, auxiliary.
*Pernell, intermediate.
*Perry, intermediate.
†Ponca City, municipal.
Shawnee, auxiliary.
Texola, commercial.
Tishomingo, fairgrounds, auxiliary.
Tulsa, McIntyre, Airport, commercial.
Tulsa, Tulsa Airport, commercial.
Wagoner, race track, auxiliary.
Walters, auxiliary.
Woodward, auxiliary.

Oregon

Albany, municipal.
*Baker, intermediate.
Canyon City, municipal.
Condon, auxiliary.
Corvallis, auxiliary.
The Dalles, fairgrounds, municipal.
Eugene, municipal.
Grants Pass, municipal.
Klamath Falls, Altamont Field, commercial.
*La Grande, intermediate.
Lakeview, municipal.
Lebanon, municipal.
Medford, Barber Field, municipal.
Milton, auxiliary.
*Pendleton, intermediate.
Portland, Rankin Airport, commercial.
†Portland, Port of Portland Airport, municipal.
Princeville, Cross Field, auxiliary.
Roseberg, auxiliary.
Roseberg, Hannan Field, municipal.
St. Helens, auxiliary.
Salem, commercial.
Salem, fairgrounds, auxiliary.
Silverton, municipal.

Pennsylvania

Altoona, auxiliary.
†Altoona, Stultz Field, commercial.
*Andreas, intermediate.
Bellefonte, auxiliary.
*Bellefonte, intermediate.
Bradford, auxiliary.
Bridgeville, Mayer Field, commercial.
Bristol, Keystone Field, commercial.
*Brookville, intermediate.
Bustleton, auxiliary.
Carmichaels, auxiliary.
*Clarion, intermediate.
*Clearfield, intermediate.
Connellsville, municipal.
*Curwensville, intermediate.
*Du Bois, intermediate.
Easton, commercial.
Elk Lick, auxiliary.
Erie, Griswold Field, commercial.
Essington, commercial.
†Fairview, commercial.
Gettysburg, commercial.
Greensburg, race track, auxiliary.
Harrisburg, ball park, auxiliary.
*Hartleton, intermediate.
Harveys, Sollars Field, municipal.
*Hometown, intermediate.
Honesdale, commercial.
Johnstown, auxiliary.
Jones Mills, commercial.
*Kennerdell, intermediate.
*Kylertown, intermediate.
*Lamartine, intermediate.
Lancaster, commercial.
Latrobe, Long View Field, commercial.
Lebanon, municipal.
Leetsdale, commercial.
Lehighton, race track, auxiliary.
Lemoyne, Stienhauer Airport, commercial.
Lewistown, race track, auxiliary.
Media, municipal.
*Mercer, intermediate.
Middletown, Olmsted Field, Army.
Mount Pleasant, commercial.
Mount Union, municipal.
New Castle, Jackson Field, commercial.
New Castle, New Castle Airport, commercial.
*Northhampton, intermediate.
Norristown, commercial.
*Numidia, intermediate.
Parkesburg, commercial.
*Park Place, intermediate.
Philadelphia, Lincoln Airport, commercial.
Philadelphia, Mustin Field, Navy.
†Philadelphia, Philadelphia Airport, municipal.
Philadelphia, Pitcairn Field, commercial.
Philadelphia, United Flying Club Field, commercial.
†Pittsburgh-McKeesport, Bettis Field, municipal.
Pittsburgh, Rodgers Field, municipal.
Reading, Whander Field, commercial.
*Ring Mountain, intermediate.
Selinsgrove, Zimmerman Airport, municipal.
Sellersville, auxiliary.
*Shamokin, intermediate.
Sharon, commercial.
Smithfield, Barton Field, auxiliary.
*Snowshoe, intermediate.
*Stockton, intermediate.
*Stroudsburg, intermediate.
Summerfield, auxiliary.
*Sunbury, intermediate.
Towanda, municipal.
Uniontown, auxiliary.
Uniontown, Burgess Field, municipal.
Uniontown, race track, auxiliary.
Waynesboro, commercial.
Waynesburg, commercial.
*Wesley, intermediate.
Westfield, race track, auxiliary.
Williamsport, commercial.
Wilkes-Barre, Suburban Park, auxiliary.
*Woodward, intermediate.
York, auxiliary.

Rhode Island

Apponaugh, auxiliary.
Jamestown, auxiliary.
Pawtucket, commercial.
Providence, Pothier Field, commercial.
Quonset Point, State camp grounds, auxiliary.
Slocum, auxiliary.
Westerly, commercial.

South Carolina

*Anderson, intermediate.
*Blacksburg, intermediate.
Cheraw, commercial.
Columbia, auxiliary.
Florence, municipal.
Fort Mills, Spring Field, commercial.
Fort Moultrie, Army.
*Gaffney, intermediate.
Greenville, Donaldson Field, municipal.
Greenville, municipal.
Myrtle Beach, commercial.
Parris Island, Marine Corps Field, auxiliary.
*Simpsonville, intermediate.
Seneca, commercial.
†Spartanburg, municipal.

South Dakota

Aberdeen, municipal.
Belle Fourche, commercial.
Dell Rapids, municipal.
Edgemont, auxiliary.
Huron, commercial.
Mitchell, municipal.
Mobridge, commercial.

Pierre, municipal.
Rapid City, commercial.
Seneca, auxiliary.
Sioux Falls, auxiliary.
Tyndal, commercial.
Volga, commercial.
Watertown, municipal.

Tennessee

Bristol, municipal.
Chattanooga, municipal.
Cleveland, auxiliary.
Jackson, fairgrounds, auxiliary.
Johnson City, municipal.
Knoxville, commercial.
Knoxville, race track, auxiliary.
Memphis, Armstrong Field, municipal.
†Memphis, New Brys Airport, commercial.
Nashville, McConnell Field, municipal.

Texas

Abilene, Kinsolving Field, commercial.
Alice, municipal.
Alief, auxiliary.
Alpine, auxiliary.
†Amarillo, commercial.
Angelus, commercial.
Aransas Pass, auxiliary.
Austin, Camp Mabry, National Guard.
Austin, University Airport, commercial.
Beaumont, auxiliary.
Beaumont, municipal.
Big Springs, commercial.
Big Springs, municipal.
Bloomington, auxiliary.
Borger, auxiliary.
Brownsville, Field No. 1, Air Corps.
Brownsville, Field No. 2, auxiliary.
Bryant, auxiliary.
Camp Travis, Army.
Carrizo Springs, auxiliary.
Castroville, municipal.
Caterina, auxiliary.
Childress, auxiliary.
Cline, auxiliary.
Comstock, auxiliary.
Corpus Christi, municipal.
Dalberg, auxiliary.
†Dallas, Love Field, municipal.
Del Rio, municipal.
Denton, municipal.
Dryden, Air Corps.
Eagle Lake, auxiliary.
El Paso, Biggs Field, Air Corps.
El Paso, commercial.
†El Paso, municipal.
Farwell, Hamlin Field, municipal.
Fort Clark, Army.
Fort Hancock, auxiliary.
†Fort Worth, Meacham Field, municipal.
Galveston, Fort Crocket, Air Corps.
Gonzales, auxiliary.
Greenville, municipal.
Harlingen, commercial.
Hondo, auxiliary.
Houston, Canon Field, commercial.
Houston, Ellington Field, National Guard.
†Houston, municipal.
Houston, Rice Institute, commercial.
Jasper, municipal.
*Krum, intermediate.
Laredo, Air Corps.
Leon Springs, Camp Bullis, Air Corps.
Leon Springs, Camp Stanley, Air Corps.
Longfellow, auxiliary.
Lubbock, municipal.
McAllen, auxiliary.
McLean, auxiliary.
Marathon, auxiliary.
Marfa, Air Corps.
Marlin, race track, auxiliary.
Marlin, Wreen Field, private.
Mexia, municipal.
Midland, municipal.
Mineral Wells, auxiliary.
*Muenster, intermediate.
Odessa, auxiliary.
Orange, municipal.
Palestine, auxiliary.
Pavo, auxiliary.
Pecos, municipal.
Port Arthur, auxiliary.
Port Arthur, commercial.
Pumpville, auxiliary.
Rio Grande, Fort Ringgold, Air Corps.
Sabinal, municipal.
San Angelo, auxiliary.
San Angelo, municipal.
San Antonio, Brooks Field, Air Corps.
San Antonio, Fort Sam Houston, Army.
San Antonio, Kelly Field, Air Corps.
San Antonio, Second Division Field, Air Corps.
San Antonio, Winburn Field, municipal.
Sanderson, auxiliary.
San Diego, auxiliary.
Sherman, municipal.
Shumla, municipal.
Sidell, auxiliary.
Sierra Blanca, municipal.
Sierra Blanca, parade grounds, auxiliary.
Spur, municipal.
Sweetwater, municipal.
Temple, auxiliary.
Temple, commercial.
Toyah, auxiliary.
Victoria, auxiliary.
Waco, Rich Field, municipal.
Wellington, auxiliary.
Wharton, auxiliary.
Wichita Falls, commercial.
Wichita Falls, municipal.
Wills Point, auxiliary.

Utah

*Coalville, intermediate.
Milford, municipal.
Ogden, municipal.
Price, race track, auxiliary.
Richfield, race track, auxiliary.
Roosevelt, race track, auxiliary.
Salburo, auxiliary.
†Salt Lake City, municipal.
Vernal, auxiliary.

Vermont

Brattleboro, auxiliary.
Burlington, municipal.
Montpelier, auxiliary.
Newport, commercial.
Rutland, auxiliary.
St. Albans, auxiliary.
St. Johnsbury, auxiliary.
Springfield, municipal.
Windsor, auxiliary.

Virginia

*Amelia, intermediate.
Arlington, Hoover Field, commercial.
Arlington, Capital Airport, commercial.
Bristol, municipal.
Cobham, auxiliary.
*Crewe, intermediate.

Dahlgren, naval air station, Navy.
Fort Eustis, Army.
†Hampton, Langley Field, Air Corps; N. A. C. A.
†Hampton Roads, naval air station, Navy.
Irvington, auxiliary.
*Keysville, intermediate.
Leechall, Fort Eustis, Army.
Leesburg, auxiliary.
Lynchburg, commercial.
Martinsville, auxiliary.
*Milford, intermediate.
*Milton, intermediate.
Norfolk, St. Helena Island, Naval Air Station.
*Ontario, intermediate.
Petersburg, Camp Lee, Army.
Port Richmond, municipal.
*Quantico, Brown Field, Marine Corps.
Richmond, Charles Field, commercial.
†Richmond, Richard E. Byrd Field, municipal.
Richmond, Richmond Air Junction, commercial.
*South Boston, intermediate.
Staunton, Fort Defiance, auxiliary.
Staunton, Lyle Field, auxiliary.
Virginia Beach, rifle range, auxiliary.
Waynesboro, commercial.
Winchester, municipal.

Washington

Bellingham, municipal.
Camp Lewis, Army.
Chehalis, Donohue Field, municipal.
Davenport, auxiliary.
Hoquim, municipal.
Inglewood, auxiliary.
Kennewick, Kelso Field, municipal.
Kent, auxiliary.
Longview, municipal.
Olympia, commercial.
Opportunity, auxiliary.
Pasco, auxiliary.
Pasco, municipal.
Renton, commercial.
Republic, fairgrounds, auxiliary.
Ritzville, commercial.
Seattle, auxiliary.
Seattle, Boeing Field, municipal.
Seattle, Sand Point, Navy.
Spokane, commercial.
Spokane, Felts Field, municipal.
Tacoma, commercial.
Uniontown, auxiliary.
University, auxiliary.
Vancouver, Pearson Field, Army.
Walla Walla, auxiliary.
Walla Walla, municipal.
Wenatchee, commercial.
Yakima, auxiliary.
Yakima, municipal.

West Virginia

Bluefield, commercial.
Charleston, auxiliary.
Green Spring, auxiliary.
Huntington, commercial.
Keyser, auxiliary.
Martinsburg, Shepherd Field, municipal.
Morgantown, auxiliary.
Moundsville, Langin Field, commercial.
Petersburg, auxiliary.
Wheeling, municipal.

Wisconsin

Appleton, commercial.
Athelstane, commercial.
*Columbus, intermediate.
Fond du Lac, commercial.
Green Bay, commercial.
*Hager, intermediate.
Janesville, commercial.
*Kenosha, intermediate.
Kilbourn, commercial.
Kohler, municipal.
La Crosse, Salzer Field, municipal.
†Madison, Madison Airport, commercial.
Madison, Pennco Field, commercial.
*Mauston, intermediate.
Menasha, municipal.
†Milwaukee, Maitland Airport, municipal.
†Milwaukee, Milwaukee County Airport, municipal.
Neenah, municipal.
*Oconomowoc, intermediate.
Oshkosh, commercial.
*Portage, intermediate.
Princeton, municipal.
Racine, municipal.
Reedsburg, auxiliary.
Rhinelander, municipal.
*Somers, intermediate.
*Sparta, intermediate.
Stevens Point, auxiliary.
Sturgeon Bay, commercial.
Superior, municipal.
Washington Island, commercial.
†Wausau, municipal.
Wisconsin Rapids, commercial.

Wyoming

*Ritter Creek, intermediate.
*Bosler, intermediate.
*Burns, intermediate.
Casper, municipal.
*Cherokee, intermediate.
†Cheyenne, municipal.
*Federal, intermediate.
Fort Bridger, commercial.
Gillette, auxiliary.
*Granger, intermediate.
*Knight, intermediate.
*Laramie, intermediate.
*Leroy, intermediate.
Lost Cabin, auxiliary.
*Medicine Bow, intermediate.
Newcastle, municipal.
Parco, municipal.
*Pine Bluff, intermediate.
*Rawlins, intermediate.
*Red Desert, intermediate.
*Rock River, intermediate.
†Rock Springs, municipal.
Sheridan, municipal.
*Walcott, intermediate.

DIPLOMATIC SERVICE OF THE UNITED STATES

Army

Berlin, Germany.....Major George E. A. Reinberg, U. S. A., Assistant Military Attaché for Air; Germany, Austria, Czechoslovakia, Denmark, Netherlands, Sweden, Switzerland.

Paris, France.....Major Barton K. Yount, U. S. A., Assistant military Attaché for Air; France and Spain.

London, England.....Major Hubert R. Harmon, U. S. A., Assistant Military Attaché for Air; Great Britain.

Rome, Italy.....Major George E. Lovell, U. S. A., Assistant Military Attaché for Air; Italy.

Navy

London .....Lt. Cmdr. Wm. D. Thomas, Assistant Naval Attaché for Aviation. (Also accredited to Paris, The Hague, Berlin, Madrid and Lisbon.)

Rome .....Cmdr. P. N. L. Bellinger, Assistant Naval Attaché for Aviation.

Naval Representative (Aviation), U. S. Naval Mission to Brazil. Lt. Cmdr. Paul Cassard.

Naval Representative (Aviation), U. S. Naval Mission to Peru. Lt. Cmdr. B. H. Wyatt.

DIPLOMATIC SERVICE TO THE UNITED STATES

Great Britain .....Wing Commander T. G. Hetherington, C.B.E., Air Attaché.

Peru .....Colonel Jose Urdanivia Ginés, Military Attaché.

Mexico .....Señor Coronel Don Samuel Rojas, Military Attaché.

Italy .....Commander Silvio Scaroni, Air Attaché.

Spain .....Major Victoriano Casajus, Royal Spanish Army, Military Attaché.

Cuba .....Captain Enrique A. Prieto, Military Attaché.

France .....Major Georges Thenault, Assistant Military Attaché for Aeronautics.

Chile .....Major Zorobabel Galeno, Military Attaché.

Japan .....Colonel Hisao Watari, I.J.A., Military Attaché.

Argentina .....Lieutenant Colonel Angel M. Zuloaga, Military Attaché.

Poland .....Mr. Witold Wankowicz, Commercial Counselor.

FOREIGN AERONAUTICAL OFFICIALS AND BUREAUS

COMPILED BY BUREAU OF FOREIGN AND DOMESTIC COMMERCE
DEPARTMENT OF COMMERCE, WASHINGTON, D. C.

The following lists are prepared for the convenience of American exporters and manufacturers of aircraft, parts, accessories, and supplies who wish to place information regarding their products before aeronautical officials and bureaus abroad.

ARGENTINA

Coronel Luis A. Cassinelli, Director del Servicio Aeronautica del Ejericto, Ministerio de Guerra, El Palomar F.C.P., Buenos Aires.

Teniente-Coronel Jorge B. Crispo, Director del Aeronautica Civile, Ministerio de Guerra, El Palomar F.C.P., Buenos Aires.

AUSTRALIA

Lieut. Col. H. C. Brinsmead, Controller of Civil Aviation, Department of Defense, Melbourne, Australia.

AUSTRIA

Ministerial Councillor Dr. Victor von Krauss, The Federal Ministry of Commerce and Transportation, Section 49, Aviation Department, 1, Stubenring L, Vienna.

BELGIUM

Major Dhanis, Technical Director of Military Aviation, Ministry of National Defense, 2, Rue de La Loi, Brussels.

General-Major Van Crombrugge, Chef, Administration de l'Aeronautique, Ministry des Postes et Telegraphie, Brussels.

Captain-Commandant, Crabbe sous-chef, Administration de l'Aeronautique, Ministry des Postes et Telegraphie, Brussels.

BRAZIL

General Mariante, Director de Aeronautica, Escola de Estade Maior, Rio de Janiero.

Coronel Othen de Oliveira Santos, Commandante de Escola de Aviacao Militar, Campo dos Affonsos, Rio de Janeiro.

Contra Almirante Alvaro Nunes de Carvalho, Director General de Aeronautica, Ministerio da Marinha, Rio de Janiero.

Capitao de Mar e Guerra Carlos Alves de Souza, Commandante de Escola de Aviacao, Ilha do Governador, Rio de Janeiro.

STATE OF SÃO PAULO (São Paulo Militia)

Mr. Orton Hoover, Rua Atlantica 17, São Paulo.

São Paulo State Police Air Service, Coronel Pedro Dias de Campos, Commandante da Forca Publica, Av. Tiradentes, 13, São Paulo.

BULGARIA

Director P. D. Popkristeff, Bureau of Aeronautics, Sofia.

CANADA

Colonel the Hon. J. L. Rolston, Minister of National Defense, Dept. of National Defense, Ottawa, Ontario.

Mr. G. J. Desbarots, Deputy Minister of National Defense, Department of National Defense, Ottawa, Ontario.

Wing Commander L. S. Breadner, Acting Director Royal Canadian Air Force, Department of National Defense, Ottawa, Ontario.

Wing Commander J. L. Gordon, Director of Civil Government Operations.

Mr. J. A. Wilson, Director of Civil Aviation, Department of National Defense, Ottawa, Ontario.

Wing Commander E. W. Stedman, Chief Aeronautical Engines, Department of National Defense, Ottawa, Ontario.

CHILE

Col. M. Merino, Director de Aviacion, Ministerio de Querra, Santiago.

Chief of Naval Aviation, Luis A. Davila E., Capitan de Fragata, Valparaiso.

CHINA

Naval Air Establishment, Mamoi, Foochow, China.

Frazar, Federal, Inc., Mukden, China, with head office in Tientsin (large importer).

COLOMBIA

Sr. Renoifo, Ministerio de Guerra, Bogota.

Major Henri Pilichody, Jefe de Escuela Militar, Madrid, Bogota.

Sr. Josede Jesus Garcia, Minister de Correos y Telegraphos, Bogota.

CUBA

Dr. Jose Antonio Montalvo, Chief of Communications, Havana.

Military Aviation: Captain Manuel Arozarena y Reyes, Havana.

Commandante Ovisio Ortega, Havana.

Brig, Jose Semidey, Suarez y Diaria, Havana.

CZECHOSLOVAKIA

Frantisek Udrzal, Minister of National Defense.

Lt. Col. Zdenek Kittler, Chief Section Administrative.

Major Eng. Julius Philip, Chief Technical Section.

Major Karel Kulin, Chief Supervisory Section.

Ministry of National Defense, ul Narodni Olrany, Prague-Bubenec.

Dr. Frantissele Spina, Minister of Public Works.

Chief Ing. V. Roubic, Chief of Transportation Division.

Ing. Zdznko Janak, Chief of Aviation Section.

Ing. J. Najbrt, Administrative Section.

Ing. H. Berounsky, Administrative Section.

Dr. Ing. Gustav Sticha, Technical Section.

Ing. F. Stoces, Technical Section.

Ministry of Public Works, Prague-Smichov.

DENMARK

Army: Col. J. P. Koch, Aviation Corps, Krigsministeriet, Copenhagen.

Navy: Capt. A. E. V. Grandjean, Chief Aviation Corps, Marineministeriet, Copenhagen,

Civil: Mr. Knud Gregersen, Trafikministeriet, Copenhagen.

EGYPT

D. D. Long, Air Consultant, Ministry of Communications, Cairo.

ESTHONIA

Lieut. Col. A. Steinberg is in command of the Air Force Tallinn.

FINLAND

Pouhustusministerion Insinooriosasto, Teknillisen Toimiston Paalikko, Korkeavnorenkatu 21, Helsinki, Finland.

Lieut. Col. W. Vuori, Chief of Air Force.

Purchases of flying equipment made by Col. Knut Solin, Chief, Engineering Department, Ministry of Defense.

Mr. K. R. Salovins, Referee at Ministry of Communications and Public Works (in charge proposed Civil Aviation Dept.).

FRANCE

Ingenieur General du Genie Maritime Fortant, Director du Service Technique de l'Aeronautique, Paris.

General Dumesnil, Directeur de l'Aeronautique Militaire, Paris.

Capitaine de Vaisseau J. J. J. N. Laborde, Directeur de l'Aeronautique Maritime, Paris.

GREECE

General Mazarakis, Hellenic Ministry of War, Direction of Aeronautics, Athens.

Captain Domestica, Hellenic Ministry of Marine, Direction of Aeronautics, Athens.

HUNGARY

Charles Vassel, Chief, Royal Hungarian Aerial Office, II, Fo-u. 6, II, Budapest.

INDIA

Air Vice-Marshal Sir E. L. Ellington, K. C. B., Royal Air Force, Imperial Secretariat, Raisina, Delhi.

JAPAN

Gen. Mone, Air Service, War Ministry.

Admiral Yamamote, Aviation Branch, Navy Ministry.

Mr. Yamagiya, Commercial Aviation, Ministry of Communications.

LATVIA

Col. Bashko, Commander of Aviation Regiment, Riga.

Lt. Col. Jakubov, Chief of Naval Aviation, Riga.

Mr. Auzins, Director, Post and Telegraph Dept., Ministry of Communications, Riga.

LITHUANIA

Captain Gustaitis, Assistant Chief of Aviation, Ministry of Defense, Kovno.

MEXICO

Brig. General Jose Luis Amezcua, Chief of Aviation, Mexican Army, Valbuena, D. F., Mexico.

Engineer, Juan Guillermo Villasana, Chief, Aviation Bureau, Dept. of Communications and Public Works, Mexico, D. F.

NETHERLANDS

Mr. E. Th. de Veer, Director, Air Navigation Department, Ministry of Public Works, The Hague.

NETHERLAND EAST INDIES

Lieut. Col. Hoeksemade Groot, Chief Army Aviation Department, Batavia, Java.

Lieutenant 1st Cl. J. Olivier, Department der Marine, Weltevreden, Batavia, Java.

Group-Commander E. A. Brunner, Naval Flying Station, Batavia, Java.

Captain W. Leenderts, Department Van Oorlog, Bandoeng, Java.

NEW ZEALAND

Major General R. Young, General Officer Commanding New Zealand Air Force, Wellington, New Zealand.

NORWAY

Colonel G. Gruner, Chairman, Eprsvarsdepartementels Luftartsrad, P. O. Box 313, Oslo.

PERSIA

Colonel Ahmed Khan Nakhitchevan, Chief of Aviation Bureau, Ministry of War, Teheran.

PERU

Capitan H. B. Grow, Director Aviation, Ancon.

Lt. Colonel K. B. Von Doering, Director of Military Aviation.

POLAND

Mr. Witold Czapski, Department Director, Ministerstwo Kolei, Warsaw (Commercial).

Colonel Ludomil Rayslei, Chief Aviation Dept., Ministry of War, Warsaw.

PORTUGAL

General Luis Domingues, Inspector-General da Aeronautica Militar, Ministerio du Guerra, Lisbon.

RUMANIA

Dlui, General Rudeanu, Department Aerunautic, Ministerul de Razboi, Bucharest.

SALVADOR

Dr. Pio Romero Bosque, Minister of War, Marine and Aviation, Salvador.

General of Engineers Carlos Carmona, First Chief of Aviation, Salvador.

SIAM

Purchases U. S. Materials through The International Engineering Co., 250 Park Avenue, New York City.

(Bureau Aeronautique, Department de Guerre, Bangkok, Siam.)

SPAIN

Col. Sr. Don Alfredo Kindelan, Ministerio de la Guerra, Tercera Seccion Jefatura Superior de Aeronautica, Aetamirano 31, Madrid.

SWEDEN

Combat Aviation: Chief of Air Service, General K. A. B. Amundson,

Civil Aviation: Chief of Air Traffic Board, Mr. C. J. Carlberg—Under-Secretary Department of Communications, Mynttorget 2, Stockholm.

SWITZERLAND

Director of Civil Aviation (Office Aerien Federal), Major al'E. M. G. A. Isler, Department des Chemins de Fer, Datiment Nord No. 52, Berne.

TURKEY

Abdul, Halik Bey, Minister of National Defense.

Fevzi Pasha, Chief of General Staff.

Muzzafer Pasha. Chief of Inspectorate General of Military Aviation.

Eski Chehir, Turkey.

URUGUAY

Teniente Coronel Don Cesareo L. Berisso, Director de la Escuela Militar de Aviacion, Gamino Mendoza, Montevideo.

VENEZUELA

General Jose Vincente Gomez, El Ministerio de Guerra y Marina, Caracas.

Colonel Daniel Lopez Henrique, Director School of Military Aviation, Caracas.

EXPORTS OF AIRCRAFT, ENGINES AND PARTS FROM THE UNITED STATES IN 1928

Compiled by the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

Countries	*Airplanes, Seaplanes and other aircraft*		*Engines for aircraft*		*Parts except tires, Dollars*
	Number	*Dollars*	*Number*	*Dollars*	
Canada	70	766,644	48	179,993	540,215
Soviet Russia in Europe	..	.....	..	.....	142,772
China	9	102,175	..	.....	78,678
Germany	1	5,500	23	132,510	70,548
United Kingdom	4	24,526	29	75,780	57,191
Philippine Islands	2	34,500	..	.....	52,499
Japan	3	63,000	6	21,000	49,531
Brazil	5	66,340	7	5,150	44,661
Panama	..	.....	1	150	22,705
Mexico	21	191,035	10	25,473	19,694
Netherlands	..	.....	15	70,117	20,483
Chile	..	.....	..	.....	17,343
Spain	..	.....	1	3,111	15,940
Argentina	5	55,052	7	23,315	15,499
Peru	26	226,360	2	8,002	15,459
Colombia	1	19,250	..	.....	9,894
Ceylon	..	.....	..	.....	8,210
Italy	2	84,950	4	8,338	6,546
Cuba	4	51,887	3	250	6,450
Poland and Danzig	..	.....	1	3,574	4,575
Sweden	..	.....	2	10,566	4,455
Czechoslovakia	..	.....	..	.....	3,890
Netherlands East Indies	..	.....	2	.....	3,323
Rumania	..	.....	..	1,525	2,791
Australia	7	50,872	2	980	2,777
Hong Kong	..	.....	4	.....	2,182
Honduras	1	9,000	..	.....	2,253
Norway	..	.....	..	.....	1,925
Guatemala	..	.....	..	.....	1,517
France	..	.....	3	6,223	1,303
Siam	4	38,400	..	.....	1,101
Nicaragua	..	.....	..	.....	990
Switzerland	..	.....	..	.....	950
Ecuador	..	.....	..	.....	688
British India	..	.....	..	.....	500
British Malaya	..	.....	..	.....	150
Denmark	..	.....	..	19,345	100
British West Indies	..	.....	..	.....	73
British West Africa	..	.....	..	.....	20
Dominican Republic	..	.....	..	.....	62
Austria	1	20,000	..	.....	.....
French Oceania	1	6,000	..	.....	.....
Belgium	1	4,183	..	.....	.....
Bermudas	1	2,850	..	.....	.....
Hungary	1	163	..	.....	.....
Total	170	1,825,687	169	595,402	1,229,943

AERONAUTICAL MAGAZINES OF THE UNITED STATES

Aero Digest, 220 West Forty-Second Street, New York, N. Y.
Aeronautic Review, National Aeronautic Association, 910 Seventeenth Street, N. W., Washington, D. C.
Aeronautical World, 1031 S. Broadway, Los Angeles, Cal.
American Aviator, 21 W. Sixtieth Street, New York, N. Y.
Air Transportation, 1265 Broadway, New York, N. Y.
Air Travel News, 1500 Buhl Building, Detroit, Mich.
Airports, Flushing National Bank Building, Flushing, Long Island, N. Y.
Airway Age, Simmons-Boardman Publishing Company, 30 Church Street, New York, N. Y.
Automotive Industries, Chestnut and Fifty-Sixth Streets, Philadelphia, Pa.
Aviation, 250 West 57th Street, New York, N. Y.
Aviation Engineering, 52 Vanderbilt Avenue, New York, N. Y.
Aviation Stories and Mechanics, 109 W. 49th Street, New York, N. Y.
Daily News Record, 8 East Thirteenth Street, New York, N. Y.
Pacific Airport News, 212 Park Street, Portland, Ore.

