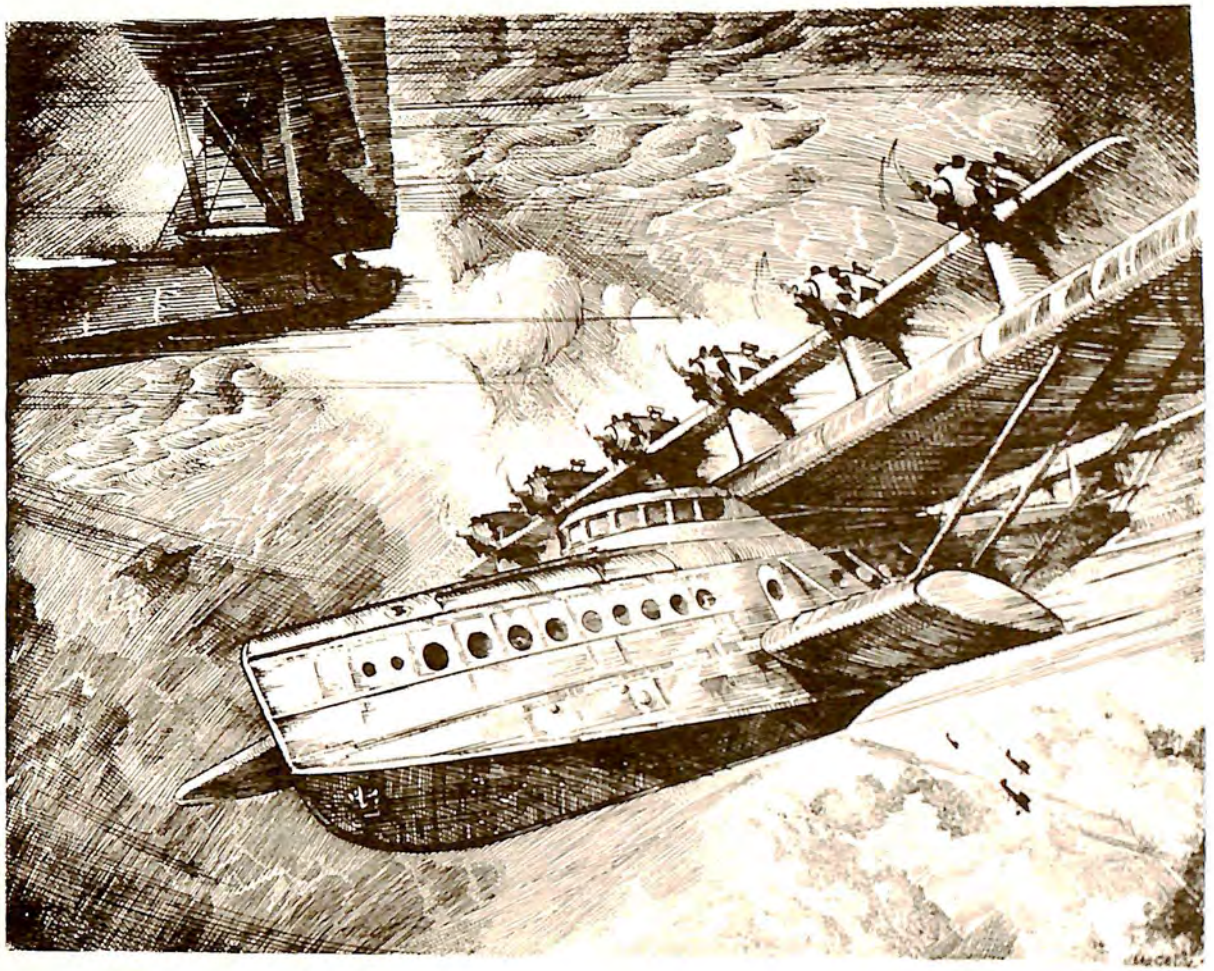
The AIRCRAFT YEAR BOOK

For 1930

HARRISON BRAND, JR.

AIRCRAFT YEAR BOOK, 1930



The AIRCRAFT YEAR BOOK For 1930

VOLUME TWELVE

Compiled, Written and Edited
By
AERONAUTICAL CHAMBER OF COMMERCE
OF AMERICA, INC.

Published for the Chamber
By
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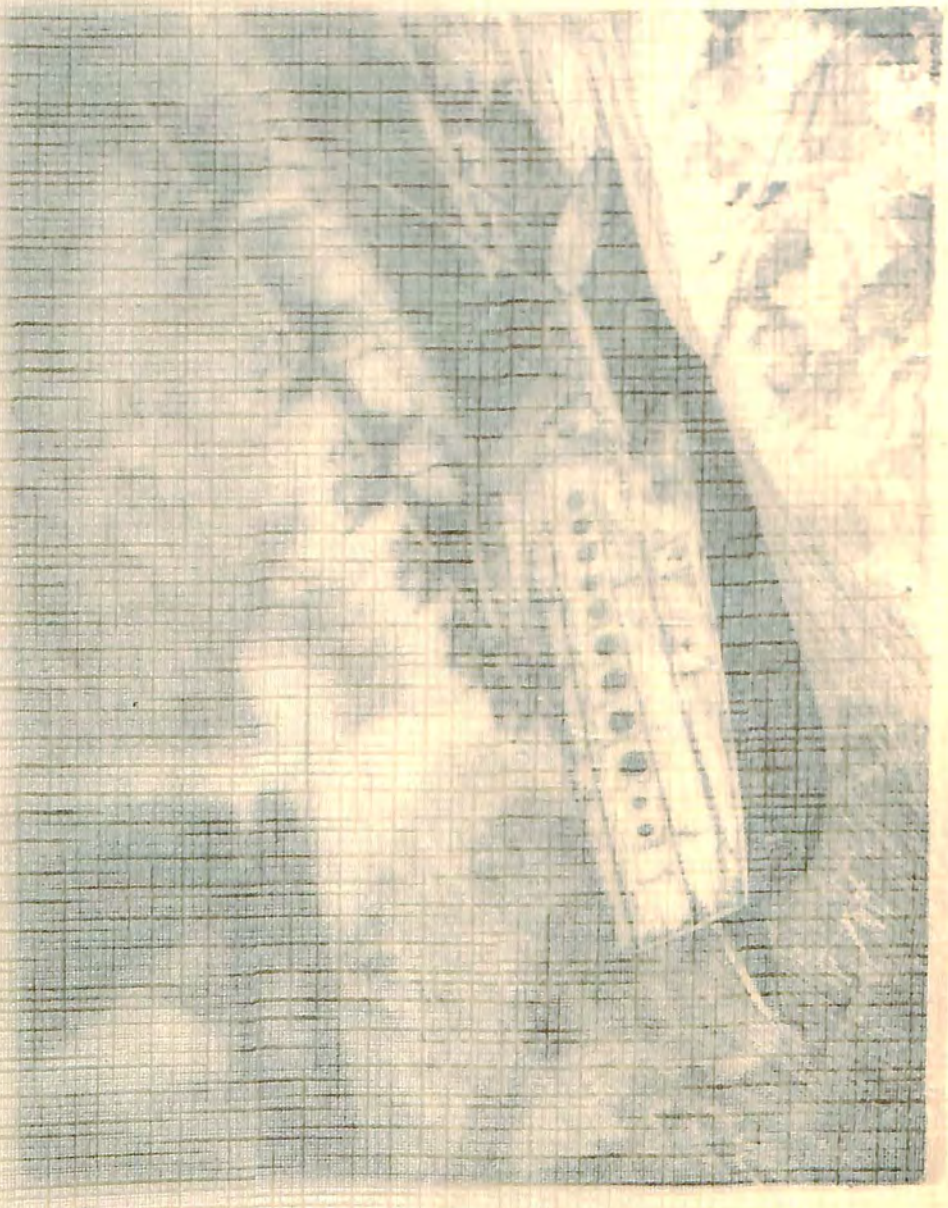

TRANSPORTS OF THE AIR

Visioning the day when Giant Air Liners will crowd the Roads of the Sky, carrying huge cargoes of passengers and goods . . . From an original etching by John Mac Gilchrist

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250 FOURTH AVENUE NEW YORK

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CHAPTER I

REFLECTING THE TRENDS IN AVIATION

WHILE aviation experienced the most stupenduous period of progress and expansion in its history during 1929, the industry was passing through its first major readjustment when the year ended. This, the twelfth successive edition of *The Aircraft Year Book*, is a mirror of the year's brilliant achievements in every branch of the art. It is a story that writes itself as the facts of the year's progress are recorded, reflecting the trends in every field of aeronautic endeavor.

Man flew faster, higher, farther and longer in 1929 than he did during any other year since the Wright brothers made their first flights. The year's spectacular flights and the routine maintenance of daily air transport schedules into every corner of the country reflect the great strides made in the field of engineering. The laboratories, occupied by engineers who seldom found a place in the limelight afforded those who flew their products, continued to offer the greatest prospects for future successes.

In the transport field, new mail, express and passenger services were inaugurated to offer a network of air lines regularly serving 90,000,000 people. Air transport passenger services were raised to the standard of luxury enjoyed by those who travel in the fine salons of fast ocean liners or the well appointed cars of the better trains. Expansion in the transport field, aided in no small way by contract air mail support, proved a great stimulus to every branch of the manufacturing industry.

The aircraft industry represented a total public investment of no less than half a billion dollars during 1929. Compared with those great industries which have an annual output in excess of this investment, aviation would appear to be relatively minor. Judged, however, from the triple viewpoint of national defense, public service and scientific progress, aviation ranked as a major industry. It employed, directly or indirectly, more than 100,000 persons and its ramifications extended into nearly three score allied industries which were affected in some way.

The story of aviation's progress has been marked by a succession of waves of expansion, each receding after peak marks were reached, only to have a new crest mount higher than ever before. The World War was responsible for the first great wave of expansion, when the industry was created and plants were pressed into heavy production schedules through abnormal government demands for fighting planes.

The end of the War brought a sharp recession, which was checked only after far-visioned manufacturers, who had confidence in the possibilities of commercial aviation, marshalled a small amount of capital to support the industry. But their investments were swallowed up in general education, and the industry again found itself in the trough of the wave.

Government development of regular service for mail and goods in 1920 brought a new wave of development which demonstrated the pos-

AMERICA'S LARGEST LAND PLANE

The giant Fokker F-32 (double tandem Pratt and Whitney Hornets) passenger plane to be used by Western Air Express on its transport lines, carrying 32 passengers.

sibilities of aviation, but emphasized the necessity for day and night operations if the airplane was to become an economic necessity.

Inauguration of the night air mail in 1924 pushed the wave to new heights. This was followed quickly by the establishment of contract air mail. Private operation of air mail lines was found to be arduous, however, owing to the continued necessity for public education. Again there came an indicated lull and it was at this time that a pilot on the St. Louis-Chicago air mail route—Colonel Lindbergh—flew to fame in a night and carried with him the imagination of the world. Thus,

wave was succeeded by wave, but always the trough of the last was higher than the peak of its predecessor. The latest and greatest was started in 1927 and continued through 1929, aided by the sustained interest of the Post Office Department, the application of the Five Year Military Program and continually growing public confidence.

Using the immediate past as an index of the immediate future, and buoyed up by generally voiced prosperity current on all sides early in 1929, production of aircraft and engines during the first six months of the year approximated 75 per cent of the total production in 1928. The

IN LAND OF INCAS

Fairchild (Pratt and Whitney Wasp) cabin monoplane operated on regular schedule by Pan American-Grace Airways Inc. between Peru and Ecuador, flying above the coastal Andes with air mail and passengers.

result was a general period of over-production, which would be serious in any industry, but which was especially critical in an industry so closely related to national defense.

From the middle of the year on, production schedules were re-adjusted, so that by the end of the year the output of commercial airplanes and engines was relatively in line with the domestic demand, to which was being added an attractive export market.

Commercial aviation on an unstable foundation offers no substitution, or even a dependable reserve, for the nation's air defense. It became

evident in 1929 that a sound foundation could be constructed only through maintenance of government orders, as typified in the Five Year Military Program, and through the continued development of the contract air mail system upon an economic basis.

Capital invested by the public flowed impartially into the manufacturing and operating branches of the industry. The manufacturers of military and commercial aircraft and the operators of air mail and passenger routes alike drew their capital from public sources. Military manufacturing and contract air mail proved the backbone of the in-

COURTEOUS SERVICE

Stewards, couriers and other air line attendants, all smartly dressed, set a new standard of service for travel. Passengers are seen leaving a tri-motored Fokker plane of Pan American Airways Inc.

dustry—a condition which it was expected would be necessary for some time. Their satisfactory continuation was not only of great concern to the investing public, but of prime importance to the industry in its efforts to keep engineering and production organizations intact for purposes of civil and military development in the future and for the rapid expansion of manufacturing facilities in times of national emergency.

In its state of over-expansion and over-production toward the middle

of 1929, the aircraft industry was scarcely different from any other industry. Capital inflation came in two forms: first, isolated and distinctly limited amounts invested in manufacturing or operating projects, and, second, massed capital by financial groups extending their activities into all phases of aviation.

At the end of the year, the industry was contracting in some phases and expanding in others. Isolated capital was in some instances liquidating. Group capital was wisely economizing and boldly advancing, will-

FLAT TIRE?

Flat tires are no worry to this pilot. The Fokker Super-Universal laboratory plane of the Goodyear Tire and Rubber Company is equipped with the new Goodyear "Airwheel."

ing to risk a long period of attrition, providing it had definite assurance of public support for the transport lines, government backing for the contract air mail system, and an assurance that the Five Year Military Program would be carried out.

The trend from corporate ownership to group control of manufacturing and operating units, started late in 1928, continued during 1929 and had a marked influence on the progress of the industry. At the close of the year, the major groups had a sound economic footing in the

industry which promised to affect, in no small way, future expansion. Using the past as an index of the future, leaders in the industry expected the next wave of expansion, based on sound experience, to surpass its

TO CATALINA ISLAND

Boeing (Pratt and Whitney Wasp) B-1E flying boat flown by Western Air Express in passenger service between Los Angeles and Catalina Islands.

predecessors in size and importance. It was this confidence in the future which inspired the major financial groups in the industry to proceed with their programs, taking proper regard for economy into consideration.

CHAPTER II

AIRCRAFT PRODUCTION AND OPERATIONS

PRODUCTION in American aircraft manufacturing plants reached the highest peak in its history during 1929, and operating statistics—far in excess of any previous year—were staggering to the mind. More than 6,000 commercial and military planes and 7,000 aircraft engines were produced during the year. American planes engaged in all branches of civil and military operations flew nearly 200,000,000 miles.

Ninety-six major aircraft manufacturers reporting to the Aeronautical Chamber of Commerce in its annual production survey for 1929 listed the manufacture of 6,034 commercial and military airplanes with a total retail value less motors of $44,457,300.60. Planes designed for commercial use alone totaled 5,357 with a value of $33,624,756.60. Six hundred and seventy-seven military planes were produced with a total value less motors of $10,832,544. Ninety-one per cent of all planes produced were manufactured by members of the Aeronautical Chamber of Commerce.

Commercial production increased 51 per cent more than 1928, 1,815 more planes being manufactured during 1929 than during the previous year.* While the percentage of increase in units produced was high, the sharp rise in valuation was even higher. The valuation less motors for all commercial planes increased 96 per cent over 1928, aircraft manufactured in 1929 showing an increase in valuation of $16,430,458.60 over 1928.

Military production during 1929 experienced a decided slump, falling 44 per cent under the 1928 figures. Since no valuation was placed upon military production in 1928, it was impossible to compare figures on valuation for the two years. Total production, despite the military slump, increased 27 per cent over 1928.

Twenty-five aircraft engine manufacturers reported a total of 7,378 engines produced during 1929 for both military and commercial use, representing a total valuation of $26,495,830.15. The commercial market received 5,517 of the engines, and the military 1,861. Commercial engines represented a total value of $17,895,300 and military motors $8,600,530.15.

Ninety-five per cent of the engines were manufactured by members of the Aeronautical Chamber of Commerce.

*Comparative production tables for 1928 and 1929 in Appendix.

Comparing this report with 1928 figures, commercial production increased 3,667 units or 193 per cent. Military engine production was 448 units higher than in 1928, representing an increase of 32 per cent. The value of commercial engines increased $8,958,575, or 100 per cent. The valuation of military engines was not compiled in 1928, so that it is impossible to compare figures in that field. Total engine production, including those for military and commercial purposes, showed an increase of 4,115 units or 126 per cent.

Adding spare parts for both engines and airplanes of all types, it is estimated that the total retail valuation of aircraft and engines produced in 1929 was $98,000,000, as compared with $62,000,000 in 1928.

Open cockpit biplanes led in the number produced as to type, with closed cockpit monoplanes second. However, of all types manufactured during 1929, amphibians showed the greatest increase over 1928. The closed cockpit biplane was the only type to show a decrease in the number produced when compared with 1928 figures.

Amphibians increased 363 per cent, showing the marked interest in this versatile type. Multi-motored monoplanes increased 207 per cent over 1928; flying boats and seaplanes, 190 per cent. Open cockpit monoplanes increased 81 per cent; closed cockpit monoplanes, 80 per cent; multi-motored biplanes, 60 per cent; and open cockpit biplanes, 30 per cent. The closed cockpit biplane decreased 32 per cent below the 1928 totals.

In 1928, there were 124 per cent more biplanes than monoplanes of all types, while in 1929 only 51 per cent more biplanes were manufactured. The ratio between biplanes and monoplanes was rapidly shifting in favor of the monoplane.

The average unit value, without motors, of aircraft produced during 1929 was $6,276.75, an increase of $1,422.25 more than in 1928 when the average unit value was $4,854.50. Commercial engine production showed an average unit price of $3,243.65 during 1929 as compared to $4,830.65 in 1928.

The average unit value of all types of aircraft including motors during 1929 was $9,520.40 as compared to $9,685.15 in 1928. These comparative figures show that while the average price of airplanes without engines was considerably higher during 1929, this increase in cost was offset by a lower average price for engines. The lower average engine price resulted from the entrance of the lower power new production engines into the field, while the marked increase in aircraft unit values can be attributed to the larger number of multi-engined transports, amphibians and flying boats produced.

The production report for 1929 was exceptionally complete with 96 manufacturers filing their figures with the Aeronautical Chamber of

Commerce. A glance at the list of manufacturers who submitted reports included in the 1929 totals will indicate its thoroughness:

Acme Aircraft Corporation, Aeromarine-Klemm Corporation, Aeronautical Corporation of America, Aircraft Manufacturing Corporation, Alexander Aircraft Company, Alliance Aircraft Corporation, American Aeronautical Corporation, American Eagle Aircraft Company, Arrow Aircraft & Motors Corporation, Atlanta Aircraft Corporation, Bach Aircraft Company, Inc., Bellanca Aircraft Corporation, Berliner-Joyce Aircraft Company, Inc., Bischof Airplane Manufacturing Company,

CHRISTENS "BUENOS AIRES"

Mrs. Herbert Hoover christens the flagship of the New York, Rio and Buenos Aires Lines, Inc., fleet.

Boeing Airplane Company, Brunner Winkle Aircraft Corporation, Buhl Aircraft Company, Cairns Aircraft, Century Aircraft Corporation, Cessna Aircraft Company, Commandaire, Inc., Commercial Aircraft Corporation, Consolidated Aircraft Corporation, Corman Aircraft, Inc., Crawford Airplane & Motor Manufacturers, Curtiss Aeroplane & Motor Company, Curtiss-Robertson Airplane Manufacturing Company, Dare Aircraft Company, Davis Aircraft Corporation, Douglas Company, Doyle Aero Corporation, Driggs Aircraft Corporation, Dycer Airport, Eastman Aircraft Corporation, Eyerly Aircraft Corporation, Fairchild

Airplane Manufacturing Company, Fleet Aircraft, Inc., Fokker Aircraft Corporation of America, General Airplanes Corporation, Granville Brothers Aircraft, Inc., Great Lakes Aircraft Corporation, Hall-Aluminum Aircraft Corporation, Hamilton Metalplane Company, Heath Airplane Company, Hise Aircraft Corporation, Ireland Aircraft, Inc., Irwin Aircraft Company, Keystone Aircraft Corporation, Knoll Aircraft Corporation, Kreider-Reisner Aircraft Company, Inc., Joseph Kruetzer, Inc., Lenert Aircraft Company, Lincoln Aircraft Company, Lockheed Aircraft Company, Loening Aeronautical Engineering Corporation, Marchetti Motor Patents, Inc., Glenn L. Martin Company, Mercury Aircraft, Inc., Metal Aircraft Corporation, Miami Aircraft Corporation, Miller Corporation, Mohawk Aircraft Corporation, Mono Aircraft Corporation, Mooney Aircraft Corporation, Moth Aircraft Corporation, New Standard Aircraft Corporation, Nicholas-Beazley Airplane Company, Inc., Noran Aircraft Company, Northeast Airways, Inc., Parks Aircraft, Inc., Pheasant Aircraft Company, Inc., Pitcairn Aircraft, Inc., Pittsburgh Metal Airplane Company, Ryan Aircraft Corporation, Schmuck Aircraft Company, Sikorsky Aviation Corporation, Solar Aircraft Company, Spartan Aircraft Company, Inc., Spear Aircraft Corporation, Stearman Aircraft Company, Stinson Aircraft Company, Stout Metal Airplane Company, Swallow Airplane Manufacturing Company, Taft Airplane Company, Ta-Ho-Ma Aeroplane & Motor Corporation, Taylor Brothers Airplane Manufacturing Company, Towle Marine Aircraft Engineering Company, Travel Air Company, U. S. Aircraft Company of New Jersey, Verville Aircraft Company, Viking Flying Boat Company, Chance Vought Corporation, Waco Aircraft Company, Watkins Aircraft Company, Whittelsey Manufacturing Company, Inc., H. F. Wilcox Aeronautics, Inc.

In the engine field, the reports were equally thorough. The following engine manufacturers filed their production figures for the year with the Aeronautical Chamber of Commerce:

Aero Development Company, Aeromarine-Klemm Corporation, Alliance Aircraft Corporation, Axelson Aircraft Engine Company, Century Rotary Motor Corporation, Chevrolet Aircraft Corporation, Comet Engine Corporation, Continental Aircraft Engine Company, Curtiss Aeroplane & Motor Company, Fairchild Engine Corporation, General Airmotors Company, Irwin Aircraft Company, Kinner Airplane & Motor Corporation, Lambert Aircraft Engine Corporation, LeBlond Aircraft Engine Corporation, Lycoming Manufacturing Company, MacClatchie Manufacturing Company, Menasco Motors, Inc., Michigan Aero-Engine Corporation, Arthur J. Paige, Pratt & Whitney Aircraft Company, Rearwin Airplanes, Inc., Spear Aircraft Corporation, Warner Aircraft Corporation, Wright Aeronautical Corporation.

Aircraft Operations

American aircraft, including civilian, commercial and government planes, flew a total of 197,546,590 miles during 1929, more than trebling the totals for 1928. The distance flown was more than five and a half times that between the earth and Mars, or equal to 73,000 flights across the continent from New York to Los Angeles.

During 1929, 3,160,793 persons were carried in planes operated by air transport lines or aerial service companies. This figure did not include the number of persons carried in privately owned civilian planes or in craft of the Army, Navy, Marine Corps, Coast Guard or Department of Commerce. Less than 600,000 persons were carried in similar operations during 1928.*

Planes engaged in contract air mail service alone flew a total of 13,205,640 miles during 1929 and carried 7,096,930 pounds of mail. Contractors to the government on the 32 domestic mail routes received $13,869,606.16 compensation from the Post Office Department. At the end of the year, routes totaling 14,369 miles were in operation.†

Air transport operators, carrying passengers, mail and express, flew 20,242,891 miles during 1929, according to detailed reports filed with the Aeronautical Chamber of Commerce by the 27 major operators. Aerial Service operators doing a widely diversified business piled up 104,336,560 miles, and it was estimated that privately owned planes, both corporate and personal, were flown 25,000,000 miles during the year. All branches of the government, including the Army, Navy, Marine Corps, Coast Guard and Department of Commerce, flew 47,967,139 miles. As contrasted with this figure for government operations, civilian and commercial planes flew a total of 149,579,451 miles.

Licensed Planes

At the close of 1929, there were 7,843 licensed aircraft in operation in the United States and 4,520 identified planes, making a total of 12,363 ships available for commercial and civilian operations. New York led all the states in the number of licensed and identified planes with 1,429 having federal licenses and 351 identified. California was second with 961 licensed and 515 identified; Illinois, third, with 542 licensed and 375 identified; Missouri, fourth, with 431 licensed and 262 identified; and Ohio, fifth, with 451 licensed and 183 identified.‡

*Complete comparative summary of all operations in Appendix under "Flying in the United States"; also see chapters on "Air Transport Progress," "Aerial Service," "Private Flying" and "Military Aviation" for analysis of total figures given here.

†Complete statistics on air mail operations by routes in Appendix.

‡Complete list of licensed and identified aircraft by states in Appendix.

Aircraft Accident Statistics

With the phenomenal increase in the volume of operations during 1929 came a rise in the number of aircraft accidents, but the percentage of accidents to miles flown decreased to indicate a higher level of safety for all operations. While the Department of Commerce had not yet completed the compilation of accident statistics for the second six months of 1929, figures available for the first six months showed a decline in the accident rate. The Department of Commerce was authority for the statement that a preliminary review of the reports for the second six months indicate a further decline in the percentage of accidents per mile flown.

Approximately a half million miles were flown for every fatal accident during the first six months of 1929, if all types of commercial operations were taken into consideration. A large number of accidents in this classification were in unlicensed planes with unlicensed pilots.

More than 1,000,000 miles were flown for every fatal accident on the regular air transport lines during the six months period reported. This figure can be compared with 884,000 miles flown per fatal accident in the second six months of 1928, and 896,000 miles per fatal accident during the first six months. Only 7.75 per cent of the accidents were in scheduled operations.

Fifty-nine per cent of all accidents were attributed to errors of personnel, pilots being charged with 57.31 per cent of the errors. Structural failures were responsible for only six per cent of the accidents and power plant failures for 18 per cent.*

The year under review was marked with brilliant progress in the manufacturing and operating branches of the industry which brought a new measure of safety and regularity of service for passengers, mail and express. The developments in each of these fields will be described in later chapters.

*Comparative accident statistics in Appendix.

CHAPTER III

AIR TRANSPORT PROGRESS

THE United States led the world in air transport at the close of 1929. Passengers, mail and express were being flown more than 90,000 miles every 24 hours, serving a territory with 90,000,000 population. Scheduled transport lines were flying one-third of the distance between dusk and dawn on lighted airways, providing night service unparalleled anywhere else in the world.

America's major air transport lines, operating on regular schedules, flew more than 20,000,000 miles during the year, carried more than 7,000,000 pounds of mail, and transported more than 165,000 passengers to double and treble previous peak figures. More than a score of new lines were inaugurated, old ones extended, and existing services improved. The first coast-to-coast combined air-rail services became a reality, and the world's first regular night passenger route with tri-motored planes was inaugurated.

While air transport statistics for 1929 were bewildering, they could not mirror the full measure of progress made during the year. Only those who used the transport lines regularly and were able to compare them with services of a year or two before obtained a complete picture of the achievements.

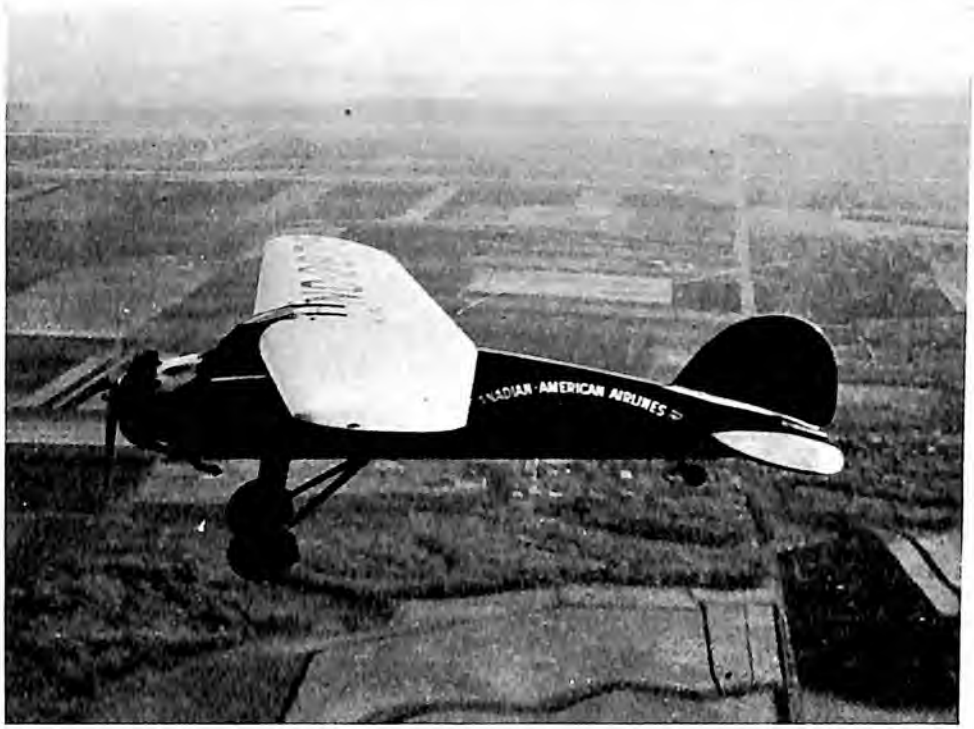
To the air traveler, the transformation was almost unbelievable. Only a short time before, he had to poke his way into a cumbersome flying suit, buckle himself into a parachute and waddle out on a dusty field like a penguin to prepare for each flight. The patience of the uninitiated passenger was tried to the limit and he stood on one foot, then on the other, waiting for the engine to warm up. Some tried flying in those days. Few found it in keeping with their notions of comfortable transportation.

During 1929, the safety, comfort and conveniences of the passenger became paramount considerations. The latest refinements brought the deft hand of the artist and the interior decorator to the transport plane cabins; the science of the radio engineer and the weather bureau expert to aid on each flight; and a type of service for the passenger rivalling the finest railroad trains or ocean liners.

The type of the chairs had been studied and changed so that the passenger rode more easily. The cushions were made deeper, and modern designs and patterns introduced in the upholstering. A certain individuality was maintained in each plane interior, so that the air passenger

enjoyed freshness of new surroundings in almost every plane on his journey.

The windows—tiny peep-holes in the early cabin planes—were extended the full length of the cabin interior, flooding the plane with light and providing correct ventilation for summer or winter travel. Artistically designed ceiling lamps and wall lights were added for night flying. The cabin floor—formerly covered with battleship linoleum—had a rug which harmonized with pillows, curtains and wall paneling.



HIGH SPEED TRANSPORT

Lockheed Vega (Wright Whirlwind) of the Canadian American Air Lines flown on fast schedule between Minneapolis and Winnipeg.

Instruments in the cabin on some lines kept the air traveler informed of the speed and altitude at which he was flying.

A butler's pantry became regular equipment on the bigger planes, with a refrigerator, electric plate, dishes and cutlery to provide full course dinners on long flights or little "snacks" on shorter hops. Hot and cold running water brought added comfort.

From the time the passenger arrived at the airport of embarkation until he stepped from the plane at his destination, uniformed attendants

HURDLING MT. RAINIER

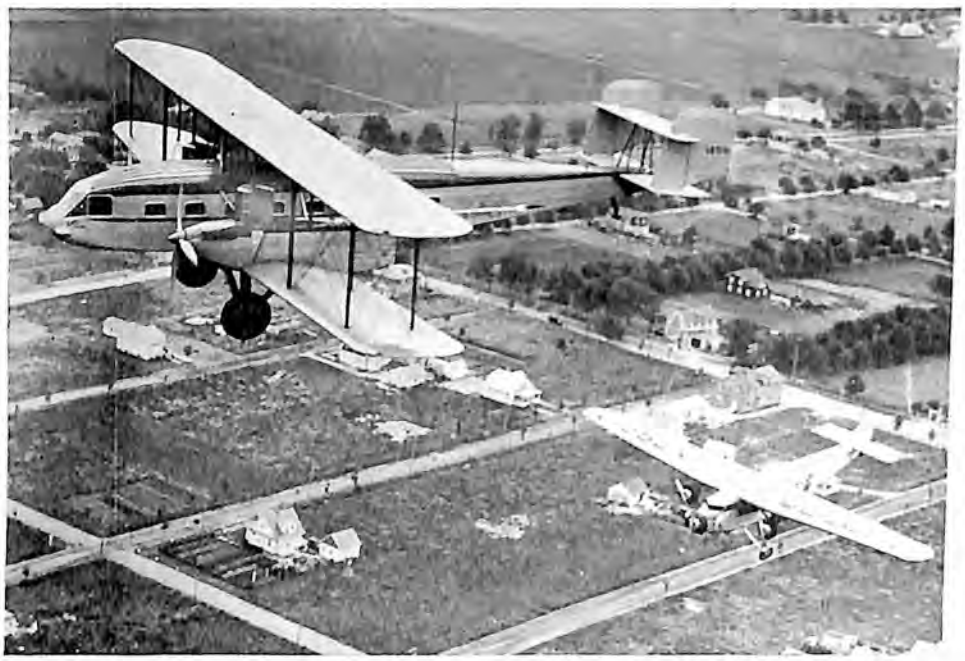
Eighteen-passenger Boeing (3 Pratt and Whitney Hornets) transport in flight over cloud banks near Mt. Rainier, 14,408 feet. One of fleet built for 20-hour Chicago-San Francisco service.

NIGHT PASSENGER SERVICE

First night flying of passengers on regular schedule was inaugurated by the Boeing System between Salt Lake City and Oakland, Cal.; 634 miles flown in one-fourth of the time required by trains.

were at his service. A telescopic canopy, run out from the air terminal building to the door of the plane, brought a reassurance that the passenger's safety and comfort were paramount in the mind of the air line operator. Pilots and navigators were dressed in swanky uniforms. A radio operator was carried on some planes, while the co-pilot maintained two-way radio communication with the ground on other lines where a special radio operator was not carried.

Limousine service from downtown hotels to the airport or speed-boat service from the city to the seaplane base were added as a part of the



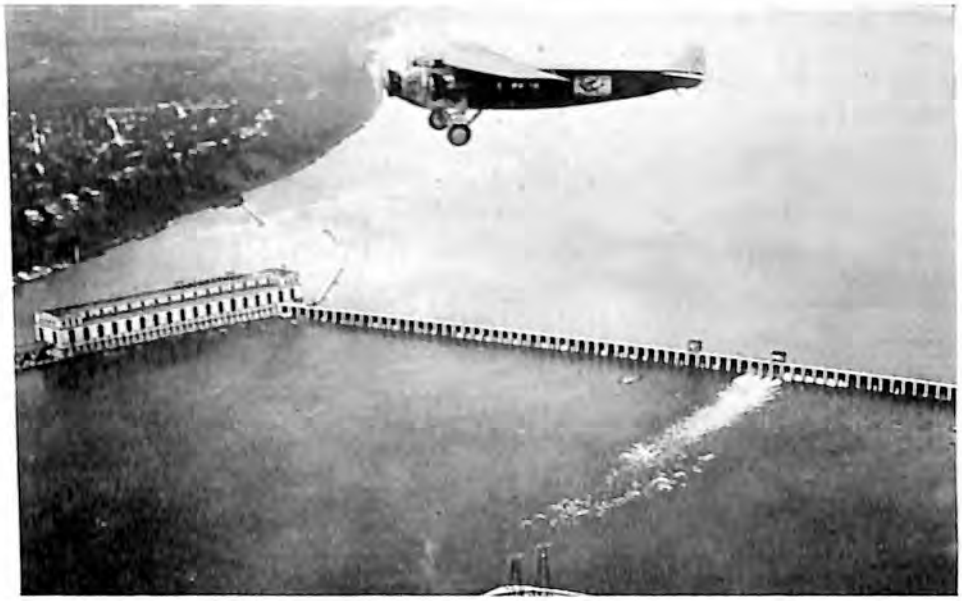
18 PASSENGER CONDOR

Huge Curtiss (2 Curtiss Conquerors) Condor in daily service on Transcontinental Air Transport, Inc., route between Columbus, O., and Waynoka, Okla., with Ford (3 Pratt and Whitney Wasps) below.

de luxe service of the major lines. Motion pictures were introduced as an experiment to entertain passengers on long flights by one line, and others devised unique means of entertaining their guests and making their flight pleasant.

Group Control and Public Support

The phenomenal expansion of air transport lines can be traced to increased public support, which resulted in the active participation of



CROSSING MISSISSIPPI RIVER

Fokker tri-motored monoplane of Universal Air Lines over Keokuk Dam on lap of coast-to-coast air rail service.

LUNCHEON ON AIR LINER

Luncheon being served in a tri-motored Fokker monoplane of the Universal Air Lines System shortly after leaving Chicago.

major financial interests and the backing of established transportation lines, bringing about a transition from corporation effort to group control. The last three months of 1928 provided ample evidence that a majority of the lines were being welded together by groups identified with many branches of the aircraft industry. What resulted during 1929 was, in a large measure, the fruits of this change in the financial structure of the industry.

Most of the major air transport lines were allied with one of four great financial groups, which interested themselves in almost every phase

FLYING THE MAIL

Stearman "Speed Mail" carrying mail on the Varney Air Lines, Inc., route from Salt Lake City into the northwest.

of aeronautical development. The Aviation Corporation of Delaware, one of the holding companies, included a vast system of air transport lines under its control with Universal Aviation Corporation, Southern Air Transport, Colonial Air Transport, Canadian Colonial Airways, Colonial Western Airways, Embry-Riddle Aviation Corporation, and Interstate Air Lines as its operating divisions.

Closely associated with the Curtiss-Wright or C. M. Keys and Richard F. Hoyt interests were Transcontinental Air Transport, Maddux Air Lines, National Air Transport, Pitcairn Aviation, and the units included in the Aviation Corporation of the Americas, a holding company for Pan American Airways, Mexican Aviation Company, New

OVER CATHEDRAL ROCKS

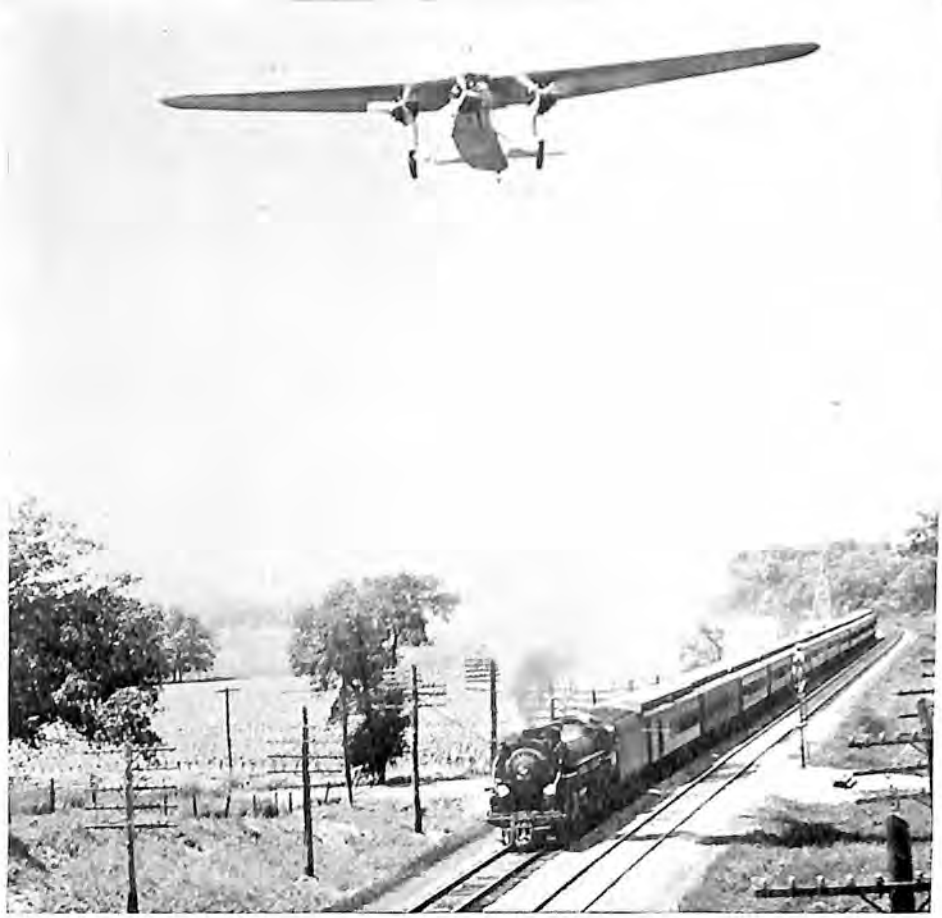
Twelve-passenger Ford (3 Pratt and Whitney Wasps) monoplane of Transcontinental Air Transport, Inc., over Cathedral Rocks near Gallup, N. M., the scene of Pueblo Indian religious ceremony each year.

TIA JUANA NEXT STOP

Tri-motored Ford monoplane of Maddux Air Lines, Inc., taking off from Grand Central Air Terminal, Los Angeles, Cal., for Tia Juana and Agua Caliente.

York Airways, Pan American Airways of Texas, and Pan American-Grace Airways.

The third great system, bringing Boeing Air Transport and Pacific Air Transport into the Boeing System, was included as the operating division of United Aircraft and Transport Corporation.



NOSE AND NECK

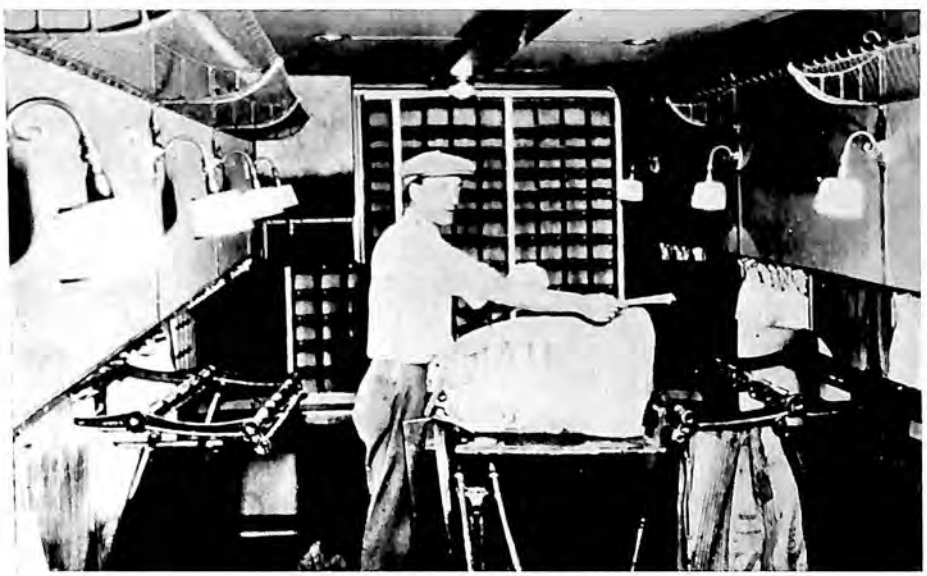
Fokker transport plane of Universal Air Lines crosses New York Central right of way as Engineer Harry Meredith of the Twentieth Century salutes Pilot Clyde Holbrook in daily coast to coast air-rail service.

The fourth system centered in the individuals and banking interests was linked with Western Air Express and Fokker Aircraft Corporation, and included Standard Air Lines, Midcontinent Air Transport and West Coast Air Transport in addition to Western Air Express.

It was these mergers of interest and the stronger financial setups

"RAIN NOR SLEET NOR SNOW"

Storms in the mountainous region flown over by Pacific Air Transport Inc. fail to stop these Boeing 40 (Pratt and Whitney Wasp), four-passenger mail planes between Los Angeles and Seattle.



FLYING POST OFFICE

The 18-passenger Boeing transport converted into a mail compartment, resembling rolling post offices maintained on trains. Chairs in the cabin can be removed in 15 minutes.

which resulted that influenced the development of air transport during 1929 more than any other single factor. The "independent" lines, if the companies not included in the four major financial groups can be properly called that, also were alive to the possibilities of expansion and made remarkable strides to keep abreast of the phenomenal progress.

Lower Passenger Tariffs

The extensive statistical survey made by the Aeronautical Chamber of Commerce at the close of 1929 revealed that the average passenger rate per mile on the established air transport lines was 10.6 cents. However, the last two months of the year saw most of the lines make radical cuts

AT CLEVELAND AIRPORT

Ford tri-motored monoplane of Stout Air Lines Inc. receiving passengers at the new Cleveland Airport Administration Building before taking off for Detroit.

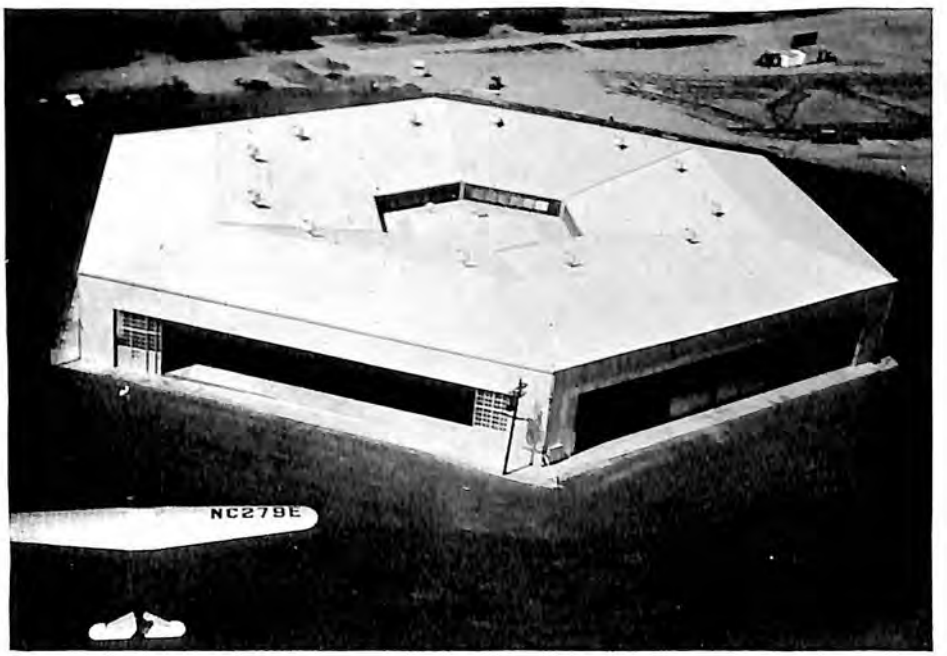
in their tariffs which forecast a far lower rate than the 10.6 cents average for 1929. Considering the excellence of the service offered and the time saved through the use of air transport, the tariffs at the close of the year were within the range of favorable comparison with railroads. The fare on the established coast-to-coast lines was less than one-third higher than first class railroad fare.

Equipment

Twenty-seven major transport lines employed 619 planes in their services during 1929, 594 land planes, seven seaplanes, and 19 amphibians. Single-engined planes outnumbered all other classes with 480, principally because of the large number of efficient mail and express planes so equipped. Seventeen had twin engines; and 122 were tri-motored planes.

CARRIES 32 PASSENGERS

Western Air Express takes delivery of the first of a fleet of new Fokker F-32 (double tandem Pratt and Whitney Hornets) transports for use in the West.



"AERIAL ROUNDHOUSE"

New hexagon shaped hangar built by Western Air Express at its new Los Angeles terminal. Six doors are electrically operated, with 24,000 square feet of floor space.

Air cooled engines had the ascendancy over other types with 836 used during 1929, while 169 water cooled motors were employed.

Huge tri-motored or twin-motored planes were favored on the exclusive passenger lines, seating from 10 to 18 passengers beside their crews. Smaller planes of from five to eight place were used on lines feeding the trunk systems. Description of the various type transport planes in use will be found in the chapters on "Aircraft Manufacturing" and "Trends in Design." Suffice it to say here that the progress in aircraft design kept pace with the demands for larger and faster planes on the transport lines.

The 27 major transport lines reporting used airways aggregating 41,728 miles, almost half of which were fully equipped for night flying. They developed their own air terminals and intermediate landing fields on routes where public facilities were not available; installed weather reporting systems; perfected radio communication from station-to-station and with planes in flight. These achievements are described in the chapters on "Aviation Radio" and "Airports and Airways."

Personnel

The transport lines were employing an unusually high type of personnel, both in the operating and traffic departments. First-pilots were men with thousands of hours of flying experience; co-pilots or assistant-pilots were men well trained; most stewards or couriers were clean cut college men. The employment of a high class personnel, while costly to the operators, was directly in line with the policy of unusual service unparalleled in the older transportation systems.

The twenty-seven lines employed 2,867 persons, of which 372 were pilots and 1,425 mechanics or ground personnel. This tabulation demonstrated graphically the need for about eight men on the ground for every pilot-employe in the air.

Air Transport Statistics

The total mileage flown by the 27 lines almost doubled the reports of 1928 and quadrupled the figures for 1927. The month by month reports showed a total of 20,242,891 miles flown during 1929,* as compared with 10,472,024 miles in 1928, and 5,242,839 miles in 1927. These mileage figures included only scheduled operations on regular passenger, mail and express lines, and did not include short hops or charter flights, which are considered in the chapter on "Aerial Service."

The lines reporting to the Aeronautical Chamber of Commerce listed

*Some December figures were estimated.

SOUTH AMERICAN SERVICE

Thirty-two passenger Consolidated Commodore (twin Pratt and Whitney Hornets) flying boat to be used by the New York, Rio and Buenos Aires Line, Inc.

COMMODORE CABIN

One corner of the luxuriously decorated interior of the 32-passenger Consolidated Commodore flying boat built for the New York, Rio and Buenos Aires Line.

165,263 passengers carried in 1929, as compared with 52,934 passengers in 1928 and 12,594 passengers in 1927. Mail poundage reported almost double the 1928 figures, 7,096,930 pounds being carried in 1929, as compared with 3,632,059 pounds in 1928 and 1,222,843 pounds in 1927. Express poundage carried was reported at 197,538 pounds.