Pacific Flyer, 593 Market Street, San Francisco, Cal.
Popular Aviation, 608 South Dearborn Street, Chicago, Ill.
S. A. E. Journal, 29 West Thirty-ninth Street, New York, N. Y.
U. S. Air Services, Star Building, Washington, D. C.
Western Flying, Occidental Publishing Company, 145 South Spring Street, Los Angeles, Cal.

FOREIGN AERONAUTICAL MAGAZINES

Argentine

Aviacion—Uruguay 1093, Buenos Aires. *Boletin del Aero-Club Argentine*—Avenida de Mayo 0646, Buenos Aires.

Australia

Aircraft—Peacock House, 486-490 Bourke St., Melbourne.

Austria

Oesterreichischer Motor der Flug—Josefstaderstrasse, 87, Vienna VIII. *Flugzeug und Jacht*—Freidrichstrasse, 3, Vienna I.

Belgium

Conquête de l'Air—16, Rue Theresiènne, Brussels.

Brazil

Aeronautica—149 Avenida Rio Branca, Rio de Janeiro. *Aviacao*—Escola de Aviacion Militar, Rio de Janeiro. *Aviacion*—Florida 171, U. T. 33 Avenida, 6900, Buenos Aires.

Canada

Aircraft and Airways—Toronto. *Canadian Air Review*—Grosvenor at Bay St., Toronto. *Canadian Aviation*—153 University Ave., Toronto.

Chile

Auto y Aero—7 Pasaje Balmaceda, Santiago.

Czechoslovakia

Flugwesen—Prague. *Letec*—Lucemburska, 8, Prague, 12. *Letectvi*—Fochova, 8 Prague, 11. *Zpravyo-Letectvi*—Letnaney, Prague.

Denmark

Motor—Vinmelskafft, 42, Copenhagen.

Finland

Aero—Ilmailuvoimen Esikunta, Helsingfors.

France

L'Aéroauto—47 Rue de La Victorie, Paris. *L'Aéronautique*—55 Quai des Grands Augustins, Paris. *L'Aérophile*—35 Rue Francois, Paris. *Les Ailes*—40 Quai des Célestins, Paris. *L'Air*—5 Rue de l'Isly, Paris. *Bulletin de la Chambre Syndicale des Industries Aéronautique*—9 Rue Anatole-de-la-Forge, Paris. *Bulletin de la Fédération Aéronautique Internationale*—35, Rue François, Paris. *Bulletin de la Navigation Aérienne*—7 Rue St. Lazare, Paris. *Le Document Aéronautique*—40 Quai des Célestins, Paris. *Etudes Aéronautiques*—282 Blvd. St. Germain, Paris. *L'Indicateur Aérien*—5 Rue de l'Isly, Paris. *Revue de l'Aéronautique Militaire*—55 Quai de Grands Augustins, Paris. *Revue Juridique Internationale de la Locomotion Aérienne*—4 Rue Tronchet, Paris. *La Technique Aéronautique*—5 Rue de l'Isly, Paris. *La Vie Aérienne*—7 Rue de Metz, Paris. *La Vie Maritime et Aérienne*—24 des Ardennes, Paris.

Germany

Automobil und Flugverkehr—Uhlandstr. 184, Charlottenburg. *Deutsche Motor-Zeitschrift*—Dresden. *Flugsport*—Bahnhofsplatz 8, Berlin, W. 62. *Illustrierte Flug-Woche*—Budepesterstrasse, 35, Berlin, W. 62. *Luftfahrt*—Linkstrasse, 38, Berlin, W. 9. *Luftwacht*—Blumenshof, 17, Berlin, W. 35. *Luftweg*—Blumenshof, 17, Berlin, W. 35. *Nachrichten für Luftfahrer*—Radetzki, Berlin, S. W. 48. *Zeitschrift für Flugtechnik und Motorluftschiffahrt*—Oldenburg, Munich. *Zeitschrift für dasgesamte Luftrecht*—Genthinerstrasse, 38, Berlin, W. 10.

Great Britain

Aero Field—Sutton Coldfield. *Aeroplane*—175 Picadilly, London, W. 1. *Air* (Formerly *Air League Bulletin*)—Astor House, Aldwych, London, W. C. 2. *Air Pilot*—H. M. Stationery Office, Adastral House, Kingsway, London, W. C. 2. *Airways*—110-111 Strand, London, W. C. 2. *Flight*—36 Great Queen St., Kingsway, London, W. C. 2. *Journal of the Royal Aeronautical Society*—7 Albermarle St., London, W. 1.

Hungary

Aviatikai Ertesitö—Hungarian Aero Ass'n, 36 Rue Lomjay, Budapest IX.

Italy

Aeronautica—Via Gesu, 6, Milan. *L'Aerotecnica*—Via delle Coppelle, 35, Rome, 20. *L'Ala d'Italia*—Via Valpetrosa, 2, Rome. *Atti dell'Associazione Italiana di Aerotecnica*—Via delle Coppelle, 85, Rome. *L'Aviazione*—Via del Tritone, 183, Rome. *Bollettino Aviazione Civile e Traffico Aereo*—Via della Mercede, 9, Rome. *Il Diritto Aeronautico*—Via della Sorofa, 29, Rome. *La Gazetta dell'Aviazione*—Via Petrarcoa, 4, Milan. *Nel Cielo*—Corso Porta Nuova, 19, Milan. *Notiziario Tecnico di Aeronautica*—Via Agostina Depretis 45A, Rome. *Rassegna Marittima Aeronautica Illustrata*—Via Ulisse Seni, 5, Rome. *Rendiconti Tecnici*—Ministero dell Aeronautica, Rome. *Rivista Aeronautica*—Via Agostino Depretis, 45A, Rome. *La Via Azzura*—28 Via Cuma, Naples.

Japan

Hiko-Kwai—Irifunecho, Kyobashiku, Tokyo.

Mexico

Tohtli—Avenida Francisco Madero, 1, Mexico City.

Netherlands

Aeronautica—Koningstraat, 15, Arnheim. *Het Vliegveld*—Singel 464, Amsterdam.

Peru

El Motor—694 Lampa, Lima.

Poland

Lot Polski—Dluga, 50, Warsaw. *Lotnik*—Rzeczypospolitej, 9, Posen. *Mlody Lotnik*—Krakowski Przedmiescie, 57, Warsaw,

Portugal

Revista Aeronautica—Aero Club de Portugal, Lisbon.

Roumania

Aripa—Str. Clemenceau, 9, Bucharest.

Russia

Technica Stroitelstwoz Promichleunost—Leningrad. *Samoliot*—Moscow. *Westnik Wosdouchnar Flota*—Moscow.

Spain

Aerea—Glorieta de Atocha, 8, Madrid. *Alas*—Plaza de la Lealtad, 4, Madrid. *Boletin Official del Real Aero-Club de Espagna*—Madrid. *España Automovil y Aeronautica*—Plaza de Isabel II, 5, Madrid. *Icaro*—Pi y Margau, 18, Madrid.

Sweden

Flygnig—Jacobsgaten, 6, Stockholm. *Svensk Motortidning*—Nybrogatan, 3, Stockholm.

Switzerland

Aéro-Revue—Sihlstrasse, 43, Zurich.

AIRWAY STRIP MAPS

The Department of Commerce, under the Air Commerce Act, is charged with future charting of the civil airways. The work is being done by the Coast and Geodetic Survey, one of the bureaus of the department. The program undertakes the publication of the airways "strip" maps listed herein, in form generally similar to those of the Army Air Corps and the Hydrographic Office of the Navy, also listed herein.

All strip maps, as published, are on sale at the U. S. Coast and Geodetic Survey, Washington, D. C. The Department of Commerce and Army Air Corps maps are sold at 35 cents each; the Hydrographic Office maps at 40 cents each.

Orders for strip maps must be accompanied by remittance in the form of cash, postal money order, draft, or certified check.

Department of Commerce Maps

(Published maps available from the Aeronautical Branch, Department of Commerce, at 35 cents each.)

Maps Published

102. Dallas-Oklahoma City.
103. Oklahoma City-Wichita.
104. Wichita-Kansas City.
105. Kansas City-Moline.
110. St. Louis-Chicago.
111. Chicago-Milwaukee.
128. Atlanta-Greensboro.
129. Greensboro-Richmond.
130. Richmond-Washington.
131. Pueblo-Cheyenne.

Maps in Process

101. Galveston-Houston-Dallas.
106. Pilottown-New Orleans.
107. New Orleans-Jackson.
108. Jackson-Memphis.
109. Memphis-St. Louis.
112. Milwaukee-Twin Cities.
113. Twin Cities-Fargo.
114. Cincinnati-Indianapolis-Chicago.
115. Louisville-Cincinnati-Cleveland.
116. Cleveland-Buffalo.
117. Detroit-Grand Rapids-Milwaukee.
118. Detroit-Buffalo.
119. Buffalo-Albany.
120. Albany-Boston.
122. Albany-Montreal.
123. Miami-West Palm Beach-Titusville.
124. Tampa-Titusville.
125. Titusville-Jacksonville.
126. Jacksonville-Atlanta.
127. Birmingham-Atlanta.
132. Los Angeles-Las Vegas.
133. Las Vegas-Milford.
134. Milford-Salt Lake City.
135. Salt Lake City-Boise.
136. Boise-Pasco.
137. Pasco-Portland.
138. Salt Lake City-Pocatello.
139. Pocatello-Butte.
140. Butte-Great Falls.
141. Laredo-San Antonio.
142. Fargo-Winnipeg.
143. Atlanta-Nashville.
144. Nashville-Evansville.
145. Evansville-Chicago.
146. Evansville-St. Louis.
147. South Bend-Kalamazoo-Bay City.
148. Laredo-Houston.
149. Tulsa-Ponca City.
150. Kansas City-Omaha.

Army Air Corps

(Available from Aeronautics Branch, Department of Commerce, at 35 cents each.)

1. Uniontown-Dayton.
2. Washington-Uniontown.
3. Washington-New York.
4. Washington-Norfolk.
5. Dayton-Rantoul.
6. New York-Boston.
7. Baumont-New Orleans.
8. New Orleans-Montgomery.
9. Chicago-Iowa City.
10. Iowa City-Omaha.
11. Omaha-North Platte.
12. North Platte-Cheyenne.
13. Cheyenne-Rock Springs.
14. Rock Springs-Salt Lake City.
15. Montgomery-Augusta.
16. Augusta-Fayetteville.
17. .....
18. Fayetteville-Norfolk.
19. New York-Bellefonte
20. Bellefonte-Cleveland.
21. Cleveland-Chicago.
22. Chicago-Rantoul-St. Louis.
23. St. Louis-Kansas City.
24. Kansas City-Muskogee.
25. Muskogee-Dallas.
26. Dallas-San Antonio.
27. San Antonio-Beaumont.
28. San Antonio-Dryden.
29. Dryden-El Paso.
30. El Paso-Tucson.
31. Tucson-Phoenix.
32. Phoenix-San Diego.
33. Salt Lake City-Elko.
34. Elko-Reno.
35. Reno-San Francisco.
36. Dayton-Louisville.
37. Louisville-St. Louis.
38. San Diego-Tucson.
39. San Diego-Los Angeles.
40. Los Angeles-San Francisco.
41. San Francisco-Yreka.
42. Yreka-Vancouver.
43. Vancouver-Seattle.
44. Detroit-Rantoul.
45. Detroit-Cleveland-Pittsburgh-Uniontown.
46. Washington-Middletown.
47. Detroit-Dayton.
48. Louisville-Nashville.
49. Nashville-Birmingham.
50. Birmingham-Montgomery-Pensacola.
51. St. Louis-Muskogee.
52. St. Louis-Dayton.

Hydrographic Office Maps

(Published maps available from Aeronautics Branch, Department of Commerce, at 40 cents each.)

Maps Published

V-232. New York-Philadelphia.
V-233. Philadelphia-Hampton Roads.
V-234. Washington-Hampton Roads.
V-235. Hampton Roads-Morehead City
V-236. Morehead City-Charleston.
V-237. Charleston-Jacksonville.
V-238. Fernandina-Miami.
V-239. Miami-Isle De Pinos, Cuba.
V-240. Key West-Cedar Keys.
V-241. Cedar Keys-Pensacola.
V-242. Pensacola-New Orleans.
V-249. Habana-Port Morelos.
V-250. Port Morelos-Puerto Barrios.
V-251. Puerto Barrios-Cape Gracias a Dios.
V-252. Cape Gracias a Dios-Port Limon.
V-253. Port Limon-Panama Canal Zone.
V-264. Media Luna Cay-Cape Haitien.
V-266. Batabano-Media Luna Cay.
V-416. San Diego-San Luis Obispo Bay-San Francisco.
V-417. San Luis Obispo Bay-San Francisco.
V-422. Astoria-Vancouver Island.

Maps in Process

V-230. Eastport, Me.-Boston.
V-231. Boston-New York City.
V-243. New Orleans-Galveston.
V-244. Galveston-Corpus Christi.
V-245. Corpus Christi-Tampico.
V-246. Tampico-Puerto Mexico.
V-247. Puerto Mexico-Campeche.
V-248. Campeche-Cape Catoche.
V-254. Gulf of Darien-Santa Marta.
V-255. Santa Marta-Curacao Island.
V-256. Maracaibo-Caracas.
V-257. Caracas-Port of Spain.
V-258. Port of Spain-Santa Lucia.
V-259. Barbados-Barbuda.
V-260. Barbuda-Porto Rico.
V-261. Porto Rico-Port au Prince.
V-262. North Coast of Haiti.
V-263. Port au Prince-Jamaica.
V-265. Cape Maisa-Nuevitas.
V-267. Habana-Nuevitas.
V-401. Panama Canal Zone-Cape Mala.
V-402. Cape Mala-Puntarenas.
V-403. Puntarenas-La Union.
V-404. La Union-San Jose.
V-405. San Jose-Salina Cruz.
V-406. Salina Cruz-Acapulco.
V-407. Acapulco-Manzanillo.
V-408. Manzanillo-Mazatlan.
V-409. } Gulf of California.
V-412. }
V-413. Mazatlan-Cape San Lucas.
V-414. Magdalena Bay-Rosarita.
V-415. Rosarita-San Diego.
V-418. San Francisco-Humboldt Bay.
V-419. Humboldt Bay-Coos Bay.
V-420. Coos Bay-Astoria.
V-421. Columbia River.
V-423. Olympia-Vancouver, B. C.
V-424. Vancouver-Alert Bay.
V-425. Alert Bay-Ketchikan.
V-426. Ketchikan-Juneau.

MEDICAL EXAMINERS FOR PILOTS

The following is a complete list of Medical Examiners authorized by the Department of Commerce to make the physical examinations of airplane pilots. This list is complete as of Dec. 31, 1928. Additions will be made from time to time. Applicants are cautioned that when the examination is made by a group of two or more men, that it is necessary to see all those in the group for the completion of the examination. For example, one man may give the eye examination, one man the ear, nose, and throat, and the other, the general physical examination. In some instances one man gives the complete examination.

The fees for the complete examinations are as follows: original examination of Transport, Limited Commercial, and Industrial Pilots, $15.00; original examination of Private and Student Pilots, $10.00; all annual re-examinations of whatever class, $10.00; mid-year check of Transport and Limited Commercial Pilots, $5.00.

ALABAMA

Anniston—Dr. Wade H. Brannon, 1211 Noble St.; Dr. C. Hal Cleveland.

Birmingham—Dr. E. P. Green, 423 First National Bank Bldg.; Dr. E. M. Robinson, Jr., 2016 Highland Ave.

Mobile—Dr. Toxey D. Haas, Van Antwerp Bldg.; Dr. John C. O'Gwynn, O'Gwynn Bldg.

Montgomery—Dr. Bruce G. Holding, 1112 Bell Bldg.

ALASKA

Anchorage—Dr. Arthur D. Haverstock.

Fairbanks—Dr. Frank de la Vergne.

ARIZONA

Phoenix—Dr. William A. Schwartz, 605 Goodrich Bldg.; Dr. Thomas W. Woodman, 404 Heard Bldg.

Tucson—Dr. Edward J. Gottheil, 9 E. Pennington St.; Dr. Bascom F. Morris, 59 S. Scott St.

ARKANSAS

Conway—Dr. I. N. McCollum, 5-6 Halter Bldg.; Dr. N. E. Fraser.

El Dorado—Dr. H. H. Noihuss, El Dorado Clinic, 112 W. Peach St.; Dr. J. G. Mitchell, 211 E. Peach St.

Fort Smith—Dr. Jefferson S. Southard, Merchants Bank Bldg.; Dr. W. R. Brooksher, 610 First National Bank Bldg.

Helena—Dr. Henry H. Righter, 402 Solomon Bldg.; Dr. William P. Orr, Solomon Bldg.

Hot Springs—Dr. J. F. Rowland, Thompson Bldg.; Dr. Thomas N. Black, Thompson Bldg.

Jonesboro—Dr. J. Wilson Ramsey, The Jonesboro Clinic, 624 S. Main St.; Dr. Charles H. Lutterloch, The Jonesboro Clinic, 624 S. Main St.

Lake Village—Dr. E. P. McGehee, Lake Village Infirmary.

Little Rock—Dr. Phil E. Thomas, Jr., 520 Boyle Bldg.

McGehee—Dr. W. B. Grayson.

Pine Bluff—Dr. A. A. Hughes, 404 Citizens Bank Bldg.; Dr. Benjamin D. Luck, P & S Clinic.

Texarkana—Dr. Harry H. Smiley; Dr. Theron E. Fuller.

CALIFORNIA

Bakersfield—Dr. Robert M. Jones, 208 Hopkins Bldg.

Barstow—Dr. James A. Graham.

Berkeley—Dr. Werner F. Hoyt, Medico-Dental Bldg.

Fillmore—Dr. J. E. Whitlow, Post Office Box 116.

Fresno—Dr. D. H. Trowbridge, 719 T. W. Patterson Bldg.

Glendale—Dr. Harold J. Cooper, 208 Lawson Bldg.

Los Angeles—Dr. Theo. C. Lyster, 1920 Wilshire Blvd.; Dr. Isaac A. Jones, 1920 Wilshire Blvd.

Modesto—Dr. L. D. Mottram, 1007 Tenth St.

Needles—Dr. H. W. Seiger, Coule Blk.

Oakland—Dr. Francis M. Shook, Medical Bldg., 1904 Franklin St.; Dr. Arthur Perkins, Medical Bldg., 1904 Franklin St.

Palo Alto—Dr. Granville Wood, 2265 El Camino Real; Dr. Ward Cooper, Frazer Bldg.

Sacramento—Dr. Charles B. McKee, California State Life Insurance Bldg.

San Diego—Dr. Samuel A. Durr, 1304 Medico-Dental Bldg., 3rd and A Sts.

San Francisco—Dr. B. J. Edger, Jr., 240 Stockton St.; Dr. C. L. Callander, 240 Stockton St.

San Luis Obispo—Dr. Howard A. Gallup, 774 Marsh St.

San Mateo—Dr. Clarence G. Potter.

Santa Ana—Dr. M. W. Hollingsworth, 409 First National Bank Bldg.

Santa Barbara—Dr. Philip C. Means, 103 E. Micheltorena St.

Santa Cruz—Dr. Samuel B. Randell; Dr. Grant Hatch.

Santa Maria—Dr. Charles G. Baird, 301 East Chapel St.; Dr. Zach B. Coblentz, 301 E. Chapel St.; Dr. W. D. Sink, 301 E. Chapel St.

Stockton—Dr. George H. Sanderson, 809 Medico-Dental Bldg.; Dr. Hunter L. Gregory, 805 Medico-Dental Bldg.

Visalia—Dr. W. C. Zeller, 208 Bank of Italy Bldg.; Dr. C. M. White, 508 Bank of Italy Bldg.

Yreka—Dr. Clyde G. Reynolds, 707 Oregon St.; Dr. V. W. Hart, 707 Oregon St.

COLORADO

Colorado Springs—Dr. H. W. Woodward, Ferguson Bldg.

Denver—Dr. John S. Chase, 423 Majestic Bldg.

Lamar—Dr. L. E. Likes.

CONNECTICUT

Hartford—Dr. William B. Smith, Capitol Bldg., 410 Asylum St.

New Haven—Dr. James C. Fox, Jr., New Haven Hospital, 330 Cedar St.

CUBA

Havana—Dr. Armando de la Torre, Escuela de Aviacion, Columbia.

DELAWARE

Wilmington—Dr. William F. Bonner, 224 Delaware Trust Bldg.

DISTRICT OF COLUMBIA

Washington—Dr. Bernard L. Jarman, The Rochambeau, 815 Connecticut Ave.

FLORIDA

Fort Myers—Dr. B. Whisnant, 1 Leon Bldg.; Dr. W. A. Harrison, 204 Pythian Bldg.

Jacksonville—Dr. Ralph N. Greene, 1022 Park St.; Dr. A. K. Wilson, 334 St. James Bldg.

Miami—Dr. Bascom Palmer, 502 Huntington Bldg.; Dr. Thomas W. Hutson, 5 N. E. 2nd Ave.

Orlando—Dr. J. S. McEwan; Dr. L. C. Ingram.

St. Petersburg—Dr. W. C. McConnell, Medical Arts Bldg., 7th Ave. and 11th St., N.; Dr. J. H. Cooper, First National Bank Bldg.

Tampa—Dr. S. B. Forbes, 409 Citizens Bank Bldg.

Tarpon Springs—Dr. A. McCallister, Post Office Box 261.

West Palm Beach—Dr. S. Ward Fleming, Harvey Bldg.; Dr. William Y. Sayad, Harvey Bldg.

GEORGIA

Atlanta—Dr. David D. Moncrief, Atlanta National Bank Bldg.

Augusta—Dr. George A. Tralor, Lamar Bldg.; Dr. W. R. Bedingfield, Lamar Bldg.

Columbus—Dr. Francis B. Blackmar, 408 Woolworth Bldg.; Dr. J. T. Tidwell, 507 Swift-Kyle Bldg.

Savannah—Dr. St. J. R. deCaradeuc, DeRenne Apartments; Dr. E. Carson Demmond, DeRenne Apartments.

HAWAII

Honolulu—Dr. Clarence E. Fronk, 235 S. Beretania St.; Dr. William H. Wynn, 235 S. Beretania St.; Dr. Rufus H. Hagood, Jr., 235 S. Beretania St.

IDAHO

Boise—Dr. George H. Wahle, Eastman Bldg.; Dr. Urban H. Merrill, 518 Overland Bldg.

Pocatello—Dr. C. W. Pond, Kane Bldg.; Dr. A. M. Newton, Kane Bldg.

ILLINOIS

Aurora—Dr. Clarence E. Robertson, Aurora National Bank Bldg.; Dr. Elliott S. Denney, Graham Office Bldg.

Bloomington—Dr. Watson W. Gailey (Working with Dr. Humphries at Towanda).

Champaign—Dr. Hanly L. Ford, Roheson Bldg.; Dr. Earl D. Wise, Illinois Bldg.

Chicago—Dr. August Anderson, 1107 Bryn Mawr Ave.; Dr. William P. McCracken, 24 N. Wabash Ave.; Dr. R. Ralph Ferguson, 4175 Irving Park Blvd.

Danville—Dr. Melvin L. Hole, Temple Bldg.; Dr. Herschel E. Baldwin, Temple Bldg.

East St. Louis—Dr. William L. Hanson, 316 Murphy Bldg., 234 Collingsville Ave.

Freeport—Dr. Karl F. Snyder, State Bank Bldg.; Dr. W. J. Rideout, State Bank Bldg.

Hoopeston—Dr. Lemuel B. Russell; Dr. Charles O. Nelms.

Kankakee—Dr. Ernest N. Greenman; Dr. Jesse H. Roth, 504 Cobb Bldg.

La Salle—Dr. Walter W. Greaves, La Salle State Bank Bldg.

Moline—Dr. Chester C. Sloan, Sohrbeck Bldg.

Monmouth—Dr. Harold M. Camp, 203 Lahl Bldg.; Dr. Frank C. Winters, Lynch Bldg.

Peoria—Dr. Fred M. F. Meixner, 827 Peoria Life Bldg.; Dr. Carroll B. Welton, 827 Peoria Life Bldg.

Quincy—Dr. Walter Stevenson, 904 W. C. U. Bldg.; Dr. Carson Gabriel.

Rockford—Dr. Harry H. Davis, 902 Rockford National Bank Bldg.; Dr. Norman L. Sheehe, 904 Rockford National Bank Bldg.

Rock Island—Dr. Daniel F. Paul, Robinson Bldg.; Dr. C. E. Robb, Central Trust Bldg.

Springfield—Dr. E. K. Lockwood, 401 South Seventh; Dr. Edward Morris, 717 E. Capitol Ave.

Streator—Dr. Bernard O. Bendixon, 208 E. Main St.

Towanda—Dr. Paul A. Humphries. (Working with Dr. Gailey at Bloomington.)

Waukegan—Dr. O. C. Breitenbach, Waukegan National Bank Bldg.

Woodstock—Dr. Clyde F. Baccus, Woodstock National Bank.

INDIANA

Bedford—Dr. Frank D. Martin; Dr. W. H. McKnight.

Ft. Wayne—Dr. D. D. Johnston, 624 Calhoun St.

Gary—Dr. A. F. Lenzen, 738 Broadway; Dr. Thomas D. Keckich, 34 W. 5th Ave.

Indianapolis — Dr. Wilbur F. Smith, 1819½ College Ave.

Lafayette—Dr. George R. Clayton, Lafayette Life Bldg.; Dr. A. C. Arnett, Schultz Bldg., 4th and Main Sts.

Logansport—Dr. James J. Stanton; Dr. Will W. Holmes.

Muncie—Dr. Karl T. Brown, 503 Johnson Bldg.

Seymour—Dr. Guy Martin.

South Bend—Dr. V. E. Harmon, 316 Sherland Bldg.

Terre Haute—Dr. Albert M. Mitchell, Tribune Bldg.; Dr. Walter E. Stewart, Tribune Bldg.

IOWA

Battle Creek—Dr. George A. Hartley; Dr. G. S. Millice.

Burlington—Dr. George L. Dixon, Tama Bldg.; Dr. D. F. Huston, Iowa State Bank Bldg.

Carroll—Dr. O. C. Morrison.

Cedar Falls—Dr. George E. Hearst.

Cedar Rapids—Dr. Frank P. Riggle, 230 Granby Bldg.; Dr. Roy K. Koech, 502 Mullin Bldg.; Dr. John E. Stansbury, Merchants National Bank Bldg.