Mail and express lines flew a total of 13,344,172 miles, while passengers were flown a total of 14,889,850 miles during 1929. It should be remembered that some lines carried mail, express and passengers, while some were devoted exclusively to passenger service and others exclusively to mail and express. The total miles flown, 20,242,891, took these duplications into consideration.

STEARMAN LIGHT TRANSPORT

Four passengers and load of mail are carried at a cruising speed of 110 miles an hour in this Stearman (Pratt and Whitney Hornet) Light Transport.

The transport lines included in this survey were: Alaska-Washington Airline; Boeing Air Transport; Canadian Colonial Airways; Colonial Western Airways; Colonial Air Transport; Embry-Riddle Aviation Corporation; Interstate Air Lines; Maddux Air Lines; Mamer Air Transport; Middle States Air Lines; National Air Transport; National Parks Airways; Northwest Airways; Pacific Air Transport; Pan American Airways, including Mexican Aviation Company, Pan American Airways of Texas, and Pan American-Grace Airways; Pitcairn Aviation; Southern Air Transport; Southern Air Express; Southwest Air Fast Express; Standard Air Lines; Stout Air Services; Thompson Aeronautical Corporation; Transcontinental Air Transport; Universal Aviation Corpora-

HEADED FOR EL PASO

Fokker F-10 (3 Pratt and Whitney Wasps) passenger plane of Standard Air Lines, Inc., enroute between Los Angeles and El Paso on daily schedule.

AIR MESSENGER SERVICE

Colonial Air Transport, Inc., inaugurates air messenger service in conjunction with Western Union Telegraph Company to speed the delivery of parcels between New York and Boston.

tion; United States Airways; Varney Air Lines; and Western Air Express.

Of these lines, eight were carrying passengers exclusively. They were: Maddux Air Lines, Middle States Air Lines, Southern Air Express, Southwest Air Fast Express, Standard Air Lines, Stout Air Services, Transcontinental Air Transport, and United States Airways. Only three were carrying mail and express exclusively: National Air Transport, Pitcairn Aviation, and Varney Air Lines. The other 16 carried mail and passengers, and most of them included express either through an American Railway Express contract or some special arrangement.

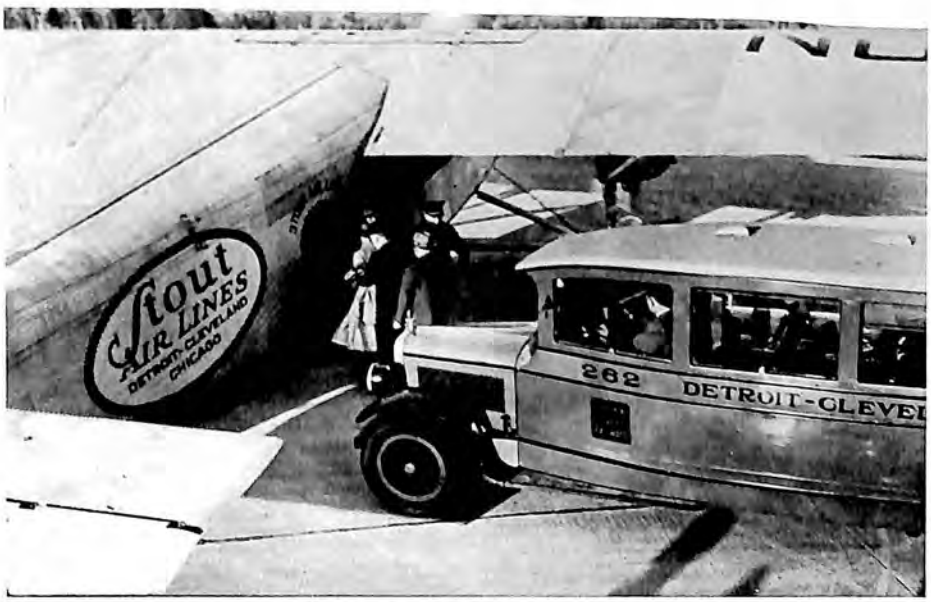
Business Houses Support Air Transport

While some passengers on the air lines were using the new mode of transportation for the richness of the experience on a pleasure jaunt, surveys conducted by several lines showed that most passengers used the lines for business purposes. The increased support of large manufacturing concerns and business houses was evident through a survey made by the Air Transport Section of the Aeronautical Chamber of Commerce, which attempted to place the chiefs of great corporations, employing thousands of men, on record as willing to approve the expense accounts of their employes when they use the air lines for business purposes.

The response was gratifying to the transport operators, 80 big corporations filing letters with the Aeronautical Chamber of Commerce to the effect that they were ready to approve expense accounts of their employes and executives who use the air lines to economic advantage. Some of the companies endorsing the air lines in this way were: Western Electric Company; Binks Manufacturing Company; Aluminum Industries, Inc.; Independence Indemnity Company, The Sherman Corporation; Haskelite Manufacturing Corporation; Wyman-Gordon Company; Thompson Products, Inc.; The Texas Company; Rome Wire Company; Moto Meter Gauge and Equipment Corporation; Standard Oil Company of California; Elgin National Watch Company; The Electric Storage Battery Company; Park Drop Forge Company; Sun Oil Company; The Pyle-National Company; Radiomarine Corporation of America; The Robbins Company; Richfield Oil Company; The Packard Electric Company; H. H. Robertson Company; Sinclair Refining Company; The B. F. Goodrich Rubber Company; Lycoming Manufacturing Company; Standard Oil Company of New Jersey; McGraw Hill Publishing Company, Inc.; The Goodyear Tire and Rubber Company, Inc.; The Cleveland Pneumatic Tool Company; Champion Spark Plug Company; Bigham, Englar, Jones & Houston, Counsellors at Law; American Bosch

TWIN CITIES TO CHICAGO

Twelve-passenger Ford monoplane (3 Pratt and Whitney Wasps) of Northwest Airways Inc. leaving Minneapolis (left) and St. Paul for Chicago on regular run.



FROM BUS TO PLANE

Passengers transferring from special bus to Ford tri-motored plane of Stout Air Lines Inc. at Ford Airport, Dearborn, enroute to Chicago.

Magneto Corporation; A. C. Spark Plug Company; Van Schaack Brothers Chemical Works, Inc.; Loomis, Suffern and Fernald, C.P.A.s; Lando-Azpiazu, Inc.; Summerill Tubing Company; The American Rolling Mills Company; Barr Shipping Corporation; Packard Motor Car Company; National Carbide Sales Corporation; Westinghouse Lamp Company; United States Rubber Company; F. Schumacher & Company; Postal Telegraph-Cable Company; General Electric Company; The Foundation Company; Rand McNally and Company; Valentine and Company; The Curtis Publishing Company; and others.

OVER DALLAS FAIR

Passengers of Southern Air Transport Inc. were given a glimpse of the Dallas, Tex., Fair while flying the regular route through Texas in this Travel Air (Wright Whirlwind) monoplane.

National Air Traffic Conference

Traffic executives of all transport lines were afforded their first opportunity for exchange of data and ideas of the development of mail, express and passenger traffic at the first National Air Traffic Conference of the Aeronautical Chamber of Commerce in Kansas City, Mo., September 16, 17 and 18. The call for this meeting was issued by F. B. Rentschler, President of the Chamber, and Col. Paul Henderson, President of the

LEAVING MEACHAM FIELD

Travel Air (Wright Whirlwind) monoplane of Southern Air Transport, Inc., leaving Meacham Field, the Fort Worth, Tex., airport.

BOARDING COLONIAL TRANSPORT

Passengers boarding the 12-passenger Ford (3 Pratt and Whitney Wasps) transport plane at Boston for New York.

American Air Transport Association. The Chamber's conference brought together traffic chiefs from all parts of the country, and resulted in a better understanding of problems facing the operators, and their most likely method of solution.

The three day sessions were divided so that experts in each phase of the industry might consider the problems in which they were particularly interested through small committee discussions. Reports were prepared by committees on airports, radio and communications, publicity and adver-

Associated Press.

LINKING THE AMERICAS

Col. Charles A. Lindbergh lands at Miami, Fla., with Sikorsky amphibion, completing a circuit linking the Americas by air mail. H. L. Buskey (left), who accompanied Colonel Lindbergh; Mayor of Miami; Col. John Hambleton; Postmaster Owen Pittman and Lindbergh.

tising, standard baggage weights, passenger handling facilities, development of mail and express traffic, handling mail and express, accounting, ticket sales and solicitation, and insurance and submitted to general sessions at which they were discussed more fully. The minutes of the National Air Traffic Conference, published later by the Aeronautical Chamber of Commerce, provided a compendium of information on every phase of air traffic development for the guidance of operators.

It was during the National Air Traffic Conference that announce-

THE RAINBOW ROUTE

Ford tri-motored plane of Scenic Airways, Inc., over Canyon Lake and Apache Trail enroute to Roosevelt Dam on its "Rainbow Route."

BOARDING BIG TRANSPORT

Passengers entering the spacious cabin of an 18-passenger Boeing (3 Pratt and Whitney Hornets) transport used by the Boeing Air Transport System.

ment was made of the formation of the Air Transport Section of the Aeronautical Chamber of Commerce, with Harris M. Hanshue of Western Air Express as chairman. The newly formed section, devoted exclusively to the problems of the air transport industry, rounded out the organization of the Aeronautical Chamber of Commerce according to a plan approved several months before by its governors.

Other members of the Air Transport Section Committee were: Col. L. H. Brittin, Northwest Airways; Capt. T. B. Doe, Pitcairn Aviation; Col. Halsey Dunwoody, Universal Aviation; Col. Paul Henderson, Transcontinental Air Transport and National Air Transport; P. G. Johnson, Boeing Air Transport; S. E. Knauss, Stout Air Services; Maj. Gen. J. F. O'Ryan, Colonial Airways; and J. T. Trippe, Pan American Airways.

IN GREAT LAKES SERVICE

Dornier Superwal flying boat (4 geared Pratt and Whitney Hornets) imported for use on the Great Lakes by the Stout D & C Air Lines. It carries 32 passengers.

At a later meeting in Washington, the Air Transport Section was authorized to proceed with the compilation of vital statistical data on air transport according to a questionnaire which was to be approved by the operators themselves. The section also was active in the development of new ideas for building traffic and in co-operating directly with members on special problems which confronted them. Practically every operator in the country was included in the Air Transport Section's membership.

GIANT PASSENGER PLANE

Keystone Patrician (3 Wright Cyclones) delivered to Transcontinental Air Transport, Inc., late in 1929 for its coast-to-coast service. It carries 18 passengers in transport luxury.

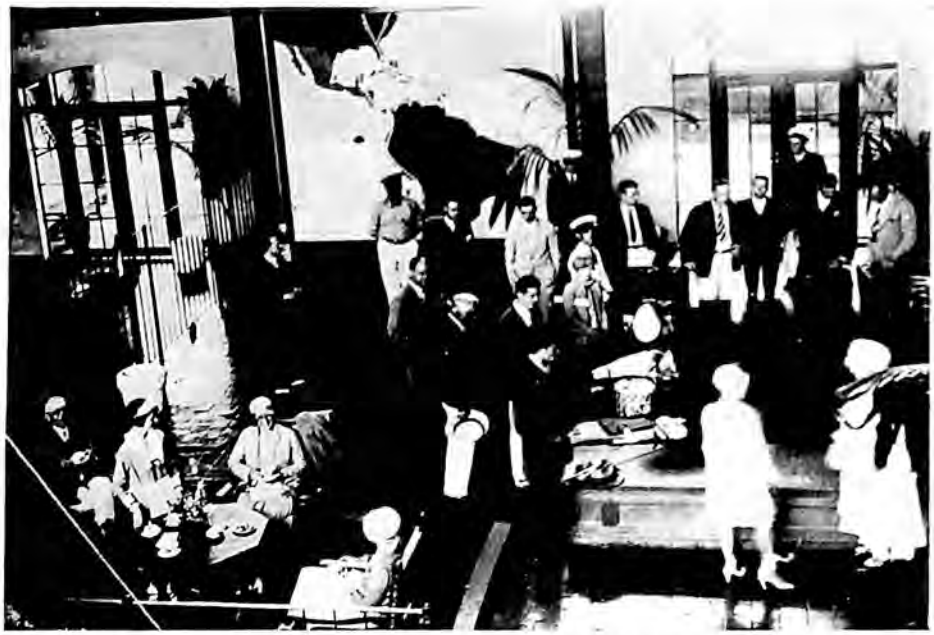
PATRICIAN CABIN

Luxurious cabin of the 18-passenger Keystone (3 Wright Cyclones) Patrician, looking aft.

Air-Rail Connections

Almost every important railroad in the United States was linked with some air transport line in providing combined air-rail service for mutual customers of the air and rail lines. A list of all railroads affiliated in some way with air transport ventures would fill several pages. One transport company alone listed 40 railroads at the end of the year with which it was making connections.

Eleven air transport lines had provided air-rail connections for their through passengers. They were: Colonial Air Transport, Maddux Air



PASSING THROUGH CUSTOMS

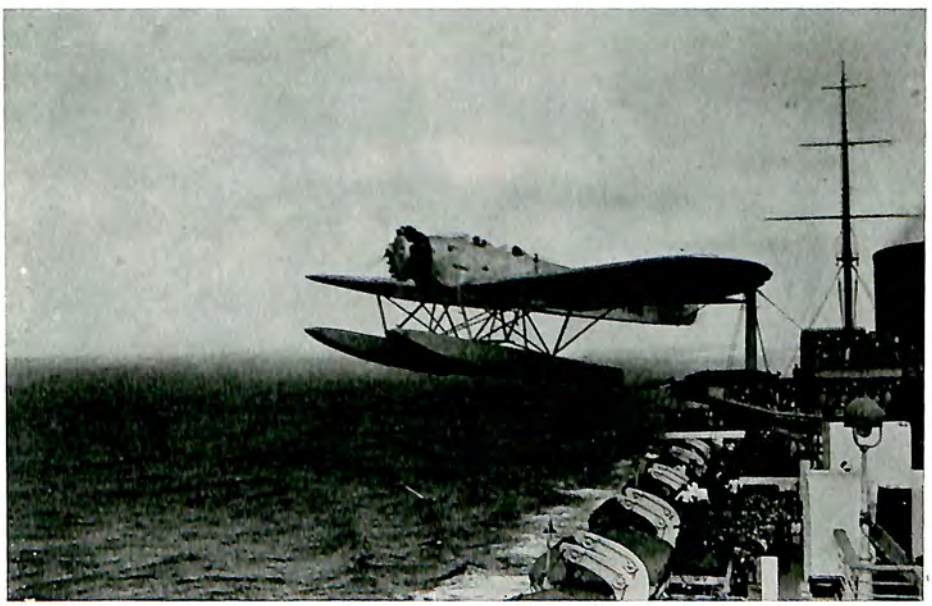
Passengers of Pan American Airways Inc. arriving from Havana quickly pass customs at the Miami Air Terminal.

Lines, Northwest Airways, Pan American Airways, Southern Air Transport, Southwest Air Fast Express, Standard Air Lines, Stout Air Services, Transcontinental Air Transport, Universal Aviation Corporation and Western Air Express.

The latter three provided through service from New York to Los Angeles and San Francisco through their railroad connections. Universal Aviation Corporation, extending its existing lines to Garden City, Kas., and entering into an arrangement with the New York Central and Atchison, Topeka and Santa Fe railroads, opened the first coast to

SHIP-TO-SHORE SERVICE

A CAMS-37 amphibian biplane (Lorraine 450) alighting at Quarantine with mail after being catapulted from the deck of the Ile de France at sea.



CATAPULTED FROM BREMEN

Heinkel low-wing seaplane powered with American Hornet engine catapulted from the deck of the S.S. Bremen at sea to inaugurate the first regular ship-to-shore mail service.

coast air-rail service June 14. Transcontinental Air Transport, organized especially for train and plane service between New York and Los Angeles, began its transcontinental operations July 8 after more than a year of careful preparation. It was linked with the Pennsylvania Railroad, which had a financial interest in the venture, and the Atchison, Topeka and Santa Fe Railroad. The Pennsylvania Railroad was the first to actively invest in air transport. The merger of Maddux Air Lines with Transcontinental Air Transport November 16 brought the first through air-rail service from New York to San Francisco. Western Air Express, flying between Kansas City and Los Angeles, linked its service with railroads entering Kansas City from the east to provide a third air-rail transcontinental service. Western Air Express further prepared to open an all-air service from coast to coast in 1930 in co-operation with Universal Aviation Corporation, which would operate the eastern end of the route from New York.

New Lines Opened; Others Extended

The achievements of each transport company constitute interesting stories that could fill volumes. It seems worthwhile to review the activities of each air transport line briefly.

Alaska Washington Airways, Inc., opened regular service between Wenatchee, Yakima, Ellensburg and Pasco, Wash., April 15 with two round trips each day, as well as operations between Olympia, Tacoma, and Seattle in Washington; Victoria, Vancouver, and Nanaimo in British Columbia; and Ketchitan, Juneau and Sitka in Alaska. Water landings were made on the Alaska route. Two land planes and four seaplanes were employed to carry 3,811 passengers from April 15 until the close of the year.

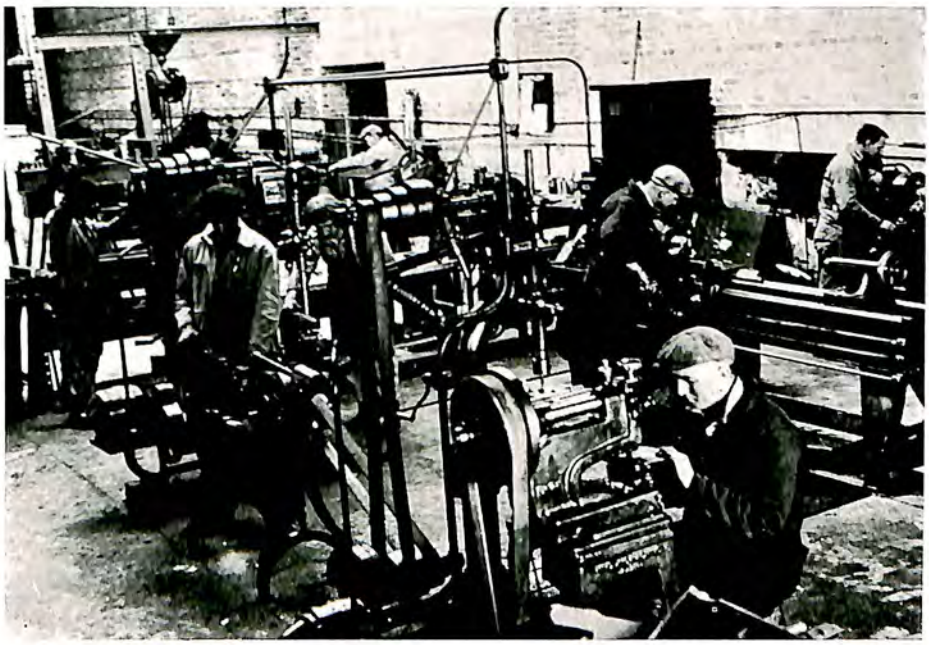
Clifford Ball, Inc., continued to carry mail and passengers on C.A.M. 11* between Cleveland, Youngstown and Pittsburgh and extended its passenger service to Washington. In co-operation with the Post Office Department, Mr. Ball conducted extensive practical tests on the Adams Air Mail Pickup Device, designed to speed up mail service by permitting the planes to receive their cargoes in the air without landing.

Boeing Air Transport, Inc., a division of United Aircraft and Transport Corporation, operated the Chicago-San Francisco mail C.A.M. 18, express and passenger route. Approximately twenty-five per cent of the nation's air mail radiating into Chicago, Omaha, Cheyenne and Salt Lake was carried on the Boeing end of the transcontinental route. The fleet of two-passenger mail planes was augmented by a fleet of Boeing Model 95 high speed planes, with Pratt and Whitney Hornet

*Contract Air Mail Route Number 11.

FLYING THE ALLEGHENIES

Boeing cargo transport of National Air Transport, Inc., carrying mail and express between Chicago and New York.



KEEPING MAIL PLANES FIT

Machine shop of the National Air Transport, Inc., general overhaul and repair base at Chicago municipal airport.

engines, capable of carrying 60,000 letters at a cruising speed of 120 miles an hour. The first regular night passenger service with trimotored transports was inaugurated May 1 between Oakland and Salt Lake. Plans were formulated for inauguration of 18 passenger transport planes on regular service in 1930 to care for increased traffic. The Boeing System, which included Pacific Air Transport, moved approximately 30 per cent of all air mail in the country during 1929, its planes calling daily at airports in nine states. There were two Boeing System planes in the air each hour of the twenty-four, and often eight. Forty-six per cent of the mileage was flown at night; this company alone exceeding the total mileage of all scheduled night operations in Europe.

Canadian-American Air Lines, Inc., a division of the Schlee-Brock Corporation, operated daily passenger service each way between Minneapolis, Winnipeg and intermediate points in Lockheed (Wright Whirlwind) monoplanes.

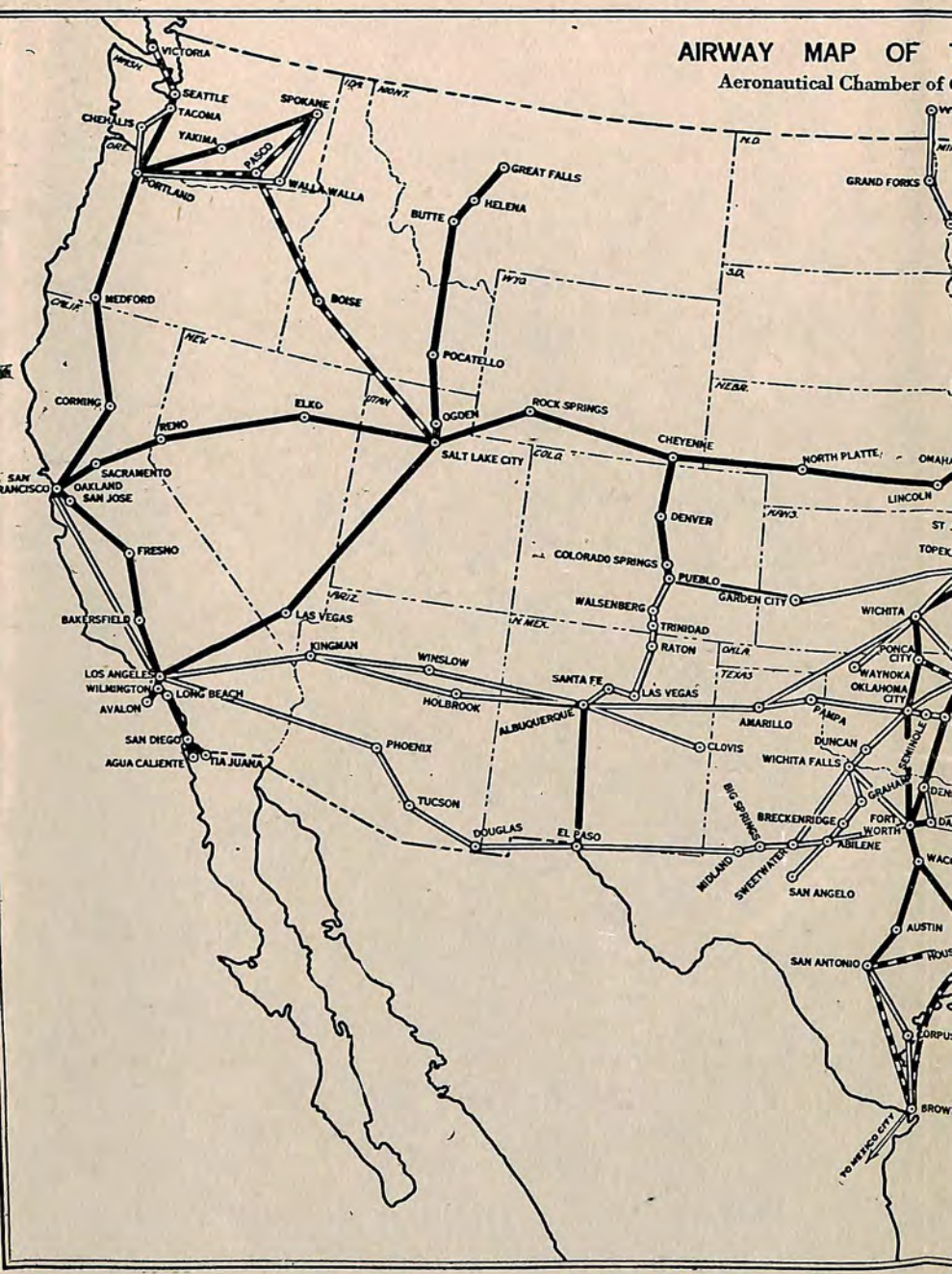
Canadian Colonial Airways, Inc., a division of the Aviation Corporation, operating F.A.M. 1* between New York and Montreal with accommodations for passengers, carried increasingly heavy mail loads, reaching a peak load of 15,278 pounds in October. This was an increase of more than 5,000 pounds over the first load carried on the route. Fairchild cabin planes were used on the 334 mile daily schedule each way.

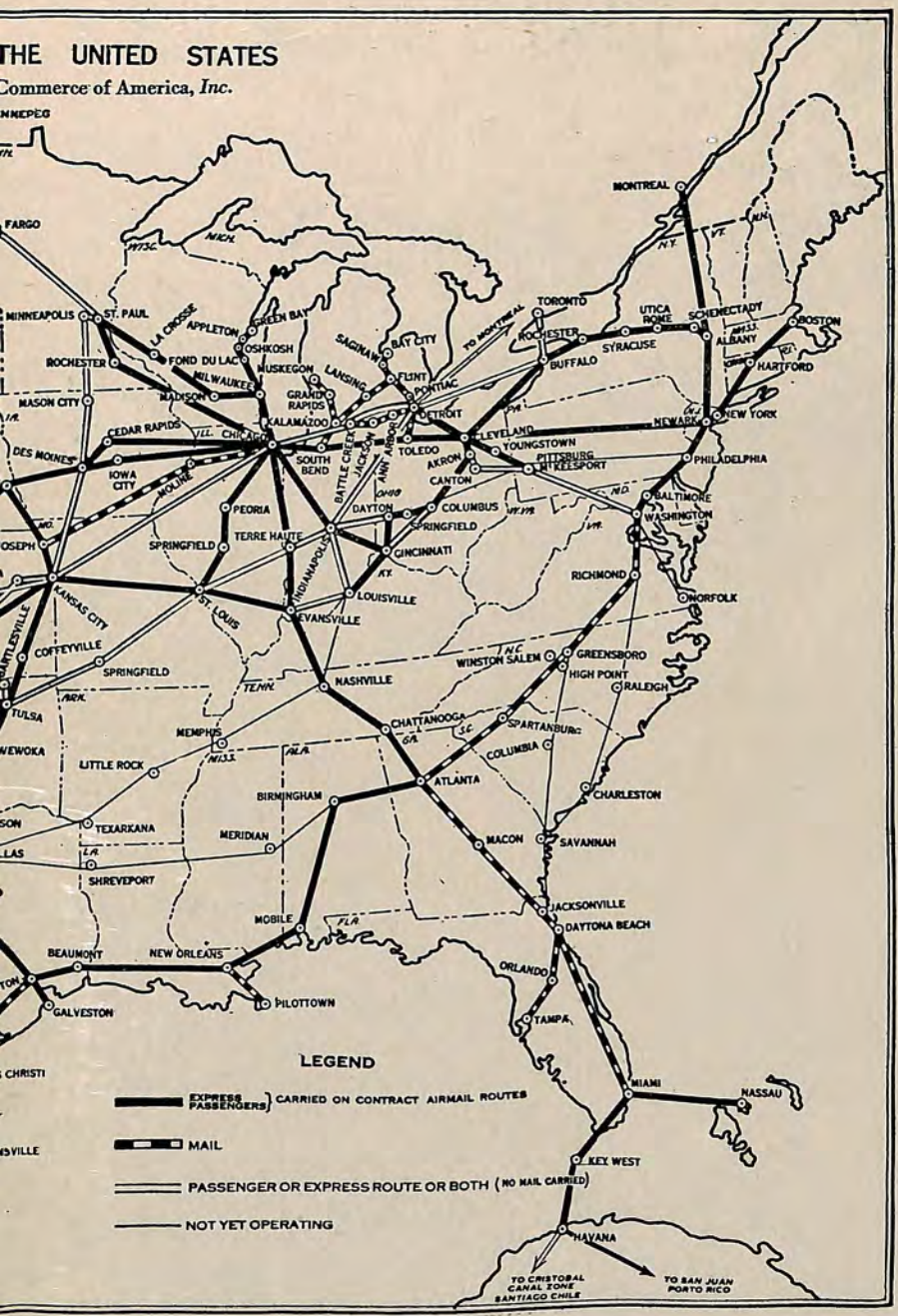
Colonial Western Airways, Inc., a division of the Aviation Corporation, operated C.A.M. 20 between Albany, Buffalo and Cleveland with increasingly heavy mail loads, reaching a peak in October with 12,557 pounds carried. A two-trip daily passenger service was inaugurated between Buffalo and Toronto June 29, and mail was carried on the route beginning July 15. Sikorsky amphibions were used during the summer months, but Fairchild cabin planes were put into operation September 28 for the winter schedule of only one-trip daily.

Colonial Air Transport, Inc., a division of the Aviation Corporation, opened passenger service between New York and Boston, April 15, with two round trips each day. More than twenty 10-trip and seventeen 50-trip commutation tickets were sold for the 200 mile service during 1929. To meet a positive demand for quick dispatch of small high class commodities, a package service was inaugurated August 19 in co-operation with Western Union. C.A.M. 1, opened July 1, 1926, between New York and Boston, enjoyed a steady increase in traffic during the year with peak loads in August when 13,140 pounds were carried.

Delta Air Service, flying six place Travel Air (Wright Whirlwind) monoplanes, connected Dallas with Birmingham by way of Shreveport, Monroe, Jackson, Tuscaloosa and Meridian, in an eight hour passenger service.

*Foreign Air Mail Route Number 1.


AIRWAY MAP OF
Aeronautical Chamber of
VICTORIA
WASH.
SEATTLE
SPOKANE
IDA.
MONT.
CHEHALIS
TACOMA
YAKIMA
ORE.
PASCO
PORTLAND
WALLA WALLA
GREAT FALLS
BUTTE
HELENA
N.D.
GRAND FORKS
S.D.
WYO.
MEDFORD
BOISE
CALIF.
NEV.
POCATELLO
NEBR.
CORNING
ELKO
UTAH
OGDEN
ROCK SPRINGS
CHEYENNE
RENO
SALT LAKE CITY
COLO.
NORTH PLATTE
OMAHA
SAN FRANCISCO
SACRAMENTO
OAKLAND
SAN JOSE
LINCOLN
DENVER
KANS.
FRESNO
COLORADO SPRINGS
PUEBLO
GARDEN CITY
TOPEKA
ARIZ.
WALSENBERG
WICHITA
BAKERSFIELD
LAS VEGAS
N. MEX.
TRINIDAD
KINGMAN
RATON
OKLA.
PONCA CITY
WINSLOW
LOS ANGELES
SANTA FE
TEXAS
WAYNOKA
WILMINGTON
LONG BEACH
LAS VEGAS
OKLAHOMA CITY
AVALON
HOLBROOK
ALBUQUERQUE
PAMPA
AMARILLO
SAN DIEGO
PHOENIX
CLOVIS
DUNCAN
AGUA CALIENTE
TIA JUANA
WICHITA FALLS
GRAHAM
SEMINOLE
TUCSON
BIG SPRINGS
BRECKENRIDGE
FORT WORTH
DOUGLAS
EL PASO
ABILENE
MIDLAND
SWEETWATER
SAN ANGELO
AUSTIN
SAN ANTONIO
CORPUS
TO MEXICO CITY


THE UNITED STATES
Commerce of America, Inc.
WINNIPEG
FARGO
MINNEAPOLIS
ST. PAUL
LA CROSSE
APPLETON
GREEN BAY
OSHKOSH
FOND DU LAC
MILWAUKEE
MUSKEGON
SAGINAW
BAY CITY
LANSING
FLINT
PONTIAC
DETROIT
TO MONTREAL
TORONTO
ROCHESTER
BUFFALO
UTICA
ROME
SYRACUSE
SCHENECTADY
ALBANY
BOSTON
HARTFORD
NEW YORK
NEWARK
MONTREAL
ROCHESTER
MASON CITY
MADISON
GRAND RAPIDS
KALAMAZOO
CEDAR RAPIDS
CHICAGO
DES MOINES
IOWA CITY
SOUTH BEND
BATTLE CREEK
JACKSON
ANN ARBOR
TOLEDO
CLEVELAND
YOUNGSTOWN
AKRON
CANTON
PITTSBURG
MCKEESPORT
PHILADELPHIA
BALTIMORE
WASHINGTON
PEORIA
DAYTON
COLUMBUS
SPRINGFIELD
TERRE HAUTE
SPRINGFIELD
CINCINNATI
RICHMOND
NORFOLK
INDIANAPOLIS
LOUISVILLE
EVANSVILLE
KANSAS CITY
ST. LOUIS
COFFEYVILLE
SPRINGFIELD
WINSTON SALEM
GREENSBORO
HIGH POINT
RALEIGH
NASHVILLE
TULSA
MEMPHIS
CHATTANOOGA
SPARTANBURG
COLUMBIA
LITTLE ROCK
ATLANTA
CHARLESTON
BIRMINGHAM
TEXARKANA
MERIDIAN
MACON
SAVANNAH
SHREVEPORT
JACKSONVILLE
DAYTONA BEACH
MOBILE
BEAUMONT
NEW ORLEANS
ORLANDO
GALVESTON
PILOTTOWN
TAMPA
MIAMI
NASSAU
KEY WEST
HAVANA
TO CRISTOBAL CANAL ZONE SANTIAGO CHILE
TO SAN JUAN PORTO RICO
LEGEND
EXPRESS PASSENGERS
CARRIED ON CONTRACT AIRMAIL ROUTES
MAIL
PASSENGER OR EXPRESS ROUTE OR BOTH (NO MAIL CARRIED)
NOT YET OPERATING

Embry-Riddle Company, operating C.A.M. 24 between Cincinnati and Chicago, with accommodations for passengers, was taken over by the Aviation Corporation in April and the Embry-Riddle Aviation Corporation formed. Thirty-four planes were operated by the corporation, which flew 380,000 miles during the year with more than 800 passengers and increasingly heavy loads of mail and express.

Interstate Air Lines, Inc., a division of the Aviation Corporation, operated C.A.M. 30 between Chicago and Atlanta and St. Louis and Evansville, Ind., flying 1,576 miles daily. Passengers were carried intermittently, but because of poor airport facilities passenger operations were not regular. Despite handicaps, planes on the line maintained a 100

SOUTHWEST TRANSPORT

One of the fleet of 12-passenger Ford metal monoplanes (3 Pratt and Whitney Wasps) flown by Southwest Air Fast Express taking off.

per cent record for scheduled mail deliveries for 17 weeks with 98 per cent average for the year.

Maddux Air Lines, operating a 599 mile daily service exclusively for passengers between Los Angeles-San Francisco and Los Angeles-Tia Juana and Agua Caliente, flew more than 1,000,000 miles during 1929 and carried more than 40,000 passengers. Sixteen pilots were employed to operate the line's 14 planes, 12 of which were tri-motored Fords. Maddux Air Lines was merged with Transcontinental Air Transport November 16.

Mamer Air Transport inaugurated daily passenger service between Seattle, Portland, Spokane and intermediate cities April 15, operating 11 planes on the routes. Plans were formulated for the opening of

11 hour service between Spokane and Minneapolis, stopping at Missoula, Butte, Livingston, and Bismarck. Tri-motored planes connecting with the new line at Livingston were to fly over Yellowstone National Park on daily trips in 1930.

Mason and Dixon Air Lines, Inc., started operation of daily passenger service between Cincinnati and Detroit in July, using all metal Flamingo cabin monoplanes powered with Pratt and Whitney Wasp engines. Stops were made at Middletown, Dayton, Lima and Toledo. Plans for 1930 included extension of the line to Atlanta.

Midcontinent Air Express, closely affiliated with Western Air Express, began operations September 21 with a daily passenger service between Denver and El Paso, making connections at Albequerque with Western Air Express planes flying between Los Angeles and Kansas City. Operation of a line between Denver and Kansas City was started November 9. Fokker Super-Universal six passenger cabin planes were used on both lines.

Middle States Air Lines, Inc., inaugurated daily service between Detroit, Akron and Pittsburgh in June, with stops at Canton, Cleveland and Toledo. Two Lockheed cabin planes and one Fairchild were in service.

National Air Transport, Inc., one of the pioneer air mail contractors, continued exclusive mail operations on three routes: New York-Chicago, Chicago-Dallas, and Tulsa-Ponca City, totaling 1,789 miles of airways. The Chicago-Kansas City day mail and express line was extended to Dallas July 1 by way of Tulsa, giving the Oklahoma city both day and night service through connections with the night line from Chicago to the southwest over a spur line from Tulsa to Ponca City. More than 8,600 miles were being flown every 24 hours, half of the mileage at night, to meet the demands of heavy mail and express shipments. Six Boeing 95 transports, five Curtiss Falcon mail and express planes, and a Curtiss Carrier Pigeon II, capable of carrying a 2,000 pound pay load, made up the line's fleet. A huge new hangar was completed at Chicago and an addition made to the repair base there. More than 2,500,000 miles were flown and more than 2,000,000 pounds of mail carried during the year. Three hundred and two persons were employed, 35 being pilots.

National Parks Airways, Inc., operated mail and passenger service over a 500 mile route between Sale Lake City and Great Falls, Mont., C.A.M. 26. Stops were made at Ogden, Pocatello, Butte and Helena. Six planes flew more than 350,000 miles and carried 1,600 passengers, in addition to 70,000 pounds of mail.

Nevada Air Lines, Inc., inaugurated daily passenger service May 1 between Los Angeles, Reno and Las Vegas, with stops at Independence,

Bishop, and Tonopah. Four Lockheed (Pratt and Whitney Wasp) cabin monoplanes were used on the line.

New York, Rio and Buenos Aires Air Line inaugurated the first mail and passenger service over a transcontinental air line in South America September 1, when the route between Buenos Aires and Santiago, Chile, was opened. The line was 850 miles in length crossing the Andes at 17,000 feet and operated on a seven hour and fifteen minute flying schedule. The first section of the route northward was opened August 21 between Buenos Aires and Montevideo, Uraguay. Mail was carried over the route under contracts with the governments of Argentina, Chile and Uruguay. Plans were completed for extending the line northward from Buenos Aires to Rio de Janeiro and opening a section between Florida and Cuba early in 1930. Service was then to be extended to Port of Spain, Trinidad, from Rio and from Cuba to Trinidad in the spring of 1930. A fleet of twelve twin-motored Consolidated Commodore flying boats, each to accommodate 20 passengers in luxury, were ordered for the line. The first of the fleet, "Buenos Aires," was christened by Mrs. Herbert Hoover. Plans of the company embrace operations over airways 8,903 miles in length, linking New York with Buenos Aires. William P. MacCracken, Jr., former Assistant Secretary of Commerce for Aeronautics, late in 1929 became Chairman of the Board of the New York, Rio and Buenos Aires Line.

Northwest Airways, Inc., operated daily mail and passenger service on C.A.M. 9 over a 503 mile airway between Chicago and St. Paul-Minneapolis. Fifteen planes flew approximately 3,000 miles daily seven days a week. The world's first co-ordinated air-rail service was started by this line September 1, 1928, in co-operation with the Northern Pacific, Great Northern, Chicago, Milwaukee and St. Paul, Pennsylvania, Baltimore and Ohio, and New York Central railroads.

Pacific Air Transport, Inc., a unit of the Boeing System and a division of United Aircraft and Transport Corporation, operated over the 1,099 mile airway between Seattle and Los Angeles, with stops at Tacoma, Portland, Medford, Oakland, San Francisco, Fresno, and Bakersfield. Passengers, mail and express were carried 750,000 miles during the year. New terminal facilities were provided at Seattle, Medford, Oakland and Los Angeles. A new $2,500,000 model terminal at Burbank, called United Airport, became the Los Angeles terminus.

The Pan American Airways system, including Pan American Airways, Inc., Mexican Aviation Company, Pan American Airways of Texas, Inc., and Pan American-Grace Airways, Inc., flew 2,700,000 miles during 1929 and carried 17,500 passengers over its extensive routes which brought scores of centers in Central and South America within days or hours of the United States as compared with weeks of travel

under older modes of transportation. It operated Foreign Air Mail Contracts 4, 5, 6, 7, 8, and 9, and used a fleet of 58 planes, 27 tri-motored land planes, 20 single engined land planes, and 11 twin-engined amphibians. Seventy-two pilots and 330 mechanics and ground operations men were employed on the eight routes which totaled 12,019 miles of airways. The routes were: Miami to Parmaribo, Dutch Guiana, 2,787 miles; Miami to Cristobal, C. Z., 2,074 miles; Miami to Nassau, Bahamas, 200 miles; Cristobal, C. Z., to Curacoa, Dutch West Indies, 1,023 miles; Brownsville, Tex., to Mexico City, 472 miles; Brownsville to Guatemala City, 1,155 miles; Tampico, Mexico, to Merida, Yucatan, 766 miles; and Cristobal, C. Z., to Buenos Aires, Arg., 4,442 miles. The latter route, operated by Pan American-Grace Airways, was owned jointly by the Aviation Corporation of the Americas and W. R. Grace and Company.

Pitcairn Aviation, Inc., operated C.A.M. 19 and C.A.M. 25, carrying mail exclusively between New York, Miami and Tampa, a distance of 1,546 miles. Forty-four planes, three of them tri-motored transports, were used on the line which flew more than 1,000,000 miles and carried nearly a half million pounds of mail.

Rapid City Air Lines, in connection with their sight seeing tours over the Black Hills, operated scheduled service between Huron and Rapid City in South Dakota.

Southern Air Express inaugurated exclusive passenger service between Jackson, Miss., Montgomery, Ala., and Atlanta in July over a 400 mile route. Weekly service was maintained over the route to obtain operating data sufficient to become the basis for daily operations.

Southern Air Transport, Inc., a division of the Aviation Corporation, operated three passenger routes, totaling 1,334 miles, and four mail routes totaling 1,634 miles. The passenger routes were Fort Worth to Houston; Dallas to El Paso; and Dallas to Brownsville, while mail was carried on C.A.M. 21, Dallas to Galveston; C.A.M. 22, Dallas to Brownsville; C.A.M. 23, New Orleans to Atlanta; and C.A.M. 29, New Orleans to Houston. Passengers and mail were being carried 5,936 miles daily when the year closed. Eighty-four single engined land planes were used in the mail and passenger service. The company grew from a small operator with seven planes at the beginning of the year to a corporation linking cities throughout the south with scheduled transport.

Southwest Air Fast Express was organized early in 1929 and began operations April 2 between St. Louis and Tulsa, Kansas City and Tulsa, and Tulsa-Oklahoma City-Fort Worth-Dallas. Additional one hour service between Tulsa and Oklahoma City was inaugurated later in the year. Another line from Tulsa through Oklahoma City and

Wichita Falls to Sweetwater, Tex., was opened July 15. Nine tri-motored cabin planes were in service at the end of the year. During the nine months of operations, 649,420 miles were flown and 9,783 paid passengers carried.

Standard Air Lines, closely affiliated with Western Air Express, inaugurated daily passenger service from Los Angeles to El Paso February 4, after operating a tri-weekly service from Los Angeles to Tucson, Ariz. Increased traffic forced the abandonment of six and eight passenger planes August 4 for Fokker tri-motored ten passenger planes. During the summer, a service also was operated from Los Angeles to Bear Mountain Lake, a pleasure resort in the San Bernardino Mountains.

Stout Air Lines, the oldest exclusively passenger air transport organization in the United States, extended its service to Battle Creek, Mich., Kalamazoo, Mich., South Bend, Ind., and Toledo November 1. The extension was made on the second anniversary of operation on the Detroit-Cleveland route and one year of operation on the Detroit-Chicago division. Two fare reductions were made during the year, and four new Ford (three Pratt and Whitney Wasps) monoplanes added to the fleet. More than 11,000 passengers were carried and 365,000 miles flown.

Thompson Aeronautical Corporation inaugurated the first amphibian passenger service on America's inland waterways, when a trans-lake service was started May 14 between Detroit and Cleveland with four round trips a day. The 91 mile flight was made in 55 minutes. The Michigan mail route, C.A.M. 27, was extended April 1 from Bay City to Cleveland on a night schedule. Night planes were added on the Chicago-Kalamazoo division; passenger service was inaugurated July 17 on the day mail routes in Michigan; and express service was added September 14.

Transcontinental Air Transport, Inc., inaugurated its coast-to-coast air-rail service in connection with the Pennsylvania and Santa Fe railroads July 8 after a year of thorough preparation and the expenditure of $3,000,000. Private airports were constructed on the western division between Clovis, N. M., and Los Angeles, while municipalities provided ports on the eastern division between Columbus and Waynoka, Okla. Emphasis was placed upon the provision of de luxe service exclusively for passengers. A fleet of ten multi-motored transport planes, carrying from ten to eighteen passengers, was used on the 1,809 mile airway. Transcontinental passengers were flown by day and transferred to Pullmans at night on a 48 hour schedule from New York to Los Angeles. Nearly 3,000 passengers were carried and more than 500,000 miles were flown during the six months of operations.

United States Airways, Inc., inaugurated daily service between

Kansas City and Denver June 1, exclusively for passengers. Four planes carried more than 850 passengers 185,000 miles on the 566 mile airway.

Universal Aviation Corporation, a division of the Aviation Corporation, opened the first coast-to-coast air-rail service June 14 in conjunction with the New York Central and Santa Fe Railroads. Eleven thousand miles were being flown on lines of the corporation at the end of 1929 over 4,500 miles of airways. Passenger lines were operated between Cleveland-Chicago-Kansas City-Garden City, Kas.; between St. Louis and Chicago; between Chicago-Kansas City-Omaha; between Kansas City-Wichita-Oklahoma City-Tulsa and Dallas. Three air mail routes were operated: Cleveland to Louisville; St. Louis to Chicago; and St. Louis to Kansas City and Omaha. Plans were formulated for an all-air coast-to-coast service in 1930 in conjunction with Western Air Express. Sixty-six planes were used exclusively in air transport, with 1,500,000 miles flown and nearly 14,000 passengers carried.

Varney Air Lines, Inc., continued the operation of C.A.M. 5 between Salt Lake and Pasco, and extended its service on a new route, C.A.M. 32, to serve the cities of the northwest, including Portland, Seattle, Tacoma and Spokane. The new route was opened September 15. The volume of mail from the northwest increased 50 per cent after the new route was opened. More than a half million miles were flown on the two routes, which carried mail exclusively.

Western Air Express flew more than 2,000,000 miles during 1929, operating two mail routes, C.A.M. 4, C.A.M. 12, and an extensive passenger service. New services were inaugurated or expanded calling for an additional daily total of 4,870 flying miles and bringing the daily total miles flown to 8,000. Not an hour of the day or night passed without at least one Western Air Express plane in the air. Twelve Fokker F-10s, two Loening amphibians, three Boeing mail planes and one Stearman. It had placed orders with the Fokker Aircraft Corporation for immediate delivery of six F-14s, mail planes, and five Fokker F-32s, giant 30 passenger planes. Daily passenger service was established between Los Angeles and Kansas City, 1,420 miles, on a 12 hour schedule. Night air mail service between Los Angeles and Salt Lake was added; service between Los Angeles and San Francisco was doubled; amphibian planes replaced seaplanes on the Los Angeles-Catalina Island hop; and service was inaugurated between Los Angeles-Tia Juana-Agua Caliente. A new million dollar air terminal with a giant hexagon hangar was under development near Los Angeles, the terminus of the lines. More than 22,000 passengers were carried and more than 2,000,000 miles flown during 1929.

West Coast Air Transport, affiliated with Western Air Express, established daily service between San Francisco, Portland and Seattle.

CHAPTER IV

AVIATION RADIO

RADIO, adapted to the use of airplanes in flight, has provided the link between aircraft and their ground stations necessary to insure safety and regularity of operations. The advances made during 1929 in harnessing the world's two newest inventions—airplanes and radio—into one great transportation system can be called nothing short of phenomenal.

Radio has become to the airplane what the block system is to the railroad. It is the nerve system of the air transport company, being even more important to aviation than shipping. A steamship, rarely traveling at more than 20 miles an hour, can ride out a storm or anchor off port for a prolonged period, while an airplane must travel at a far greater speed and find its airport quickly. The new developments in radio bring a reassurance that the major problems of air transport—regularity and safety of operation—have been solved.

The early months of 1929 found aviation radio in the laboratory stage of development. It was a very promising "novelty" which had not been applied to daily use of transport lines or itinerant flying in the United States. The end of the year found better equipment in production, daily use of radio for plane to ground and station to station communication on major transport lines, a better understanding of the technical problems involved in transmission and reception aboard planes, an active program of the Department of Commerce in providing radio aids to navigation, and a definite policy toward aviation radio established by the Federal Radio Commission in the allocation of wavelengths to air transport companies for chain operations.

The reports of the Technical Radio Committee of the Aeronautical Chamber of Commerce Air Transport Section constitute almost a complete history of the progress made during the year in the building up of an efficient communication net for air transport lines. Because the committee was representative of the entire industry and carried its brief, the Federal Radio Commission, Department of Commerce and other agencies, commercial and governmental, were in constant contact with its members on all radio problems linked with aviation.

It was through a series of conferences between the Chamber Technical Radio Committee and officials of the Federal Radio Commission, Army, Navy and Commerce Departments that the commission's basis of designating frequencies for aviation purposes was worked out. The

resulting Federal Radio Commission order of September 9 and amendments of October 1* formed the foundation upon which the air transport companies proceeded to develop their communication network for 24 hour operations along the airways. It made it possible for the transport companies to co-operatively plan construction of a network of radio stations throughout the country at points where governmental facilities could not be made available.

The order provided for the allocation of frequencies solely for the use of stations along the airways making up a chain or chains serving the various transport lines and maintained by them.