Davenport—Dr. Gordon F. Harkness, 509 Putnam Bldg.; Dr. John I. Marker, 631 Union Bank Bldg.

Des Moines—Dr. W. W. Pearson, 417 Bankers Trust Bldg.; Dr. J. A. Downing, 417 Bankers Trust Bldg.; Dr. E. B. Winnett, 619 Southern Surety Bldg.

Dubuque—Dr. W. J. Connell, City Hall, 9th and Locust Sts.; Dr. H. E. Thompson, 1100 Main St.

Ft. Dodge—Dr. Sumner B. Chase, 208 Carver Bldg.; Dr. William R. Turner, 404 Carver Bldg.

Mason City—Dr. C. E. Chenoweth, Park Hospital; Dr. George M. Crabb, Park Hospital.

Ottumwa—Dr. Murdock Bannister; Dr. D. E. Graham.

Shenandoah—Dr. Benjamin S. Barnes; Dr. J. O. Weaver.

Sioux City—Dr. T. R. Gittins, 401 Davidson Bldg.; Dr. John W. Schwartz, 109 Sioux National Bank Bldg.

Waterloo—Dr. E. I. Dunkelberg, 710 James Black Bldg.; Dr. F. Harold Reuling, James Black Bldg.

Woodbine—Dr. Harry N. Anderson, 511 Walker St.

KANSAS

Arkansas City—Dr. L. M. Beatson, 201½ S. Summit St.; Dr. Walter H. Rea, Trimper Bldg.

Coffeyville—Dr. Harold J. Bagby; Dr. Charles A. Thomas.

Emporia—Dr. Clarence S. Trimble; Dr. C. E. Partridge.

Garden City—Dr. Oliver W. Minor.

Hutchinson—Dr. G. R. Walker, 510 Rorabaugh-Wiley Bldg.; Dr. B. L. Greever, 610 Rorabaugh-Wiley Bldg.

Iola—Dr. O. L. Garlinghouse, 1-2 Garlinghouse Bldg.; Dr. Omar L. Cox.

Kingman—Dr. Boyd H. Pope, State Bank of Kingman; Dr. Charles W. Longenecker.

Lawrence—Dr. Lyle S. Powell, 813½ Massachusetts St.

Lindsborg—Dr. Arvid Pihlblad.

McPherson—Dr. Andrew Engbert; Dr. William C. Heaston.

Salina—Dr. Edwin G. Ganoung, 686 Highland Ave.

Topeka—Dr. Alexander B. Jeffrey, 1001 National Reserve Bank.

Wichita—Dr. C. H. Briggs, 510 Schweiter Bldg.; Dr. George B. Morrison, 510 Schweiter Bldg.

KENTUCKY

Lexington—Dr. Judd E. Hammond, 310 Guaranty Bank Bldg.; Dr. C. W. Trapp, 306 City National Bldg.; Dr. A. L. Johnson, McClelland Bldg. (Associate of Dr. Trapp.)

Louisville—Dr. Benjamin D. Choate, 2740 Frankfort Ave.; Dr. Gaylord C. Hall, Brown Bldg.

Paducah—Dr. J. Vernon Pace, 711 City National Bank Bldg.; Dr. Erret Pace, 711 City National Bank Bldg.

LOUISIANA

Monroe—Dr. George W. Wright, 231½ DeSiard St.

New Orleans—Medical Officer in Charge U. S. Marine Hospital 14, Tehoupitoulas and Henry Clay.

Shreveport — Dr. D. Bean, Tri-State Clinic, Medical Bldg., 710 Cotton St.; Dr. R. D. McIntyre, 528 Ricou-Brewster Bldg.

MAINE

Bangor—Dr. Alfred H. Schriver, 77 Essex St.

Caribou—Dr. Frederick L. Gregory (To be associated with Dr. Sawyer at Ft. Fairfield).

Fort Fairfield—Dr. Alfred L. Sawyer, Box 308 (To be associated with Dr. Gregory at Caribou).

Portland—Dr. S. J. Beach, 704 Congress St.

MARYLAND

Baltimore—Medical Officer in Charge U. S. Marine Hospital No. 1, 31st St. and Remington Ave.; Dr. Harold R. Bohlman, Medical Arts Bldg.

Cumberland—Dr. J. Lile Cowherd, Riverside Bldg., 41 Greene St.; Dr. George O. Sharrett, 119 Bedford St.

Hagerstown—Dr. B. B. Kneisley, 122 W. Washington St.

MASSACHUSETTS

Boston—Dr. J. Herbert Waite, 5 Bay State Rd.; Dr. G. Philip Grabfield, 23 Bay State Rd.

Brockton—Dr. John R. Noyes, 47 W. Elm St.; Dr. Leo P. Crimmin, 47 W. Elm St.

North Attleborough—Dr. Michael E. Vance, 63 N. Washington St.; Dr. Willis L. Hale, 47 N. Washington St.

Springfield—Dr. Harry F. Byrnes, 67 Chestnut St.; Dr. Harold C. Goodwin, 111 Dickinson St.; Dr. Eugene G. Boss, 1537 Main St., Springfield National Bank Bldg.

Taunton—Dr. Andrew J. McGraw, 93 Washington St.; Mr. John H. Doyle.

Worcester—Dr. Earl E. Fipphen, 21 West St.; Dr. William F. Holzer, Medical Arts Bldg., 36 Pleasant St.

MICHIGAN

Battle Creek—Dr. W. R. Chynowith, Battle Creek Sanitarium; Dr. B. G. Holtum, 529 Post Bldg.

Bay City—Dr. Charles L. Hess, 308 Davidson Bldg.; Dr. R. N. Sherman, Ridotto Bldg.

Detroit—Dr. D. S. Brachman, Addison Hotel, 3101 Woodward Ave.; Dr. J. L. Derosier, 14703 Kercheval St.; Dr. Edgar E. Paos, 26 Waverly at Woodward Ave.; Henry Ford Hospital.

Escanaba—Dr. Wm. B. Boyce; Dr. John J. Walch.

Grand Rapids—Dr. F. C. Warnshuis, Michigan State Medical Society, 1508 G. R. National Bank Bldg.

Iron Mountain—Dr. Geron Fredrickson, Dr. Claude W. Walker.

Jackson—Dr. R. H. Alter, 312 Michigan Ave., W.; Dr. Wayne Cochrane, 312 Michigan Ave., W.

Kalamazoo—Dr. Reader J. Hubbell, 418 S. Rose St.

Lansing—Dr. Harold W. Wiley, Medical Bldg., 300 W. Ottawa St.; Dr. Harry B. Weinburgh, 709 American State Bank Bldg.

Saginaw—Dr. Frederick J. Cady, 506 Wiechman Bldg.; Dr. John T. Sample, 309 S. Washington Ave.

MINNESOTA

Bemidji—Dr. DeWitt H. Garlock; Dr. E. A. Marcum.

Crookston—Dr. C. L. Oppegaard, Northwest Clinic, 220 S. Broadway; Dr. O. E. Locken, Northwest Clinic, 220 S. Broadway.

Duluth—Dr. D. D. Murray, 225 Fargusson Bldg.; Dr. F. N. Knapp, 329 Bradley Bldg., 10 E. Superior St.

Elk River—Dr. G. E. Page.

Minneapolis—Dr. A. J. Herbolsheimer, 323 LaSalle Bldg.

Rochester—Dr. Joel A. Peterson, Mayo Clinic.

St. Cloud—Dr. John J. Gelz, 303 St. Mary's Bldg.; Dr. Charles S. Sutton, 614½ St. Germain St.

St. Paul—Dr. M. A. Shillington, 1515 Charles St., Northern Pacific Hospital.

Winona—Dr. G. H. Walker, Winona Clinic; Dr. E. M. McLaughlin, Winona Clinic.

MISSISSIPPI

Clarksdale—Dr. Andrew B. Carney, Carney-McDaniel Clinic; Dr. J. R. McDaniel, Carney-McDaniel Clinic.

Greenwood—Dr. L. B. Otken, Medical Bldg. Laboratory, 308 Fulton St.; Dr. J. C. Adams, Medical Bldg. Laboratory, 308 Fulton St.

Jackson—Dr. L. F. Armstrong, Merchants Bank Bldg.; Dr. Victor W. Maxwell, Baptist Hospital.

MISSOURI

Carthage—Dr. Lloyd G. Clinton.

Columbia—Dr. C. R. Bruner, Exchange National Bank Bldg.; Dr. A. W. Kampschmidt.

Florissant—Dr. A. C. Leggat.

Joplin—Dr. Robert M. James, Frisco Bldg.; Dr. Charles T. Reid, Frisco Bldg.

Kansas City—Dr. Wade H. Miller, 712 Argyle Bldg.

Kirksville—Dr. Edward A. Grim, Grim Bldg.

Marshall—Dr. W. M. Bickford, Marshall Bldg.; Dr. S. P. Simmons, Bank of Marshall Bldg.

St. Joseph—Dr. W. H. Minton, First State Bank Bldg.

St. Louis—Dr. Maurice L. Greene, 311 Metropolitan Bldg.; Dr. Joseph F. Mayes, 1800 Olive St.; Dr. John P. Murphy, Lister Bldg.; Dr. R. J. Payne, University Club Bldg.

MONTANA

Billings—Dr. William R. Morrison, Hart-Albin Bldg.; Dr. William G. Richards, Hart-Albin Bldg.; Dr. Elmer G. Balsam, Hart-Albin Bldg.

Bozeman—Dr. Glem C. Seerly, 405 Commercial National Bank Bldg.; Dr. Charles F. Jump.

Butte—Dr. Edward C. Person, Murray Hospital, 55 W. Quartz St.

Glendive—Dr. J. A. Evert, Northern Pacific Hospital; Dr. A. L. Hammerel, Northern Pacific Hospital.

Great Falls—Dr. Ivan A. Allred, Stanton Bank Bldg.

Havre—Dr. F. W. Briggs, Havre Clinic; Dr. A. A. Husser, Havre Clinic.

Helena—Dr. William M. Copenhaver; Dr. Thomas L. Hawkins, Power Block Annex.

Lewiston—Dr. George R. Hageman, Attix Clinic; Dr. Curtis W. Wilder.

Miles City—Dr. Malcolm C. Pfunder; Dr. John H. Garberson.

Missoula—Dr. M. R. Marshall, The Western Montana Clinic; Dr. James D. Hobson, The Western Montana Clinic.

NEBRASKA

Edgar—Dr. C. W. Keith.

Hastings—Dr. Ralph G. Cressman, Nebraska National Bank Bldg.; Dr. E. C. Foote, Foote Bldg.

Lincoln—Dr. Charles H. Arnold, 908 Terminal Bldg.; Dr. J. J. Loomis, 908 Terminal Bldg.

McCook—Dr. Roland R. Reed; Dr. J. Stanley Hill.

Norfolk—Dr. S. A. Campbell, Campbell Clinic; Dr. Lloyd L. Nelson, Campbell Clinic.

North Platte—Dr. Theodore J. Kerr, First National Bank Bldg.; Dr. Harold H. Walker, McDonald State Bank Bldg.

Omaha—Dr. J. A. Tamisiea, 522 World Herald Bldg.

Scottsbluff—Dr. Earl E. Griggs, 1704 Broadway; Dr. William P. Hodnett.

NEVADA

Reno—Dr. David Shaw, Medico-Dental Bldg.; Dr. Arthur E. Landers, Medico-Dental Bldg.

NEW HAMPSHIRE

Concord—Dr. Harold J. Connor, 8 N. State St.; Dr. A. L. MacMillan, Jr., 28 S. Main St.

Keene—Dr. Osmun H. Hubbard, 101 Main St.; Dr. Robert W. Holmes.

NEW JERSEY

Asbury Park—Dr. Harry G. Thomas, 1113 Fifth Ave.; Dr. Henry B. Dorr, Asbury Park Trust Co. Bldg.

Atlantic City—Dr. Charles C. McGivern, 101 S. Indiana Ave.

Mount Holly—Dr. Daniel F. Remer, 29 Washington St.; Dr. F. D. Fahrenbruch, Garden and Buttonwood Sts.

New Brunswick—Dr. C. J. Sullivan, 57 Paterson St.; Dr. Howard C. Voorhees, 43 Bayard St.

Paterson—Dr. Louis R. Burnett, City Hall; Dr. E. A. Atwood, 203 Park Ave.; Dr. A. F. Graham, 42 Park Ave.

Red Bank—Dr. Frank J. Goff, 68 Maple Ave.; Dr. William Mathews, 65 Broad St.

Trenton—Dr. Enoch Blackwell, Trenton Trust Bldg.; Dr. Samuel Blaugrund, 553 S. Broad St.

NEW MEXICO

Albuquerque—Dr. C. LeRoy Brock, First National Bank Bldg.; Dr. Edward C. Matthews, First National Bank Bldg.

Roswell—Dr. H. A. Ingalls, Station Hospital, New Mexico Military Institute; Dr. Alexander P. Horwitz, Station Hospital, New Mexico Military Institute.

NEW YORK

Albany—Dr. A. Wallace Todd, 463 Delaware Ave.

Batavia—Dr. C. C. Wolcott (Associated with Dr. Knoll, LeRoy).

Buffalo—Dr. Howard Osgood, 131 Linwood Ave.; Dr. Edward H. Kraemer, 131 Linwood Ave.; Dr. Otto S. McKee, 131 Linwood Ave.

Castle Point—Dr. James L. Hammond, U. S. Veterans Hospital.

Elmira—Dr. Arthur C. Glover, 311 W. Church St.; Dr. Donald Tillou, 311 W. Church St.

Endicott—Dr. R. D. Mead, 1405 E. Main St.; Dr. R. T. Allen, 136 Washington Ave.; Dr. J. H. Robertson, 136 Washington Ave.

Hancock—Dr. Donald R. Davidson; Dr. Lester E. Woolsey.

Hempstead, Long Island—Dr. Luther H. Kice, Professional Bldg.

Ithaca—Dr. Hudson J. Wilson, 156 E. State St.

Jamestown—Dr. John S. Hickman, 706 Hotel Jamestown Bldg.

LeRoy—Dr. C. Henry Knoll (Associated with Dr. Wolcott, Batavia).

Medina—Dr. Frank Wehle, 549 Main St.

New York City—Dr. Conrad Berens, 30 E. 40th St.; Dr. H. T. Smith, 30 E. 40th St.; Dr. P. O. Northington, Bellevue and Allied Hospital, 26th St. and 1st Ave.; Dr. Ermin L. Ray, 150 W. 58th St.

Niagara Falls—Dr. Norman W. Price, 445 Third St.; Dr. R. H. Sherwood, 7813 Buffalo Ave.

Oneonta—Dr. Alexander F. Carson, 28 Watkins Ave.; Dr. LeRoy S. House.

Rochester—Dr. E. S. Ingersoll, 26 S. Goodman St.; Dr. Clarence P. Thomas, 26 S. Goodman St.; Dr. E. W. Kennedy, 707 Gas and Electric Bldg.

Schenectady—Dr. E. MacD. Stanton, 102 Medical Arts Bldg., 146 Barrett St.; Dr. C. W. Woodall, Medical Arts Bldg., 182 Barrett St.; Dr. Albert W. Greene, 102 Medical Arts Bldg., 146 Barrett St.

Syracuse—Dr. Glendon R. Lewis, Medical Arts Bldg., 713 E. Genesee St.

Troy—Dr. Thurman Hull, 505 Broadway; Dr. Edward S. Welles.

Utica—Dr. James W. Fleming, 246 Genesee St.; Dr. Walter S. Pugh, Clarendon Bldg., 219 Genesee St.

Watertown—Dr. Walter S. Atkinson, 168 Sterling St.; Dr. Walter F. Smith, 185 Stone St.

Wellsville—Dr. Lloyd E. Tefft, 284 N. Main St.

NORTH CAROLINA

Charlotte—Dr. A. Wylie Moore, 405½ E. Trade St.; Dr. John H. Tucker, 309 Professional Bldg.

Greensboro—Dr. J. M. McGee, 527 Greensboro Bank and Trust Bldg.

Pinehurst—Dr. M. W. Marr, Carolina Hotel.

Raleigh—Dr. William B. Dewar, Professional Bldg.; Dr. V. M. Hicks, Professional Bldg.

Rocky Mount—Dr. John L. Lane, 313 S. Church St.; Dr. W. H. Dixon.

Southern Pines—Dr. Erastus E. Holt.

Winston-Salem—Dr. J. E. Kerr, 212 Masonic Temple; Dr. G. C. Cooke, Lawrence Hospital, 719 Oak St.

NORTH DAKOTA

Bismarck—Dr. George M. Constans, Quain & Ramstad Clinic.

Fargo—Dr. C. N. Callander, Fargo Clinic; Dr. Joel Swanson, Fargo Clinic.

Minot—Dr. Roy W. Pence; Dr. Archibald D. McCannel.

OHIO

Akron—Dr. J. C. Root, 489 E. South St.

Cincinnati—Dr. J. Henry Schroeder, 11½ E. Eighth St.; Dr. William J. Topmoeller, 577 Doctors Bdg., 19 Garfield Place.

Cleveland—Dr. H. M. Strachan, 1052 Rose Bldg.; Dr. Herbert D. Wright, 9400 Euclid Ave.; Dr. Frederick A. Snyder, 13177 Cedar at Lee Road.

Columbus—Dr. P. B. Wiltberger, 1271 N. High St.; Dr. William J. Gorey, 6½ W. Goodale St.

Dayton—Dr. Alfred G. Farmer, 1040 Fidelity Medical Bldg.

Springfield—Dr. Frank P. Anzinger, 726 First National Bank Bldg.; Dr. Charles L. Minor, 726 First National Bank Bldg.

Toledo—Dr. James H. Smith, 606 Euclid Ave.

Youngstown—Dr. John U. Buchanan, 234 North Phelps St.

OKLAHOMA

Ardmore—Dr. G. E. Johnson, Ritz Bldg.; Dr. John R. Pollock, Ritz Bldg.

Clinton—Dr. Frank Vieregg, Post Office Bldg., Frisco Ave.; Dr. C. J. Alexander, Post Office Bldg., Frisco Ave.

Cushing—Dr. Wallace N. Davidson (Associated with Dr. Hudson, Yale).

Enid—Dr. John R. Walker; Dr. Glenn Francisco, American National Bank Bldg.

Mangum—Dr. Frank M. McGregor, Border Hospital.

Muskogee—Dr. Samuel E. Mitchell, 703 Barnes Bldg.

Oklahoma City—Dr. Theodore G. Wails, 902 Medical Arts Bldg.

Tulsa—Dr. James C. Braswell, 1109 Medical Arts Bldg.; Dr. Samuel Goodman, 319 Roberts Bldg.; Dr. S. C. Shepard, 309 Roberts Bldg.

Yale—Dr. Walter B. Hudson (Associated with Dr. Davidson, Cushing).

OREGON

Corvallis—Dr. H. M. Francis.

Eugene—Dr. Haven C. Dyott, 321 I. O. O. F. Bldg.; Dr. Carl W. Robbins, Tiffany Bldg.

LaGrande—Dr. R. Graham McCall; Dr. F. L. Ralston.

Medford—Dr. Jocelyn J. Emmens, Medford Center Bldg.; Dr. James C. Hayes, Medford Center Bldg.

Portland—Dr. William House, 1010 Selling Bldg.; Dr. DeWitt Burkes, Selling Bldg.; Dr. Ralph A. Fenton, 806 Medical Arts Bldg.; Dr. Irving B. Lupton, 806 Medical Arts Bldg.

Salem—Dr. W. Carlton Smith, Masonic Temple; Dr. R. Lee Wood, U. S. National Bank Bldg.

PENNSYLVANIA

Altoona—Dr. H. W. Weest, 1905 Eighth Ave.; Dr. J. D. Hogue, 1200 Fourteenth Ave.

Bradford—Dr. F. W. Paton, 23 Main St.; Dr. L. R. Carson, 26 Main St.

Erie—Dr. Fred Fisher, Jr., 343 E. 6th St.; Dr. D. W. Kramer, 920 E. 21st St.

Harrisburg—Dr. George L. Laverty, 226 State St.

Johnstown—Dr. Wm. E. Grove, 408 Main St.

New Castle—Dr. Don C. Lindley, Lawrence Savings and Trust Bldg.; Dr. Ralph G. Campbell, 327½ E. Washington St.; Dr. Earl Eakin.

Philadelphia—Dr. John V. Allen, Jr., 1516 Harrison St., Frankford; Dr. Edward H. Bedrossian, 601 Central Medical Bldg., 18th and Chestnut Sts.; Dr. Ben C. Gile, 1906 Chestnut St.; Dr. F. S. Gillespie, 1824 Pine St.

Philipsburg—Dr. Charles E. McGirk; Dr. John Dale.

Pittsburgh—Dr. George R. Harris, 7133 Jenkins Arcade.

Reading—Dr. W. Wendel Becker, 150 N. 6th St.; Dr. Solon L. Rhode, 238 N. 6th St.

Shenandoah—Dr. A. Lebendig, 23 S. White St.

Tamaqua—Dr. Joseph R. Sweeney, 230 W. Broad St.; Dr. J. M. West, 12 W. Broad St.

Troy—Dr. George E. Boyer; Dr. George L. Smith.

Uniontown—Dr. Thomas B. Semans, Fayette Title and Trust Bldg.; Dr. D. E. Lowe, 63 S. Beeson Ave.

Wilkes-Barre—Dr. C. F. Kistler, 43 N. Franklin St.; Dr. Allan C. Brooks, 84 N. Franklin St.

Williamsport—Dr. Herman F. W. Flock, 416 Pine St.; Dr. Lloyd E. Wurster, 416 Pine St.

RHODE ISLAND

Providence—Dr. William N. Hughes, 112 Waterman St.

SOUTH CAROLINA

Anderson—Dr. Halbert H. Acker.

Charleston—Dr. Charles W. Kollock, 86 Wentworth St.

Columbia—Dr. Walter Bristow, Medical Bldg., 1512 Marion St.; Dr. F. M. Routh, Medical Bldg., 1512 Marion St.

Florence—Dr. S. R. Lucas, 120 S. Irby St.; Dr. M. R. Mobley, 120 S. Irby St.

Greenville—Dr. Hugh P. Smith, 228A N. Main St.; Dr. J. W. Jervey, Jervey Hospital, 101 Church St.

Spartanburg—Dr. F. H. Sanders, 110 W. Main St.; Dr. L. Rosa H. Gantt, 404 Andrews Bldg.

SOUTH DAKOTA

Aberdeen—Dr. J. Douglas Alway, 323 S. Lincoln St.

Chamberlain—Dr. Fred Treon, State Medical Association; Dr. Robert A. Crawford, Chamberlain Hospital and Sanitarium.

Hot Springs—Dr. Henry O. Ruud, 115 River Ave.; Dr. P. T. Geyerman, 115 River Ave.

Huron—Dr. Howard L. Saylor, Huron Clinic; Dr. Buell H. Sprague, Huron Clinic.

Miller—Dr. David A. Gregory; Dr. John C. Hagin, Bohning Bldg., 3rd and Main Sts.

Mitchell—Dr. John H. Lloyd, Commercial Bank Bldg.; Dr. Oscar J. Mabee.

Rapid City—Dr. N. T. Owan, First National Bank Bldg.; Dr. J. M. Walsh, First National Bank Bldg.

Sioux Falls—Dr. Edmund D. Putnam, 800 Citizens National Bank Bldg.

TENNESSEE

Chattanooga—Dr. T. Lyles Davis, Volunteer Life Bldg.; Dr. A. F. Ebert, Volunteer Life Bldg.

Jackson—Dr. Benjamin C. Arnold, Cor. Market and Lafayette Sts.; Dr. Sam T. Parker, Cor. Market and Lafayette Sts.

Knoxville—Dr. Robert H. Newman, 425 W. Clinch St.; Dr. Walter S. Nash, 611 Walnut St.

Memphis—Dr. John J. Shea, 1018 Madison Ave.; Dr. James B. Stanford, 1052 Madison Ave.

Nashville—Dr. J. B. Hibbitts, Jr., 712 Bennie-Dillon Bldg.

TEXAS

Amarillo—Dr. Neal Hall, 903 Medical and Professional Bldg.; Dr. A. E. Winsett, 903 Medical and Professional Bldg.

Austin—Dr. C. H. Brownlee, 924 Littlefield Bldg.

Beaumont—Dr. William F. Taliaferro, 719 Goodhue Bldg.; Dr. Jay C. Crager, 706 Goodhue Bldg.

Brownsville—Dr. James L. Rentfre; Dr. Oscar V. Lawrence, Merchants National Bank Bldg.

Dallas—Dr. G. E. Morris, 335 Wilson Bldg.

El Paso—Dr. W. R. Jamieson, 921 First National Bank Bldg.; Dr. F. P. Schuster, 403 First National Bank Bldg.; Dr. S. A. Schuster, 403 First National Bank Bldg.

Ft. Worth—Dr. Thomas J. Cross, 203 Medical Arts Bldg.

Houston—Dr. Louis G. Pawelek, 413 Kress Bldg.; Dr. Willard M. Pratt, 622 Medical Arts Bldg.

Lubbock—Dr. Fred W. Standefer, c/o West Texas Hospital.

McAllen—Dr. S. Joe McKinsey, Harrison Bldg.; Dr. David H. Carson.

Midland—Dr. W. E. Ryan, Box 117; Dr. T. C. Bobo, Box 117.

Palestine—Dr. A. Arthur Speegle, 201 Palestine Ave.; Dr. Allen D. Wages.

San Antonio—Dr. Eldridge Adams, 528 Moore Bldg.; Dr. W. A. Ostendorf, 528 Moore Bldg.

Temple—Dr. W. A. Chernosky, King's Daughters Hospital.

Waco—Dr. J. Edward Quay, 511 Liberty Bank Bldg.; Dr. Clute E. Rayburn, 514 Liberty Bank Bldg.

Wichita Falls—Dr. J. A. Little, Staley Bldg.; Dr. Robert E. Hilburn, Staley Bldg.

UTAH

Salt Lake City—Dr. M. Skolfield, 809 Medical Arts Bldg.

VERMONT

Newport—Dr. Winfred O. Brown, 35 Coventry St.

Springfield—Dr. A. B. Woodman, Bank Block.

VIRGINIA

Danville—Dr. E. Howe Miller, 6 Chestnut Place; Dr. T. W. Edmunds, Edmunds Hospital.

Norfolk—Medical Officer in Charge, U. S. Marine Hospital No. 82, Hampton Blvd., Larchmont.

Richmond—Dr. Nelson Mercer, 1100 West Franklin St.; Dr. R. E. Mitchell, 409 Medical Arts Bldg.

Roanoke—Dr. Geo. M. Maxwell, Shenandoah Life Bldg.; Dr. David A. Dunkley, Shenandoah Life Bldg.

Williamsburg—Dr. P. G. Hamlin, Eastern State Hospital.

WASHINGTON

Aberdeen—Dr. Oliver R. Austin, 720 Becker Bldg.; Dr. E. E. Maxey, Becker Bldg.

Bellingham—Dr. Charles V. Farrell, 412 Bellingham National Bank Bldg.; Dr. Spencer S. Howe, Bellingham National Bank Bldg.

Chehalis—Dr. R. H. Hester, Columbus Block; Dr. J. L. Petit, Rush Bldg.

Everett—Dr. Harry R. Secoy, 500 Hodges Bldg.

Mount Vernon—Dr. George H. Crabtree.

Port Angeles—Dr. W. M. Davidson, 201 First National Bank Bldg.; Dr. Frederick T. Hyde.

Port Townsend — Medical Officer in Charge, U. S. Marine Hospital No. 17, Franklin and Quincy.

Olympia—Dr. Floyd A. Bird, Security Bank Bldg.; Dr. J. Frank Gibson, 513 Security Bank Bldg.

Seattle—Dr. Leland L. Bull, Stimson Bldg.; Dr. Harry V. Wurdemann, 320 Stimson Bldg.

Spokane—Dr. E. E. Langley, 515 Old National Bank Bldg.

Tacoma—Dr. R. D. Wright, Northern Pacific Beneficial Association; Dr. J. M. Odell, Mountain View Sanatorium, Lakeview.