One chain was designated to serve Universal Air Lines, Aviation Corporation, Braniff Air Lines, Central Air Lines, Continental Air Lines, Northern Air Lines, Southern Air Transport, Texas Air Transport, Gulf Air Lines, Interstate Air Lines, Clifford Ball and Colonial Air Transport. A second chain was designated to serve Western Air Express, Standard Air Lines, Mid-Continent Air Lines and West Coast Air Transport. A third chain was set aside for the use of Transcontinental Air Transport, Inc., National Air Transport, Inc., Northwest Airways, Pitcairn Aviation, Inc., and Maddux Air Lines. The fourth domestic chain served Boeing Air Transport, Pacific Air Transport, Stout Air Services, Varney Air Lines, and National Parks Airways. Frequencies were allocated also to Pan-American Airways and Pan-American Grace Airways for operations extending out of the United States. Definite calling, distress and navigational frequencies also were assigned for common use of all operators.

While the service provided through these several chains was primarily to insure safety of operations for the transport lines using it, any itinerant flier was free to make use of the weather reports while flying along the airway. No charge was made for such service to the occasional flier, while those using the service regularly were to share in the expense of operations.

Chief Uses of Radio

Radio was used in air transport to keep the pilot informed as to changes of weather along his route; to get the position of the plane either by means of bearing observations in the airplane or on the ground; to follow a definite course as marked out by a radio beacon; to obtain information as to landing conditions at an airport; to send and receive traffic dispatches while in the air, and to call for aid in giving the airplane's position should an emergency landing be necessary.

*Order and amendments printed in full in Appendix.

Underwood & Underwood.

FLIES BLIND

Lieut. James Doolittle and the Consolidated NY-2 (Wright Whirlwind) in which he took off, flew and landed successfully in conditions simulating fog, without seeing ground or obstructions.

Underwood & Underwood.

INSTRUMENTS DEFEAT FOG

Lieut. James Doolittle examining instruments which guided him on his blind flight. Radio receiver and key, through which two-way communication with ground was maintained, seen at lower right. New "directional gyroscope" is seen at top center.

The government, through the Department of Commerce, had developed a vast weather reporting and radio beacon network for use of the itinerant flier and transport plane alike along the principal airways. The system developed by the transport lines themselves further supplemented the government facilities and provided weather and radio service where the government was not yet able to extend its network. Weather transmission schedules from the 24 stations broadcasting weather reports were increased during the year, first from hourly to half-hourly reports and later to broadcasts at 15 minute intervals. When the complete network of weather broadcasting stations is completed in 1930 there will be hardly a square mile in the United States not covered by the service.

Radio beacons, which send out a directional beam to guide pilots on their course despite weather conditions, were in operation from Boston to Hadley Field, N. J., and along the transcontinental airways to Cleveland, Chicago and Des Moines. Eight aural type beacons were in operation at the end of the year, with construction schedules calling for the completion of 35 by May, 1930. The aural beacon sends out a directional beam in such a way that the pilot, using the same receiver with which he picks up weather broadcasts, can tell whether he is on his course or to the right or left by characteristic breaks in the stream of long dashes.

Progress was made in the perfection of a visual type beacon, which substitutes a tuned reed indicator for the pilot's headphones and eliminates constant attention to an audible signal. Two vibrating reeds in a dashboard instrument tells the pilot whether he is on the true course or to the right or left. The Bureau of Standards, working with such a beacon at College Park, Md., made many successful tests with the beacon during the year. A subsidiary of the Consolidated Instrument Company undertook the commercial manufacture of the indicators, and the Department of Commerce considered the advisability of establishing visual beacons along several of the airways to further the experiments along practical lines.

The antenna system of the radio beacon station consists of two directional loops supported on a pole. Using long waves in the 285-350 kilocycle band, the transmitter sends out a characteristic signal from equivalent loops alternately in a character that interlocks, marking the radio course by interlocking dashes. There are four courses, each approximately three degrees in width, ranging from the beacon. They can be shifted by means of the goniometer to coincide with the lighted airway.

Two-Way Radio Communication

Possibly the most useful and striking advances in the development of aviation radio equipment during 1929 were found in the perfection of two-way radio telephone and telegraph sets for airplanes. Early in the year the Technical Radio Committee of the Aeronautical Chamber of Commerce sent out a bulletin to manufacturers and scientific agencies concerned with the development of radio equipment, outlining air transport operators' requirements relating to power supply, acceptable

RADIO-EQUIPPED MAIL PLANE

One of the Curtiss Carrier Pigeon II (Curtiss Conqueror) mail planes of National Air Transport, Inc., between New York and Chicago. Mast behind pilot's cockpit is for radio.

antennae, space and position of equipment in planes, preferred controls, microphones, head sets, receivers, transmitters and ignition shielding.

The result was a co-ordinated effort of such agencies as the Bell Telephone Laboratories, Radio Corporation of America, American Telephone and Telegraph Company, Westinghouse Electric and Manufacturing Company, Western Electric Company, General Electric Company, Radiomarine Corporation of America, government departments and the experimental staffs of the transport companies.

At the close of the year, the major transport lines were maintaining two-way communication with their planes in flight, using transmitters of small sizes, light weight and great power. The transmitters used by Transcontinental Air Transport, Inc., and Pan American Airways, Inc., were representative of the trend in design. Both installations were small enough to permit placing them in the tail of the ship rather than in the passenger cabin. The TAT transmitter with all controls, tubes, dynamotor, antenna and microphone weighed 87 pounds. Equipment used earlier in the year on the same planes weighed 165 pounds, making necessary installation in the passenger cabin. Only five electrical connections to the transmitter were necessary, two high voltage connections to the dynamotor, two to the tube filaments and one to the microphone. A trailing wire antenna which could be let down on a reel operated from the pilot's cockpit was used for transmission. The antenna was weighted down by a two and a quarter pound attachment streamlined to offer the least wind resistance. Operation of a single switch changed the circuits from receiving to transmission. While the sets were designed for transmission up to 200 or 250 miles, the company reported unusually clear two-way telephone communication between a plane flying over Kingman, Ariz., and a ground station at Clovis, N. M., 617 miles away during a test flight.

The radio equipment on Pan American Airways, Inc., completely installed, weighed 42 pounds. Pan American was the first to install radio equipment in the tail of an airplane in March, 1929. Two-way communication with all planes on the Central and South American routes has been maintained since early in 1929. A radio operator is carried on each plane, and telegraph is used throughout because of static and other conditions which make radio telephone less valuable. Opening the new Pan-American mail route from Miami to Panama in February, Col. Charles A. Lindbergh flew a plane completely equipped for two-way communication. It was the first time that Colonel Lindbergh had flown a long distance in a radio equipped ship. The consistent range of the Pan American Airways, Inc., equipment was reported at 800 miles with only 10 watts antenna power.

All mail planes of the Boeing System, flying the transcontinental air mail from Chicago to San Francisco, were equipped with sets to receive frequent weather report broadcasts and other instructions which might be relayed to the pilots in flight. The communications engineer of the Boeing System and his staff spent several months in the testing and perfection of two-way radiophone communication for use on the tri-motored transports planned for passenger service between Chicago and the Pacific coast as well as mail planes of the system. Radio was

found to be an indispensable aid to the maintenance of the system's schedules.

Western Air Express engineers spent the major part of the year developing a station-to-station radio network for the relay of messages to points along their route not served by the regular land lines. After considerable experimental work in the field of two-way communication, the engineers selected radio telephone equipment which was to be delivered for installation on all planes early in 1930.

New York Times.

SPLIT SECOND FROM BROADWAY

Although the Byrd Antarctic Expedition at Little America was thousands of miles from civilization, the radio tower seen here kept it in touch with the outside world. It was through this station that New York was linked directly with a plane in the air over Antarctica.

National Air Transport, Inc., one of the first air lines in the country to make use of radio in scheduled operations, continued to use improved receiving sets on all its mail planes between New York and Chicago, enabling the pilots to receive the weather broadcasts and keep on their course by using the Department of Commerce radio beacons on the eastern division of the trans-continental route. The company reported a 30 per cent increase in the regularity of operations through the use of the radio beacon.

Similar equipment for two-way radio telephone or telegraph communication was used, regularly or experimentally, by Universal Air Lines System, Pitcairn Aviation and other American lines.

While the two-way radio communication was provided primarily to insure safety and regularity of operations, the possibilities of its uses were demonstrated dramatically several times during the year when passengers flying over New Jersey communicated through radio telephone and the regular land lines to offices in New York, London, St. Paul, Washington, Los Angeles and other cities. It was not the plan, however, to permit general use of the aerial telephone facilities by passengers on the regular transport routes except in cases of emergency.

Station-to-Station Radio

While most of the air transport lines employed teletype for the transmission of weather reports and traffic messages between their ground bases, a few organizations, such as Western Air Express and Pan American Airways, developed a system of station-to-station radio communication between their ground bases where they found the land lines to be inadequate. The Federal Radio Commission authorized the use of radio in such cases, and allocated frequencies where applications were made and justified.

Radio Altimeters

Experiments to develop radio altimeters to indicate the exact height of an airplane from the ground at all times and offer a further aid to pilots when "flying blind" were continued with two different principles receiving consideration. Dr. E. F. W. Alexanderson of the General Electric Company was working with an instrument which indicates position between nodes produced by transmitted and reflected radio waves. It uses a counter or memory indicator, as it is called, to indicate the particular nodal space within which the direct indication is obtained.

W. L. Everitt of Ohio State University was developing a radio altimeter in which the frequency of the carrier wave is varied by rotation of an air condenser. For a certain rate of frequency change the beat note set up by the transmitted and reflected waves has a pitch which is a direct function of the altitude. Only a single loop is used for transmission and for receiving the directed wave. The Everitt altimeter is simpler in principle and has the advantage of indicating altitude directly instead of altitudes within a nodal distance. The Daniel Guggenheim Fund for the promotion of Aeronautics made a grant to Ohio State University to further the development of the Everitt instrument.

Radio Landing Device

The use of a "radio beam" or "radio sheet" for guiding a pilot down into a landing field was looked upon as one of the most attractive solutions to the fog landing problem. Localizing beacons would indicate the distances from the point of contact with the ground, and guide the plane along a direct line to a safe landing. Experiments of directional beams of short wavelengths were reported at the Green Radio Station, Round Hill, Kolster at Palo Alto, Calif., and the Bureau of Standards.

HUGE TELEPHONE BOOTH

Ford (3 Pratt and Whitney Wasps) monoplane used by the Bell Telephone Laboratories in the development of two-way radio telephone communication between plane and ground.

Electrified Cables

Because of the comparative simplicity of detecting magnetic fields, considerable attention was given to the use of electrified cables for indicating flight paths over the ground. The "leader cable" developed for guiding surface craft in harbors was tested by the Army Air Corps at Wright Field and found to have possibilities. The pilot, arriving at an airport covered with fog, would be directed by the regular directional radio beacon and through radio telephone to a point over the

field where the electrified leader cable would be picked up. He could then drop into the field, either following marker beacons or receiving directions by radio telephone until a safe landing was effected.

Televox Lights Airport

The Westinghouse Electric and Manufacturing Company perfected a device which enables a pilot to turn on the floodlights of a landing field which he is approaching by sounding a siren. While it does not employ a radio as its medium, it is associated to the same general problems being considered in this chapter and it is interesting to review the achievement.

The plane, equipped with a wind-driven siren which gives off sound waves of a frequency to which the instrument on the ground is tuned, turned on the floodlights of the Newark Airport while several thousand feet above it. The siren sound wave was picked up by a megaphone on the ground and so amplified that its energy was increased ten million times and became strong enough to turn on the floodlights.

The possibilities of the device lay particularly in facilitating the lighting of intermediate or auxiliary fields, which may be used in emergencies but are not regularly attended.

Radio Pictures to Plane

While still far from commercial application for daily use, it is interesting to note that the German Lufthansa, the German air transport syndicate, reported the successful transmission of three pictures, including a weather chart, to a plane in flight. Radio was used to send the pictures to the plane, employing the same principles involved in the transmission of radio pictures across the seas, but with lighter equipment for airplane use.

Doolittle Guggenheim Tests

While other factors entered into the success of Lieut. James H. Doolittle's "blind flying" feat sponsored by the Daniel Guggenheim Fund for the Promotion of Aeronautics, radio played an important and spectacular rôle. His months of experiments to solve the problems of fog flying were climaxed September 24 when he took off from Mitchel Field in a "blind cockpit," flew away from the airport and then returned to make a safe landing without once seeing the ground.

The Consolidated (Wright Whirlwind) Husky plane was equipped with a covered cockpit so that the pilot was forced to rely

upon radio and his instruments alone. The visual radio beacon and two-way radio communication were important aids in directing Lieutenant Doolittle back to the field for a safe landing. The other factors concerned in this feat are considered in the chapter on "Trends in Design."

Hague Radio Conference

Two committees considered international aspects of the problems related to aircraft communications at the C. C. I. R. Conference in The

FLYING RADIO LABORATORY

Fokker Super-Universal (Pratt and Whitney Wasp) used for experimental work by the Radio Frequency Laboratories.

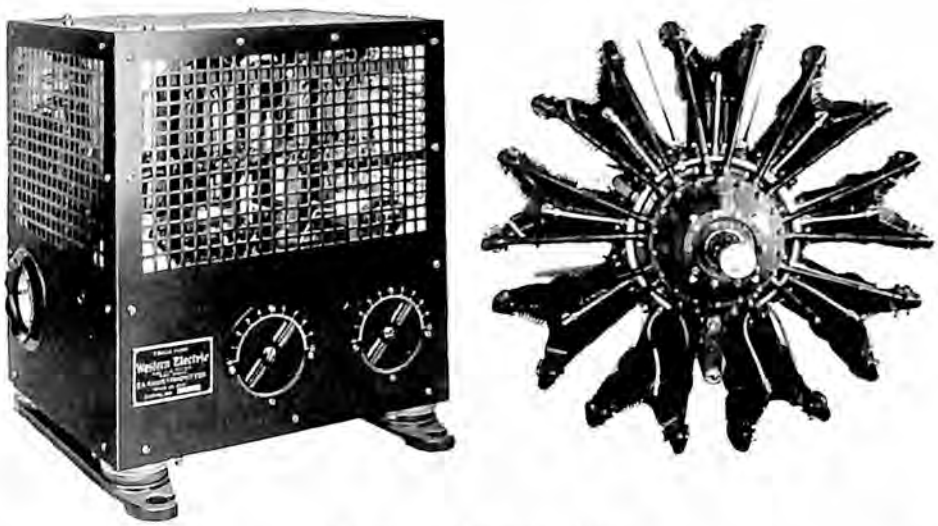
Hague, Holland, September 18 to 27. The American air transport operators were represented by H. C. Leuteritz, official delegate of the Aeronautical Chamber of Commerce. The discussions laid the groundwork for a future conference at Madrid, but did not result in the adoption of any set rules by the nations represented.

Upon his return to the United States, Mr. Leuteritz recommended that tests be undertaken immediately to investigate the use of frequencies above 6,000 kilocycles for aircraft use and that the frequencies found most useful be registered at Berne through the federal government.

He further recommended that those frequencies below 6,000 kilocycles now in use or contemplated, together with all other frequencies set aside by regional agreement in accordance with the Federal Radio Commission decision, be registered at Berne for use by the United States.

European Radio Survey

Following the Hague Conference, Mr. Leuteritz made a survey of Holland, Germany, France and England to investigate radio progress in those countries for the Technical Radio Committee of the Air Trans-



RADIO EQUIPMENT

Western Electric radio transmitter for aircraft (left) and an illustration of ignition shielding for radio on aircraft engines as developed by Breeze Corporations.

port Section. He reported the exclusive use of continuous wave telegraphy for communication with planes of the German Lufthansa, while in all other European countries weather information is broadcast by telephone on a 900 meter wavelength with 2 kilowatt output transmitter.

All traffic between European airports is handled on a wavelength of 1,400 meters and the service is maintained by the governments. The transmitters in use in Germany and France are rated at 2 kilowatt output while in England they are rated at 4 kilowatts. All direction and position finding for land planes is done by ground direction finders in Europe, a system little used in America. For seaplane work the planes themselves are equipped with rotating loop direction finders.

In Germany, government legislation compels airplanes carrying four passengers or more to be equipped with radio. In 1930 a modification of the law will become effective making it necessary for planes carrying two or more passengers to carry radio, as well as a radio operator. The airplane transmitters in general use on German airlines are of the vacuum tube type rated at 70 watts output, with a trailing wire antenna and wind-driven generator.

In France, government legislation also provides for the use of radio on all planes but the law is not strictly enforced, many planes being unequipped and some having old type sets which are of little value. Transmitters of from 50 to 70 watts output are used with wind driven generators supplying the power.

In England, the pilot generally operates the radio equipment himself, using either radio telegraphy or telephony, although there is a trend toward employment of a radio operator for each plane.

Conclusion

The rapid strides made in the United States during 1929 utilizing high frequencies for aircraft has resulted in a reduction of weight and greater reliability of equipment, and provides a fair indication that American air transport lines plan a radio network unparalleled any place in the world.

SPEEDING THROUGH SOUTH

Southern Air Transport Inc. Travel Air (Wright Whirlwind) flying along the edge of Lake Worth, near Fort Worth, Tex.

EN ROUTE TO ROOSEVELT DAM

Scenic Airways, Inc., monoplane flying over mountainous region enroute to Roosevelt Dam.

CHAPTER V

AERIAL SERVICE

THE annual survey of aerial service operations made by the Aeronautical Chamber of Commerce disclosed that more than one hundred million miles were flown and nearly three million passengers carried during 1929 in this specialized field of aeronautical activity. All flying not classed as scheduled air transport or private flying was included in the aerial service summary, embracing short pleasure "hops," charter flights, student instruction and solo, aerial advertising, demonstration, exhibition flying, crop dusting, photography, mapping and other miscellaneous activities.

During 1929 the Department of Commerce listed 633 concerns doing short "hops" and charter business, 94 doing aerial advertising, 11 engaged in crop dusting, 50 engaged in exhibition flying, 164 making aerial photographs and maps, and 419 operating flying schools. Allowing for duplications in which single operators engaged in more than one line of activity there were 800 aerial service concerns in the United States according to the Department of Commerce directory.

The statistical estimates made by the Aeronautical Chamber of Commerce were based on reports of 75 typical operators and computed to include all aerial service concerns in the United States listed by the Department of Commerce. The survey showed that aerial service operators were located on 1,064 airports scattered throughout the United States, ready to serve individuals or corporations throughout the 24 hours of the day. It also indicated that a large share of the airplanes in operation were in the hands of these operators. The statistical estimates revealed that 7,695 airplanes were operated in aerial service, 7,408 being single-engined land planes, 49 tri-motored land planes, and 238 seaplanes and amphibians.

A total of 1,304,207 hours were flown during the year in all classes of activity considered under the general head of aerial service. Estimating all flights upon an average of 80 miles an hour, the survey showed that 104,336,560 miles were flown—a distance equal to more than 4,000 times around the earth at the equator. Short hops and charter flights required 362,256 hours in the air; photography and mapping, 3,075 hours; crop dusting, 1,958 hours; student instruction and solo, 711,352 hours, and unclassified flying, 225,568 hours. The number of passengers carried totaled 2,995,530.

The number of persons employed in aerial service operations was

20,944, including 3,658 pilots and 14,080 mechanics, mechanics' helpers and laborers. Two hundred and ninety-three hours was the average time flown during the year by each pilot employed. The survey indicated unmistakably that large ground forces, including shop workers, executives and salesmen, were necessary to keep a relatively small number of pilots busy.

Almost without exception, the operators reporting expanded their business during 1929 and bought new airplanes, enlarged their service facilities, built new buildings and in many cases improved the airports from which they were operating. A majority of the reports indicated substantial increases in business volume varying from 50 to 500 per cent, while a few reported decreases in their volume of business traceable to some unusual cause.

The employment of better equipment, more experienced pilots, sounder business and accounting methods, and a far greater measure of regularity in operations brought renewed confidence in aerial service from the flying public. Several of the most enterprising concerns had developed feeder lines connecting with the principal air transport routes, operating regular air taxi or ferry service over routes from 25 to 200 miles in length.

The Aeronautical Chamber of Commerce survey showed that the average charter rates per mile were: 45 cents for single-engined land planes, $1.34 for tri-motored land planes, 38 cents for seaplanes, 96 cents for single-engined amphibians and $1.60 for twin-engined amphibians. Rates for short hops reported through the survey averaged $3.26 per person, with 2.6 persons as the average load on each flight, which lasted an average of 9½ minutes.

The reports also provided an interesting study of the equipment used. The average passenger capacity of the single-engined land planes was 3; tri-motored land planes, 12; seaplanes, 3, and amphibians, 6. The number of air-cooled engines in use more than doubled the number of water-cooled engines. In the air-cooled engine class below 100 h.p. there were 704. However, most were classed over 100 h.p. but below 300 h.p., where 4,752 engines were estimated to be in use. Five hundred and sixty-five air-cooled engines of more than 300 h.p. were in service. In the water-cooled class, 2,744 were of 100 h.p. or under, while 104 were over 100 h.p. but under 200 h.p. The total number of engines in use by aerial service operators was set at 8,869, 6,021 being air cooled and 2,848 being water cooled.

The statistical estimates showed that 6,968 students were trained for pilots' licenses during 1929, 324 receiving instruction and solo toward transport licenses, 2,396 toward limited commercial licenses, and 4,248

toward private pilots' licenses. The rating of flying schools by the Aeronautics Branch of the Department of Commerce and the active campaign of the Aeronautical Chamber of Commerce Flying School Committee against doubtful schools provided an important stimulus to the development of adequate flying courses and equipment. The result was greater confidence from the general public in the established schools which had received the Department of Commerce rating or had applied for it after fulfilling all requirements for such a rating.

SKY HARBOR

Chicago's new north shore airport, "Sky Harbor," used as a terminus by Gray Goose Air Lines, showing administration building in the background.

Curtiss-Wright Develops Chain

Nationwide chain operation of airplane service stations was carried on during 1929 by the Curtiss Flying Service and its successor, the Curtiss-Wright Flying Service, with the establishment of more than 40 standardized bases in as many cities throughout the United States. Additions to the list were being planned when the year ended.

The Curtiss-Wright Flying Service, formed during the year after the merger of the Curtiss and Wright interests, is a direct descendant of the Curtiss Exhibition Company, formed by Glenn H. Curtiss at Hammondsport, N. Y., in 1910. The present company, which retains

the title of the "world's oldest flying organization," is like its predecessor in that it is ready to supply any type of flying service for which there may be a demand.

At the opening of 1929 the Curtiss Flying Service, Inc., formed the previous year and capitalized at $10,000,000, had four bases in operation and employed about 100 persons. In November the Curtiss-Wright Flying Service, Inc., had established 42 bases, all but four of which were in operation. The number of employees totaled 1,105, of which 930 were field personnel and 175 were employed in the company's national headquarters in New York City. Practically all of the bases were established before the Curtiss-Wright merger became effective August 15.

The activities at each base of the Curtiss-Wright Flying Service include: retail sale of airplanes and complete line of accessories, servicing of all types of airplanes by standardized methods, aerial charter and taxi service, standardized flying instruction for all classes of students, aerial photography, dusting of farm lands to eliminate insect pests, special missions for newspapers and news reel organizations and all other forms of commercial aviation work.

The activities of the traffic department during 1929, in addition to charter flying, included the operation of experimental lines on daily schedules between New York and Atlantic City; New York, Saratoga and Lake George, and Boston, Hyannis and Martha's Vineyard. Radio engineers of the marine division perfected equipment for two-way radio communication between amphibians in flight and their shore stations. Later all marine division passenger planes were ordered equipped with radio to increase safety and regularity of operations.

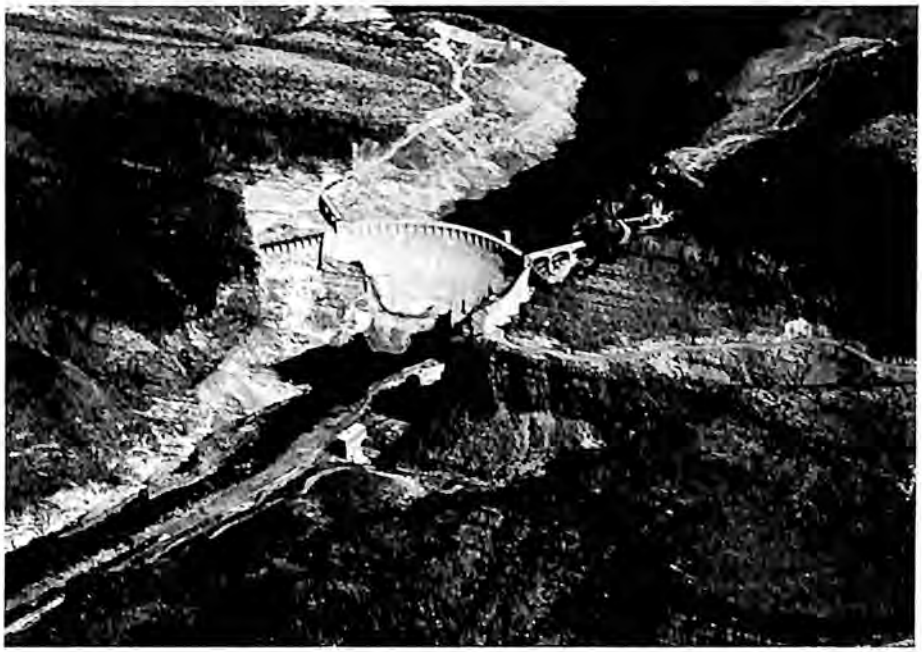
A women's department was organized to promote interest in aviation among women. The new department was rapidly moving into its extensive program of educational and promotional work when the year ended.

Because of the magnitude of the undertaking, the 42 bases of the Curtiss-Wright Flying Service reported total operation figures far exceeding those of any other aerial service operator. The report showed that 99,217 passengers were carried by this one organization, with a gross volume of business from all sources of approximately $4,000,000. Eleven thousand hours were flown on short hops and charter flights, 100 hours on photographic and mapping missions, 500 hours in crop dusting, 35,000 hours in student instruction and solo, and 15,564 hours in miscellaneous flights.

The Curtiss-Wright flying schools, comprising the most extensive chain in the country, had 1,250 students enrolled for ground school work and 1,025 for flight instruction during the year. Thirty-five instructors were employed full time to carry on the work at six schools

which had received the Department of Commerce Approved Type Flying School rating and eight others which had applied for the rating. The schools already rated were located in San Francisco, Los Angeles, Kansas City, Chicago, Detroit, and Valley Stream, L. I. Those which had applied for rating were in Bridgeport, Conn.; Hartford, Conn.; Portland, Columbus, Indianapolis, Louisville, Memphis and Buffalo.

Gorst Air Transport, Inc., carried 17,500 persons between June 15 and October 15 on its Seattle-Bremerton air ferry established this



ROOSEVELT DAM

Famous dam just 25 minutes from the Phoenix, Ariz., Sky Harbor of Scenic Airways, Inc., by Ford tri-motored planes.

year. Eleven 15-minute trips each way were made during the day to demonstrate the practicability of air ferries. The line proved one of the most successful aerial service ventures of the year.

Roosevelt Flying Corporation at Mineola, L. I., carried 15,900 passengers from May until the end of the year; the Aero Corporation of California in Los Angeles reported 14,988 passengers flown; Chicago Air Service, Inc., operating Gray Goose Air Lines, 12,520 persons; Rogers Aircraft, Inc., in Los Angeles, 12,265 passengers, and Scenic Airways, Inc., in Phoenix, Ariz., 16,336 passengers.

In the flying school field, Parks Air College, Inc., in East St. Louis,

Ill., erected a new factory, new school for airplane and engine mechanics, and a new student dormitory as a part of its program to maintain the largest flying school in the country. The school became a division of the Detroit Aircraft Corporation in September at a reported purchase price in excess of $1,000,000.

The new mechanics' school is a $75,000 structure of brick and steel with glass sides. Throughout the year an average of 185 students were in attendance and the close of 1929 found graduates at work in aircraft factories throughout the country. A $60,000 dormitory to house 200 students at a low rental rate was completed on the airport. The school was one of the first three to obtain the Department of Commerce approved type rating.

The Boeing School of Aeronautics was opened on the Oakland, Calif., Airport, with an ambitious program for raising the standard of flying and ground school instruction comparable to the academic level maintained by universities. A graduate transport pilot's course, known as a "Master Pilot's Course," was offered as one of the features of the new school. The course was designed to provide air transport companies with trained men who need but little seasoning to qualify them as mail and passenger pilots after graduating from the school.

An extensive ground school curriculum was required with all flying courses. In the private pilot's license course 35 hours of classroom work was required. The ground school course for the master pilot was 864 hours, and the master mechanic's course 1,008 hours. The school was sponsored by the Boeing manufacturing and operating interests.

The Aviation Corporation, through Roosevelt Aviation College, Inc., and the chain of Universal Aviation Schools operated as divisions of the holding company, forwarded its plans for an extensive system of flying schools in all parts of the country. The Roosevelt Aviation College at Mineola, L. I., operating under an approved type rating of the Department of Commerce, was typical of the Aviation Corporation's school units. It reported 2,129 hours of student instruction, 1,286 hours of student solo and 236 hours of unclassified flying from May 1 until the end of the year. The facilities of the college were expanded to care for an increase in the gross volume of business, reported at $75,000.

Divisions of the Universal Aviation Schools system were operating in St. Louis, Mo.; Minneapolis and St. Paul, Minn.; Marion, Ill.; Kansas City, Mo., and Rochester, Minn. More than $100,000 worth of flying equipment alone was added to the facilities of these schools during the year. Executives of the system adopted a policy of expanding the chain by absorbing well-established schools in strategically located centers rather than opening new schools.

The flying school of the Aero Corporation of California, Inc., in Los Angeles, also operating under an approved type rating, reported the training of 106 private pilots and 10 limited commercial pilots during a year in which the school's facilities were materially expanded.

Flying School Ratings

The movement to raise the standards of flying schools through the rating of each institution was started by the major operators themselves

ALONG THE HUDSON

New York's new span across the Hudson River, photographed by Fairchild Aerial Surveys, Inc.

through the Flying School Committee of the Aeronautical Chamber of Commerce. When it became apparent that the Department of Commerce was not empowered by the Air Commerce Act of 1926 to supervise and rate flying schools, the Chamber committee took steps to establish regulations for such a system of ratings.

An amendment to the Air Commerce Act, passed Feb. 28, 1929, authorized the Secretary of Commerce to provide for the examination and rating of flying schools upon the request of owners or representatives of the schools. The regulations drafted by the Chamber Flying School

Committee were turned over to the Department of Commerce and the committee worked with the new administrative officers in the development of its present system. The regulations became effective May 1 when they were mailed to the 800 aerial service and flying school operators. Seven aeronautical inspectors began the task of inspecting schools June 1 on the basis of applications received. Five schools were in the first group of approved certificates issued July 15. Additions were made to the list until at the end of the year 24 were included with the number still mounting.

The Flying School Committee of the Aeronautical Chamber of Commerce was active throughout the year, devoting considerable time

IN THE NORTHWEST

Loening amphibian (Wright Cyclone) of Gorst Air Transport, Inc., landing at Seattle, operating base for the service in the northwest.

and energy to the investigation of doubtful schools reported to it. Working in co-operation with the Better Business Bureaus, the committee hoped to rid the country of inadequate schools which misrepresented their facilities and training.

Photography and Mapping

Aerial photography and mapping continued to play an increasingly important part in the activities of operators especially equipped for this work. Industrial concerns were making greater use of aerial photographs to aid in planning new developments, and newspapers were constantly

in the market for new views of striking events or scenes from the air.

The photographic division of the Curtiss-Wright Flying Service completed an aerial mosaic map of more than 8,000 square miles of the Mississippi flood district in the vicinity of Memphis, Tenn., in connection with President Hoover's flood relief program. The photographic division also perfected a method of making aerial photographs of golf courses for use in diagraming plans.

Fairchild Aerial Surveys, Inc., a division of the Aviation Corporation, continued the development of its cameras and technique to care for an

FIGHTING BOLL WEEVIL

War on the boll weevil during 1929 was extended over 500,000 acres in the South. A plane is seen dusting cotton in Louisiana, leaving a trail of poisonous powder behind.

increased volume of business in mosaic maps for governmental engineering work, public utility engineering, park developments and oblique photographs for use in advertising makeup. Branches of the company were located in Dallas, Tex., and Los Angeles.

Boll Weevil Control

The Department of Agriculture through its crop insect investigation unit in Louisiana conducted new experiments in cotton and crop dusting

in line with the policy established almost a decade ago. Experimental work included the dusting of several thousand acres during 1929, although no commercial dusting was done by the department.

Commercial operators were aided by Dr. B. R. Coad and his research assistants at Tallulah, La., but no attempt was made to carry on commercial dusting operations with Government planes. This field was left exclusively to manufacturers and operators interested in perfecting equipment to do the work. Hoppers, agitators and other equipment were developed by the Department of Agriculture and adapted to 20 different model airplanes. Blueprints of design and installation were made available to any manufacturer or operator interested in the work.

Approximately 500,000 acres of cotton were dusted in the United States during 1929 in an effort to control the boll weevil, according to Department of Agriculture reports from its southern field laboratory. Planes also were used to rid plants of the cotton louse, leaf worm, flea hopper and bollworm. Large scale operations in this specialized field brought several new operators into the South with a resultant reduction in contract prices for commercial dusting.

The widespread interest in cotton dusting was exemplified by the fact that representatives of several foreign nations visited the Tallulah experiment station to study methods of operation and equipment. Approximately twoscore plant pests were being fought through airplane dusting, although operations against the boll weevil were the most extensive.

Pink Bollworm Control

Several years of studying the insect content of the upper air with airplanes were climaxed with the tracking of the American cotton field pest—the pink bollworm—to its lair. "Bug-traps," rigged onto the wings of planes, collected insects at various levels in the upper air and formed the basis for extended studies. It was found that the pink bollworm moth flew at high altitudes during a certain season of the year. Later it was learned that the moth was borne aloft by wind currents which made possible migration over hundreds of miles, although it could not fly far with its own wings.

The problem which had perplexed entomologists for years was solved, and the pink bollworm, the world's most extensive cotton pest, was tracked to its lair in the fields of Mexico. It changed the scientists' line of attack and demonstrated the necessity of treating the center of infection in Mexico, although it might be hundreds of miles from Texas cotton fields devastated by the insect.

CHAPTER VI

AIRCRAFT MANUFACTURING

AIRCRAFT manufacturing units of the industry underwent a period of expansion during 1929 unprecedented in their history. The generous flow of capital resulting from public support brought many new companies into the field and resulted in expansion programs for the established concerns. At the end of 1929 there were more plants in the United States manufacturing aircraft than there were producing automobiles. It was evident that some of the companies lacked the necessary engineering background and sound business management which would make them successful. The condition forecast keen competition for existing markets, with the ultimate triumph of those units soundly financed and backed by engineering skill capable of offering the public a superior product.

Despite the apparent overcrowding of the manufacturing field, the established and well-founded companies made great strides in the technical development of their products and the improvement of production methods necessary to the conduct of a profitable business. The remarkable progress made in the refinement of engineering designs to increase the speed and efficiency of planes and the development of production methods, similar to those which have made the automotive industry so successful, will be considered in a later chapter on "Trends in Design." The chief purpose of this chapter is to consider the type and character of the principal manufacturers' products and to describe the trends in the manufacturing branch of the industry.

The Department of Commerce listed 157 companies manufacturing aircraft in the United States at the end of 1929. The progress made by 89 of these concerns, 71 of which were in production and 18 in experimental work worthy of note, will be considered in this chapter. There were 101 firms in 29 states engaged in the manufacture of aircraft, according to a survey made in May by the U. S. Bureau of Labor Statistics. Seventy-eight of these companies reported that they had turned out planes. There were 68 aircraft manufacturers in the Aeronautical Chamber of Commerce in 1929.

The Department of Commerce had issued 282 Approved Type Certificates for aircraft to 72 different manufacturing companies at the end of 1929. Such certificates were required for all aircraft offered the general public by manufacturing concerns, and placed the government's stamp of approval upon the craft after completing tests outlined

by the Department of Commerce in its engineering code, known as the Airworthiness Requirements. During 1929, 186 Approved Type Certificates were issued by the Department of Commerce on new airplanes.

There were 16,105 employees on the payrolls of the 101 establishments reporting to the Bureau of Labor Statistics in May. At the close of 1929, 53 of the manufacturing companies reporting to the Aeronautical Chamber of Commerce had 17,031 employees in their plants.

Expansion during the year was exceptionally rapid. New plants were built or additions providing hundreds of thousands of square feet of floor space were made to old ones. New machinery and equipment was employed and for the first year in the history of the commercial industry, the larger concerns were using line production methods similar to those in the automotive field.

With some notable exceptions, a major share of the manufacturing units which undertook great expansion programs were affiliated in some way with the several great financial groups formed through mergers in 1928 and 1929. While, as it was pointed out in the chapter on "Air Transport Progress," the Aviation Corporation devoted a major share of its attention to the transport field, this holding company had a manufacturing unit in the Fairchild Aviation Corporation, with plants in Farmingdale, N. Y., and Hagerstown, Md.

No fewer than seven manufacturing units were included in the holdings of the Curtiss and Wright interests, with five of them directly controlled by the Curtiss-Wright Corporation. The seven were: Curtiss Aeroplane and Motor Company, Inc.; Curtiss-Robertson Airplane Manufacturing Company; Curtiss-Caproni Corporation; Keystone Aircraft Corporation; Loening Aeronautical Engineering Corporation, a division of Keystone; Moth Aircraft Corporation, and the Travel Air Manufacturing Company, Inc. The first six named were directly included in the Curtiss-Wright merger, and the latter was closely affiliated through the Wright interests, headed by Richard F. Hoyt, chairman of the board of the Curtiss-Wright Corporation.

Detroit Aircraft Corporation, a new holding company formed during the year with Edward S. Evans of Detroit as its president, controlled Blackburn Aircraft Corporation, Eastman Aircraft Corporation, Marine Aircraft Corporation, Parks Aircraft, Inc., Ryan Aircraft Corporation, and Lockheed Aircraft Corporation.

General Motors made its entry into the aircraft manufacturing field during the year by obtaining control of the Fokker Aircraft Corporation of America through a 40 per cent interest in the company.

United Aircraft and Transport Corporation, a $200,000,000 holding company organized late in 1928, controlled five companies manu-

facturing aircraft which were operated as divisions of the larger corporation. The five divisions were: Boeing Airplane Company, Hamilton Metal Plane Company, Sikorsky Aviation Corporation, Stearman Aircraft Company, and the Chance Vought Corporation.

Distribution Methods

Realizing that heavy production schedules necessary to a profitable business must mean the active marketing of their products, most of the airplane manufacturing companies organized sales departments on a national scale or provided for the marketing of their planes through some national agency. Distributorships were authorized in all parts of the country and dealers were set up in the most promising territories.

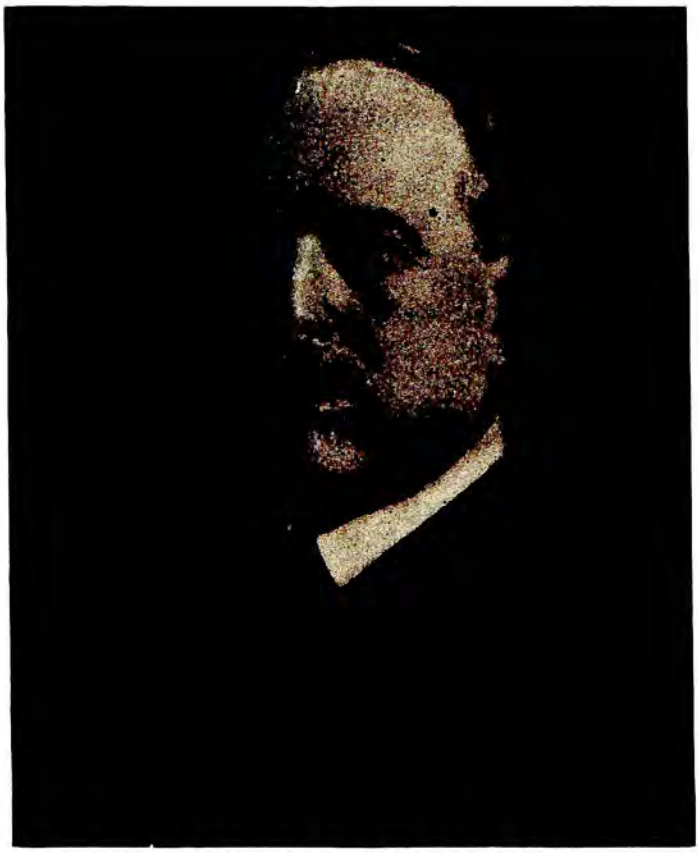
The formation of a national organization of distributors and dealers within the Aeronautical Chamber of Commerce to study marketing methods and work out a uniform business code was accomplished during the year in line with the policies of the major manufacturing concerns. The Distributor-Dealer Section, with units in several widely scattered centers, was set up at the request of the Commercial Airplane Manufacturer's Section of the Aeronautical Chamber of Commerce. It held its first national meeting in Cleveland during the National Air Races, and the several units in New York, Chicago, Cleveland, Indianapolis, and other centers were active in the development of sales aids through shows and other promotional projects.

Some of the manufacturing companies organized export departments to expand their markets beyond the borders of the United States and reported marked success in their first year's efforts. Both the Curtiss-Wright Corporation and the United Aircraft and Transport Corporation organized divisions to develop the export field. The Curtiss-Wright Corporation set up the Curtiss-Wright Export Corporation, and the United group organized the United Aircraft Exports, Inc.

At the end of the year, the Export Committee of the Aeronautical Chamber of Commerce was busily engaged in the development of an export cable code, designed to save the industry thousands of dollars in cable and wire charges through the use of simple symbols in ordering aircraft, engines or parts. The code had been approved by the committee and the money necessary for its preparation appropriated.

Growth of Manufacturers' Section

The growth of the industry was reflected in the expansion of the Commercial Airplane Manufacturers' Section of the Aeronautical Chamber of Commerce. At the end of the year, approximately 95 per cent



RESIGNS CHAMBER POST

Samuel Stewart Bradley, first general manager of the Aeronautical Chamber, resigned May 1, 1929, to devote his full time to the Manufacturers' Aircraft Association, of which he has been general manager since 1917.

AN APPRECIATION

"There was a time when this body, which today embraces within its membership hundreds of corporations from all parts of the United States, existed only as an idea, and that idea was first expressed, nurtured and developed by Samuel S. Bradley.

"Since its inception in 1921, the Aeronautical Chamber of Commerce has been under the management of Mr. Bradley. That it was able to survive during its first difficult years was due to his untiring efforts. That it was able to meet the long expected opportunity to serve the industry, when our commercial expansion began three years ago, was due to Mr. Bradley more than any other man.

"Mr. Bradley leaves this work with the realization that what once existed only as an idea is now a tangible powerful reality. The impartial spirit which characterized his actions has, through his personal example, inspired in all the operations of the Chamber a spirit of mutual co-operation and good-will.

"We are indebted to him. We are grateful to him. In accepting his resignation, which he has several times offered, we are unwilling to admit that he shall completely separate himself from the work to which he devoted himself for so many years. While releasing him from labor now grown impossible because of other exacting duties, we shall still look to an unbroken continuance of his friendly association and mature counsel."—*Resolution of Chamber Executive Committee Accepting the Resignation.*

of all companies engaged in some phase of the aeronautical industry were included in the membership of the Aeronautical Chamber of Commerce which had passed the 1,000 mark. Out of this membership, 68 corporations engaged in the manufacture of aircraft were active in the Commercial Airplane Manufacturers' Section.

The annual national meeting of the section in Cleveland during the National Air Races found the manufacturers generally well satisfied with the present engineering requirements set up by the Department of Commerce as a basis for issuing approved type certificates.

Since it was considered highly important for designers and constructors of aircraft to know exactly what the Airworthiness Requirements are at any one time, the manufacturers and government officials agreed that changes in the requirements should be made according to a definite code of procedure, which should not work a hardship on the constructors or unnecessarily burden the Department of Commerce.

The Commercial Airplane Manufacturers' Section maintained a close liaison with the Department of Commerce on all technical matters arising during the year. The section also published a Directory of Sources of Supply to aid manufacturers in the selection of parts, materials or accessories.

Manufacturing Progress

While necessarily brief, the following résumés of the year's activities in 88 widely scattered aircraft manufacturing establishments provide a picture of the general expansion and progress during the year. Established companies added new products to their lines or refined those already in production, while new concerns entering the field put products into competition with those on the market. They are listed alphabetically for convenience in future reference.

Acme Aircraft Corporation of Rockford, Ill., completed its experimental work on a two place open cockpit biplane mounted with a Wright Gipsy 85 horsepower engine. The Acme Sportsman, as the new model was called, was designed by Edward A. Stalker, head of the department of aeronautical engineering in the University of Michigan. The initial flight was made October 2 and company officials expected to receive their Approved Type Certificate so that they might enter production in 1930.

Aeromarine-Klemm Corporation of Keyport, N. Y., continued the production of light planes. Besides the Model AKL-25-A, a two place open low wing monoplane powered with a Salmson 40 horsepower radial engine, a new model, the AKL-60 was introduced during the year. It was powered with a Le Blond 60 horsepower radial engine and incorpo-

rated slight changes in the design of the tail surfaces and the length of the fuselage.

Aeronautical Corporation of America in Cincinnati, O., moved into a new factory on Lunken Airport and started manufacture of the Aeronca C-2, a two place open monoplane powered with a two cylinder air cooled radial motor of their own manufacture with a rating of 30 horsepower. The plane weighed but 700 pounds and was designed for low cost of operation as well as low initial cost.

NEW STEARMAN IN FLIGHT

Stearman (Wright Whirlwind) C4A biplane with special N.A.C.A. cowling accommodates three persons.

Alexander Aircraft Company of Colorado Springs, Colo., manufactured seven different biplane models, powered with Curtiss OX5, Kinner, Hispano Suiza A, Comet, Curtiss Challenger, Wright J-6 and Wright J-5 engines. Beside this line of Eaglerock models which was in standard production, the Alexander Bullet, a low wing, dual control, four place monoplane, was produced experimentally during the year. It was equipped with retractable landing gear and powered with either the Wright J-6 165 horsepower, or Kinner engine. Its high speed to horsepower ratio was an outstanding feature.

Alliance Aircraft Corporation of Alliance, Ohio, produced the Argo, a two place open cockpit biplane powered with a Hess Warrior engine.

American Aeronautical Corporation of Port Washington, N. Y., closely affiliated with the Great Lakes Aircraft Corporation, was the American manufacturer of Savoia-Marchetti flying boats and amphibians of Italian design. The S-55, a double hull, 17 place flying boat with two 500 horsepower Isotta Fraschini engines, was produced, and an experimental S-55 powered with two Wright Cyclone engines was tested. The S-62, an eight place flying boat or amphibian powered with a 500 horsepower Isotta Fraschini engine, and the S-56, a three place baby amphibian powered with a Kinner engine, were produced during the year in the temporary factory at Whitestone, L. I. A new factory with 250,000 square feet of floor space adjoining a seaplane terminal was under construction at Port Washington, L. I.

American Eagle Aircraft Corporation of Kansas City., Kas., moved into its new factory on Fairfax airport designed for line production on a large scale, with 60,000 square feet of floor space. The American Eagle Phaeton, a three place open cockpit biplane powered with a Wright Whirlwind (165 or 225 HP), Hispano Suiza A (150 HP) or Hispana Suiza E (180 HP) engine, was introduced during the year together with the Wallace Touroplane, which was acquired through American Eagle's purchase of the Wallace Aircraft Company, Inc., of Chicago. They also continued production of the standard American Eagle three place open cockpit biplane powered with Curtiss OX5 or Kinner engines.

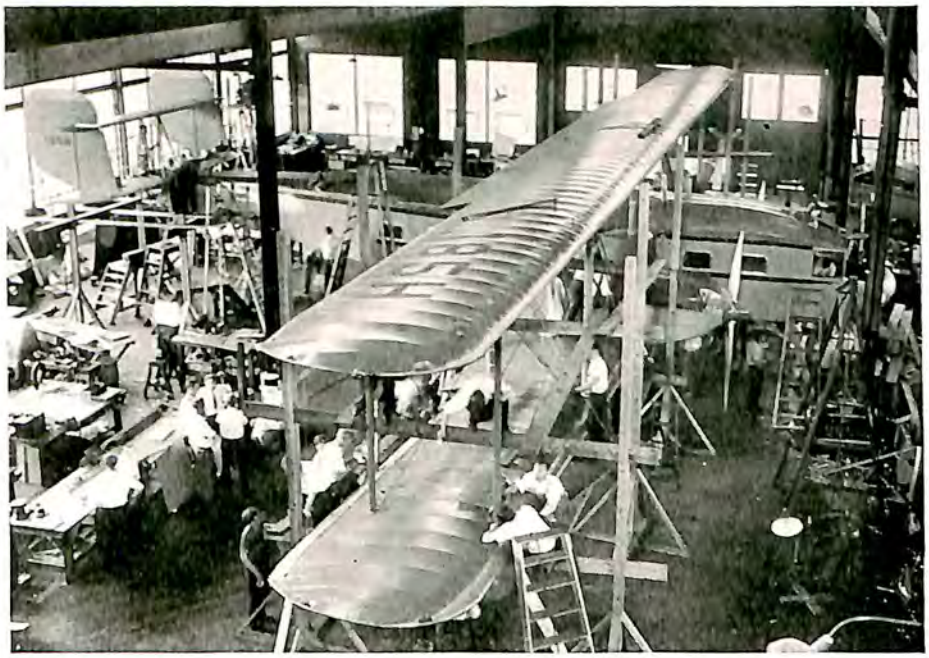
Arrow Aircraft and Motors Corporation of Havelock, Neb., continued production of the A-2-L-60, a two place side by side open cockpit biplane, and introduced the A-2-K-100, powered with a Kinner engine and named the Arrow Sport Pursuit. The A-2-1-90 was of the same general design, but was powered with a Le Blond 90 Horsepower radial engine.

Atlanta Aircraft Corporation of Atlanta, Ga., was formed during 1929 to manufacture aircraft and was still in the experimental stage when the year ended.