Walla Walla—Dr. George R. Gowen; Dr. Harry C. Cowan.

Wenatchee—Dr. G. Francis Hilton, 423 Savings and Loan Bldg.

Yakima—Dr. Joseph E. Bittner, Jr., Miller Bldg.

WEST VIRGINIA

Huntington—Dr. T. W. Moore, 1050 Fifth Ave.; Dr. W. C. Swann, 622½ Twentieth St.

Parkersburg—Dr. Eugene C. Hartman, 610½ Market St.; Dr. T. L. Harris.

Wheeling—Dr. E. Lloyd Jones, Wheeling Clinic, 16th and Eoff Sts.; Dr. D. A. MacGregor, Wheeling Clinic, 16th and Eoff Sts.

WISCONSIN

Appleton—Dr. Edward F. Mielke, Insurance Bldg.; Dr. Everett H. Brooks, 108 College Ave.

Beloit—Dr. C. H. Dawson, The Beloit Clinic, Inc.

Eau Claire—Dr. Frank A. LaBreck; Dr. Arthur L. Payne, 1-2-3 Opera House Block.

Janesville—Dr. A. H. Pember, 500 West Milwaukee St.; Dr. G. C. Waufle, 322 Hayes Block.

LaCrosse—Dr. E. E. Gallagher, Gateway City Bank Bldg., 4th and Jay Sts.; Dr. V. Leo Simones, Gateway City Bank Bldg., 4th and Jay Sts.

Madison—Dr. Albert R. Tormey, 717 Gay Bldg., 16 North Carroll St.; Dr. V. B. Hyslop, 301 Gay Bldg., 16 North Carroll St.

Manitowoc—Dr. H. W. Aldridge, 902 South Eighth St.; Dr. A. F. Stueck, State Bank Bldg.

Milwaukee—Dr. Gilbert E. Seaman, 407 Wells Bldg., 120 East Wisconsin Ave.; Dr. R. L. Kenney, 407 Wells Bldg., 120 East Wisconsin Ave.

Oshkosh—Dr. G. A. Steele, First National Bank; Dr. Wilbur N. Linn, Wisconsin Public Service Bldg.

Racine—Dr. George L. Ross, 203 Hotel Racine.

Rhinelander—Dr. Gentz Perry, The Shiek Clinic; Dr. A. F. Harter, The Shiek Clinic.

Richland Center—Dr. Beauford I. Pippin.

Sheboygan—Dr. L. J. DeSwarte, 201 National Security Bldg.; Dr. O. B. Bock, State Medical Society; Dr. Fred A. Nause, Jr., 925 North 8th St.

Superior—Dr. William H. Schnell, Columbia Bldg.; Dr. Frank C. Sarazin, Columbia Bldg.

Wausau—Dr. J. M. Freeman, 506 Third St.; Dr. H. T. Schlegel, 503 Third St.

Wisconsin Rapids—Dr. Oscar N. Mortensen; Dr. Will G. Merrill, Mead-Witter Bldg.

WYOMING

Casper—Dr. Allan McLellan, Daly Bldg.

Cheyenne—Dr. Walter M. Lacey, 302 Hynds Bldg.; Dr. George L. Strader, 408 Hynds Bldg.

Thermopolis—Dr. C. Dana Carter.

NATIONAL AIR RACES

I—"On to LOS ANGELES" Cross Country Races

TRANSCONTINENTAL CLASS "A" RACE—New York to Los Angeles: 2939 Miles

Prize Money:

Winner	$ 5,000.00
Second	2,500.00
Third	1,000.00
Fourth	700.00
Fifth	500.00
Sixth	300.00
Total	$10,000.00

Elizabeth C. T. Miller Prizes:

Winner	$500.00
Second	300.00
Third	200.00

Winner: May Company Trophy
Russell Lobe Parachute
Popular Aviation Trophy

Place	*Entrant*	*Pilot*	*Plane*	*Motor*	*Time*
1st	Cessna Aircraft Co	Earl Rowland	Cessna	Warner	27:00:31
2nd	Dake & Taney	Dake and Taney	Amer. Moth	Warner	28:18:43
3rd	W. H. Emery, Jr.	W. H. Emery, Jr.	Travel Air	Warner	28:48:28
4th	Theo. W. Kenyon	Theodore Kenyon	Challenger	Warner	29:19:47
5th	Tex Rankin	Tex Rankin	Waco	Curtiss OX5	29:36:29
6th	James S. Charles	James S. Charles	Eaglerock	Curtiss OX5	30:48:50
7th	Eugene J. Detmer	Eugene J. Detmer	Travel Air	Curtiss OX5	31:20:00
8th	Louis E. Derryberry	Louis E. Derryberry	Travel Air	Curtiss OX5	31:31:56
9th	W. P. Runyon, Jr.	Warren B. Smith	Swallow	Curtiss OX5	32:57:14
10th	Rainbow Aviation Co.	G. Zinn and G. Hand	Challenger	Curtiss OX5	33:06:15
11th	Lieber-Norton Realtors	George W. Hopkins	Stinson SM-2	War. "Scarab"	34:25:13
12th	S. J. Wittman	S. J. Wittman	Bi-plane Lone Eagle	Moundsville 4 cyl. vert.	34:33:10
13th	Arthur W. Killips	Arthur W. Killips	Waco 10		
14th	Wm. B. Harding	Stewart Chadwick	Waco 10	Curtiss OX5	34:45:23
15th	Berliner Aircraft Co.	Samuel H. Turner	Berliner Mono	Curtiss OX5	35:02:14
16th	Stanley Airways, Inc.	Stanley and R. Haynes	Waco 10	Curtiss OX5	35:48:31
17th	Challenger Flying Ser.	A. H. Kreider	Challenger	Curtiss OX5	35:54:08
18th	John E. Carberry	John E. Carberry	Moth	Curtiss OX5	36:05:38
19th	Gardner Aviation Ser.	M. E. Grevemberg	Lincoln-Page	Cirrus 4-cyl.	38:11:34
20th	Bus. Men of Reading	A. K. Owen	Pitcairn PA-4	Curtiss OX5	38:48:26
21st	Daniel A. Kundle	Sidney A. Riley, Jr.	Travel Air 2000	Curtiss OX5	38:49:56
22nd	Don S. Phillips	Don S. Phillips	Kreider-Reisner	Curtiss OX5	40:23:46
			Challenger	Curtiss OX5	40:35:56
23rd	San Gabriel Val. Airport	G. W. Brill	Travel Air	Curtiss OX5	44:44:06

Lap Prize Awards given by Control Cities to Leaders in Transcontinental Class "A"

McKeesport, Pa.	1st	Earl Rowland	239-48	$100.00
	2nd	W. H. Emery, Jr.	248-11	50.00
	3rd	Dake and Taney	248-19	25.00
	4th	Tex Rankin	261-05	25.00
Columbus, Ohio	1st	Earl Rowland	249-49	200.00
	2nd	Dake and Taney	263-19	150.00
	3rd	W. H. Emery, Jr.	268-18	50.00
Terre Haute, Ind.	1st	Earl Rowland	298-48	50.00
Kansas City, Mo.	1st	Earl Rowland	483-10	225.00
	2nd	Dake and Taney	520-29	100.00
	3rd	W. H. Emery, Jr.	540-57	75.00
Wichita, Kansas	1st	Earl Rowland	578-50	150.00
	2nd	Dake and Taney	630-02	100.00
	3rd	W. H. Emery, Jr.	652-14	50.00
Fort Worth, Texas	1st	Earl Rowland	790-31	125.00
	2nd	Dake and Taney	852-05	50.00
	3rd	W. H. Emery, Jr.	886-31	25.00
Abilene, Texas	1st	Earl Rowland	870-11	200.00
	2nd	Dake and Taney	932-22	100.00
Midland, Texas	1st	Earl Rowland	961-33	60.00
	2nd	Dake and Taney	1022-34	25.00
Pecos, Texas	1st	Earl Rowland	1011-00	Wrist Watch
El Paso, Texas	1st	Earl Rowland	1068-06	Mexican Serape
Tucson, Arizona	1st	Earl Rowland	1225-06	100.00
	2nd	Dake and Taney	1288-40	50.00
Yuma, Arizona	1st	Earl Rowland	1354-46	200.00
	2nd	Dake and Taney	1427-35	100.00
San Diego, Calif.	1st	Earl Rowland	1379-23	100.00
	2nd	Dake and Taney	1457-03	50.00
	3rd	W. H. Emery, Jr.	1484-48	25.00

TRANSCONTINENTAL CLASS "B" RACE—New York to Los Angeles: 2939 Miles

Prize Money:

Winner	$7,000.00
Second	3,500.00
Third	2,500.00
Fourth	1,000.00
Fifth	700.00
Sixth	300.00

Elizabeth C. T. Miller Prizes:

Winner	$1,000.00
Second	750.00
Third	250.00

Winner: Sid Grauman Trophy.
Second: Western Auto Supply Co. Trophy.

Special sweepstake awards for shortest elapsed time in Transcontinental Races to John Livingston, $2,500; E. E. Ballough, $1,500.

Place	*Entrant*	*Pilot*	*Plane*	*Motor*	*Time*	*No.*
1st	Advance Aircraft Co.	John Livingston	Waco 10	Whirlwind	22:56:59	95
2nd	E. M. Laird Airplane Co.	E. E. Ballough	Laird LC-R	Whirlwind	23:16:24	40
3rd	John P. Wood	John P. Wood	Waco 10	Whirlwind	24:31:08	114
4th	Cessna Aircraft Co.	Edw. G. Schultz	Cessna	Whirlwind	24:55:08	96
5th	Advance Aircraft Co.	Chas. W. Meyers	Waco 10	Whirlwind	25:04:13	70
6th	Thos. B. Colby	L. F. Shoenhair	Buhl Airsedan	Whirlwind	26:11:20	49
7th	T. A. Wells	T. A. Wells	Travel Air	Whirlwind	26:12:01	106
8th	Paul Allen	Jay Sodowsky	Cessna B	Whirlwind	26:57:53	100
9th	Syracuse Flying Serv.	Ive McKinney	Pacer	Whirlwind	27:47:05	110
10th	The Texas Co.	Maurice Marrs	Lockheed Vega	Whirlwind	29:47:13	48
11th	Christopher Moran	B. H. Shaw	Lockheed Vega	Whirlwind	31:42:04	186
12th	Newcastle Aircraft, Inc.	R. J. Merritt	Ryan B-1	Whirlwind	33:59:32	154
13th	Mathew W. Whittall	M. W. Whittall	Fairchild	Whirlwind	37:05:16	41
14th	Cessna Aircraft Co.	G. C. Quick	Cessna A	Anzani	40:14:22	97

Lap Prize Awards given by Control Cities to Leaders in Transcontinental Class "B" Race

McKeesport, Pa.	1st	John Livingston	227-05	$100.00
	2nd	Smith & Litzenberger	233-40	50.00
	3rd	Edward G. Schultz	240-15	25.00
	4th	Raymond Joseph Merritt	264-45	25.00
Columbus, Ohio	1st	John Livingston	235-25	200.00
	2nd	Smith & Litzenberger	248-10	150.00
	3rd	Edward G. Schultz	252-50	50.00
Terre Haute, Ind.	1st	John Livingston	283-16	100.00
Kansas City, Mo.	1st	John Livingston	462-16	225.00
	2nd	Edward G. Schultz	500-35	100.00
	3rd	E. E. Ballough	546-26	75.00
Wichita, Kansas	1st	John Livingston	548-33	150.00
	2nd	Edward G. Schultz	586-37	100.00
	3rd	E. E. Ballough	622-15	50.00
Fort Worth, Tex.	1st	John Livingston	717-59	125.00
	2nd	E. E. Ballough	782-21	50.00
	3rd	Edward G. Schultz	702-20	25.00
Midland, Texas	1st	John Livingston	852-23	60.00
	2nd	E. E. Ballough	902-48	25.00
Pecos, Texas	1st	John Livingston	892-05	Wrist Watch
El Paso, Texas	1st	John Livingston	916-00	Mexican Serape
Tucson, Arizona	1st	John Livingston	1040-34	100.00
	2nd	E. E. Ballough	1063-46	50.00
Yuma, Arizona	1st	John Livingston	1134-32	250.00
	2nd	E. E. Ballough	1152-40	150.00
San Diego, Calif.	1st	John Livingston	1142-10	100.00
	2nd	E. E. Ballough	1162-00	50.00
	3rd	John P. Wood	1237-32	25.00

TRANSCONTINENTAL CLASS "C" RACE—New York to Los Angeles: 2939 Miles

Prize Money:

Winner	$5,000.00
Second	2,500.00
Third	1,500.00

Elizabeth C. T. Miller Prizes:

Winner	$1,000.00
Second	750.00
Third	250.00

Winner: Elizabeth C. T. Miller Trophy, Second: H. J. Barneson Trophy.

Place	*Entrant*	*Pilot*	*Plane*	*Motor*	*Time*	*No.*
1st	Earl P. Halliburton	Robt. W. Cantwell	Lockheed Vega	Wasp	24:09:01	22
2nd	Fairchild Airplane Mfg. Corp	Capt. C. B. Collyer	Fairchild	Wasp	27:10:45	143
3rd	A. E. Humphreys, Jr.	Edward J. Brooks	Fokker Spec. Univ.	Wasp	27:24:53	12

Lap Prize Awards given by Control Cities in Transcontinental Class "C" Race

McKeesport, Pa.	1st	Robert Cantwell	210-12	$ 50.00
	2nd	Edward Brooks	230-08	25.00
	3rd	Capt. C. B. D. Collyer	241-55	25.00
Columbus, Ohio	1st	Robert Cantwell	222-23	200.00
Terre Haute, Ind.	1st	Robert Cantwell	281-07	100.00
Kansas City, Mo.	1st	Robert Cantwell	488-49	200.00
Wichita, Kansas	1st	Robert Cantwell	584-26	150.00
	2nd	Edward Brooks	641-14	100.00
	3rd	Capt. C. B. D. Collyer	658-25	50.00
Fort Worth, Texas	1st	Robert Cantwell	771-07	75.00
	2nd	Edward Brooks	854-59	25.00
Midland, Texas	1st	Robert Cantwell	912-59	30.00
Pecos, Texas	1st	Robert Cantwell	949-47	Wrist Watch
El Paso, Texas	1st	Robert Cantwell	971-30	Mexican Scrape
Tucson, Arizona	1st	Robert Cantwell	1113-29	100.00
Yuma, Arizona	1st	Robert Cantwell	1210-32	200.00
	2nd	Capt. C. B. D. Collyer	1379-27	100.00
San Diego, Calif.	1st	Robert Cantwell	1220-42	50.00

INTERNATIONAL AIR RACE—Windsor to Los Angeles: 2145 Miles

Winner.....$5,000.00
Second..... 2,500.00

Winner: Broadway Dept. Store Trophy.

Place	*Entrant*	*Pilot*	*Plane*	*Motor*	*Time*	*No.*
1st	Wm. H. E. Drury	Wm. H. E. Drury	Waco		19:55:41	159
2nd	H. R. Campbell & Kenneth Whyte	Kenneth Whyte	Moth DeHaviland	Cirrus	29:50:17	31

Lap Prize Awards given by Control Cities to the International Race

Windsor, Canada	1st	Wm. H. E. Drury	$500.00
Omaha, Nebraska	1st	Wm. H. E. Drury	150.00
	2nd	Kenneth Whyte	100.00
Cheyenne, Wyo.	1st	Wm. H. E. Drury	Chaparajos and Hat
	2nd	Kenneth Whyte	Traveling Bag and Sweater
Iowa City, Iowa	1st	Wm. H. E. Drury	Watch
Rock Springs, Wyo.	1st	Wm. H. E. Drury	Chaparajos, Hat, etc.
Las Vegas, Nevada	1st	Wm. H. E. Drury	100.00
	2nd	Kenneth Whyte	50.00

CALIFORNIA CLASS "A" RACE—San Francisco to Los Angeles

Winner.....$1,000.00
Second..... 500.00
Third..... 250.00
Fourth..... 150.00
Fifth..... 100.00

Winner: San Francisco Junior Chamber of Commerce Trophy.
Union Company Trophy.
Second: Harry Sperl Aero Corp. Trophy.

Place	*Entrant*	*Pilot*	*Plane*	*Motor*	*Time*	*No.*
1st	Myhres & Smith	H. S. Myrhes	Simplex Red Arrow	Kinner	3:10:20	57
2nd	Dycer Airport	Chas. F. Dycer	Lincoln-Page	Curtiss OX5	3:19:00	65
3rd	Aero Corp. of Calif.	Jack Frye	Eaglerock	Curtiss OX5	3:20:00	85
4th	Mono Aircraft, Inc.	Vern Roberts	Monocoupe	Velie M5	3-25:15	92
5th	W. D. Wright	W. D. Wright	Travel Air	Curtiss OX5	3:37:40	91
6th	Summitt Aircraft Co.	R. Williams	Monocoupe	Velie M5	3:44:25	187
7th	Los Angeles Airways, Inc.	Ivan R. Olson	Brown Mercury	OX5	3:46:07	155
8th	Royal Airlines	Milo Campbell	Travel Air	OX5	3:56:50	178
9th	MacClatchie Co.	L. F. Root	Air King	OX5	4:02:25	115

CALIFORNIA CLASS "B" RACE—Oakland to Los Angeles

Prize Money:

Winner	$1,250.00
Second	800.00
Third	500.00
Fourth	300.00
Fifth	150.00

Winner: Oakland Chamber of Commerce Trophy.
So. California Building & Finance Trophy.
H. Reeve Darling Trophy.

Place	*Entrant*	*Pilot*	*Plane*	*Motor*	*Time*	*No.*
1st	H. C. Lippiatt	H. C. Lippiatt	Travel Air	Whirlwind	2:26:49	7
2nd	Lockheed Aircraft Co.	Larry Fritz	Lockheed Vega	Whirlwind	2:31:18	116
3rd	D. C. Warren	D. C. Warren	Travel Air 3000	Hisso	2:31:37	66
4th	Howard Hawks	Leo Nomis	Travel Air	Whirlwind	2:33:00	59
5th	Buhl Aircraft Co.	Louis G. Meister	Buhl Airsedan (Spec.)	Whirlwind	2:35:20	102
6th	Herb Kraft	Herbert Kraft	Stearman C 2B	Whirlwind	2:38:48	170
7th	A. E. Cameron	Lee Flanigan	Eaglerock	Whirlwind	2:42:19	64
8th	Les Carson	Paul Richter, Jr.	Eaglerock	Whirlwind	2:49:37	86
9th	R. Shaffer & Metcalf	Lt. H. H. Ogden	Thunderbird	Hisso	3:00:47	171
10th	Royle Airlines	Jerry Andrews	Swallow	Hisso	3:03:05	105
11th	Yellow Wing Com. Air.	H. J. Kelsey	Amer. Eagle	Hisso E	3:03:51	166

Special Lap Prizes given by Control City in California Class "B" Race

Bakersfield, California	Winner	H. C. Lippiatt	$150.00
	Second	Larry Fritz	100.00
	Third	D. C. Warren	50.00

II—SPECIAL Races at MINES FIELD, Los Angeles

AROUND THE WORLD FLIGHT MEMORIAL RACE—Event No. 1—Special

Limited to Military VB-2B Planes. Distance 50 Miles

Place	*Name*	*Time*	*No.*
1st	Lt. Herbert P. Becker	23:21	802
2nd	Lt. Thos. J. Cushman	23:22⅕	806
3rd	Sergt. Walter L. Pounders	23:26	809
4th	Sergt. Robt. B. Ewalt	23:27	807
5th	Sergt. Harlan Hull	23:35	804
6th	Michael Wodarszk	23:40	805

ARMY OBSERVATION PLANE RACE, TWO PLACE TYPE—Event No. 2—Special

Place	*Pilot*	*Plane*	*Motor*	*Time*	*Speed*	*No*
1st	Lt. Barber	Douglas	Liberty	28:14:19	127.40	2
2nd	Lt. Goss	Douglas	Liberty	28:19:22	127.11	3
3rd	Lt. Walthall	Douglas	Liberty	28:23:10	126.82	8
4th	Lt. Coyle	Douglas	Liberty	28:28:89	126.39	1
5th	Lt. Bond	Douglas	Liberty	28:52:27	124.09	5
6th	Lt. Bobzein	Douglas	Liberty	29:16:74	122.95	7
7th	Lt. Little	Douglas	Liberty	29:44:23	121.06	4

MODEL RACE—Event No. 3—Special

(Under Ten Ounces)

$150.00 Cup, First
$125.00 Cup, Second
$100.00 Cup Third
Bronze Medal, Fourth
Bronze Medal, Fifth
Bronze Medal, Sixth

Model Winners:
David J. Evans
Thompson Elrod
Paul Channon
Kenneth Wiley
Wesley Cook
Jerome E. Smith

1st	Beanfield	1550.	11th	D. Sullivan	106.
2nd	Fox	373.4	12th	Hassard	99.
3rd	Snyder	323.	13th	Keltz	79.
4th	Walton	216.4	14th	Hulbert	75.
5th	Miller	207.2	15th	White	56.3
6th	Chatland	134.4	16th	Boynton	50.
7th	Seiler	120.	17th	Sullivan	50.
8th	Kramer	118.	18th	Shekies	42.3
9th	Case	116.	19th	Bernstone	42.
10th	Scully	108.2	20th	Evans	39.7

MODEL RACE—Event No. 4—Special

(Over Ten Ounces)

1st	Endoo	478.5	11th	Krubl	82.1
2nd	Whitney	341.	12th	Campbell	76.2
3rd	Thickstunt	234.7	13th	Rose	74.
4th	Lippert	161.	14th	Rounsavelle	72.
5th	Dempster	124.6	15th	Hager	61.
6th	Thickstunt, J.	91.6	16th	Beanfield	58.
7th	Sandborgh	90.	17th	Andrews	53.6
8th	Hager	86.	18th	Smith	45.10
9th	Friend	85.	19th	Nacarati	41.6
10th	Tanenbaum	83.	20th	Geidner	31.

MARINE CORPS 50 MILE RACE—Event No. 5—Special

Closed Event for Observation Squadron No. Eight

1st	Michael Wodarczyk	23:14	805	4th	Lt. Thomas J. Cushman	23:20	806
2nd	Sergt. Walter L. Pounders	23:17	809	5th	Sergt. Robert B. Ewalt	23:21	807
3rd	Lt. Herbert P. Becker	23:18	802	6th	Sergt. Harlan Hull	23:42	804

MASON M. PATRICK TROPHY RACE—120 Miles, Event No. 6—Special

Closed Event for Pilots of Third Attack Group

Place	*Name*	*Time*	*Speed*	*No.*
1st	Lt. Geo. R. Acheson	51:36:22	139:525	5
2nd	Lt. Herbert W. Anderson	51:46:07	139.083	13
3rd	Lt. Earl C. Robbins	51:46:58	139:060	14
4th	Capt. Ralph H. Wooten	51:57:09	138:551	15
5th	Lt. G. A. McHenry	52:25:16	137:354	39
6th	Lt. Geo. H. MacNair	52:25:33	137:346	42
7th	Lt. Otto Clyde George	52:32:80	137:021	41
8th	Lt. Walter W. Gross	52:43:00	136:540	4
9th	Capt. Horace Nevil Heisen	52:46:03	136:423	30
10th	Lt. John G. Williams	52:56:60	135:994	43
11th	Lt. Herbert M. Newstron	53:41:46	134:101	11
12th	Major John H. Jouett	54:55:42	131:091	0

JOHN L. MITCHEL TROPHY RACE—120 Miles, Event No. 7—Special

Closed Event for Pilots of First Pursuit Group

Place	*Name*	*Time*	*Speed*	*No.*
1st	Lt. Lawson	46:31:72	154:743	3
2nd	Lt. James H. Doolittle	46:30:54	154:311	4
3rd	Lt. Frank H. Robinson	46:55:67	153:427	12
4th	Capt. Victor H. Stram	47:01:56	153:107	9
5th	Lt. Julian B. Haddon	47:02:78	153:041	10
6th	Lt. Robt. L. Schoenlein	47:02:91	153:034	2
7th	Lt. Frank G. Irvin	47:26:96	151:743	5
8th	Lt. Rex K. Stoner	47:47:42	150:923	13
9th	Major Ralph Royce	48:13:21	149:315	1
10th	Lt. Frank D. Klein	49:36:18	145:153	8

U. S. NAVY RACE—Event No. 8—Special

Closed Event for Pilots of UB-2B Squadron

Place	*Name*	*Time*	*Ship No.*
1st	Lt. Johnson	20:12	2B9
2nd	Lt. W. V. Davis	20:20	2B3
3rd	E. R. Peck	20:49	2B11
4th	D. C. Allen	20:47	2B5

DEAD STICK LANDING CONTEST—Event No. 9—Special

Place	*Name*	*Plane*	*Motor*	*Distance*	*No.*
1st	F. Frisch	Aeromarine Klemm		4'5"	
2nd	Lee Flanigan	Waco 10	Curtis Ox	14'	246
3rd	Stahley & R. Haynes	Travel Air	Curtis Ox	29'4"	36
4th	Arthur W. Callies	Travel Air	Hispano Suiza	84'6"	82
5th	D. C. Warren			96'	66
6th	John H. Hancock			179'	24

III—CLOSED COURSE Races at MINES FIELD, Los Angeles

CIVILIAN RELAY RACE—40 Miles, Event No. 1—Closed Course

$1,500.00—Two Place Airplanes

B. H. Dyas Trophy

Team No. 1. Color White
Eaglerock Team—Capt. Jack Frye

J. S. Charles	248
Lee Flanigan	246
Paul Richter, Jr.	245
Harvey Bolton	247
Jack Frye	85

First— $150.00 each pilot or team
Second— 75.00 each pilot or team

Team No. 2. Color Yellow
Swallow Team—Capt. B. D. Fuller

Jeff Warren	239
Chas. F. Dycer	244
Al Hobart	241
Marion E. McKeon	243
Burdett D. Fuller	240

Team	*Elapsed Time*	*Speed*
White	37:37:11	79:748
Yellow	37:59:19	78:975

CIVILIAN FREE-FOR-ALL—50 Miles, Event No. 2—Closed Course

510 Cubic Inch Class

First Heat—Sept. 13, 1928.

Place	*Name*	*Time*	*Speed*	*No.*
1st	Earl Rowland	27:26:39	109:331	99
2nd	Robert Dake	28:28:01	105:386	83
3rd	H. S. Myrhes	29:00:48	103:419	57
4th	Ray J. Solomon	29:57:60	100:134	84
5th	Lee Flanigan	29:58:47	100:085	63
6th	Jack Frye	30:26:77	98:535	85
7th	Samuel H. Turner	31:07:16	96:403	26
8th	Arthur W. Callies	32:59:32	90:941	82

Second Heat—Sept. 13, 1928.

Place	*Name*	*Time*	*Speed*	*No.*
1st	Tex Rankin	29:17:00	102:447	13
2nd	Vern Roberts	29:45:66	100:804	92
3rd	W. H. Emery, Jr.	29:51:31	100:485	20
4th	Casey Jones	30:45:47	97:536	9
5th	A. H. Kreider	30:47:03	97:183	93
6th	John E. Carberry	30:53:04	97:138	29
	L. Morton Bach		Out Lap No. 2	32
	Chas. F. Dycer		Out Lap No. 7	62
	Don S. Philips		Out Lap No. 9	46

FINALS

$2,500.00 Prize Money (For Winners in Finals):

Winner	$1,200.00
Second	600.00
Third	400.00
Fourth	200.00
Fifth	100.00

Winner: West Coast Theatre Trophy
Second: California Compressed Gas Co. Trophy.

Place	*Entrant*	*Pilot*	*Type of Plane*	*Motor*	*Time*	*Speed*	*No.*
1st	Cessna Aircraft Co.	Earl Rowland	Cessna	Warner	26:50:74	111.74	99
2nd	Myhres & Smith	H. S. Myhres	Simplex	Kinner	28:06:54	106.72	57
3rd	Dake & Taney	Robert Dake	American Moth	Warner	28:17:38	106.04	83
4th	Mono-Aircraft, Inc.	Vern Roberts	Monocoupe	Velie	29:35.64	101.37	92
5th	E. Burrell Smith	Lee Flanigan	Eaglerock	Hallett	29:58:45	100.08	63
6th	W. H. Emery, Jr.	W. H. Emery	Travel Air	Warner	30:09:60	99.46	20
7th	Challenger Flying Service	A. H. Kreider	Challenger	Curtis OX5	30:54:16	97.07	93

CIVILIAN FREE-FOR-ALL—50 miles, Event No. 3—Closed Course

720 Cubic Inch Class
1st, $700; 2nd, $400; 3rd, $250; 4th, $150
Winner: Western Flying Magazine Trophy

Place	*Entrant*	*Pilot*	*Plane*	*Motor*	*Time*	*Speed*	*No.*
1st	D. C. Warren	D. C. Warren	Travel Air	Hisso	24:18:75	123:39	66
2nd	Reginald Sinclaire	Reginald Sinclaire	Eaglerock	Curtis	27:15:04	110.03	43
3rd	Dake & Taney	Theodore Taney	American Moth	Warner	27:59:15	107.19	83
4th	Myhres & Smith	H. S. Myhres	Simplex Red Arrow	Kinner	28:13:50	106.29	57

CIVILIAN FREE-FOR-ALL—75 Miles, Event No. 4—Closed Course

800 Cubic Inch Class—Winner, A. C. Spark Plug Trophy
1st, $1500; 2nd, $800, 3rd, $500; 4th, $350, 5th, $250, 6th, $100

Place	*Entrant*	*Pilot*	*Plane*	*Motor*	*Time*	*Speed*	*No.*
1st	Laird Airplane Co.	E. E. Ballough	Laird	Whirlwind J4B	33:52:78	137.82	40
2nd	J. P. Wood	J. P. Wood	Waco	Whirlwind	34:03:06	132.09	114
3rd	Jno. Livingston	John Livingston	Waco	Whirlwind	34:23:95	130.81	95
4th	Chas. W. Meyers	Chas. W. Meyers	Waco	Whirlwind	34:28:33	130.54	79
5th	T. A. Wells	T. A. Wells	Travel Air	Whirlwind	34:32:96	130.24	106
6th	Howard Hawks	Leo Nomis	Travel Air	Whirlwind	36:05:57	124.67	59
7th	D. C. Warren Co.	D. C. Warren	Travel Air	Hisso	36:10:06	124.42	66
8th	A. E. Cameron	Lee Flanigan	Eaglerock	Wright J4	37:00:67	121.58	64
9th	Paul R. Braniff	Paul Braniff	Travel Air	Whirlwind	37:06:45	121:26	45
10th	Les Carson	Paul Richter, Jr.	Eaglerock		37:47:40	119.07	86

SPEED AND EFFICIENCY CONTEST—Event No. 5—Closed Course

800 Cubic Inch Class
Speed: 1st, $750; 2nd, $450; 3rd, $200; 4th, $100
Efficiency: 1st, $1200; 2nd, $700; 3rd, $400; 4th, $200
Aviation Town and Country Club of Detroit Trophy

SPEED

Place	*Entrant*	*Pilot*	*Plane*	*Motor*	*Time*	*Speed*	*No.*
1st	Buhl Air Craft	Louis G. Meister	Buhl	Whirlwind	25:41:88	116.74	102
2nd	Henry DuPont	Victor Dalin	Bellanca	Whirlwind	28:30:92	104.65	*54

Planes 49 and 100 disqualified for long take off.

EFFICIENCY

Place	*Pilot*	*Plane*	*Motor*	*Engine Disp.*	*Pay Load*	*Effic.*	*No.*
1st	Victor Dalin	Bellanca	Whirlwind	788	1185 lbs.	629.493	54
2nd	Louis G. Meister	Buhl	Whirlwind	788	609 lbs.	360.886	102

Planes 49 and 100 disqualified.
*Winner Aviation Town and Country Club Trophy.

UNLIMITED FREE-FOR-ALL—50 Miles, Event No. 6—Closed Course

1000 lbs. Minimum Pay Load
Speed: 1st, $800; 2nd, $500; 3rd, $200
Efficiency: 1st, $800; 2nd, $500; 3rd, $200

SPEED

Place	*Entrant*	*Pilot*	*Plane*	*Motor*	*Time*	*Speed*	*No.*
1st	E. P. Halliburton	Robert Cantwell	Lockheed Vega	P. & W. Wasp	21:22:96	140.30	22
2nd	Harry J. Tucker	Arthur Goebel	Lockheed	P. & W. Wasp	21:28:11	130.73	44
3rd	Thomas B. Colby	L. F. Shoenhair	Buhl	Whirlwind	25:25:64	117.98	49
4th	Fairchild Aviation	C. B. D. Collyer	Fairchild	P. & W. Wasp	25:28:32	117.77	143
5th	Buhl Aircraft Co.	Louis G. Meister	Buhl	Whirlwind	25:46:79	116.37	102
6th	Aero Corp. of Cal.	Jack Frye	Fokker	P. & W. Wasp	27:15.43	110.06	254
7th	Henry DuPont	Victor Dalin	Bellanca	Whirlwind	30:41:61	97.79	54
8th	Roscoe Turner	Roscoe Turner	Timm	Menasco	33:04:19	90.71	145

EFFICIENCY

Place	*Pilot*	*Plane*	*Motor*	*Disp.*	*Pay Load*	*Efficiency*	*No.*
1st	Victor Dalin	Bellanca	Whirlwind	788	1739 lbs.	863.232	†54
2nd	Jack Frye	Fokker	P. & W. Wasp	1344	2523 lbs.	826.432	254
3rd	L. F. Shoenhair	Buhl	Whirlwind	788	1030 lbs.	603.075	49
4th	Louis G. Meister	Buhl	Whirlwind	788	*960 lbs.	567.082	102
5th	Robert Cantwell	Lockheed V.	P. & W. Wasp	1344	1235 lbs.	515.686	22
6th	Arthur Goebel	Lockheed	P. & W. Wasp	1344	1073 lbs.	446.221	44
7th	Roscoe Turner	Timm	Menasco	1146	1367 lbs.	432.811	145
8th	C. B. D. Collyer	Fairchild	P. & W. Wasp	1344	1007 lbs.	352.959	143

*Pilots waiver signed allowing 40 lb. shortage on weight out.
†Winner Detroit News Air Transport Trophy.

PARACHUTE JUMPING CONTEST—Event No. 7—Closed Course

Precision Landing Contest—Army, Navy, Marine Participating only.

Place	Name	No.	Distance from Center of Circle	
			Feet	Inches
1st	G. W. Wehling	163	89	5
2nd	G. H. Brink	71	90	6
3rd	T. Dworzynski	74	130	6
4th	H. W. Booth	162	141	10
5th	F. W. Johnson	72	183	
6th	S. Walek	74	183	9
7th	F. J. Garjola	161	208	2
8th	H. P. Utterback	164	252	
9th	J. H. Garner	77	262	8
10th	W. T. Dodson	69	342	
11th	E. C. Lundquist	76	363	

Second Day's Jumps

September 15, 1928

Place	Name	No.	Distance from Center of Circle	
			Feet	Inches
1st	S. Walek	75	66	5
2nd	F. J. Garjola	161	91	6
3th	G. W. Wehling	163	96	6
4th	H. W. Booth	162	142	6
5th	E. C. Lundquist	76	145	
6th	H. R. Utterback	164	153	
7th	H. L. Whitby	3	174	
8th	F. W. Johnson	72	242	
9th	J. H. Garner	77	296	
10th	T. Dworzynski	74	335	
11th	T. Augustine	112	343	
12th	W. L. Musgrove	73	358	
13th	W. T. Dodson	69	490	
14th	G. H. Brink	71	640	

Third Day's Jumps

September 16, 1928

Place	Name	No.	Distance from Center of Circle	
			Feet	Inches
1st	Geo. W. Wehling	163	14	7
2nd	E. C. Lundquist	76	118	
3rd	C. H. Brink	71	141	
4th	F. J. Garjola	161	172	
5th	H. R. Utterback	164	229	
6th	F. W. Johnson	72	422	
7th	W. T. Dodson	69	540	
8th	H. L. Whitby	3	553	
9th	H. W. Booth	162	555	
10th	Steve Walek, Jr.	75	565	

Finals

Winner, $350; 2nd, $200; 3rd, $100; 4th, $50.
Average Compiled on Three Days Jumping:

Place	Name	Number	Average
1st	Geo. W. Wehling	163	66'9⅔"
2nd	Frank J. Garjola	161	157'2"
3rd	E. C. Lundquist	76	208'8"
4th	Harlan R. Utterback	164	211'4"
5th	Steve Walek, Jr.	75	271'8⅔"
6th	Harry W. Booth	162	279'9⅓"
7th	Fred W. Johnson	72	282'4"
8th	Geo. Harold Brink	71	290'6"
9th	H. L. Whitby	3	329'10"
10th	W. T. Dodson	69	457'4"

LIBERTY ENGINE BUILDERS' TROPHY RACE—Event No. 8—Closed Course

120 Miles—For Observation Type 2 Place Planes
Douglas Company Award

Place	Pilot	Plane	Motor	Time	Speed	No.
1st	Lt. J. L. Kane, U. S. N.	Vought Corsair	P. & W. Wasp	25:18:19	142.275	6
2nd	Lt. H. C. Fick, U. S. N.	Vought Corsair	P. & W. Wasp	26:15:47	137.102	3
3rd	Lt. M. W. Ellis, U. S. N.	Vought Corsair	P. & W. Wasp	26:29:08	135.876	5
4th	Lt. Rufus C. Young, U. S. N.	Vought Corsair	P. & W. Wasp	27:03:50	133.045	2
5th	Lt. T. S. Taylor, U. S. N.	Vought Corsair	P. & W. Wasp	27:12:34	132.326	1

NAVY PURSUIT RACE—50 Miles, Event No. 9—Closed Course

Navy Pursuit Service Pilots Only

Place	Pilot	Plane	Motor	Time	Speed	No.
1st	Lt. R. J. Crommelin, U. S. N.	F-2-B1	P. & W. Wasp	20:18:06	147.77	12
2nd	Lt. E. A. Cruise, U. S. N.	F-2-B1	P. & W. Wasp	20:26:19	146.79	9
3rd	Capt. Driscoll, U. S. N.	F-2-B1	P. & W. Wasp	20:35:25	145.71	10
4th	Lt. W. W. Harvey, U. S. N.	F-2-B1	P. & W. Wasp	20:45:62	144.50	16
5th	Lt. D. C. Allen, U. S. N.	F-2-B1	P. & W. Wasp	20:52:86	143.67	6

ARMY PURSUIT RACE—50 Miles, Event No. 10—Closed Course

Army Service Pilots Only

Place	Pilot	Plane	Motor	Time	Speed	No.
1st	Lt. W. L. Cornelius	Curtiss-Hawk	Curtiss-D-12	20:18:41	147.73	8
2nd	Lt. I. A. Woodring	Curtiss-Hawk	Curtiss-D-12	20:23:16	147.15	2
3rd	Lt. J. E. Mallory	Curtiss-Hawk	Curtiss-D-12	20:51:61	143.81	5
4th	Lt. N. H. Ives	Curtiss-Hawk	Curtiss-D-12	20:53:14	143.67	12
5th	Lt. R. V. Williams	Curtiss-Hawk	Curtiss-D-12	20:54:16	143.52	14
6th	Lt. A. F. Roth	Curtiss-Hawk	Curtiss-D-12	20:57:56	143.13	13
7th	Lt. A. C. Strickland	Curtiss-Hawk	Curtiss-D-12	20:57:70	143.11	3
8th	Lt. K. J. Gregg	Curtiss-Hawk	Curtiss-D-12	20:59:75	142.88	4
9th	Lt. E. J. Meadows	Curtiss-Hawk	Curtiss-D-12	21:09:02	141.84	7
10th	Lt. J. G. Hopkins	Curtiss-Hawk	Curtiss-D-12	21:20:39	140.58	6

NATIONAL GUARD RACE—100 Miles, Event No. 11—Closed Course

2 Place Airplanes in National Guard Service

Place	Pilot	Plane	Motor	Time	Speed	No
1st	Lt. Brooks	Douglas O-2H	Liberty	24:02:27	124.88	3
2nd	Lt. D. F. Kearns	Douglas O-2H	Liberty	24:39:34	121.67	1
3rd	Capt. Symons	Douglas O-2H	Liberty	25:25:57	117.98	2
4th	E. H. Robinson	Douglas O-2H	Liberty	26:01:75	115.25	4
5th	Lt. Jack Allenberg	Douglas O-2H	Liberty	26:27:93	113.35	6

MILITARY PURSUIT RACE—120 Miles, Event No. 12—Closed Course

Military Planes Only, Free-for-All

Aero Digest Trophy

Place	Pilot	Plane	Motor	Time	Speed	No.
1st	Lt. T. P. Jeter, U. S. N.	Boeing XF4B	P. & W. Wasp	20:53:85	172.26	1
2nd	Lt. S. A. Cruise, U. S. N.	Boeing	P. & W. Wasp	22:31:17	159.86	7
3rd	Lt. D. W. Harrigan, U. S. N.	Boeing	P. & W. Wasp	23:44:68	151.61	4
4th	Lt. S. E. Burrows, U. S. N.	Boeing	P. & W. Wasp	23:56:25	150.39	12
5th	Lt. J. G. Crommelin, U. S. N.	Boeing	P. & W. Wasp	24:01:74	149.81	5
6th	Lt. T. B. Williams, U. S. N.	Boeing	P. & W. Wasp	24:38:57	146.08	6

NATIONAL GUARD RACE—25 Miles, Event No. 14—Closed Course

2 Place Airplanes 180 h.p. Hispano Suiza Motors

1st, $250; 2nd, $125; 3rd, $75; 4th, $50

Place	Pilot	Elapsed Time	Speed	No.
1st	Claude Owen	15:59:24	93.82	5
2nd	T. Williams	16:41:79	89.83	2
3rd	George Sherwood	16:46:01	89.46	1
4th	C. E. Forbes	17:07:09	87.62	6

LIGHT AIRPLANE SPEED—EFFICIENCY CONTEST—50 Miles, Event No. 15—Closed Course

Civilians Only

Efficiency: 1st, $750; 2nd, $375; 3rd, $250; 4th, $125

Speed: Winner, $750; 2nd, $375; 3rd, $250; 4th, $125.

Place	Entrant	Pilot	Plane	Motor	Time	Speed	No.
1st	Heath Airplane Co.	E. B. Heath	Heath Monoplane	Bristol "Cher."	27:01:62	112.00	6
2nd	Mono-Aircraft	Vern Roberts	Monocoupe	Velie	30:52:55	97.16	92
3rd	Chas. A. LaJotte	Chas. A. LaJotte	Monocoupe	Velie	31:31:90	95.14	88
4th	Jno. E. Carberry	Jno. E. Carberry	Moth	Cirrus	31:56:19	93.93	29
5th	Szekely Aircraft	Gene Gephart	Flying Dutchman		34:54:85	85.92	260
6th		J. R. Williams		Szekely	41:58:83	71.46	253

EFFICIENCY

Place	Pilot	Engine Disp.	Contest Load	Efficiency	No.
1st	John E. Carberry	297 cu. inch	561 lb.	709.693	29
2nd	Vern Roberts	250.6 cu. inch	402 lb.	623.436	92
3rd	E. B. Heath	75. cu. inch	70 lb.	418.133	6
4th	Gené Gephart	250.6 cu. inch	145 lb.	198.857	260
5th	Chas. A. LaJotte	250.6 cu. inch	None	1.518	88
6th	James R. Williams	190. cu. inch	None	1.504	253

NATIONAL ELIMINATION BALLOON RACE 1928

Starting from Pittsburgh, Pa., May 30

Place	*Entry*	*Pilot and Aide*	*Place of Landing*	*Distance Miles*
1.	Scott Field	Capt. W. E. Kepner Lt. Wm. O. Eareckson	1 mi. N. Weems, Va., 22 mi. W. Irvington, Va.	261½
2.	C. A. Palmer	C. A. Palmer J. W. Mell	4 mi. E. S. S. E. Cumnor, Va.	248
3.	Detroit Balloon Club	W. C. Naylor Russell Wherritt	3 mi. W. Widewater, Va.	187½
4.	Detroit Balloon Club	G. M. LeGallee W. A. Klikoff	3½ mi. E. Connellsville, Pa.	30½
5.	N.A.S., Lakehurst, N.J.	Lt. T. G. W. Settle Geo. N. Steelman	1½ mi. S. Perryopolis, Pa.	21½
6.	Langley Field, Va.	Lt. Paul Evert Lt. U. G. Ent	Foxdale, Pa., 1 mi. S. Youngwood, Pa.	18¾
7.	Goodyear Tire & Rubber Company	W. T. VanOrman W. W. Morton	Youngwood, Pa., Christy Park	17¼
8.	Cleveland Chamber of Commerce	C. K. Wollam J. F. Cooper	Near Youngwood, Pa., W. Newton Rd.	14¼
9.	E. J. Hill and A. G. Schlosser	E. J. Hill A. G. Schlosser	3 mi. E. Irwin, Pa.	12¼
10.	Geo. Hineman	Geo. Hineman E. F. Johnson	6 mi. W. Jeanette, Pa., 5 mi. N. Irwin, Pa.	11
11.	Scott Field	Capt. Edmund Hill Lt. J. G. Fisher	Irwin, Pa.	10
12.	Gardner Motor Co., St. Louis, Mo.	H. E. Honeywell Arthur C. Hoskins	3 mi. N. Irwin, Pa. on Pa. R. R. Tracks	8
13.	N.A.S., Lakehurst, N. J.	Lt. J. H. Stevens Lt. Geo. F. Watson	Pitcairn, Pa.	7¼
14.	Sun Telegraph, Pittsburg	W. G. Bennett Walter Chambers	4 mi. W. Trafford City	5¾

INTERNATIONAL BALLOON RACE 1928

Starting from Detroit, Mich., June 30

Place	*Balloon*	*Country*	*Pilot and Aide*	*Place of Landing*	*Distance Miles*
1.	U. S. Army	United States	Capt. W. E. Kepner Lt. Wm. O. Eareckson	3 mi. S. of Kenbridge, Va., Lunenburg Co.	460.
2.	Barmen	Germany	Hugo Kaulen, Sr. Hugo Kaulen, Jr.	3 mi. S. of Chase City, Va., Mecklenberg Co.	459.4
3.	Blanchard	France	Charles Dollfus Georges Cormier	3 mi. N. E. of Walnut Cove, N. C., bank of Dan River	447.9
4.	Lafayette	France	Georges Blanchet Dr. G. A. LeGallee	1½ mi. S. Fife, 1 mi. N. E. Bula, Va., Goochland Co.	416.
5.	Denmark	Denmark	S. A. U. Rassmussen T. W. Southworth	2 mi. N. E. Roanoke, Va., Roanoke Co.	388.1
6.	Munster	Germany	F. Eimermacher Carl Zech	5 mi. W. Big Island, Va., Bedford Co.	385.1
7.	American Business Club	United States	C. A. Palmer Lt. F. M. McKee	2 mi. S. of W. Lipscombe, Va., Augusta Co.	369.
8.	Argentine	Argentine	Edward Bradley H. H. Elliff	Between Millboro and Millboro Spring, Bath County, Va.	353.
9.	Detroit	United States	W. C. Naylor Russell Wherritt	35 mi. N. E. Marlinton, W. Va., Pocahontas County	325.
10.	Wallonie	Belgium	Lt. Jos. Thonnard Maurice Boel	Beverly, W. Va., Randolph Co.	297.
11.	Brandenburg	Germany	Geo. Froebel Otto Bertram	Davis, W. Va.	295.
12.	Helvetia	Switzerland	E. L. Maag	2 mi. S. Worthington, W. Va.	251.

NATIONAL AIR TOUR 1928

June 30-July 28—6,300 Miles

Place	*Plane*	*Model*	*Type*	*Motor Used*	*Entered by*	*Pilot*	*Points*
1.	Waco	10	Biplane	Wright J-5	Advance Aircraft Co.	John P. Wood	27103.4
2.	Ford Trimotored	4-AT	Monoplane	Wright J-5	Stout Metal Airplane Co. (Div. Ford Motor Co.)	F. M. Hawks	24390.8
3.	Stinson-Detroiter Jr.	SM 2	Monoplane	Warner	Stinson Aircraft Corp.	Randolph Page	22786.5
4.	Waco	10	Biplane	Wright J-5	Advance Aircraft Co.	Chas. Myers	22127.1
5.	Stinson-Detroiter	SM 1D	Monoplane	Wright J-5	Stinson Aircraft Corp.	Eddie Stinson	21243.0
6.	Stinson-Detroiter Jr.	SM 2	Monoplane	Warner G 1 B	Stinson Aircraft Corp.	Bruce Braun	19871.3
7.	Ryan Brougham	B-1	Monoplane	Wright J-5	B. F. Mahoney Aircraft Corp.	Al Henley	19728.9
8.	Bellanca	C H	Monoplane	Wright J-5	Wayco Air Service Inc.	Wm. S. Brock	19445.3
9.	Ryan Brougham	B-1	Monoplane	Wright J-5	B. F. Mahoney Aircraft Corp.	Vance Breese	18389.3
10.	Buhl "Airsedan"	CA-3C	Sesqueplane	Wright J-5	Buhl Aircraft Co.	Louis Meister	17948.1
11.	Lockheed	"Vega"	Monoplane	Wright J-5C	Lockheed Aircraft Co.	L. Schoenhair	17596.6
12.	Fairchild	FC-2	Monoplane	Wright J-5	Fairchild Airplane Mfg. Co.	R. Pears	15974.5
13.	Travel Air	8000	Biplane	Caminez	Travel Air Mfg. Co.	J. N. Kelly	15780.2
14.	Bellanca	01	Monoplane	Wright J-5CA	Wayco Air Service Inc.	George Haldeman	15080.8
15.	Swallow	J-5	Biplane	Wright J-5AB	Swallow Airplane Co.	Milton Aavang	13604.8
16.	Buhl "Airster"	CA-3	Biplane	Wright J-5	Buhl Aircraft Co.	Alger Graham	13528.2
17.	Stearman	C3B	Biplane	Wright J-5AB	Stearman Aircraft Co.	David Levy	12700.8
18.	Eaglerock	Hispano	Biplane	Hispano-Suiza "E"	Alexander Aircraft Co.	C. P. Clevenger	11477.7
19.	Monocoupe	2 place	Monoplane	Velie M5	Mono-Aircraft Inc.	Jack Atkinson	8370.6
20.	Ryan Brougham	B-1	Monoplane	Wright J-5C	B. F. Mahoney Aircraft Corp.	E. P. Cleveland	8169.4
21.	Waco	10	Biplane	Caminez	Advance Aircraft Co.	M. G. Beard	7850.6
22.	Travel Air	9000	Biplane	Siemens-Halske	Travel Air Mfg. Co.	Geo. B. Peck	6715.4
23.	Curtiss "Robin"		Monoplane	Curtis CX-5	Curtiss-Robertson A.M. Co.	D. R. Robertson	5949.9
24.	Monocoupe	2 place	Monoplane	Velie M5	Mono-Aircraft Inc.	Phoebe Omlie	5523.0

OFFICIAL WORLD AND AMERICAN AIR RECORDS

Established under Rules and Regulations of the

FEDERATION AERONAUTIQUE INTERNATIONALE

Compiled by the Contest Committee, National Aeronautic Association, Washington, D. C.

DEC. 31, 1928

WORLD RECORDS

CONFIRMED BY FEDERATION AERONAUTIQUE INTERNATIONALE

AMERICAN RECORDS

CONFIRMED BY CONTEST COMMITTEE NATIONAL AERONAUTIC ASSOCIATION OF U. S. A.

CLASS A—BALLOONS

GRAND "FREE FOR ALL" RECORD

Duration (Germany)—H. Kaulen, Dec. 13-17, 1913. 87h.

Distance (Germany)—Berliner, Feb. 8-10, 1914. 3,052.7 kms.—1,896.9 miles.

Altitude (Germany)—Suring and Berson, June 30, 1921. 10,800 meters—35,424 feet.

Duration—C. B. Harmon, St. Louis to Edina, Mo., Oct. 4, 1909. 48h. 26m.

Distance—A. R. Hawley, St. Louis to Lake Tschotogama, Oct. 17-19, 1910. 1,887.6 kms.—1,172.9 miles.

Altitude—Capt. Hawthorne C. Gray, Scott Field, Belleville, Ill., March 9, 1927. 8,690 meters—28,510 feet.

FIRST CATEGORY (600 CUBIC METERS)

Duration (France)—G. Cormier, Aug. 10-11, 1924. 22h. 34m.

Distance (France)—Georges Cormier, July 1, 1922. 804.173 kms.—499.69 miles.

Altitude—(No Record).

Duration—(No Record).

Distance—(No Record).

Altitude—(No Record).

SECOND CATEGORY (601-900 CUBIC METERS)

Duration (France)—Jules Dubois, May 14-15, 1922. 23h. 28m.

Distance (France)—Georges Cormier, July 1, 1922. 804.173 kms.—499.69 miles.

Altitude—(No Record).

Duration—W. C. Naylor and K. W. Warren, "Skylark," Little Rock, Ark., to Crawford, Tenn., April 29-30, 1926. 19h.

Distance—W. C. Naylor and K. W. Warren, "Skylark," Little Rock., Ark., to Crawford, Tenn., April 29-30, 1926. 660 kms.—410 miles.

Altitude—(No Record).

THIRD CATEGORY (901-1,200 CUBIC METERS)

Duration (United States)—E. J. Hill and A. G. Schlosser, Ford Airport to Montvale, Va., July 4-5, 1927. 26h. 46m.

Distance (United States)—S. A. U. Rasmussen, Ford Airport to Hookerton, N. C., July 4-5, 1927. 920.5 kms.—572 miles.

Altitude—(No Record).

Duration—E. J. Hill and A. G. Schlosser, Ford Airport to Montvale, Va., July 4-5, 1927. 26h. 46m.

Distance—S. A. U. Rasmussen, Ford Airport to Hookerton, N. C., July 4-5, 1927. 920.5 kms.—572 miles.

Altitude—(No Record).

FOURTH CATEGORY (1,201-1,600 CUBIC METERS)

Duration (United States)—E. J. Hill and A. G. Schlosser, Ford Airport to Montvale, Va., July 4-5, 1927. 26h. 46m.

Distance (United States)—S. A. U. Rasmussen, Ford Airport to Hookerton, N. C., July 4-5, 1927. 920.5 kms.—572 miles.

Altitude—(No Record).

Duration—E. J. Hill and A. G. Schlosser, Ford Airport to Montvale, Va., July 4-5, 1927. 26h. 46m.

Distance—S. A. U. Rasmussen, Ford Airport to Hookerton, N. C., July 4-5, 1927. 920.5 kms.—572 miles.

Altitude—(No Record).

FIFTH CATEGORY (1,601-2,200 CUBIC METERS)

Duration (France)—Georges Blanchet and Dr. Geo. LeGallee Gordon Bennett, Detroit-Waverley Hall, Ga., Sept. 10-11-12, 1927. 49h.

Distance (United States)—E. J. Hill and A. G. Schlosser, Gordon Bennett, Detroit-Baxley, Ga., Sept. 10-11-12, 1927. 1,198.9 kms.—745 miles.

Altitude—(No Record).

Duration—E. J. Hill and A. G. Schlosser, Gordon-Bennett, Detroit to Baxley, Ga., Sept. 10-11-12, 1927. 47h. 55m.

Distance—E. J. Hill and A. G. Schlosser, Gordon Bennett, Detroit to Baxley, Ga., Sept. 10-11-12, 1927. 1,198.9 kms—745 miles.

Altitude—(No Record).

SIXTH CATEGORY (2,201-3,000 CUBIC METERS)

Duration (France)—Georges Blanchet and Dr. Geo. LeGallee, Detroit to Waverley Hall, Ga., Sept. 10-11-12, 1927. 49h.