Bach Aircraft Corporation of Van Nuys, Cal., produced four different models of a tri-motored ten place cabin monoplane. The four models were designed for these power combinations: one Pratt and Whitney Hornet and two Comets; one Pratt and Whitney Hornet and Wright J-6 165 horsepower engines; one Pratt and Whitney Wasp and two Wright J-6 225 horsepower engines; and three Wright J-6 300 horsepower engines.

Bellanca Aircraft Corporation of New Castle, Del., put three new models into production: the Pacemaker, Pacemaker Wasp, and Pace-

maker Freighter. The Pacemaker and Pacemaker Wasp were six place cabin monoplanes powered with the Wright J-6 300 horsepower and Pratt and Whitney Wasp engines respectively. The Pacemaker Freighter was a four place cabin monoplane with ample room for cargo of freight, powered with a Wright J-6 300 horsepower engine. The CH-300 was continued as a standard production model, while a new two place model designed for a cruising range of 7,000 miles and known as the Tandem was built for a special long distance flight. It was equipped with two



BUILDING HUGE TRANSPORT

A corner of the Curtiss Aeroplane and Motor Company plant at Garden City, L. I., while an 18-passenger Curtiss (2 Curtiss Conquerors) Condor transport is under construction.

Pratt and Whitney Wasp engines in tandem and embodied many departures from conventional design.

Berliner-Joyce Aircraft Corporation of Baltimore, Md., moved into its new factory on Logan Field, May 30, and the first B/J Commercial plane, a two place cabin model with a new wing arrangement, was test flown August 23. Three new experimental models for military use were manufactured on government contracts: the XFJ-1, a single place fighter for the Navy; the XP-16, a two place pursuit for the Air Corps; and the XO-31, a light observation plane for the Navy. Pontoons also were manufactured on Navy contracts.

Bird Wing Commercial Aircraft Company of St. Joseph, Mo., received an Approved Type Certificate December 5 on its Bird Wing Imperial model 10, powered with a Wright Whirlwind 165 horsepower engine, and planned production of the model in 1930.

Boeing Airplane Company of Seattle, Wash., a division of United Aircraft and Transport Corporation, increased its factory floor space from 165,201 square feet to 272,470 square feet and employed 1,520 employees during peak production in the summer. The normal factory force was 1,174. Seven commercial models and seven military models

NEW SIKORSKY PLANT

The new Sikorsky plant at Bridgeport, Conn., with its land and seaplane ports is typical of the new developments in plant engineering.

were produced during the year. The new Boeing 80-A, a 20 place trimotored transport powered with three Pratt and Whitney Hornet engines; the Boeing 95, a high speed one place biplane powered with a Pratt and Whitney Hornet engine to carry 1,600 pound pay load; the Boeing 40-B-4, a biplane powered with a Pratt and Whitney Hornet engine and designed to carry four passengers in a cabin with pilot outside; the Boeing 40-B-2, similar to the 40-B-4 but with accommodations for only two passengers; the Boeing 100, a commercial version of the P-12, a single place high performance biplane powered with a Pratt

and Whitney Wasp engine, for sport purposes; the Boeing 204, a six place flying boat powered with a Pratt and Whitney Wasp engine; and the Boeing 203, a three place open biplane powered with a Wright J-6 165 horsepower engine for sport and training, made up the Boeing line of commercial planes. One hundred Army pursuit planes and 29 Navy single-seater fighters were constructed or in production when the year ended.

Brunner Winkle Aircraft Corporation of Brooklyn, N. Y., produced the Bird Model A, a three place open cockpit biplane powered with a

FINAL ASSEMBLY ROOM

Interior of the Boeing Airplane Company plant at Seattle, Wash., showing final assembly of single-seater fighting planes in the foreground and 18-passenger transport in rear.

Curtiss OX5 engine, and the Bird Model B, a ship of the same general design powered with a Kinner engine.

Buhl Aircraft Company of Marysville, Mich., produced three different models during the year. The Sport Airsedan was a three place cabin sesqui-plane powered with a Wright J-5 or Wright J-6 300 horsepower engine. The Standard Airsedan was a six place cabin sesqui-plane powered with a Wright J-6 300 horsepower engine, and the Senior Airsedan was an eight place cabin sesqui-plane powered with a Wright

Cyclone, Pratt and Whitney Wasp or Hornet engines. The Standard Airsedan was first flown in February. A square mile of land was purchased for a factory site and airport with frontage on the St. Clair River, which will later be developed into a seaplane base.

Butler Manufacturing Company of Kansas City, Mo., produced the Black Hawk, a three place open cockpit biplane powered with a Wright J-5 engine.

Cessna Aircraft Company of Wichita, Kas., supplemented its standard line of monoplanes with three new models, each having a passenger capacity of four and powered with the Curtiss Challenger, Wright J-6 200 horsepower, and Wright J-6 300 horsepower engine. The new models followed very closely the lines of the original Cessna model with some refinements, except that all dimensions were increased in size. The company began the development of its own sales organization late in the year after the sales agreement with the Curtiss Flying Service was terminated.

Command-Aire, Inc., of Little Rock, Ark., continued to produce its standard line of three place open biplanes powered with four different engines: Curtiss Challenger, Wright J-6 165 horsepower, Axelson, and Warner. A Challenger powered stock model was entered in the Guggenheim Safe Aircraft Competition.

Consolidated Aircraft Corporation of Buffalo, N. Y., produced the Commodore flying boat, a 25 place ship powered with two Pratt and Whitney Hornet engines. The Fleetster, an all metal eight place cabin monoplane powered with a Pratt and Whitney Hornet engine and having a top speed of 195 miles an hour, was introduced. The Fleet, a two place open cockpit biplane, designed for training, was produced with both Kinner and Warner engines, and Consolidated Husky land and seaplane training craft were supplied to the Army and Navy. The Thomas-Morse Aircraft Corporation was absorbed during the year.

Corman Aircraft, Inc., of Dayton, O., was organized during 1929 and produced one experimental tri-motored cabin monoplane.

Cunningham-Hall Aircraft Corporation of Rochester, N. Y., produced the PT-6, a six place cabin sesqui-plane powered with a Wright J-6 300 horsepower engine. A two place open cockpit plane with a high lift wing was especially designed for entry in the Guggenheim Safe Aircraft Competition.

The Curtiss Aeroplane and Motor Company, with plants in Garden City, L. I., and Buffalo, N. Y., employed 3,257 persons, an increase of 1,100 over 1928. Six planes were in production, four of them developed during 1929. The Condor B-20, a 21 place cabin biplane powered with two Curtiss Geared Conquerer engines, was designed for heavy transport work. It was adapted from the Condor B-2, bombing plane, which was

in production for the Army Air Corps. The Falcon O1-E, powered with a Curtiss Conqueror engine, was produced for a mail contractor as well as a number of Falcons powered with Liberty engines. The Carrier Pigeon II, powered with a Curtiss Geared Conqueror, was developed as a high speed heavy duty mail plane. Fledgling Junior, powered with Curtiss Challenger engine, was manufactured for sport and training purposes, while the military services were supplied with a large number of Fledgling training planes. The Hawk-P6, powered with a Curtiss Conqueror, was developed as a new Army Corps pursuit plane. The King Bird, an eight place cabin monoplane powered with two Wright J-6 225 horsepower engines, was developed for commercial use, and the Tanager, a special plane powered with a Curtiss Challenger and embodying many departures from conventional designs, was entered in the Guggenheim Safe Aircraft Competition.

Curtiss-Robertson Airplane Manufacturing Company of Anglum, St. Louis County, Mo., expanded its factory space from 55,000 to 140,000 square feet and employed 508 persons during peak production. The Curtiss Robin, powered with Curtiss OX5 and Curtiss Challenger engines, was continued in production, while a Robin powered with a Wright J-6 165 horsepower or Warner engine was developed. Plans for production of the Thrush, a six place cabin monoplane powered with a Wright J-6 225 horsepower engine was completed and a Robin 4-C, a four place cabin monoplane powered with a Curtiss Challenger engine, was in the experimental stage.

Dare Aircraft Company of Detroit, Mich., was in the experimental stage on a three place ship powered with either a Kinner or Warner engine, to be known as the Dare Variable Camber.

Davis Aircraft Corporation of Richmond, Ind., produced its model D-1, a two place parasol type monoplane powered with a Le Blond engine, and a D-1K, a model of similar design, but powered with a Kinner engine.

Douglas Aircraft Company, Inc., of Santa Monica, Cal., moved into a huge new plant during the year and continued the manufacture of its models exclusive for military and mail transportation purposes. A production line was maintained on adaptations of the O2 series, army two place observation planes, with O2-H and O2-K as the models manufactured during 1929. A contract for navy patrol boats also was filled. From 500 to 950 employees were on the payroll throughout the year.

Doyle Aero Corporation of Baltimore, Md., produced a two place open parasol wing monoplane known as the Oriole O-2, powered with a Le Blond engine.

Eastman Aircraft Corporation of Detroit, Mich., a division of the

Detroit Aircraft Corporation, produced the Sea Rover, a four place open biplane flying boat powered with a Curtiss Challenger engine.

G. Elias and Bros., Inc., of Buffalo, N. Y., had two models known as the Air Coupe and Air Sport, two place monoplanes with Anzani engines, in the experimental stage.

Emsco Aircraft Corporation of Downey, Cal., purchased the Albatross Aircraft Corporation and produced the Emsco Cirrus, a two place center wing open cockpit monoplane powered with an American Cirrus engine, and the Emsco Challenger, a tri-motored eight place cabin monoplane powered with three Curtiss Challenger engines. The planes were in the experimental stage and were to be placed in production early in 1930.

Fairchild Aviation Corporation of Farmingdale, L. I., and Hagerstown, Md., a division of the Aviation Corporation, produced as standard models the Fairchild 71, a seven place cabin monoplane powered with a Pratt and Whitney Wasp engine, and the KR-21, a two place open cockpit biplane originally developed by the Kreider-Reisner Aircraft Company, powered with a Kinner engine, for training and sport purposes. The KR-34, three place open cockpit biplane with Wright J-6 165 horsepower engine, was introduced during the year, and the Fairchild 42, a four place cabin monoplane powered with a Wright J-6 300 horsepower engine, was developed.

Fokker Aircraft Corporation of America, with factories at Hasbrouck Heights, N. J., Passaic, N. J., and Wheeling, W. Va., was controlled by General Motors through a 40 per cent interest and was closely affiliated with Western Air Express. The F-32, a 32 place cabin transport monoplane with four Pratt and Whitney Hornet engines mounted in double tandem, was developed during the year as America's largest transport plane. The F-14, a special mail plane designed to carry six passengers in addition to cargo and powered with either Pratt and Whitney Hornet or Wright Cyclone engine, was put into production during the year. F-11A, an eight place monoplane amphibian with a Pratt and Whitney Hornet or Wright Cyclone engine mounted above the wing, was produced, while manufacture of the standard model F-10A and the Super-Universal was continued. The F-10A was a 14 place trimotored cabin monoplane with three Pratt and Whitney Wasp engines, and the Super-Universal was a seven place cabin monoplane powered with a single Pratt and Whitney Wasp engine. The standard Universal, formerly powered with the Wright J-5, was supplied to the market with the Wright J-6 300 horsepower engine. Through arrangements with General Motors, Dr. Claude Dornier, designer of the DO-X which carried 169 persons on test flights in Germany, arrived in the United States late in the year to plan the manufacture of Dornier flying boats

in America. Fokker also completed plans for erection of a new factory on the Alhambra Airport of Western Air Express, near Los Angeles, in 1930.

Golden Eagle Aircraft Corporation of Englewood, Cal., produced a two place open cockpit parasol type monoplane powered with a Le Blond Chief engine.

Great Lakes Aircraft Corporation of Cleveland, O., a division of Allied Motor Industries, produced its model T2-1A, a two place open

FOLDING WING MONOPLANE

Wallace (Kinner) Touroplane, a three place folding wing cabin monoplane built by American Eagle Aircraft Corporation.

cockpit biplane powered with an American Cirrus engine. Production of 18 Martin T4M-1, three purpose, all metal, bombing, torpedo and observation biplanes, was started late in the year on contract for the Navy. Ten thousand square feet were added to the factory floor space during the year, with from 500 to 900 employees on the payroll.

Hall-Aluminum Aircraft Corporation of Buffalo, N. Y., produced two experimental planes for military purposes: the XFH-1, a shipboard fighter with metal fuselage for the navy; and the XPH-1, a two engine patrol boat.

Hamilton Metalplane Division of the Boeing Airplane Company, a

unit of the United Aircraft and Transport Corporation, produced two models at its Milwaukee, Wis., factory. The H-47, an eight place all metal cabin monoplane powered with a Pratt and Whitney Hornet engine, and the H-45, a similarly designed plane with a Pratt and Whitney Wasp engine, were in production.

Hise Aircraft Company of Detroit, Mich., produced an experimental tri-motored six place monoplane powered with three Kinner engines.

Huntington Aircraft Corporation of Bridgeport, Conn., completed wind tunnel tests on a two place monoplane and a four to six place amphibian, with plans for producing these models in 1930.

Inland Aircraft Corporation of Kansas City, Mo., manufactured the Inland Sport, a two place side by side parasol type monoplane powered with a Le Blond or Warner engine.

Ireland Aircraft, Inc., of Garden City, N. Y., produced three amphibian biplane models during 1929. The N-2-B was a five place open or closed amphibian biplane powered with either a Wright J-6 300 horsepower or Pratt and Whitney Wasp engine. The ND-5 and ND-6 were similar to the N-2-B except that the hull was of metal construction.

Kellett Aircraft Corporation of Philadelphia, Pa., was formed during 1929 with plans to produce under licenses of the Cierva Autogiro.

Keystone Aircraft Corporation of Bristol, Pa., a division of the Curtiss-Wright Corporation, moved into a larger plant and produced the Patrician, a 21 place cabin monoplane powered with three Wright Cyclone engines, as well as bombers, LB-6, LB-7, LB-8, LB-9, LB-10, and LB-11, for the Army Air Corps, and training planes, NK-1, and patrol boats of the PN-12 type for the navy. A new observation plane, the XO-15 was delivered to the Army Air Corps.

Joseph Kreutzer, Inc., of Los Angeles, Cal., continued production of its Air Coach, a tri-motored six place cabin monoplane with three Le Blond engines. Other models powered with three Kinner or three Warner engines also were manufactured.

E. M. Laird Airplane Company of Chicago, Ill., continued production of the Laird LCB-200, a three place open cockpit biplane powered with a Wright J-5 engine, and brought out three new models. The LCB-300, a plane of the same general design, was powered with a Wright J-6 300 horsepower engine. The Speed Wing LCR-300 for sport and racing purposes was of the same general design as the LCB series with the exception of less wing surfaces and more streamlining. The LCR-300 was produced with a Wright J-5 engine also.

Lenert Aircraft Company of Pentwater, Mich., continued experimental work on an all metal three place open cockpit biplane. The latest model C was powered with a Continental 165 horsepower engine.

Lincoln Aircraft Company of Lincoln, Neb., produced its model P-3, a three place open cockpit biplane powered with a Curtiss OX5 engine, as well as the Lincoln PT, a two place open cockpit biplane powered with a Curtiss OX for sport and training.

Lockheed Aircraft Corporation of Burbank, Cal., a division of Detroit Aircraft Corporation, continued production of its standard Vega line of five passenger cabin monoplanes powered with Pratt and Whitney Wasp engines, and added to the Vega series a model powered with the Wright J-6 300 horsepower engine as well as a seven place cabin monoplane powered with either Pratt and Whitney Wasp or Wright J-6 300 horsepower engines. The Air Express model, a parasol type wing monoplane, with pilot outside and four passengers in the fuselage, also was produced. The Lockheed Sirius, a two place low wing monoplane with N.A.C.A. cowling similar to the one developed for Lieutenant Bromley's trans-Pacific flight, was put into production late in the year.

Loening Aeronautical Engineering Corporation of New York City, a division of Keystone Aircraft Corporation, increased its personnel during the year to meet increased production schedules. Twenty OL-8 observation amphibians were delivered to the Navy. Forty Air Yachts, an eight place cabin biplane amphibian, were delivered to transport lines and private owners, and two new type amphibians were developed. The Commuter, a small four passenger cabin amphibian developed for the private owner-pilot, was put in production, and an XO-10 experimental observation amphibian was built for the Army Air Corps. The latter included the Loening mono-wheel retractable landing gear and the first Wright Tornado, a 12 cylinder inverted V air cooled engine.

Glenn L. Martin Company of Baltimore, Md., continued to supply the navy with their standard patrol boats and torpedo planes, working in a huge new factory in Baltimore, Md.

Mercury Aircraft, Inc., of Hammondsport, N. Y., completed experimental work on its Mercury Chic T-2, all metal open cockpit training plane powered with a Le Blond engine.

Metal Aircraft Corporation of Cincinnati, O., moved into a new plant adjoining Lunken Airport and supplemented its series with the G-2-W, an eight place all metal cabin monoplane powered with a Pratt and Whitney Wasp engine, and the G-2-H, a similar ship powered with a Pratt and Whitney Hornet engine.

Mohawk Aircraft Corporation of Minneapolis, Minn., brought out a new model in the M-1-C, a two place low wing open cockpit monoplane powered with a Kinner engine.

Mono Aircraft Corporation of Moline, Ill., supplemented its Monocoupe model with the Monoprep, a semi-cabin monoplane having side by

side seating arrangement and powered with a Velie M-5. The Monosport, a two place cabin monoplane powered with Kinner or Warner engines, and the Monocoach, powered with the Wright J-5 or Wright J-6 225 horsepower engine, also were produced during the year.

Mooney Aircraft Corporation of Wichita, Kas., was formed during 1929 and completed design of a four place low wing cabin monoplane.

Moreland Aircraft, Inc., of Englewood, Cal., produced its model M-1, a three place semi-cabin high wing monoplane powered with a Wright J-5 engine.

Moth Aircraft Corporation of Lowell, Mass., a division of the Curtiss-Wright Corporation, produced the De Havilland Moth under its American license rights. It is a two place open cockpit biplane powered with a Wright Gipsy engine, and may be equipped with slotted wings at the option of the purchaser.

New Standard Aircraft Corporation of Paterson, N. J., produced five different models. The D-29 series of two place open cockpit biplanes, powered with American Cirrus or Kinner engines, was designed primarily for training. Production of the D-25-A, a five place open cockpit biplane with Wright J-6 225 horsepower engine, and the D-26-A, a three place open cockpit biplane, as well as the D-27-A, one place mail plane powered with a Wright J-6 225 horsepower engine, was continued.

Nicholas-Beazley Airplane Company, Inc., Marshall, Mo., produced the NB-3 series of three place low wing monoplanes powered with either Velie, Le Blond or Genet engines. The wing is composed of stamped aluminum alloy parts riveted together and has an unusual dihedral at the tip.

Parks Aircraft, Inc., of East St. Louis, Ill., a division of the Detroit Aircraft Corporation, produced the P-1, a three place open cockpit biplane mounted with a Curtiss OX5 engine, near the close of 1929. The P-2 and P-2-A were of the same general design except that they were powered with Axelson and Wright J-6 165 horsepower engines respectively.

Pitcairn Aircraft, Inc., of Bryn Athyn, Pa., completed a new factory at Hallowell, Pa., and continued to manufacture its Mail Wing series as well as to do considerable construction work for Pitcairn Cierva Autogiro Company. The Mail Wing PA-5 with Wright J-5 engine and the Super Mail Wing PA-6 with Wright J-5, were produced for mail transport purposes, while the Sport Mail Wing, a three place biplane with Wright J-5 engine, also was manufactured. The Mail Wing PA-7, a new model, was in the experimental stage when the year ended.

Pitcairn Cierva Autogiro Company of Philadelphia, Pa., formed during 1929 to manufacture autogiros under the Cierva licenses, manufactured three experimental autogiros during the year, powered with Wright

J-6 300 horsepower or Wright J-6 225 horsepower geared engines.

Pittsburgh Metal Plane Company of Pittsburgh, Pa., formerly the Thaden Aircraft Corporation, was moved to Pittsburgh as a part of the Pittsburgh Aircraft Industries. During the latter part of 1929, experiments on the Thaden T-4, a four place all metal monoplane, were being carried forward rapidly.

Rearwin Airplanes, Inc., of Kansas City, Kas., moved into a new factory adjacent to Fairfax Airport and began the production of the Ken-

CURTISS THRUSH

One of the new planes produced during 1929, the Curtiss-Robertson (Wright Whirlwind) Thrush was designed to carry a heavier load than its predecessor, Curtiss Robin, with greater cruising range.

Royce model, a three place open cockpit biplane powered with a Curtiss Challenger engine.

Ryan Aircraft Corporation of Anglum, Mo., a division of the Detroit Aircraft Corporation, supplemented its B-1 series with the model B-5, a six place cabin monoplane powered with a Wright J-6 300 horsepower engine. Near the end of the year, the model B-7, a six place cabin monoplane powered with a Pratt and Whitney Wasp engine was produced.

Sikorsky Aviation Corporation of Bridgeport, Conn., a division of the United Aircraft and Transport Corporation, moved into a huge new fac-

tory, where an experimental division was established to work on new designs to be announced in 1930. Production of the S-38 series, a 10 to 12 place cabin sesqui-wing amphibion powered with two Pratt and Whitney Wasp engines, was continued on a heavy schedule.

Simplex Aircraft Corporation of Defiance, O., manufacturers of a two place side by side center wing monoplane, supplemented their K-2-S, Kinner engined plane, with the W-2-S, a Warner powered ship.

Solar Aircraft Company of San Diego, Cal., formerly the Prudden Aircraft Corporation, remained in the experimental stage during 1929 but planned production for 1930.

Spartan Aircraft Company of Tulsa, Okla., produced three models during the year. The C-3 Challenger, a three place open cockpit biplane with Curtiss Challenger engine, was flown April 16, but later discontinued. The C-3-165, powered with a 165 horsepower Wright Whirlwind engine, was first flown July 5, and the C-3-225, powered with a 225 horsepower Wright Whirlwind engine, was introduced late in the year.

Star Aircraft Company of Bartlesville, Okla., manufactured the Cavalier, a two place cabin monoplane with either a Velie or Le Blond engine. During the latter part of the year experimental planes with American Cirrus and Genet engines were produced.

Stearman Aircraft Company of Wichita, Kas., became a division of the United Aircraft and Transport Corporation. Production of the M-2, a one place biplane powered with a Wright Cyclone engine and designed especially as a mail transport, was continued. The model C-3 was supplemented by production of the C-3R, a three place open cockpit biplane powered with a 225 horsepower Wright J-6 engine; the C-4A, a three place open cockpit biplane powered with a Wright J-6 300 horsepower engine; and the C-4AM, similarly powered. The Model LT-1, a combination mail and passenger transport biplane with four passengers in the fuselage cabin and the pilot outside, also was introduced with a Pratt and Whitney Hornet engine for power.

Stinson Aircraft Company of Wayne, Mich., moved into a modern plant designed for line production methods. The SM-2AA, a four place cabin monoplane powered with a 165 horsepower Wright J-6 engine, was produced along with the SM-2AB and SM-2AC, similar in every respect except that they were powered by the 225 horsepower Wright J-5 or the Wright J-6 engines. The SM-1F, a six place cabin monoplane powered with the Wright J-6 300 horsepower engine, and the SM-6B, an eight place cabin monoplane powered with a Pratt and Whitney Wasp engine also were manufactured.

Stout Metal Airplane Company of Dearborn, Mich., a division of the Ford Motor Company continued to manufacture its tri-motored all metal monoplanes. The current models were the 4-AT-E, a 14 place

cabin monoplane powered with three Wright J-6 300 horsepower engines; the 5-AT-C, a 17 place cabin monoplane powered with three Pratt and Whitney Wasp engines; the 6-AT, a 15 place cabin monoplane powered with three Wright J-6 300 horsepower engines; and the 7-AT, a 15 place cabin monoplane with one Pratt and Whitney Wasp and two Wright J-6 300 horsepower engines.

Sullivan Aircraft Manufacturing Company of Wichita, Kas., completed their experimental work during the latter part of 1929 and planned production of a new model in 1930.

Swallow Airplane Manufacturing Company of Wichita, Kas., concentrated its production on the TP model series, a two place open cockpit biplane powered with Curtiss OX5, designed especially for training. The model also was offered with a Warner engine. They supplemented their three place open cockpit series with the F-28-AX, a ship of the same general design, powered with an Axelson engine. During the latter part of 1929 experimental flight tests were being conducted on a low wing four place cabin monoplane.

Swift Aircraft Corporation of Wichita, Kas., moved into a new factory and continued experimental work during 1929.

Szekely Aircraft and Engine Company of Holland, Mich., manufactured the Flying Dutchman, a one place low wing monoplane powered with a Szekely SR-3 40 horsepower three cylinder radial engine.

Texas Aero Corporation of Dallas, Tex., formerly the Temple Aircraft Company, completed construction of a new factory adjacent to Love Field, Dallas, and planned to begin production on a series of Temple monoplanes in 1930.

Thomas Morse Aircraft Corporation of Buffalo, N. Y., was merged with Consolidated Aircraft Corporation late in 1929 and continued the manufacture of planes for military purposes.

Timm Airplane Corporation of Los Angeles, Cal., went into production late in the year on their Collegiate K-90, a two place open cockpit parasol type monoplane powered with a Kinner engine. Experiments were continued on a twin-motored monoplane.