Distance (United States)—E. J. Hill and A. G. Schlosser, Gordon Bennett, Detroit to Baxley, Ga., Sept. 10, 11, 12, 1927. 1,198.9 kms.—745 miles.

Altitude (United States)—Capt. Hawthorne C. Gray, at Scott Field, Belleville, Ill., March 9, 1927. 8,690 meters—28,510 feet.

Duration—E. J. Hill and A. G. Schlosser, Gordon Bennett, Detroit to Baxley, Ga., Sept. 10-11-12, 1927. 47h. 55m.

Distance—E. J. Hill and A. G. Schlosser, Gordon Bennett, Detroit to Baxley, Ga., Sept. 10-11-12, 1927. 1,198.9 kms.—745 miles.

Altitude—Capt. Hawthorne C. Gray at Scott Field, Belleville, Ill., March 9, 1927. 8,690 meters—28,510 feet.

SEVENTH CATEGORY (3,001-4,000 CUBIC METERS)

Duration (France)—Georges Blanchet and Dr. Geo. LeGallee, Gordon Bennett, Detroit to Waverley Hall, Ga., Sept. 10-11-12, 1927. 49h.

Distance (United States)—E. J. Hill and A. G. Schlosser, Gordon Bennett, Detroit to Baxley, Ga., Sept. 10-11-12, 1927. 1,198.9 kms.—745 miles.

Altitude (United States)—Capt. Hawthorne C. Gray, at Scott Field, Belleville, Ill., March 9, 1927. 8,690 meters—28,510 feet.

Duration—E. J. Hill and A. G. Schlosser, Gordon Bennett, Detroit to Baxley, Ga., Sept. 10-11-12, 1927. 47h. 55m.

Distance—E. J. Hill and A. G. Schlosser, Gordon Bennett, Detroit to Baxley, Ga., Sept. 10-11-12, 1927. 1,198.9 kms.—745 miles.

Altitude—Capt. Hawthorne C. Gray, at Scott Field, Belleville, Ill., March 9, 1927. 8,690 meters—28,510 feet.

EIGHTH CATEGORY (4,001-5,000 CUBIC METERS)

Duration (France)—Georges Blanchet and Dr. Geo. LeGallee, Gordon Bennett, Detroit to Waverley Hall, Ga., Sept. 10-11-12, 1927. 49h.

Distance (United States)—E. J. Hill and A. G. Schlosser, Gordon Bennett, Detroit to Baxley, Ga., Sept. 10-11-12, 1927. 1,198.9 kms.—745 miles.

Altitude (United States)—Capt. Hawthorne C. Gray, at Scott Field, Belleville, Ill., March 9, 1927. 8,690 meters—28,510 feet.

Duration—E. J. Hill and A. G. Schlosser, Gordon Bennett, Detroit to Baxley, Ga., Sept. 10-11-12, 1927. 47h. 55m.

Distance—E. J. Hill and A. G. Schlosser, Gordon Bennett, Detroit to Baxley, Ga., Sept. 10-11-12, 1927. 1,198.9 kms.—745 miles.

Altitude—Capt. Hawthorne C. Gray, at Scott Field, Belleville, Ill., March 9, 1927. 8,690 meters—28,510 feet.

CLASS B—AIRSHIPS

RETURNING TO POINT OF DEPARTURE

Duration (Italy)—Castracane and Castruccio, P-5, June 25, 1913. 15h.

Distance (Germany)—Dr. Hugo Eckener, "Graf Zeppelin" Maybach, 5 motors, Lakehurst, U.S.A., to Friedrichshafen, Germany, Nov. 29-30-31, 1928. 6,384.5 kms.—3,967 miles.

Altitude (France)—Cohen, at Conte, June 18, 1912. 3,080 meters—10,102 feet.

Duration—Ens. Maytham, Navy A-236, at Miami, Fla., Dec. 24-25, 1918. 40h. 26m.

Distance—(No Record).

Altitude—(No Record).

CLASS C—AIRPLANES

RETURNING TO POINT OF DEPARTURE WITHOUT REFUELING

Duration (Germany)—Johann Risztios and Whilhelm Zimmerman, Junkers W-33, Junkers LV 280 h.p., at Dessau, July 5, 6, 7, 1928. 65h. 25m.

Duration — William Brock and Edward Schlee, Bellanca, Wright Whirlwind 220 h.p., at San Diego, Calif., Sept. 29-30-Oct. 1, 1928. 59h. 19m. 15s.

Distance (Closed Circuit) (Italy)—Arturo Ferrarin and Carlo Del Prete, Savoia-Marchetti, S-64, Fiat A-22, Course Casale dei Prati, Torre Flaria, Fara, d'Anzio, May 31-June 1-2, 1928. 7,666.6 kms.—4,763.7 miles.

Distance (Airline) (Italy)—Arturo Ferrarin and Carlo del Prete, Savoia-Marchetti, S-64, Fiat 550 h.p., Rome to Touros, Brazil, July 3-4-5, 1928. 7,186 kms.—4,466 miles.

Altitude (United States)—Lt. C. C. Champion, U.S.N., Wright Apache, Pratt & Whitney "Wasp," Supercharged 425 h.p., at Anacostia, D. C., July 25, 1927. 11,710 meters—38,418 feet.

Maximum Speed (France)—Warrant Officer Bonnett, Ferbois monoplane, Hispano Suiza, 550 h.p., at Istres, France, Dec. 11, 1924. 448.171 k.p.h.—278.480 m.p.h.

SPEED FOR SPECIFIED DISTANCES
Without Pay Load

Speed for 100 Kilometers (United States)—Lt. Cyrus Bettis, U.S.A.S., Curtiss R3C-1, Curtiss V-1400, 600 h.p., Mitchel Field, Oct. 12, 1925. 401.279 k.p.h—249.342 m.p.h.

Speed for 500 Kilometers (France)—Sadi-LeCointe, Nieuport to Delage, Hispano Suiza, 500 h.p., at Istres, June 23, 1924. 306.696 k.p.h.—190.567 m.p.h.

Speed for 1,000 Kilometers (France)—Fernand Lasne, Nieuport to Delage, 42C-1, Hispano Suiza, 500 h.p., Etampes, Aug. 29, 1925. 248.292 k.p.h.—154.293 m.p.h.

Speed for 2,000 Kilometers (France)—Fernand Lasne, Nieuport to Delage, 42C-1, Hispano Suiza, 500 h.p., Etampes, Sept. 12, 1925. 218.759 k.p.h.—135.930 m.p.h.

Speed for 5,000 Kilometers (Italy)—Arturo Ferrarin and Carlo Del Prete, Savoia-Marchetti, S-64, Fiat A-22, Course Casale dei Prati, Torre Flaria, Fara, d'Anzio, May 31-June 1-2, 1928. 139.177 k.p.h.—86.479 m.p.h.

Distance—Lts. Kelly and Macready, U.S.A. T-2, Liberty, 375 h.p., at Wilbur Wright Field, Dayton, Ohio, April 16-17, 1923. 4,050 kms.—2,516.55 miles.

Distance (Airline)—Clarence D. Chamberlain, Wright Bellanca J-5, 200 h.p., Roosevelt Field to Isleben, Germany, June 4-5-6, 1927. 6,294 kms.—3,911 miles.

Altitude—Lt. C. C. Champion, U.S.N., Wright Apache, Pratt & Whitney "Wasp," Supercharged 425 h.p., at Anacostia, D. C., July 25, 1927. 11,710 meters—38,418 feet.

Maximum Speed—Lt. A. J. Williams, U.S.N., Curtis Racer, R-2-C-1, Curtis D-12a, 500 h.p., at Mitchel Field, L. I., N. Y., Nov. 4, 1923. 429.025 k.p.h.—266.59 m.p.h.

SPEED FOR SPECIFIED DISTANCES
Without Pay Load

Speed for 100 Kilometers—Lt. Cyrus Bettis, U.S.A.S., Curtiss R3C-1, Curtiss V-1400, 600 h.p., Mitchel Field, Oct. 12, 1925. 401.279 k.p.h.—249.342 m.p.h.

Speed for 500 Kilometers—Lt. Alex Pearson, U.S.A., Verville Sperry R-3, Wright 350 h.p., at Wright Field, Dayton, Ohio, March 29, 1923. 270.06 k.p.h.—167.80 m.p.h.

Speed for 1,000 Kilometers—Lt. Harold R. Harris, U.S.A., and Ralph Lockwood, DH-4L Liberty 400 h.p., at Wright Field, March 29, 1923. 205.06 k.p.h.—127.42 m.p.h.

Speed for 2,000 Kilometers—Lt. Harold R. Harris, U.S.A., DH-4L, Liberty 375 h.p., at Wright Field, April 17, 1923. 183.83 k.p.h.—114.22 m.p.h.

Speed for 5,000 Kilometers—(No Record).

CLASS C—WITH PAY LOAD OF 500 KILOGRAMS
(1,102.31 lbs.)

Duration (Germany)—W. K. Schnabele and Fritz Loose, Junkers W-35, Junkers L-5 engine, 320 h.p., at Dessau, March 21-22, 1927. 22h. 11m. 45s.

Distance (Germany)—W. K. Schnabele and Fritz Loose, Junkers W-35, Junkers L-5 engine, 320 h.p., at Dessau, March 21-22, 1927. 2,735.586 kms.—1,699.81 miles.

Altitude (Germany)—Reginald Schinzinger, Junkers W-34, Bristol Jupiter VII, 420 h. p., at Dessau, Sept. 14, 1928. 9,190 meters—30,150 feet.

Speed for 100 Kilometers (France)—Fernand Lasne, Nieuport-Delage, Hispano Suiza, 500 h.p., at Etampes, Oct. 7, 1925. 281.030 k.p.h.—174.622 m.p.h.

Duration—Lt. H. R. Harris, U.S.A.S., Douglas DT-2, Liberty 400 h.p., at Wright Field, Dayton, June 28, 1924. 9h. 11m. 53.4s.

Distance—Lt. H. R. Harris, U.S.A.S., Douglas DT-2, Liberty 400 h.p., at Wilbur Wright Field, June 28, 1924. 950 kms.—590.3 miles.

Altitude—Lt. H. R. Harris, U.S.A.S., USA-TP-1, Liberty 400 h.p., at McCook Field, May 21, 1924. 8,578 meters—28,143 feet.

Speed for 100 Kilometers—R. Lockwood, Army C-5, Liberty 400 h.p., at Wright Field, June 28, 1924. 180.805 k.p.h.—112.346 m.p.h.

Speed for 500 Kilometers (Great Britain)—Capt. H. S. Broad, deHaviland "Hound," Napier-Lion XI, 550 h.p., at Stag Lane, Reading, April 27, 1928. 255.333 k.p.h. —158.656 m.p.h.

Speed for 500 Kilometers—Louis C. Meister, Martin Bomber, MB-2, 2 Liberty 400 h.p., at Wright Field, June 28, 1924. 120.55 k.p.h.—74.90 m.p.h.

Speed for 1,000 Kilometers (France)—Fernand Lasne, Nieuport-Delage, Type 42, Hispano Suiza, 500 h.p., at Etampes, May 14, 1926. 236.028 k.p.h.—146.660 m.p.h.

Speed for 1,000 Kilometers—(No Record).

Speed for 2,000 Kilometers (Germany)—H. Steindorff, Rohrbach-Roland, 3 BMW, 230 h.p. ea., at Staaken, July 31, 1927. 205.407 k.p.h.—127.632 m.p.h.

Speed for 2,000 Kilometers—(No Record).

Speed for 5,000 Kilometers—(No Record).

Speed for 5,000 Kilometers—(No Record).

CLASS C—WITH PAY LOAD OF 1,000 KILOGRAMS

(2,204.12 lbs.)

RETURNING TO POINT OF DEPARTURE

Duration (Germany)—Fritz Horn, Junkers G-24, 3 Junkers L-11, 230 h.p. ea., at Dessau, April 4, 1927. 14h. 23m. 45s.

Duration—Lt. J. S. Macready, U.S.A.S., Curtiss (Martin) Bomber, NBS-1, 2 Liberty 400 h.p., at Wright Field, Oct. 2, 1924. 2h. 13m. 49.6s.

Distance (Germany)—H. Steindorff, Rohrbach-Roland, 3 BMW 230 h.p. ea., at Staaken, July 31, 1927. 2,315.338 kms.—1,438.680 miles.

Distance—(No Record).

Altitude (Germany)—Reginald Schinzinger, Junkers W-34, Bristol Jupiter VII, 420 h.p., at Dessau, Sept. 14, 1928. 7,907 meters—25,941 feet.

Altitude—Lt. H. R. Harris, U.S.A.S., U. S.A. TP-1, Liberty 400 h.p., at Wright Field, May 22, 1924. 5,100 meters—16,732 feet.

Speed for 100 Kilometers (Great Britain) —Capt. H. S. Broad, deHaviland "Hound," Napier-Lion XI 550 h.p., at Stag Lane, Reading, April 27, 1928. 261.172 k.p.h.—160.280 m.p.h.

Speed for 100 Kilometers—(No Record).

Speed for 500 Kilometers (Great Britain) —Capt. H. S. Broad, deHaviland "Hound," Napier-Lion XI 550 h.p., at Stag Lane, Reading, April 27, 1928. 255.333 k.p.h.—158.656 m.p.h.

Speed for 500 Kilometers—(No Record).

Speed for 1,000 Kilometers (France)—M. Paillard, Bernard Jupiter, 420 h.p., at LeMerle-Arles-Port Louis, Jan. 24, 1928. 218.274 k.p.h.—135.628 m.p.h.

Speed for 1,000 Kilometers—(No Record).

Speed for 2,000 Kilometers (Germany)—Herman Steindorff, Rohrbach-Roland, 3 BMW, 230 h.p. ea., at Staaken, July 31, 1927. 205.407 k.p.h.—127.632 m.p.h.

Speed for 2,000 Kilometers—(No Record).

Speed for 5,000 Kilometers—(No Record).

Speed for 5,000 Kilometers—(No Record).

CLASS C—WITH PAY LOAD OF 2,000 KILOGRAMS

(4,409.24 lbs.)

RETURNING TO POINT OF DEPARTURE

Duration (Germany)—J. Tisctics, Junkers G-24, Junkers 280 h.p., at Dessau, June 29, 1927. 13h. 1m. 12.8s.

Duration—Lt. H. R. Harris, U.S.A.S., and Mechanician Doug. Culver, Barling Bomber, 6 Liberty 400 h.p., at Wright Field, Oct. 3, 1924. 1h. 47m. 10.5s.

Distance (Germany)—Herman Steindorff, Rohrbach-Roland, 3 BMW, 230 h.p., at Staaken, July 31, 1927. 1,750.469 kms. —1,087.68 miles.

Distance—(No Record).

Altitude (Italy)—Demonico Antonini, Captoni CA-73, 2 Isotta Fraschini, 500 h.p. ea., at Cascina Malpensa, May 26, 1927. 6,262 meters—20,544 feet.

Altitude—Lt. H. R. Harris, U.S.A.S., Barling Bomber, 6 Liberty 400 h.p. at Wright Field, Oct. 25, 1923. 2,049 meters—6,722 feet.

Speed for 100 Kilometers (France)—Paillard and Camplan, "Bernard" 190 T Hispano-Suiza, 600 h.p., LeBourget to Gondreville, Nov. 23, 1928. 223.546 k.p.h.—138.904 m.p.h.

Speed for 100 Kilometers—(No Record).

Speed for 500 Kilometers (Germany)—Herman Steindorff, Rohrbach-Roland, 3 BMW 230 h.p. ea., at Staaken, July 28, 1927. 215.378 k.p.h.—133.828 m.p.h.

Speed for 500 Kilometers—(No Record).

Speed for 1,000 Kilometers (Germany)—Herman Steindorff, Rohrbach-Roland, 3 BMW 230 h.p. ea., at Staaken, July 28, 1927. 214.855 k.p.h.—133.504 m.p.h.

Speed for 1,000 Kilometers—(No Record).

CLASS C—WITH PAY LOAD OF 5,000 KILOGRAMS (11,023 lbs.)

Duration (France)—L. Bossoutrot, Super Farman-Goliath, 4 Farman 500 h.p. ea., at LeBourget, Nov. 16, 1925. 1h. 12m. 21s.

Duration—(No Record).

Altitude (France)—L. Bossoutrot, Super Farman-Goliath, 4 Farman 500 h.p. ea., at LeBourget, Nov. 16, 1925. 3,586 meters—11,765 feet.

Altitude—(No Record).

Speed for 100 Kilometers—(No Record).

Speed for 100 Kilometers—(No Record).

Speed for 500 Kilometers—(No Record).

Speed for 500 Kilometers—(No Record).

CLASS C
GREATEST PAY LOAD CARRIED TO AN ALTITUDE OF 2,000 METERS (6,671.7 ft.)

L. Boussoutrat, Super Farman-Goliath, 4 Farman 500 h.p. ea., at LeBourget, Nov. 16, 1925. 6,000 kgs.—13.228 lbs.

Lt. H. R. Harris, U.S.A.S., Barling Bomber, 6 Liberty 400 h. p. ea., at Wright Field, Oct. 25, 1923. 2,000 kgs.—4,409 lbs.

CLASS C—REFUELING IN FLIGHT
RETURNING TO POINT OF DEPARTURE

Duration (Belgium)—Adj. Louis Crooy and Sgt. Victor Groenen, DH-9, Siddeley-Puma, at Tirlement, June 2-3-4, 1928. 60h. 7m.

Duration—Lts. Smith and Richter, U.S.A., DH-4B, Liberty 400 h.p., at Rockwell Field, San Diego, Calif., Aug. 27-28, 1923. 37h. 15m. 14.8s.

Distance—Lts. Smith and Richter, U.S.A., DH-4B, Liberty 400 h.p., at Rockwell Field, San Diego, Calif., Aug. 27-28, 1923. 5,300 kms.—3,293.26 miles.

Distance—Lts. Smith and Richter, U.S.A., DH-4B, Liberty 400 h.p., at Rockwell Field, San Diego, Calif., Aug. 27-28, 1923. 5,300 kms.—3,293.26 miles.

RECORDS FOR LIGHT AIRPLANES
CLASS C—FIRST CATEGORY

Two seaters weight empty less than 400 Kgs. (881 lbs.)

Distance (Closed Circuit) (Czechoslovakia)—Joseph Hermansky and Francois Machacek, Avia BH-9, Walter 60 h.p., at Prague, July 11, 1928. 1,500 Kms.—932 miles.

Distance (Closed Circuit)—(No Record).

Distance (Airline) (Switzerland)—Capt. Hans Wirth and Melle Erika Nauman, Klemm-Daimler, Monoplane Mercedes-Daimler, 20 h.p., Boblingen Airport to Mieschkance, Poland, Oct. 16, 1928. 1,305.5 kms.—811.10 miles.

Distance (Airline)—(No Record).

Altitude (Great Britain)—Capt. G. deHaviland and Mrs. deHaviland, DH Moth 60G, DH Gipsy 85 h.p., at Stag Lane, July 27, 1928. 6,054 meters—19,862 feet.

Altitude—(No Record).

Speed for 100 Kilometers (Great Britain)—A. S. Butler and Mrs. Butler, DH Moth Biplane, Gypsy 100 h.p., Stag Lane, Reading, Dec. 7, 1928. 192.864 k.p.h.—119.839 m.p.h.

Speed for 100 Kilometers—(No Record).

CLASS C—SECOND CATEGORY

Single seaters weight empty less than 200 Kgs. (440 lbs.)

Distance (Closed Circuit) (Hungary)—Chas. Kazala, Lanipich Monoplane, Thorutzkai engine, 18 h.p., at Budapest, Sept. 14, 1927. 650 kms.—403.9 miles.

Distance (Airline) (Hungary)—Chas Kaszala, Lanipich H-MAFD, Thorutskai 18 h.p., Budapest to Pola, June 14, 1928. 517.04 kms.—832.03 miles.

Altitude—(No Record).

Speed for 100 Kilometers—(No Record).

Distance (Closed Circuit)—(No Record).

Distance (Airline)—(No Record).

Altitude—(No Record).

Speed for 100 Kilometers—(No Record).

CLASS C—THIRD CATEGORY

Single seaters weight empty 200-350 Kgs., Inc. (440-771 lbs.)

Distance (Closed Circuit) (Czechoslovakia)—Commandant Vicherck, Avia BH-11B, Walter 60 h.p., at Prague, June 6-7, 1928. 2,500 kms.—1,553 miles.

Distance (Czechoslovakia) (Airline)—Capt. A. Vichereck, Avia Monoplane, Walter 60 h.p., de Prague A. Bednodemjanovsk, Oct. 5, 1928. 2,011 kms.—1,249.6 miles.

Altitude (Germany)—Paul W. Baumer, Baumer, Wright 60 h.p., Hamburg-Fuhlsbuttal, July 8, 1927. 6,782 meters—22,250 feet.

Speed for 100 Kilometers (Great Britain)—Capt. H. S. Broad, DH "Tiger Moth," DH 32 engine, 130 h.p., at Stag Lane, Aug. 24, 1927. 300.1 k.p.h.—186.47 m.p.h.

Distance (Closed Circuit)—(No Record).

Distance (Airline)—Harry J. Brooks, Ford Mopoplane, Ford Type AC motor, 36 h.p., Detroit to Titusville, Fla., Feb. 21, 1928. 1,564 kms.—972 miles.

Altitude—(No Record).

Speed for 100 Kilometers—(No Record).

CLASS C2—SEAPLANES

RETURNING TO POINT OF DEPARTURE WITHOUT REFUELING

Duration (United States)—Lts. Arthur Gavin and Zeus Soucek, Navy PN-12, 2 Wright R-1750, 525 h.p. ea., at Philadelphia, May 3-4-5, 1928. 36h. 1m.

Distance (United States)—Lts. B. J. Connell and H. C. Rodd, PN-10, 2 Packard 600 h.p. ea., at San Diego, Calif., Aug. 15, 16, 1927. 2,525 kms.—1,569 miles.

Distance (Airline) (United States)—Comdr. John Rodgers, U.S.N., and Lt. B. J. Connell, PN-9, 2 Packard 1-A-1500, 500 h.p. ea., San Pablo Bay, Calif., to near Hawaii, Aug. 31-Sept. 1, 1925. 2,963 kms.—1,841 statute miles.

Altitude (United States)—Lt. C. C. Champion, U.S.N., Wright "Apache," Pratt & Whitney "Wasp" Supercharged, 425 h.p., at Anacostia, D. C., July 4, 1927. 11,581 meters—37,995 feet.

Maximum Speed (Italy)—Major Mario de Bernardi, Macchi 52, Monoplane, Fiat engine Type AS3, at Venice, Italy, March 30, 1928. 512.776 k.p.h.—318.624 m.p.h.

SPEED FOR SPECIFIED DISTANCES

Speed for 100 Kilometers (Great Britain)—Lt. Webster, Supermarine S-5, Napier 1,000 h.p., at Venice, Sept. 26, 1927. 456.522 k.p.h.—283.669 m.p.h.

Speed for 500 Kilometers (United States)—Lt. R. A. Ofstie, Curtiss Navy C-R, Seaplane, Curtiss D-12, 450 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924. 259.328 k.p.h.—161.14 m.p.h.

Duration—Lts. Arthur Gavin and Zeus Soucek, Navy PN-12, 2 Wright R-1750, 525 h.p. ea., at Philadelphia, May 3-4-5, 1928. 36h. 1m.

Distance—Lts. B. J. Connell and H. C. Rodd, PN-10, 2 Packard 600 h.p. ea., at San Diego, Calif., Aug. 15-16, 1927. 2,525 kms.—1,569 miles.

Distance (Airline)—Comdr. John Rodgers, U.S.N., and Lt. B. J. Connell, PN-9, 2 Packard 1-A-1500, 500 h.p. ea., San Pablo Bay to near Hawaii, Aug. 31-Sept. 1, 1925. 2,963 kms.—1,841 Statute miles.

Altitude—Lt. C. C. Champion, U.S.N., Wright "Apache," Pratt & Whitney "Wasp," Supercharged, 425 h.p., at Anacostia, D. C., July 4, 1927. 11,581 meters—37,995 feet.

Maximum Speed (Straightaway)—Lt. Jas. H. Doolittle. U.S.A.S., Curtiss R3C-2, Curtiss V-1400, 600 h.p., Bay Shore, Baltimore, Md., Oct. 27, 1925. 395.439 k.p.h.—245.713 m.p.h.

SPEED FOR SPECIFIED DISTANCES

Speed for 100 Kilometers—Lt. G. T. Cuddihy, U.S.N., Curtiss R3C2, Curtiss V-1550, 700 h.p., at Norfolk, Va., Nov. 13, 1926. 388.944 k.p.h.—241.679 m.p.h.

Speed for 500 Kilometers—Lt. R. A. Ofstie, U.S.N., Curtiss Navy C-R, Seaplane, Curtiss D-12, 450 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924. 259.328 k.p.h.—161.14 m.p.h.

Speed for 1,000 Kilometers (United States)—Lt. R. Irvine, Vought "Corsair," Pratt & Whitney "Wasp," 425 h.p., at Hampton Roads, Va., May 21, 1927. 210.716 k.p.h.—130.932 m.p.h.

Speed for 2,000 Kilometers (Switzerland)—Richard Wagner and Georges Zinsmaier, Dorner "Merkur" BMW, 500-600 h.p., at Altenrheim, Aug. 10, 1927. 172.00 k.p.h.—106.875 m.p.h.

Speed for 5,000 Kilometers—(No Record).

Speed for 1,000 Kilometers—Lt. R. Irvine, Vought "Corsair," Pratt & Whitney "Wasp," 425 h.p., at Hampton Roads, Va., May 21, 1927. 210.716 k.p.h.—130.932 m.p.h.

Speed for 2,000 Kilometers—Lts. B. J. Connell and H. C. Rodd, U.S.N., PN-10, 2 Packard 600 h.p. ea., at San Diego, Calif., Aug. 15-16, 1927. 126.567 k.p.h. 78.644 m.p.h.

Speed for 5,000 Kilometers—(No Record).

CLASS C2—WITH PAY LOAD OF 500 KILOGRAMS
(1,102.31 lbs.)
RETURNING TO POINT OF DEPARTURE

Duration (United States)—Lts. B. J. Connell and H. C. Rodd, PN-10, 2 Packard 600 h.p. ea., at San Diego, Calif., Aug. 15-16, 1927. 20h. 45m. 40s.

Distance (United States)—Lts. B. J. Connell and H. C. Rodd, PN-10, 2 Packard 600 h.p. ea., at San Diego, Calif., Aug. 15-16, 1927. 2,525 kms.—1,569 miles.

Altitude (Germany)—Fritz Harder, Junkers W-34, Bristol Jupiter VII, 420 h.p., at Dessau, Nov. 6, 1928. 7,458 meters—27,749 feet.

Speed for 100 Kilometers (United States)—Lt. S. W. Callaway, U.S.N., Vought "Corsair," Pratt & Whitney, 425 h.p. "Wasp," at Hampton Roads, Va., April 23, 1927. 236.998 k.p.h.—147.263 m.p.h.

Speed for 500 Kilometers (United States)—Lt. J. D. Barner, U.S.N., Vought "Corsair," Pratt & Whitney "Wasp," 425 h.p., at Hampton Roads, April 30, 1927. 218.90 k.p.h.—136.023 m.p.h.

Speed for 1,000 Kilometers (Germany)—Geo. Juterbock, Junkers W-34, Bristol Jupiter, 420 h.p., at Dessau, May 11, 1927. 181.447 k.p.h.—112.695 m.p.h.

Speed for 2,000 Kilometers (Switzerland)—Richard Wagner and Geo. Zinsmaier, Dornier, "Merkur" BMW 500-600 h.p., at Altenrheim, Aug. 10, 1927. 172.00 k.p.h.—106.875 m.p.h.

Speed for 5,000 Kilometers—(No Record).

Duration—Lts. B. J. Connell and H. C. Rodd, PN-10, 2 Packard 600 h.p. ea., at San Diego, Calif., Aug. 15-16, 1927. 20h. 45m. 40s.

Distance—Lts. B. J. Connell and H. C. Rodd, PN-10, 2 Packard 600 h.p. ea., at San Diego, Calif., Aug. 15-16, 1927. 2,525 kms.—1,569 miles.

Altitude—Lt. Geo. R. Henderson, U.S.N., Vought "Corsair," Pratt & Whitney "Wasp," 425 h.p., at Washington, D. C., April 14, 1927. 6,760 meters—22,178 feet.

Speed for 100 Kilometers—Lt. S. W. Callaway, U.S.N., Vought "Corsair," Pratt & Whitney 425 h.p. "Wasp," at Hampton Roads, Va., April 23, 1927. 236.998 k.p.h.—147.263 m.p.h.

Speed for 500 Kilometers—Lt. J. D. Barner, U.S.N., Vought "Corsair," Pratt & Whitney "Wasp," 425 h.p., at Hampton Roads, April 30, 1927. 218.90 k.p.h.—136.023 m.p.h.

Speed for 1,000 Kilometers—Lt. N. J. Connell and S. R. Pope, PN-10, 2 Packard 600 h.p. ea., at San Diego, Calif., July 8, 1927. 142.74 k.p.h.—88.69 m.p.h.

Speed for 2,000 Kilometers—Lt. B. J. Connell and H. C. Rodd, U.S.N., PN-10, 2 Packard 600 h.p. ea., at San Diego, Calif., Aug. 15-16, 1927. 126.567 k.p.h.—78.664 m.p.h.

Speed for 5,000 Kilometers—(No Record).

CLASS C2—WITH PAY LOAD OF 1,000 KILOGRAMS
(2,204.62 lbs.)
RETURNING TO POINT OF DEPARTURE

Duration (United States)—Lts. Zeus Soucek and Lisle J. Maxson, Navy, PN-12, 2 Wright R-1750 525 h.p. ea., at Philadelphia, May 25-26, 1928. 17h. 55m. 13.6s.

Distance (United States)—Lt. A. W. Gorton and Chief Boatzwm, E. E. Reber, U.S.N., PN-12, 2 Pratt & Whitney 525 h.p. ea., at Philadelphia, July 11-12, 1928. 2,150 kms.—1,336 miles.

Altitude (Germany)—Franz Kneer, Junkers W-34, Bristol Jupiter VII, 420 h.p., at Dessau, Nov. 7, 1928. 6.389 meters—20,961 feet.

Speed for 100 Kilometers (Germany)—Richard Wagner, Dornier Superwal, DR-142, 4 Gnome-Rhone-Jupiter 480 h.p. ea., Frederickshavn-Lindau, Jan. 20, 1928. 209.546 k.p.h.—130.105 m.p.h.

Duration—Lts. Zeus Seucek and Lisle J. Maxson, Navy PN-12, 2 Wright R-1750, 525 h.p. ea., at Philadelphia, May 25-26, 1928. 17h. 55m. 13.6s.

Distance—Lt. A. W. Gorton and Chief Boatswn, E. E. Reber, U.S.N., PN-12, 2 Pratt and Whitney 525 h.p. ea., at Philadelphia, July 11-12, 1928. 2,150 kms.—1,336 miles.

Altitude—Lt. Arthur Gavin, U.S.N., PN-12, 2 Pratt & Whitney R-1690, 525 h.p. ea., at Philadephia, June 27-28, 1928. 5,972 meters—19,593 feet.

Speed for 100 Kilometers—B. J. Connell and S. R. Pope, PN-10, 2 Packard 600 h.p. ea., at San Diego, Calif., July 8, 1927. 148.92 k.p.h.—92.53 m.p.h.

Speed for 500 Kilometers (Italy)—A Passaleva, Savoia Marchetti, S-62, Seaplane, 500 h.p., Isotta Fraschini, at Sesto Calende (LacMajeur), Dec. 30, 1926. 190.637 k.p.h.—118.455 m.p.h.

Speed for 1,000 Kilometers (Germany)—Richard Wagner, Dornier Superwal, DR-142, 4 Gnome-Rhone-Jupiter, 480 h.p. ea., at Frederickshavn-Lindau, Feb. 2, 1928. 177.279 k.p.h.—110.155 m.p.h.

Speed for 2,000 Kilometers (United States) Lt. A. W. Gorton and Chief Boatswn E. E. Reber, U.S.N., PN-12, 2 Pratt & Whitney 525 h. p. ea., at Philadelphia, July 11, 12, 1928. 130.427 k.p.h.—81.043 m.p.h.

Speed for 5,000 Kilometers—(No Record).

Speed for 500 Kilometers—Lt. B. J. Connel and S. R. Pope, PN-10, 2 Packard 600 h.p. ea., at San Diego, Calif., July 8, 1927. 145.68 k.p.h.—90.52 m.p.h.

Speed for 1,000 Kilometers—Lts. B. J. Connell and S. R. Pope, PN-10, 2 Packard 600 h.p. ea., at San Diego, Calif., July 8, 1927. 142.74 k.p.h.—88.69 m.p.h.

Speed for 2,000 Kilometers—Lt. A. W. Gorton and Chief Boatswn E. E. Reber, U.S.N., PN-12, 2 Pratt & Whitney 525 h.p. ea., at Philadelphia, July 11-12, 1928. 130.427 k.p.h.—81.043 m.p.h.

Speed for 5,000 Kilometers—(No Record).

CLASS C2—WITH PAY LOAD OF 2,000 KILOGRAMS (4,409.24 lbs.)

RETURNING TO POINT OF DEPARTURE

Duration (United States)—Lt. A. W. Gorton and Chief Boatswn. E. E. Reber, U.S.N., PN-12, 2 Pratt & Whitney 525 h.p. ea., at Philadelphia, July 11-12, 1928. 16h. 39m.

Distance (United States)—Lt. A. W. Gorton and Chief Boatswn. E. E. Reber, U.S.N., PN-12, 2 Pratt & Whitney 525 h.p. ea., at Philadelphia, July 11-12, 1928. 2,150 kms.—1,336 miles.

Altitude (France)—Lt. de Vaisseau, Paris, C.A.M.A., 2 Jupiter-Gnome 480 h.p. ea., at St. Raphael, August 18, 1927. 4,684 meters—15,368 feet.

Speed for 100 Kilometers (Germany)—Richard Wagner, Dornier Superwal, DR-142, 4 Gnome-Rhone-Jupiter 480 h.p. ea., Frederickshavn-Lindau, Jan. 20, 1928. 209.546 k.p.h.—130.105 m.p.h.

Speed for 500 Kilometers (Germany)—Richard Wagner, Dornier Superwal DR-142, 4 Gnome-Rhone-Jupiter 480 h.p. ea., at Frederickshavn-Lindau, Feb. 2, 1928. 179.416 k.p.h.—111.483 m.p.h.

Speed for 1,000 Kliometers (Germany)—Richard Wagner, Dornier Superwal DR-142, 4 Gnome-Rhone-Jupiter 480 h.p. ea., at Frederickshavn-Lindau, Feb. 2, 1928. 177.279 k.p.h.—110.155 m.p.h.

Speed for 2,000 Kilometers (United States) Lt. A. W. Gorton and Chief Boatswn. E. E. Reber, U.S.N., PN-12, 2 Pratt & Whitney 525 h.p. ea., at Philaodelphia, July 11-12, 1928. 130.427 k.p.h.—81.043 m.p.h.

Speed for 5,000 Kilometers—(No Record).

Duration—Lt. A. W. Gorton and Chief Boatswn. E. E. Reber, U.S.N., PN-12, 2 Pratt & Whitney 525 h.p. ea., at Philadelphia, July 11-12, 1928. 16h. 39m.

Distance—Lt. A. W. Gorton and Chief Boatswn. E. E. Reber, U.S.N., PN-12, 2 Pratt & Whitney, 525 h.p. ea., at Philadelphia, July 11-12, 1928. 2,150 kms.—1,336 miles.

Altitude—Lt. Arthur Gavin, U.S.N., PN-12, 2 Pratt & Whitney 525 h.p. ea., at Philadelphia, June 26, 1928. 4,702 meters—15,426 feet.

Speed for 100 Kilometers—Lt. B. J. Connell and S. R. Pope, PN-10, 2 Packard 600 h.p. ea., at San Diego, Calif., July 8, 1927. 148.92 k.p.h.—92.53 m.p.h.

Speed for 500 Kilometers—Lt. B. J. Connell and S. R. Pope, PN-10, 2 Packard 600 h.p. ea., at San Diego, Calif., July 8, 1927. 145.68 k.p.h.—90.52 m.p.h.

Speed for 1,000 Kilometers—Lt. B. J. Connell and S. R. Pope, PN-10, 2 Packard 600 h.p. ea., at San Diego, Calif., July 8, 1927. 142.74 k.p.h.—88.69 m.p.h.

Speed for 2,000 Kilometers—Lt. A. W. Gorton and Chief Boatswn. E. E. Reber, U.S.N., PN-12, 2 Pratt & Whitney 525 h.p. ea., at Philadelphia, July 11-12, 1928. 130.427 k.p.h.—81.043 m.p.h.

Speed for 5,000 Kilometers—(No Record).

CLASS C2—WITH PAY LOAD OF 4,000 KILOGRAMS (8,818 lbs.)

RETURNING TO POINT OF DEPARTURE

Duration (Germany)—Richard Wagner, Dornier Superwal DR-142, 4 Gnome-Rhone-Jupiter 480 h.p. ea., at Frederickshavn-Lindau, Feb. 5, 1928. 6h. 1m. 56s.

Distance (Germany)—Richard Wagner, Dornier Superwal DR-142, 4 Gnome-Rhone-Jupiter 480 h.p. ea., at Frederickshavn-Lindau, Feb. 5, 1928. 1,000.160 k.p.h.—621.468 m.p.h.

Duration—(No Record).

Distance—(No Record).

Altitude (Germany) — Richard Wagner, Dornier Superwal, 4 Gnome-Rhone-Jupiter 480 h.p. ea., at Frederickshavn-Lindau, Jan. 23, 1928. 2,845 meters—9,334 feet.

Altitude—(No Record).

Speed for 100 Kilometers (Germany)—Richard Wagner, Dornier Superwal, DR-142, 4 Gnome-Rhone-Jupiter 480 h.p. ea., at Frederickshvan-Lindau, Jan. 20, 1928. 209.546 k.p.h.—130.105 m.p.h.

Speed for 100 Kilometers—(No Record).

Speed for 500 Kilometers (Germany)—Richard Wagner, Dornier Superwal DR-142, 4 Gnome-Rhone-Jupiter 480 h.p. ea., at Frederickshavn-Lindau, Feb. 2, 1928. 179.416 k.p.h.—111.483 m.p.h.

Speed for 500 Kilometers—(No Record).

Speed for 1,000 Kilometers (Germany)—Richard Wagner, Dornier Superwal DR-142, 4 Gnome-Rhone-Jupiter 480 h.p. ea., at Frederickshavn-Lindau, Feb. 2, 1928. 177.279 k.p.h.—110.155 m.p.h.

Speed for 1,000 Kilometers—(No Record).

CLASS C2—SEAPLANES

GREATEST PAY LOAD CARRIED TO AN ALTITUDE OF 2,000 METERS (6,651.7 ft.)

Germany—Richard Wagner, Dornier Superwal, 4 Gnome-Rhone-Jupiter, 480 h.p. ea., at Frederickshavn, Jan. 23, 1928. 4,037 kilograms—8,900 lbs.

Lts. B. J. Connell and H. C. Rodd, U.S.N., PN-10, 2 Packard 600 h.p. ea., at San Diego, Calif., Aug. 18, 1927. 3,504 kilograms—7,726 lbs.

AERIAL SERVICE AND FLYING SCHOOLS

COASTAL AIRWAYS, INC.
45 West 45th St., New York City
Seaplane Base—Flushing Bay
Operators: New York to Albany Service
Terminal: Pier 32, North River
Sight-Seeing Service
Charter Work
Seaplanes and Flying Boats Only

CURTISS FLYING SERVICE, INC., Garden City, N. Y. Oldest flying organization in world. Fields principal cities. Transport, photography, pleasure, instruction, sales, service. C. S. "Casey" Jones, Pres.; G. S. Ireland, E. O. McDonnell, C. A. Elliot, H. C. Ferguson, E. L. Fries, Vice Pres.

THE EMBRY-RIDDLE FLYING SCHOOL, Lunken Airport, Cincinnati, Ohio. Ground-Primary-Advanced Courses. Training in Waco OX5's and Whirlwinds. Fairchilds and Monocoupes. Capt. Wright Vermilya, Director; W. H. Cunyus, Ground School Instructor; S. H. Sharp, Chief Flying Instructor.

LUDINGTON PHILADELPHIA FLYING SERVICE, INC., Philadelphia Airport, So. Phila. Operators Philadelphia Airport. Waco and Fairchild Distributors. Instruction and Taxi Service. C. T. Ludington, Pres. and Treas.; R. S. Saltus, Jr., Vice Pres.; R. P. Hewitt, Gen. Mgr.

PARKS AIR COLLEGE, INC., Parks Airport, East St. Louis, Ill. St. Louis office, 210 Missouri Building. Complete primary and advanced flying courses. Complete ground school courses. Complete mechanical school courses. H. P. Mammen, Pres.; Oliver L. Parks, Vice Pres.

SEAPLANE AND AMPHIBIAN FLYING SCHOOL CORPORATION, 730 Fifth Avenue, New York. Flying School Division, American Aeronautical Corporation. Savoia-Marchetti Flying Boats: S-56—3-passenger, S-62—7-passenger Amphibian Biplanes; S-55—12-passenger Flying Boat Monoplane.

U. S. AIR EXPRESS COMPANY, INC., 730 Fifth Avenue, New York. Transportation Division, American Aeronautical Corporation. Savoia-Marchetti Flying Boats: S-56—3-passenger, S-62—7-passenger Amphibian Biplanes; S-55—12-passenger Flying Boat Monoplane.

AIRCRAFT MANUFACTURERS

ACME AIRCRAFT CORPORATION, Rockford, Illinois.
Acme Monoplanes, Two and Three Place Open Land and Sea Planes, Folding Wings
H. G. Tufty, Chief Eng.; A. J. Zimmermann, Sales Mgr.
Cable Address: Acmeairco.

THE ADVANCE AIRCRAFT COMPANY, Troy, Ohio. Manufacturers of WACO Airplanes. Winner of 1928 National Air Tour, Transcontinental Race (Whirlwind Class), Sweepstakes Prize International Race. Clayton J. Brukner, Pres.; L. N. Brutus, V. P.; R. E. Lees, Mgr. Sales and Advertising.

AERIAL SERVICE CORP., Hammondsport, N. Y. Mfrs. of Mercury Aircraft. Contractors to U. S. Govt. Designers and builders commercial aircraft. H. Kleckler, Pres.; W. C. Chadeayne, Vice Pres.; H. Y. Rose, Secy. and Treas.; J. F. Meade, Gen. Mgr.; H. C. Mummert, Ch. Eng.

AEROMARINE KLEMM CORPORATION. N. Y. Office: Paramount Bldg., 44th and Broadway. Factory: Keyport, N. J. Aeromarine Klemm Airplanes and Salmson 40 H.P., 9 cyl. radial aircooled engines. Inglis M. Uppercu, Pres.; Wm. H. Douglas, V. P. and G. M.; James Wright, Treas.; John German, Secy.

ALEXANDER AIRCRAFT COMPANY, Division of Alexander Industries, Inc., Colorado Springs, Colo. Alexander Eaglerock Airplanes, Commercial Type; Biplanes and Monoplanes. J. Don Alexander, Pres.; D. M. Alexander, Vice Pres.; J. A. McInaney, Vice Pres. in charge of sales.

ALLIANCE AIRCRAFT CORPORATION, Webb St., Alliance, O.
Hess "Warrior" Engines
"Argo" Airplanes
"A Unified Product"
W. E. Trump, Pres.; A. W. Hess, Vice Pres. and Gen. Mgr.; T. D. Russell, Secy.-Treas.; G. T. Waite, Chief Engineer

AMERICAN AERONAUTICAL CORPORATION, 730 Fifth Ave., New York. E. Bossi, Pres.; Paul G. Zimmermann, Vice Pres.; A. Kapteyn, Secy. and Treas. Mfrs. for North America of Savoia-Marchetti Flying Boats: S-56—3-pass., S-62—7-pass. Amphibian Biplanes; S-55—12-pass. Flying Boat Monoplane.

AMERICAN EAGLE AIRCRAFT CORPORATION, Kansas City, Kan. Bldrs. complete line aircraft from 2-place folding-wing Biplane at $1895 to a 2-motored 6-place Cabin Monoplane priced at $18,895. Featuring a 3-place Biplane and 4-place Cabin Monoplane. E. E. Porterfield, Jr., Pres.; D. H. Hollowell, Sales Mgr.

BUHL AIRCRAFT COMPANY
Marysville, Mich.
L. D. Buhl, Pres.
A. H. Buhl, Vice Pres.
Herbert Hughes, Vice Pres. and Gen. Mgr.

CESSNA AIRCRAFT COMPANY
Wichita, Kan.
Clyde V. Cessna, Pres. and Chief Eng.
Henry J. Allen, Vice Pres.
James P. Verts, Secy.
W. B. Harrison, Treas.
Howard F. Wehrle, Gen. Mgr.

COMMAND-AIRE, INC., Little Rock, Ark. Manufacturers 3-place open Biplane. Complete Air College. North American Distributors Phylax Airplane Automatic Fire Extinguishers. R. B. Snowden, Jr., Pres.; Major J. Carroll Cone, Sales Mgr.; Albert Voellmecke, Chief Eng.

CONSOLIDATED AIRCRAFT CORPORATION, Buffalo, N. Y. Contrs. to U. S. Gov. Mfrs. Army and Navy training planes; makers PT-1, PT-3A, NY-1, NY-2, O-17 and XPY-1. R. H. Fleet, Pres.-Gen Mgr.; G. Newman, V. P. and Fact. Mgr.; L. D. Bell, Gen. Sales Mgr.; R. P. Whitman, Asst. Gen. Sales Mgr.

CUNNINGHAM-HALL AIRCRAFT CORPORATION
13 Canal Street, Rochester, N. Y.
Manufacturers of Airplanes
F. E. Cunningham, Pres.; J. C. Dryer, R. F. Hall, Vice Pres.; J. W. Fulreader, Treas.; W. R. R. Winans, Secy.

CURTISS AEROPLANE AND MOTOR COMPANY, INC., Garden City, N. Y. Factories: Garden City and Buffalo, N. Y. Designers and mfrs. military and com'l Airplanes, Seaplanes, Engines, Propellers, Accessories. C. M. Keys, Pres.; F. H. Russell, C. R. Keys, L. Kennedy, V. P.; J. A. B. Smith, S. Treas.

G. ELIAS & BRO., INC.
Buffalo, N. Y.
Designers and manufacturers of all types of Military and Commercial Airplanes, Spare Parts, Accessories, and Aircraft Armament.
Factory and general office:
Buffalo, N. Y.

FAIRCHILD AVIATION CORP., Farmingdale, N. Y. Subsidiaries: **Fairchild Airplane Manufacturing Corp.,** monoplanes and engines; **Fairchild Aerial Camera Corp.,** aerial photographic equipment; **Fairchild Aerial Surveys,** aerial mapping and surveys. Boston, Dallas, Los Angeles, San Francisco.

FOKKER AIRCRAFT CORPORATION OF AMERICA. Mfrs. Airplanes, Seaplanes, Amphibians. J. A. Talbot, Chm. Bd.; H. M. Hanshue, Pres. and Gen. Mgr.; H. A. Reed, Secy. and Treas.; G. F. Lewis, Asst. Secy. Office: New York. Factories: Hasbrouck Heights, N. J., Wheeling, W. Va.

GENERAL AIRPLANES CORPORATION
550 Abbott Road, Buffalo, N. Y.
Manufacturers of satisfactory aircraft.
G. MacLean Gardner, Vice Pres., in charge of manufacturing
A. Francis Arcier, Vice Pres., in charge of engineering

GREAT LAKES AIRCRAFT CORPORATION
16800 St. Clair Ave., Cleveland, O.
Military and Commercial Airplanes, Seaplane Floats—Duralumin Parts.
William Robert Wilson, Chmn. of Board; Charles F. Van Sicklen, V. P. and Director of Sales; Richard Hunter, Director of Advg.

HALL-ALUMINUM AIRCRAFT CORPORATION
2050 Elmwood Ave., Buffalo, N. Y.
Manufacturers of All Metal Airplanes, Seaplanes, and Airplane Parts
Charles Ward Hall, Pres.; Archibald M. Hall, Vice Pres.; Charles F. Pape, Secy. and Treas.

HAMILTON METALPLANE COMPANY
530 Park Street, Milwaukee, Wis.
Division of Boeing Airplane Co.
Manufacturers of four, six and eight passenger all-metal Cabin Monoplanes and Seaplanes

IRELAND AIRCRAFT, INC.
Manufacturers of Amphibians and Flying Boats
Garden City, L. I., N. Y.

KEYSTONE AIRCRAFT CORPORATION
Bristol, Pa.
Military Bombers
Commercial Trimotored Airplanes
Amphibian Aircraft
Edgar N. Gott, Pres.
C. Talbot Porter, Chief Eng.

THE KNOLL AIRCRAFT CORPORATION
Wichita, Kan.
Aircraft Manufacturers

JOSEPH KREUTZER CORPORATION
Aircraft Division
General Offices, 1801 S. Hope St., Los Angeles, Calif.
Manufacturers of **Kreutzer Tri-Motor Planes**
Joseph Kreutzer, Pres. and Gen. Mgr.

KUCHER AIRPLANE CORPORATION
10 W. 170th Street, New York City
Commercial Airplanes
Consulting Aeronautical Engineers
Andrew A. Kucher, Pres.
H. R. Van Deventer, Vice Pres.

LOCKHEED AIRCRAFT CO. Mfrs. Lockheed Whirlwind Vega Monoplanes, Lockheed Wasp Vega Monoplanes, Air Express Models. General Office, Factory, Burbank, Calif. F. E. Keeler, Pres.; B. S. Hunter, Exec. V. P.; A. H. Loughead, V. P.; W. Collins, Secy. Treas.; S. C. Breder, Dir. Sales.

LOENING AERONAUTICAL ENGINEERING CORPORATION, 31st Street and East River, New York City
Division of Keystone Aircraft Corporation. Amphibian Aircraft, Commercial and Military
Edgar N. Gott, Pres.; Albert P. Loening, Vice Pres.

MAHONEY-RYAN AIRCRAFT CORPORATION
Anglum, St. Louis Co., Mo.
Builders of Ryan Broughams
Sisterships to the "Spirit of St. Louis"
Six place; 300 H. P. Whirlwind Engine
John C. Nulsen, V. P. and Gen. Mgr.
B. D. Adams, Asst. Sales Mgr. in charge of Advertising

M'OTH AIRCRAFT CORPORATION
Graybar Building, New York
Factory at Lowell, Mass.
D. H. Gipsy Moth Airplane
"The light car of the air"
Minton M. Warren, Pres.
Earl L. House, Vice Pres.
Frank M. Smith, Vice Pres.

NEW STANDARD AIRCRAFT CORP., Paterson, N. J.
Builders of New Standard 5-place Passenger and Mail Planes
Open section duraluminum fuselages
Charles Healy Day, designer and chief engineer
Owners and operators of New Standard Flying Service, Inc.

PARKS AIRCRAFT, INC.
Parks Airport, East St. Louis, Ill.
St. Louis office, 210 Missouri Building
High wing Monoplanes; Biplanes
H. P. Mammen, Pres.
Oliver L. Parks, Vice Pres.

SPARTAN AIRCRAFT COMPANY
Tulsa, Okla.
Willis C. Brown, Pres.
John L. Hill, Vice Pres.
J. F. Lanier, Secy. and Treas.

SWIFT AIRCRAFT CORPORATION
Manufacturers of DeLuxe Two-Place Sport Biplanes and Two-Place Training Biplanes
A. J. Edwards, General Manager, Wichita, Kan.

THOMAS-MORSE AIRCRAFT CORPORATION
Ithaca, N. Y.
Designers and manufacturers of All-metal Aircraft
Contractors to the United States Government

TRAVEL AIR COMPANY
Travel Air Field, Wichita, Kan.
Manufacturers of Travel Air Planes
Seven types of open cockpit 3-place Biplanes and two types of Cabin Monoplanes 4 and 6-place
Walter H. Beech, Pres.

CHANCE VOUGHT CORPORATION, Long Island City, N. Y.
Designers and mfrs. of Observation, Attack and Sport Convertible Land and Seaplanes and Amphibians.
Chance M. Vought, Pres.; Elwood H. Herbig, Vice Pres.; Jos. F. McCarthy, Secy.-Treas. Division of United Aircraft & Transport Corp.

WHITTELSEY MANUFACTURING COMPANY (Formerly Whittelsey Body Company)
General Offices and Plant
Bridgeport, Conn.
"Avro Avian"
Manufactured under royalty rights as "Whittelsey Avian"
Sport and Training Plane

AIRPORT AND HANGAR CONSTRUCTORS— ENGINEERS— EQUIPMENT MANUFACTURERS

A. G. A. COMPANY, builders of AGA Aviation Lighthouses, Flashing Routing Beacons, Aviation Field Limitation Beacons, Aviation Field Floodlights and similar equipment. Plant and laboratories, Elizabeth, N. J. New York office, Graybar Building, 420 Lexington Avenue.

AIRPORT DEVELOPMENT & CONSTRUCTION CO., INC.
1620 Mitten Building, Philadelphia. Airport planning and construction. Site selection, layout, design, grading, drainage, surfacing, lighting, equipping. Hangar, shop, and airport building design and construction. R. E. Lenton, Pres.; C. W. Glose, V. P.

AMERICAN AIRPORTS CORPORATION
of New England
805 Statler Building, Boston, Mass.
Airport Development
and Management
Robert A. Warren, Pres.

AMERICAN NEON LIGHT CORP.
625 Sixth Ave., New York City
Airport Beacon Division
Neon Beacons
Directional and Identification Signs
Otto B. Shulhof, Pres.

THE AUSTIN COMPANY, 16100 Euclid Ave., Cleveland, O. Airport Engnrs.; Bldrs.; Airport Site Selection, Surveys; Reports; Layout, design; construction complete airports (including hangars, administration, shops, etc.), also factory. W. J. Austin, Pres.; G. A. Bryant, Jr., V. P.; W. E. Arthur, Mgr. Airport Div.

B. B. T. CORP. OF AMERICA
Atlantic Building, Philadelphia, Pa.
Landing and Hangar Floodlights; Flashing Beacons, Boundary, Obstacle, Approach Lights
C. T. Ludington, Pres.
R. G. Kellett, Vice Pres.
W. Wallace Kellett, Secy.
W. G. Treiber, Sales Mgr.

BLACK & BIGELOW, INC., 551 Fifth Ave., New York. Air Transport Engineers, Architects, Accountants. Investigations for investors; operating cost estimates; selection, design, airports and buildings; supervision construction; audits; appraisals; airplane and engine testing.

CROUSE-HINDS COMPANY
Syracuse, N. Y.
Complete
Lighting Equipment
for
Airports and Airways
Complete information will be furnished upon request

GARRISON FIRE DETECTING SYSTEM, INC., 307 Fifth Ave., New York City. 904 American Building, Baltimore, Md. Automatic Fire Alarm Equipment for Hangars, Shops, Store Rooms, Administration Buildings, etc. Fire Detecting Wire—the only supervised Thermostat.

GENERAL ELECTRIC CO.
Schenectady, N. Y.
Offices and distributors in principal cities
Manufacturers of complete airport and airway lighting equipment, superchargers, engine testing equipment, electrical accessories

INTERFLASH SIGNAL CORPORATION, 120 Broadway, N. Y. C. Plant 361 Plane St., Newark, N. J. Mfrs. of Aids to Navigation, Aviation Beacons and Traffic Signal Equipment
W. G. Hamilton, Pres.; A. V. Conover, Vice Pres.; T. W. Sprague, Secy; C. H. Marwig, Treas.

WALTER KIDDE & COMPANY, INC.
140 Cedar Street, New York
Manufacturers of Lux Flotation Equipments and the Lux System of Fire Extinguishing in Portable and Permanently Piped Units for Protection of Airplanes, Hangars and Airports

THE PYLE-NATIONAL COMPANY, 1334 No. Kostner Ave., Chicago. Air Transportation Department. Aircraft, Airport and Airway Lighting Equipment and Accessories. R. C. Vilas, Pres.; J. Will Johnson, Sr. Vice Pres.; J. A. Amos, Vice Pres.; E. A. Sipp, Mgr. Air Trans.

H. H. ROBERTSON CO.
Grant Building
Pittsburgh, Pa.
Robertson Protected Metal Hangars
Robertson Skylights and Sash
Robertson Ventilation System
Offices in Principal Cities

THE SPERRY GYROSCOPE COMPANY
Brooklyn, N. Y.
Mfrs. of Airport and Airway Lighting Equipment
Branch in London
Agents in principal countries

WESTINGHOUSE ELECTRIC & MANUFACTURING CO., East Pittsburgh, Pa. Light and power plants, instruments, Micarta propellers, pulleys, and fairleads, floodlighting equipment, reflectors and complete airport lighting.

WESTINGHOUSE LAMP COMPANY
150 Broadway, New York City
Incandescent lamps for Airplane, Airway and Airport Lighting
Engineering service
A. E. Allen, Vice Pres. and Gen. Mgr.; S. G. Hibben, Mgr. Com'c'l Eng. Dept.

AIRSHIPS

AIRCRAFT DEVELOPMENT CORPORATION
Delray Station, Detroit, Mich.
Metalclad Dirigible Airships, Airship Mooring Towers, All-metal Amphibians
Harold H. Emmons, Pres.
Carl B. Fritsche, Vice Pres.
Edward J. Hill, Works Mgr.

AIRSHIPS INCORPORATED
Hammondsport, N. Y.
Manufacturers and designers of all types of lighter-than-air craft and accessories, "AIRAFTS" and flotation gear.
J. Lansing Callan, Pres.; Beckwith Havens, Vice Pres. and Treas.; James F. Boyle, Secy.

THE GOODYEAR TIRE & RUBBER CO., INC., and GOODYEAR-ZEPPELIN CORP., Akron, O.; mfrs. all types lighter-than-air craft; rigid, semi-rigid, and non-rigid airships, spherical and kite balloons, airplane tires and tubes, etc. Pres., P. W. Litchfield; Vice Pres., C. F. Stone; Aero Mgr., W. C. Young.

AIR TRANSPORT OPERATORS

THE EMBRY-RIDDLE COMPANY, Lunken Airport, Cincinnati, O., CAM 24. Cincinnati-Indianapolis-Chicago. Distributors: Waco-Fairchild-Monocoupe. Aerial Photography-Taxi. Embry-Riddle Flying School. T. Higbee Embry, Pres.; J. P. Riddle, Gen. Mgr.

NATIONAL AIR TRANSPORT, INC., 5936 So. Cicero Ave., Chicago, Ill. Operators of Contract Air Mail Route No. 3 between Chicago and Dallas, Tex., and Contract Air Mail Route No. 17 between Chicago and New York. Carriers of Air Mail, Air Express and Air Passengers.

PAN AMERICAN AIRWAYS, INC., Operating Company for AVIATION CORP. OF THE AMERICAS. Operating air mail, passenger transport system over F.A.M. Routes 4, 5, 6 and 7, Miami, Nassau, Havana and the West Indies and, via Central America, to Panama Canal Zone.

PITCAIRN AVIATION, INC., 1828 Land Title Bldg., Philadelphia, Pa. Air mail operation: N. Y.-Atlanta; Atlanta-Miami routes. Commercial flying; passenger carrying, instruction, etc. Factory at Bryn Athyn, Pa.; Pitcairn flying field on Doylestown Pike, above Willow Grove, Pa. Harold F. Pitcairn, Pres.

T-A-T COMPANIES, Gen. offices Fort Worth, Tex. Texas Air Transport, Inc. Contractor CAM Routes 21-22. T-A-T flying service. Daily passenger service to 15 Texas cities. T-A-T flying school. Texas Aeromotive Service, Inc. Statewide repair and maintenance service.

TRANSCONTINENTAL AIR TRANSPORT, INC.
39 Broadway, New York City
Carlton Hotel, Washington, D. C.
C. M. Keys, Pres.
Paul Henderson, Vice Pres.
Henry G. Hotchkiss, Secy.
J. A. B. Smith, Treas.

UNIVERSAL AVIATION CORP., Baker Building, Minneapolis; Boatmens' Bank Bldg., St. Louis. Louis H. Piper, Pres.; Col. Halsey Dunwoody, Exec. V. P.; George Schierberg, Treas. Divisions: Continental Air Lines, Inc.; Northern Air Lines, Inc.; Robertson Aircraft Corp.; Universal Flying Schools.

DEALERS AND EXPORTERS

AIR ASSOCIATES INCORPORATED, offices 535 5th Ave., N. Y. C. Sales and service stations at Curtiss Field, L. I.; Chicago and Newark Municipal airports. Distributors LOCKHEED VEGA and AVRO AVIAN. WRIGHT parts and service. Aircraft supplies and accessories. Aviation ticket office.

AMERICAN AERONAUTICAL SALES CORP., 730 Fifth Ave., New York. Sales division, American Aeronautical Corp. **Savoia-Marchetti Flying Boats:** S-56, 3-pass. Amphibian Biplane; S-62, 7-pass. Amphibian Biplane; S-55, 12-pass. Double Hull Flying Boat Monoplane.

CURTISS AEROPLANE EXPORT CORP., Garden City, L. I., N. Y. Sales distributors of airplanes, motors, and all types aeronautical equipment for all foreign countries. C. W. Webster, Pres.; T. A. Morgan, F. H. Russell, P. A. Hewlett, Vice Pres.; J. A. B. Smith, Secy.-Treas.

SCHLEE-BROCK AIRCRAFT CORP., 2007-8 Fisher Bldg., Detroit, Mich. Distributors of LOCKHEED VEGA airplanes. Air taxi and sight-seeing service. E. F. Schlee, Pres.; A. G. Schlee, Vice Pres. and Gen. Mgr.; W. S. Brock, Chief Pilot and Mgr. Field Operations; Dwight Davis, Asst. to Pres.

DOPES AND LACQUERS, PAINTS, ETC.

BERRY BROTHERS, INC.
Detroit, Mich.
Complete line of aircraft finishes, including:
Lionoil, Aircraft Berryloid, Berryspar
Dopes, Enamels and Varnishes
Thomas B. Colby
Mgr. Aviation Dept.

E. I. DU PONT DE NEMOURS & CO.
Parlin, N. J.
Dopes and Lacquers
Paints and Varnishes
Aviation Sales

TITANINE INC.
Union, Union County, N. J.
Aircraft Dopes—Clear or Pigmented—Nitrated or Acetate
Titwo
All Purpose Dope Lacquers
Wing and Metal
E. G. Davis, Pres.
Wm. A. Bagley, Sales Mgr.

VALENTINE & COMPANY
386 4th Ave., New York, N. Y.
Airplane Nitro-Valspar
The Valentine All Lacquer System for airplanes
Langdon B. Valentine, Vice Pres.
A. I. Boyer, Jr., Special Representative

ELECTRICAL EQUIPMENT

THE ELECTRIC STORAGE BATTERY CO
Philadelphia, Pa.
Mfrs. Storage Batteries for Airplane Lighting, Radio, Engine Cranking, Ignition, Photography, etc.
John R. Williams, Pres.
H. B. Gay, Vice Pres.

THE LEECE NEVILLE COMPANY
5363 Hamilton Ave., Cleveland, O.
Manufacturers of
Voltage Regulated Generators
for use on
Airplanes in all classes
of service
Information furnished on request.

Packard
Lighting and Ignition Cable; Packard Lac-kard High Tension Cable; Radio Shielded Cable and Harnesses
THE PACKARD ELECTRIC COMPANY
Warren, Ohio

SCINTILLIA MAGNETO CO., INC., Sidney, N. Y.
Manufacturers of Scintillia Aircraft Magnetos
W. M. Flook, Pres.; H. Hanni, Vice Pres.; T. Z. Fagan, Vice Pres.; G. E. Steiner, Secy. and Treas.; W. J. Spengler, Ch. Eng.; A. Egli, Prod. Mgr.; C. P. DeWitt, P. A.

SPLITDORF-BETHLEHEM ELECTRICAL CO.
392 High St., Newark, N. J.
Magnetos Generators
Spark Plugs
Chas. Edison, Pres.
L. W. McChesney, Vice Pres. and Gen. Mgr.

FABRICS

E. I. DU PONT DE NEMOURS & CO.
Newburgh, N. Y.
DU PONT FABRIKOID
for Upholstery
Nemoursa Airplane Fabrics
for Interior Trims

THE RUSSELL MFG. CO.
Sales and Engineering Office
349 Broadway, N. Y. C.
Factory: Middletown, Conn.
Textile Products
Elastic—Non-Elastics—Asbestos
T. MacDonough Russell, Pres.
W. C. Fisher, Gen. Mgr.
F. A. Thompson, Aero. Sales Mgr.

E. S. TWINING & COMPANY
320 Broadway, New York City
Flightex Fabric and Tapes
Grade "A" Flightex Fabric
Pinked Edge and Seamed
Reinforcing Tapes in all sizes
for immediate delivery

FLOAT AND HULL MANUFACTURERS

BREWSTER & CO., INC.
Queensboro Bridge Plaza
Long Island City, N. Y.
Designers
and manufacturers of
Pontoons
Flying Boat Hulls
and Parts for Aircraft

EDO AIRCRAFT CORPORATION, 620 2nd St., College Point, L. I., N. Y. Mfrs. of Standardized All-Metal Seaplane Float Installations. Earl D. Osborn, Pres.; George B. Post, Vice Pres.; Kenneth D. Vosler, Secy.-Treas. and Factory Supt.; B. V. Korvin-Kroukovsky, Chief Eng.

LUDINGTON AIRCRAFT, INC.
Philadelphia Airport, So. Phila.
All types of Repair and Manufacturing. Airplane parts and supplies made to specifications.
Hydro (Boat) Division
C. T. Ludington, Pres.
R. P. Hewitt, Vice Pres.
R. P. Phillips, Mgr.

FUELS AND LUBRICANTS

GULF REFINING COMPANY
No-Nox Motor Fuel
Gulfpride Oil

HARTOL REFINING CORP.
117 Liberty St., N. Y.
Hartol Aviation Oils
Custom-Made Lubrication
for
Aircraft Motors
Water and Air Cooled Types

KENDALL REFINING CO.
Bradford, Pa.
Kendall Penzbest Motor Oils
Kendall Rocker Arm Lubricant
Otto Koch, Pres.
H. H. Greene, Vice Pres.
I. H. Shearer, Treas.
M. C. "Bob" Loutt, Mgr.
Aviation Division

STANDARD OIL COMPANY
(Indiana)
910 S. Mich. Ave., Chicago, Ill.
Fuel and Lubricants; Stanolind Aviation Gasoline; Stanolind Aero Oil; Superla Aero Oil. R. W. Stewart, Chair. of Bd.; Allan Jackson, Vice Pres.; Amos Ball, Gen. Mgr., Sales.

STANDARD OIL COMPANY OF NEW JERSEY
26 Broadway, New York, N. Y.
"STANDARD" AVIATION GASOLINE and OILS
C. G. Sheffield, Vice Pres., Director of Sales, Standard Oil Co. of N. J.

STANDARD OIL COMPANY OF NEW YORK
26 Broadway, New York, N. Y.
Socony Aviation Gasoline
Socony Aircraft Oil

TEXAS PACIFIC COAL & OIL COMPANY
Refinery and General Offices
Fort Worth, Texas
Division Offices
New York—St. Louis—Los Angeles
TP Aero Motor Lubricating Oil
TP Rocker Arm Lubricant

VACUUM OIL COMPANY
61 Broadway, New York City
Manufacturers of the famous GARGOYLE MOBILOIL for airplanes, automobiles and other automotive units.

WOLVERINE LUBRICANTS CO., INC.
225 W. 34th St.,
New York, N. Y.
Wolf's Head Oil
Number 8
For all Aviation Motors

INSTRUMENTS

AC SPARK PLUG COMPANY, Flint, Mich. Mfrs. AC Spark Plugs, Tachometers, Thermo-Gauges, Oil Gauges, Ammeters, Instrument Panels. B. W. de Guichard, Pres. and Gen. Mgr.; H. H. Curtice, V. P. and Asst. G. M.; T. G. McDougal, V. P. Charge Ceramic Dvlpt.; W. S. Isherwood, Sales; E. McGinnis, Adv.

CONSOLIDATED INSTRUMENT CO. OF AMERICA, INC., 305 East 47th St., New York. Western Sales Mgr., M. E. Hulse, 5391 Broadway, Oakland, Cal. Products: Aircraft Instruments, Battery and Ignition Switches and complete meteorological equipment for airports and flight applications.

ELGIN NATIONAL WATCH CO., Aircraft Instrument Division, Elgin, Ill. Elgin Chronometric Tachometers, Avigo Compass, Ball Bank Indicators. DeForest Hulburd, Pres.; Taylor Strawn, Vice Pres.; Gordon C. Gillies, Aircraft Instrument Division.

MOTOMETER CO., INC.
Long Island City, N. Y.
Motor heat indicators for water and oil cooled aircraft engines. Oil pressure and fuel pressure gauges.
George H. Townsend, Pres.
Jerry J. Tobias, Vice Pres.
Henry G. Boynton, Mgr.
Aviation Dept.

PIONEER INSTRUMENT CO., INC., 754 Lexington Ave., Brooklyn, N. Y., Washington, San Francisco, Los Angeles, Toronto, Paris, Berlin. Mfrs. aircraft instruments and equipment. C. H. Colvin, Pres.; H. F. Colvin, Vice Pres.; H. F. Owen, Treas.; B. Davis, Secy.

THE S. S. WHITE DENTAL MFG. CO.
Industrial Division
152 W. 42nd St., New York City
Mfrs. of flexible shafting and accessories for Tachometer Driving. Our equipment has been standard for many years on U. S. aircraft.

METAL PARTS AND MATERIAL

DU PONT VISCOLOID CO.
330 Fifth Ave.
New York City
Pyralin Sheeting
Rods, Tubes and Specialties

EX-CELL-O TOOL & MFG. CO.
1200 Oakman Blvd.,
Detroit, Mich.
PARTS CONTRACTORS
to the industry's leading manufacturers. Complete facilities for production of aircraft engine parts of more than usual accuracy. Inquiries given prompt attention.

STEWART HARTSHORN COMPANY
250 Fifth Ave., New York City
Mfrs. of streamline and square section tie rods complete with end fittings for airplane external and internal bracing.
B. E. Bushnell, Director of Sales
J. M. Laying, Aero. Rep.

MACWHYTE COMPANY
2901 14th Ave., Kenosha, Wis.
Mfrs. of Macwhyte Streamline and Round Drawn Tie Rods
Fittings for Tie Rods
Airplane Cord and Strand
George S. Whyte, Pres.
Jessel S. Whyte, Vice Pres.
H. E. Sawyer, Treas.

THE NATIONAL STEEL PRODUCTS CO., Dayton, O. Contractors to U. S. Government in all Air Service Branches. Mfrs. of aircraft fittings, parts and accessories. Harry Lehman, Pres.; T. M. Heister, Vice Pres. and Gen. Mgr.; Jos. G. Lehman, Secy and Treas.

NORMA-HOFFMAN BEARINGS CORPORATION, Stamford, Conn. Branch Offices: Detroit, Cleveland, Chicago. Norma-Hoffman "Precision" Ball (open and closed type) and Roller (standard and self-aligning) Bearings, Thrust Bearings.

THE PARK DROP FORGE CO.
Cleveland, Ohio
Mfrs. of Aviation Crankshafts, Camshaft, Connecting Rod and Gear Forgings
Geo. C. Gordon, Pres.
Fred L. Ball, Treas.
Chas. C. Dodge, Sales Eng.

JOHN A. ROEBLING'S SONS CO., Trenton, N. J. Aircraft Wire, Strand, Cord, Thimbles, Ferrules, Locking and Serving Wire, Welding Wire, Control and Ignition Cables, Electrical Wires and Cables.
Horace E. Thorn
Aeronautical Representative
Catalog A-529

SKF INDUSTRIES, INC.
40 E. 34th St., New York City
Factories: Hartford, Conn., and Philadelphia, Pa.
Mfrs. of Skayef Self-Aligning Ball and Roller Bearings; Hess-Bright Deep-Groove Ball Bearings; Thrust Ball Bearings, etc. W. L. Batt, Pres.; R. F. Runge, Vice Pres.

SUMMERILL TUBING CO.
Bridgeport, Montg. Co., Pa.
Mfrs. and warehousers of Seamless Steel Tubing for Aircraft Industry made to Govt. specification. Round, Streamline and Special Shapes.
S. L. Gabel, Pres.
N. H. Wolf, Gen. Mgr.
H. C. Knerr, Metallurgist

UNION SWITCH & SIGNAL COMPANY
Swissvale, Pa.
Drop Forgings

THE WOOD & SPENCER COMPANY, Cleveland, O. Manufacturers of Connecting Rods. Plain and Castellated Nuts. Standard and Special Taps. F. W. Wood, Pres. and Gen. Mgr.; D. G. Miller, Vice Pres.; A. K. Spencer, Treas.; C. L. Reinke, Secy.

WYMAN-GORDON CO.
Worcester, Mass. Harvey, Ill.
Aviation Dept: Worcester, Mass.
Mfrs. of Aviation Crankshafts and other vital Forgings for the Aeronautical Industry

MOTOR EQUIPMENT

THE B. G. CORPORATION
136 W. 52nd St., New York
B. G. MICA AVIATION SPARK PLUGS
August Goldsmith, Pres.
George M. Paulson, Chief Eng.
Cable address: "Golsteco" N. Y. Codes
A.B.C. 5th Bentley

ECLIPSE MACHINE CO.
East Orange Plant, East Orange, N. J.
Eclipse Aviation Engine Starters and Generators
Types and equipment to suit all requirements

HEYWOOD STARTER CORP.
6547 St. Paul Ave.
Detroit, Mich.
High Pressure Injection Starters
for Aviation Engines
S. L. McKay, Pres.
F. B. Stover, Secy.

STROMBERG MOTOR DEVICES COMPANY
58-68 E. 25th St., Chicago, Ill.
Aircraft Carburetors
C. J. Stiger, Pres.
W. L. O'Neill, Vice Pres.
J. M. Miller, Eng. Chge. Aircraft

THOMPSON PRODUCTS, INC., 2196 Clarkwood Road, Cleveland, O. Thompson Valves and other high grade hardened and ground parts for airplane motors. Charles E. Thompson, Pres.; Wm. D. Bartlett, Senior Vice Pres.; J. A. Krider, Treas.; W. M. Albaugh, Secy.

UNITED STATES HAMMERED PISTON RING CO.
1222 So. Grove St.
Irvington, N. J.
Special Airplane Rings
Albert W. Wenzel, Pres.
Oliver G. Whitney, Vice Pres.

MOTOR MANUFACTURERS

ALLISON ENGINEERING CO.
Indianapolis, Ind.
Aircraft power plant engineering and construction
Contractors to U. S. Army Air Corps and Bureau of Aeronautics, U. S. Navy

AMERICAN CIRRUS ENGINES, INC., 740 Wash. Ave., Belleville, N. J. American mfrs. of famous Cirrus 4-in-line Mark III 88-95 H.P. engines. Aircooled. Light plane engines. Col. R. Potter Campbell, Pres.; Allan C. Hoffman, Vice Pres.; A. G. Lloyd, Prod. Mgr.

AXELSON MACHINE COMPANY
Randolph St. and Boyle Ave.
Los Angeles, Calif.
Airplane Engine Division
Axelson Airplane Engines
approved by
Department of Commerce

E. W. BLISS CO.
Brooklyn, N. Y.
Radial Aircooled Engines
"Bliss-Jupiter" 9 cyl., 450-550 H.P.
"Bliss-Neptune" 7 cyl., 300-350 H.P.
"Bliss-Titan" 5 cyl., 200-250 H.P.
F. C. B. Page, Pres.
F. D. MacKay, Vice Pres.

PACKARD MOTOR CAR COMPANY
Detroit, Mich.
Manufacturers of Aircraft Engines

THE PRATT & WHITNEY AIRCRAFT CO.
Manufacturers of Aircraft Engines
F. B. Rentschler, Pres.
G. J. Mead, Vice Pres.
C. W. Deeds, Secy.-Treas.
D. L. Brown, Factory Mgr.
A. V. D. Willgoos, Chief Eng.

SIEMENS & HALSKE, A. G.
Represented in U. S. A. by
K. G. Frank
Consulting Engineer
75 West St., New York City
Manufacturers of Aircraft Engines
from 80 to 600 H. P.

VELIE MOTORS CORP.
Moline, Ill.
Aeronautical Engine Division
Velie M5 Engine
Velie L9 Engine
W. L. Velie, Jr., Vice Pres.
A. T. Huesing, Secy.

WRIGHT AERONAUTICAL CORPORATION, Paterson, N. J. Manufacturers of aircraft engines. Charles L. Lawrance, Pres.; Guy W. Vaughan, Vice Pres. and Gen. Mgr.; J. F. Prince, Secy. and Treas.; B. G. Leighton, Director of Sales and Service; E. T. Jones, Chief Eng.

PARACHUTES

FOLLMER, CLOGG & CO.
Lancaster, Pa.
Manufacturers of
"Positive Opener"
Parachutes

IRVING AIR CHUTE CO., INC., 372 Pearl St., Buffalo, N. Y. Cable address: "Irvin Buffalo New York." Life-saving Parachutes for airplanes, balloons and dirigibles. George Waite, Pres.; Leslie L. Irvin, Vice Pres. and Chief Eng.

RUSSELL PARACHUTE COMPANY
1202 Kettner Blvd., San Diego, Cal.
Manufacturers of Russell
"Lobe" Parachute and
Fabric Aircraft Accessories
European factory
British Russell Parachute Co.
London, Eng.

PROPELLERS

HAMILTON AERO MFG. CO.
Milwaukee, Wis.
Division of
United Aircraft & Transport Corp.
Manufacturers of Metal and Wood Propellers and all Metal Seaplane Floats
Thos. F. Hamilton, Pres.

THE REED PROPELLER CO., INC., 113 E. 55th St., New York. Propellers with thin solid metal blades. Both fixed pitch and adjustable pitch styles. Manufactured and sold through licensees in U. S. and abroad. Protected by U. S. and foreign patents. S. A. Reed, Pres.; Willis Fowler, Secy.

STANDARD STEEL PROPELLER COMPANY
Pittsburgh, Pa.
General office and works:
221 7th Ave., W. Homestead, Pa.
All Metal, Adjustable Pitch Airplane Propellers
Harry A. Kraeling, Pres. and Gen. Mgr.

SUPREME PROPELLER COMPANY
1016 So. Santa Fe Ave.
Wichita, Kansas
Formerly Stone Propeller Company
M. J. Stone, Secy. and Gen. Mgr.

PUBLICATIONS

AERO DIGEST
Published monthly by Aeronautical Digest Pub. Corp., 220 W. 42nd St., New York City. Single copy, 35c; year subscription, $3; Canada, $3.50; foreign, $4. Frank A. Tichenor, Pres.; J. E. Horsfall, Editor; Wm. A. Rogers, Adv. Mgr.

AERONAUTICS (Formerly Popular Aviation), 608 So. Dearborn St., Chicago, Ill. Harley W. Mitchell, Editor; R. Stuart Murray, Adv. Mgr. Eastern office: 551 Fifth Ave., New York City. Published monthly. Semi-technical — Aeronautics.

AIRPORTS
Construction, Equipment, Administration
Devoted exclusively to the ground phases of Aviation
$5.00 Per Annum
Published Monthly at
Flushing, L. I., N. Y.

AIR TRANSPORTATION
The Weekly Trade Journal of Commercial Aviation
New York City
Publishers also of the Directory of the Aviation Industry appearing semi-annually

AirwayAge

Published monthly at 30 Church Street, New York City. A Simmons-Boardman publication. Annual subscription $2. Strictly a business paper covering every phase of aviation from a technical, scientific and practical standpoint.

AVIATION
Weekly Trade Magazine
Founded 1916
250 West 57th St.
New York City

U. S. AIR SERVICES, feature Aeronautical Magazine of America, devoted to the development of aeronautics in the United States, birthplace of the airplane. $3.00 a year, 35c a copy. Published monthly by Air Service Publishing Co., Inc., Star Bldg., Washington, D. C.

RADIO EQUIPMENT

RADIOMARINE CORP. OF AMERICA, 66 Broad St., New York City. Aeronautical Department. R C A radio telephone, telegraph and direction finding apparatus for aircraft and airports. David Sarnoff, Pres.; C. J. Pannill, Vice Pres. and Gen. Mgr.; E. N. Pickerill, Aeronautical Dept.

SCHOOLS

DANIEL GUGGENHEIM SCHOOL OF AERONAUTICS, New York University, University Heights, New York City. Undergraduate and Graduate Courses in Aeronautics. Particulars from Dean, College of Engineering. Information regarding Testing Laboratories, Prof. Klemin.

SUPPLIES (GENERAL)

AERO SUPPLY MFG. CO., INC.
College Point, L. I., N. Y.
Mfrs. and distributors of airplane accessories, supplies and equipment
Geo. I. Stich, Pres.
E. W. Stephenson, Vice Pres.
E. H. Kollmeier, Treas.
Guy Pomp, Secy.

JOHNSON AIRPLANE AND SUPPLY COMPANY
Dayton, Ohio
Quality aeronautical supplies and equipment for the manufacturer, operator, school, airport, pilot and mechanic

THE LINDE AIR PRODUCTS COMPANY and Assd. Co's. Units Union Carbide and Carbon Corp. Everything for Oxwelding and Cutting. Oxygen, Acetylene, Carbide, Welding and Cutting Apparatus and Supplies.
Offices: 30 E. 42nd St.,
New York, N. Y.

RAND McNALLY & COMPANY, 536 S. Clark St., Chicago; New York, San Francisco. Air Trails Maps for use in flight. Maps, Map Systems and Atlases for Airports, Aviation Executives and Pilots. Creators and printers of distinctive Air Passenger Tickets, Time Tables and Folders.

A. G. SPALDING & BROS.
105 Nassau St.
New York City
Aviation Clothing, Boots, Goggles, Helmets,, Gloves
Mr. H. R. Hart

TIRES AND RUBBER GOODS

THE B. F. GOODRICH RUBBER COMPANY
Akron, Ohio
Airplane Tires and Tubes, Shock Absorber Cord and Discs, Matting, Hose, Tubing, Cement, Special Molded Goods and Aeroboard.
H. Wacker, Mgr. Aeronautical Sales

FIRESTONE TIRE & RUBBER CO., Akron, Ohio.
Manufacturers of a complete line of airplane tires and tubes—tires in both smooth and non-skid design. Quotations made on other rubber materials for use in airplane industry.

WHEELS

AIRCRAFT PRODUCTS CORPORATION OF AMERICA, 743 Beaubien St., Detroit, Mich. Mfrs. of Oildraulic Shock Struts, Landing Wheel and Brake Units, Tail Wheels. Aircraft parts made to order. Ralph R. Irwin, Pres.; Robert S. Gans, Treas.

BENDIX BRAKE COMPANY
South Bend, Ind.
Bendix Disc Wheels and Brakes for Airplanes
Vincent Bendix, Pres.
Walter J. Buettner, Secy.-Treas.
John R. Cautley, Airplane Div.

KELSEY-HAYES WHEEL CORPORATION
Detroit, Mich.
Manufacturers of a Complete Line of Airplane Wire Wheels

WOOD PARTS AND MATERIAL

HASKELITE MANUFACTURING CORPORATION, 120 S. LaSalle St., Chicago, Ill. Factory at Grand Rapids, Mich. Manufacturers of HASKELITE, blood-albumen glue plywood and PLYMETL, metal-faced plywood. More than 85% of the plywood used in aircraft is HASKELITE.

INDEX