Travel Air Company of Wichita, Kas., closely affiliated with the Wright interests, continued the production of its line of commercial planes and introduced a Model R, a one place low wing monoplane designed for sport and racing and known as the "Mystery Ship." The current models included the A-6000-A, a six place cabin monoplane powered with a Pratt and Whitney Wasp engine; the 6000-B, a plane similar in design with a Wright J-6 300 horsepower engine; the B-4000, a three place open cockpit biplane powered with a Wright J-5 engine; and the 2000 and 3000 models powered with the Curtiss OX5 and Hispano Suiza engines respectively. These models were supplemented

with the B9-4000, a three place open cockpit biplane powered with a Wright J-6 300 horsepower engine; the C-400, a similar plane powered with a Curtiss Challenger; the 4-D, powered with a Wright J-6 225; the E-4000, powered with a Wright J-6 165; the W-4000, powered with a Warner; the A-4000, powered with an Axelson; and the K-4000, powered with a Kinner. The Model 10-D, a four place cabin monoplane powered with a Wright J-6 300 horsepower engine also was manufactured.

Verville Aircraft Company of Detroit, Mich., started production late in 1929 on the Air Coach 104, a four place cabin monoplane powered with a Wright J-6 225 horsepower engine.

Viking Flying Boat Corporation of New Haven, Conn., obtained the American Manufacturing license for the Schreck line of flying boats, a boat of French design. The Bourdon Aircraft Corporation was merged with the flying boat corporation late in 1929, and plans included manufacture of the Bourdon Kitty Hawk model.

Chance Vought Corporation, a division of United Aircraft and Transport Corporation, added 25,000 square feet of floor space to its Long Island City, N. Y., plant during the year and employed 700 men in the manufacture of military planes chiefly, although one of the models was adapted for commercial use. The plant was to be moved to new quarters on United Airport in East Hartford, Conn., in 1930. The Corsair high performance observation fighting plane series, was continued in production for the U. S. Navy with slight modifications, while more than $1,000,000 worth of them were shipped to Mexico, Cuba, Argentina, Japan and China. A new two-place fighter, the XF2U-1, was produced for exhaustive tests by the navy. Several Corsairs also were built for private operation.

Waco Aircraft Company of Troy, O., went into production on their tapered wing series, a three place open cockpit biplane powered with either a Wright J-6 300, Wright J-6 225, or Wright J-5 engine. They also supplemented their line of standard straight wing models with the SW J-5, a three place open cockpit powered with a Wright J-5; the SW Hisso, a three place open cockpit powered with a Hispano Suiza A or E, and SW OX5, a ship of the same general design with the Curtiss OX5 engine. The SW 225, powered with the Wright J-6 225 horsepower engine; and the SW 165, powered with the Wright J-6 300 horsepower engine.

Watkins Aircraft Company of Wichita, Kas., continued experimental work on their Skylark models.

Whittlesey Manufacturing Company of Bridgeport, Conn., began production of the Avian, a ship of British design for which Whittlesey has the American manufacturing rights. It is a two place open cockpit

biplane powered with an American Cirrus engine and is available either with or without slotted wings.

H. F. Wilcox Aeronautics, Inc., of Tulsa, Okla., was completing the design of its Wilcox trainer, a two place open cockpit biplane powered with a Warner engine, when the year ended.

Accessories, Equipment and Materials

The advances made by scores of allied industries which contributed some unit to the finished airplane kept pace with general developments

OVER KANSAS CITY

American Eagle (Kinner) open biplane flying over city in which it is manufactured.

in the aircraft manufacturing field during 1929. The refinement of old products and the introduction of new ones contributed in no small way to the perfection of the finished plane.

The Aluminum Company of America, Breeze Corporation, Bohn Aluminum and Brass Company, Aero Supply Manufacturing Company, Carpenter Steel Company, Summerill Tubing Company, and International Nickel Company were among the principal contributors to the refinement of metal castings, forgings and steel tubing. The Champion Machine and Forging Company, Endicott Forging and Manufacturing Company, Park Drop Forge Company, and Wyman Gordon Company were among the organizations providing drop forgings and castings for the industry.

The Balsa Wood Company, Haskelite Manufacturing Company, G. Elias and Bro., Nicholas Beazley Airplane Company and Port Orford Cedar Products Company were among the chief purveyors of lumber. The Thompson Products, Inc., and U. S. Hammered Piston Ring Company devoted their attention to the development of better valves and piston rings.

Corporations directing their attention to the making of treated fabrics and finishing materials especially for aircraft included: Berry Brothers, E. I. Du Pont de Nemours Company, Inc., Perry Austin Company, Titanine, Inc., Van Schaak Brothers, and Valentine and Company. Fabrics and tapes were developed by the Goodyear Tire and Rubber Company, Russel Manufacturing Company, Thurston Cutting Corporation, E. S. Twining and Company, and Clarence Whitman and Sons.

Navigational instruments were perfected by Consolidated Instrument Company, Elgin National Watch Company, Pioneer Instrument Company, Sperry Gyroscope Company, Taylor Instrument Corporation and the General Electric Company. Organizations devoting their attention to the development of radio navigation aids have already been named in the chapter on "Aviation Radio."

Shock absorbers and struts were refined by the Cleveland Pneumatic Tool Company, Gruss Air Spring Company of America, Aircraft Products Company, and the Russell Manufacturing Company. The Norma Hoffman Bearing Company and S.K.F. Manufacturing Company centered their attention on the manufacture of bearings. Brakes were produced by the Aircraft Products Company, Bendix Brake Company, Kelsey Hayes Steel Corporation, and Johnson Airplane and Supply Company. Pontoons were developed by the Aircraft Products Company, Boeing Airplane Company, Brewster and Company, Edo Aircraft Company, Great Lakes Aircraft Corporation, Hamilton Aero Manufacturing Company, Ireland Aircraft, Inc., and Sikorsky Aviation Company. Rubber tires were made by the Firestone Tire and Rubber Company, B. F. Goodrich Rubber Company, Goodyear Tire and Rubber Company, and the U. S. Rubber Company.

Wire for control equipment was manufactured by the Aero Supply Manufacturing Company, Aircraft Products Company, Stewart Hartshorn Company, MacWhyte Company, and John A. Roebling and Sons. The Kelsey-Hayes Steel Corporation specialized in the manufacture of wheels for airplanes. Three companies continued their development of parachutes and safety devices. They were Folmer Clogg and Company, the Irving Air Chute Company and Russell Parachute Company. A. G. Spalding and Bros. devoted considerable attention to the manufacture of special equipment and wearing apparel for pilots.

CHAPTER VII

ENGINE MANUFACTURING

STRIDES made during 1929 in the refinement of aircraft engines and in the development of new models was, in a large measure, responsible for the increased reliability and efficiency of aircraft.

The same fate which kept Paul Revere's horse from a place in the popular histories, however, often kept the names and attributes of these mechanical steeds of the sky out of the stories of man's achievements in the air. Far from the public celebrations which acclaimed new heroes of the air were designers and workmen, devoting their lives to the mechanical perfection of engines more efficient than any the world had yet demanded to propell its machines.

The aircraft engine, almost since its inception, has marked a new era in the development of power plants employing the internal combustion principle. Extraordinarily low weight and exceptional power were the two requirements which the airplane demanded from the start. The Wright brothers' first engine, crude as it was, weighed less per horsepower than the combustion engines in production at that time. The engines of 1929, which demonstrated themselves capable of millions of revolutions on spectacular flights without a sign of faltering, were such a far cry from the crude contraption of the Wrights that it was difficult to appreciate fully the progress that had been made in twenty-five years of experimentation. In fact, the commercial aircraft engine's history dates back but a few years. The development was so rapid and the future so promising that it provided an inspiration for those who worked far from the cheering crowds, to continue their search for new improvements which might lie just ahead.

While many of the commercial engines on the market weighed less than two pounds per horsepower, and, at least one weighed as low as 1.08 pounds per horsepower, the average for 54 of the best known engines was 2.36 pounds per horsepower. The Wrights' first engine weighed approximately 16.6 pounds per horsepower.

The advances made during the year from a technical standpoint will be considered in a later chapter on "Trends in Design." It is sufficient to say here that the refinements made during 1929 outstripped those of any previous year if their effect upon the life and efficiency of the engines is considered. It is the plan of this chapter to consider facts of physical expansion in the engine manufacturing field together with a brief description of the products of the principal manufacturers.

The U. S. Bureau of Labor Statistics listed a total of 5,977 persons employed exclusively in the manufacture of engines in 23 plants, 17 of which were in production. This report was based on statistics obtained in May, and it is safe to say that the number was considerably larger during periods of peak production later in the year. This did not take into consideration the thousands employed in the manufacture of engine accessories such as magnetos, etc.

The Department of Commerce had issued 35 Approved Type Certificates for engines to 19 different manufacturing firms by the end of the year.* Fourteen of these concerns were members of the Aeronautical Chamber of Commerce. The Department of Commerce issued 22 Approved Type Certificates for engines during the year.

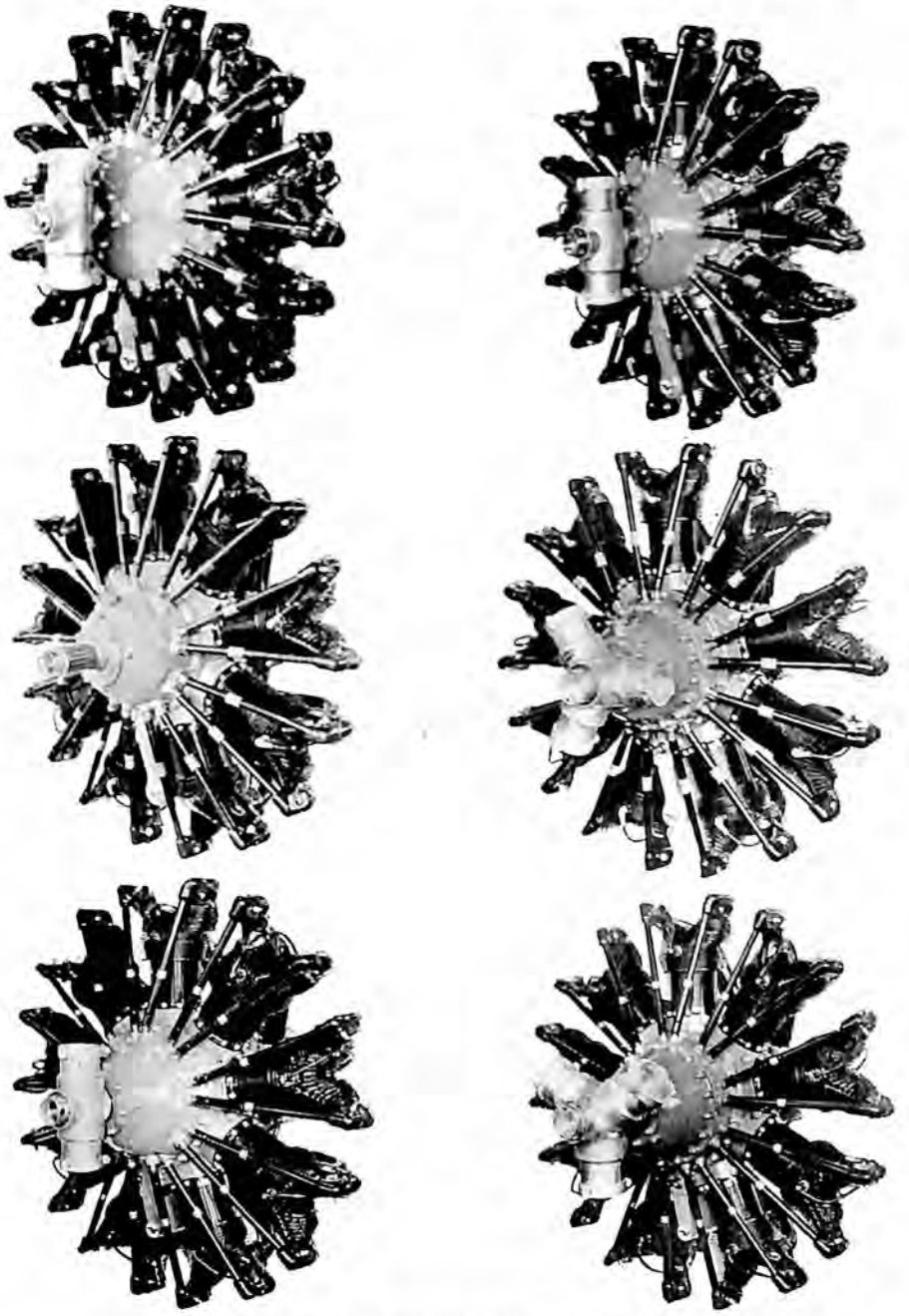
Similar to the trend in the aircraft manufacturing and air transport fields, the great financial groups which interested themselves in all phases of the industry included engine production units in their holdings. While these engine manufacturing companies affiliated with the financial groups sought widespread markets throughout the industry, they devoted particular attention to the development of power plants suitable for installation in the products of the aircraft manufacturing units in each group.

The Aviation Corporation interested itself in engine development through the Fairchild Aviation Corporation, a division of the holding company.

The Curtiss-Wright interests included two engine manufacturing units within its holdings: the engine division of the Curtiss Aeroplane and Motor Company, Inc., and the Wright Aeronautical Corporation. The Detroit Aircraft Corporation controlled the Winton Aviation Engine Company. General Motors controlled the Allison Engineering Corporation of Indianapolis, and held an interest in the Bendix Aviation Corporation, which manufactured accessories for engines. The United Aircraft and Transport Corporation included The Pratt and Whitney Aircraft Company of Hartford, Conn., as one of its divisions. Allied Motor Industries, a holding company which included two aircraft manufacturing units, controlled American Cirrus Engines, Inc.; E. L. Cord was directly connected with the Lycoming Manufacturing Company; and Allied Aviation Industries, Inc., another holding company, included the Lambert Aircraft Engine Corporation as a unit.

As in the air transport and aircraft manufacturing fields, the influence which the large financial groups exerted upon the development of the engine manufacturing branch of the industry cannot be overemphasized. It was responsible in a large measure for the national expansion programs in marketing and servicing engines, which were certain to lay a neces-

*List of Engine Approved Type Certificates in Appendix.



PRATT AND WHITNEY ENGINES

The new Wasp, Jr., 300 horsepower (upper left); Wasp Direct Drive Series C, 450 horsepower military rating, 425 horsepower commercial rating (upper right); Hornet Series B, 575 horsepower (center left); Hornet Series B Geared, 550 horsepower (center right); Hornet Direct Drive Series A-1, 525 horsepower (lower left); Hornet Series A-1 Geared, 500 horsepower (lower right).

sary foundation for future business. Parts could be obtained at easily accessible service stations in all parts of the country, and skilled mechanics were available to care for the particular needs of the airplane owner.

Engine Service Stations

The problems concerned with the development of a chain of engine service stations throughout the country formed one of the principal subjects of discussion among the manufacturers at the annual meeting of the Aeronautical Chamber of Commerce Engine Manufacturing Section in Cleveland during the National Air Races.

Efficient engine service, the manufacturers agreed, demands expensive shop equipment, substantial inventory cost and special training of personnel to give the utmost in service to the general public. Adequate engine service was considered as much of a specialty as engine manufacturing itself, and it was therefore considered best to place the major responsibility for aircraft engine service upon the manufacturers of engines rather than the aircraft producer.

To provide a sufficient return upon this investment, the engine manufacturers recognized that it was necessary for them to set up distributorships for parts and replacement engines, operating under such a scale of discounts as would insure a permanent and profitable business for the distributor.

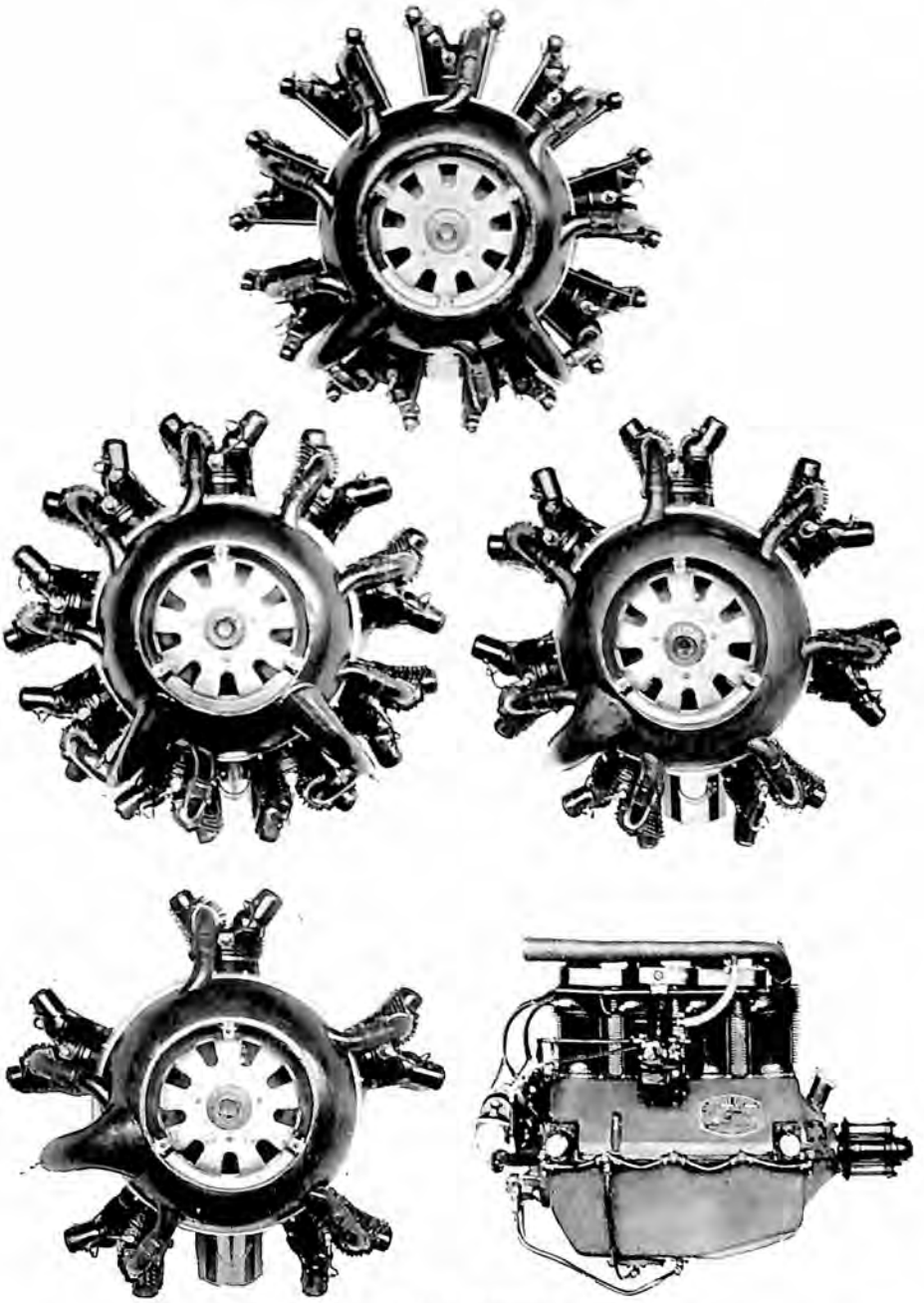
Since it was considered necessary to arrive at a system of uniform discounts upon an economic basis rather than to set them up arbitrarily, the manufacturers agreed to undertake an exhaustive study of conditions and experiences of the automobile industry through the Aeronautical Chamber of Commerce. Committees of the Engine Manufacturing Section spent several months during the latter part of 1929 preparing a system of discounts to the aircraft manufacturer, distributor and dealer which might prove equitable to all concerned.

Manufacturing Résumé

The following brief résumés of the year's activities in the major engine manufacturing plants is designed to provide a picture of the general expansion and progress in this field. They are arranged in alphabetical order for convenience in future reference.

Aeronautical Products Corporation of Naugatuck, Conn., continued the development of its Scorpion, four cylinder, in-line, air cooled engine.

Allison Engineering Company of Indianapolis, Ind., was acquired by General Motors and offered three 12 cylinder engines of the Inverted Vee type for the commercial field. The model V1410 was an air cooled



WRIGHT ENGINES

Cyclone, 525 horsepower (top); Whirlwind, 300 horsepower (center left); Whirlwind, 225 horsepower (center right); Whirlwind, 165 horsepower (lower left); Gipsy, 95 horsepower (lower right).

direct drive engine rated at 410 horsepower at 1800 revolutions per minute. The model VG1410 was similar in every respect except that it was equipped with a 5:3 epicyclic gear. The V1650 was a direct drive water cooled engine rated at 450 horsepower at 1800 revolutions per minute.

American Cirrus Engines, Inc., a subsidiary of Allied Motor Industries, Inc., moved from its plant in Belleville, N. J., to Marysville, Mich., where two factory buildings provided a total of 235,000 square feet of floor space. The first American Cirrus engine, similar to the English Cirrus Mark III and manufactured under the English patents, was built early in the year at the New Jersey plant. The company entered production on the model, a four cylinder in-line air cooled engine rated at 95 horsepower at 2100 revolutions per minute, after moving.

Axelson Machine Company of Los Angeles, Cal., turned the manufacture of engines over to a subsidiary, the Axelson Aircraft Engine Company, which erected a new plant on property adjacent to the parent company and began production on the new Type B engine. An engine a day was being produced at the close of 1929, with plans for three engines a day when the plant was fully tooled up for production in 1930. The Type B engine was a seven cylinder, radial, air cooled engine capable of developing 150 horsepower at 1800 revolutions per minute.

E. W. Bliss Company of Brooklyn, N. Y., prepared to manufacture the Jupiter engine, a nine cylinder, radial, air cooled type, under its American rights to the use of the patents of the Bristol Airplane Company of England.

Comet Engine Corporation of Madison, Wis., acquired, by direct purchase, all assets of the Aircraft Engine Corporation of Oakland, Cal., in the spring of 1929. All operations were moved to the Madison factory with its 100,000 square feet of floor space, and preparations started for production under the direction of the Gisholt Machine Company, tool makers for forty years. Production of 50 engines per month was planned, beginning January 1, 1930. The company's product was a seven cylinder, radial, air cooled, Comet engine, rated by the manufacturer at 165 horsepower at 1900 revolutions per minute.

Chevrolet Aircraft Corporation of Indianapolis, Ind., completed experimental work on a four cylinder, inverted air cooled in-line engine.

Continental Aircraft Engine Company of Detroit, Mich., a division of the Continental Motors Corporation, developed its Model A70, a seven cylinder, radial, air cooled engine, rated at 165 horsepower at 2000 revolutions per minute.

Curtiss Aeroplane and Motor Company, Inc., of Buffalo, N. Y., entered a new engine manufacturing plant with 450,000 square feet of floor space during 1929 to keep pace with military and production

orders. Three engines were in production, and a fourth was developed for production in 1930. The Conqueror was a 12 cylinder, Vee type, Prestone or water cooled engine, rated at 600 horsepower at 2400 revolutions per minute. The V-1570 Conqueror was a direct drive, and the GV-1570 had a 2:1 reduction gearing which turned the propeller over at half crankshaft speed. The Challenger was a six cylinder, radial, air cooled engine with the cylinders staggered to operate on a two-throw crankshaft, and developed 176 horsepower at 1800 revolutions per minute. The D-12 was a 12 cylinder, Vee type, water cooled engine rated at 435 horsepower at 2250 revolutions per minute. While these three engines were in production, the Crusader, an inverted six cylinder, in-line, air cooled engine developing 120 horsepower at 1800 revolutions per minute was prepared for 1930 production.

Dayton Airplane and Engine Company of Dayton, O., developed the Bear, a four cylinder, in-line, air cooled engine rated at 110 horsepower at 1550 revolutions per minute.

Fairchild Aviation Corporation, a division of the Aviation Corporation spent the last six months of the year in the development of a new engine to be known as the Fairchild 375. It was a six cylinder, in-line, air cooled engine rated at 110 horsepower at 1900 revolutions per minute. A fifty hour block test was completed in December and plans were made for production of the new engine in 1930.

General Airmotors Company of Scranton, Pa., developed the Moore "Three Valve Engine," a five cylinder radial type, rated at 120 horsepower at 1600 revolutions per minute.

Kimball Aircraft Corporation of Naugatuck, Conn., developed a seven cylinder, radial, air cooled engine, which was undergoing Department of Commerce tests when the year ended. It was rated at 135 horsepower at 1850 revolutions per minute.

Kinner Airplane and Motor Corporation of Glendale, Cal., moved from a small factory to a new building with 45,000 square feet of floor space. The latest type precision machinery was installed in preparation for increasing production to 450 engines per month. The number of employees was increased from 150 to 400, and more than 40 different aircraft manufacturers were supplied with the current model, the K-5, a five cylinder, radial engine developing 190 horsepower at 1800 revolutions per minute. Factory service depots were established in five widely scattered cities.

Lambert Aircraft Engine Corporation of Moline, Ill., successor to the Velie Aircraft Motor Corporation and a division of Allied Aviation Industries, Inc., produced the M-5, a five cylinder, radial, air cooled engine rated at 62 horsepower at 2000 revolutions per minute. The M-5 was to be replaced with a new engine developed, known as the

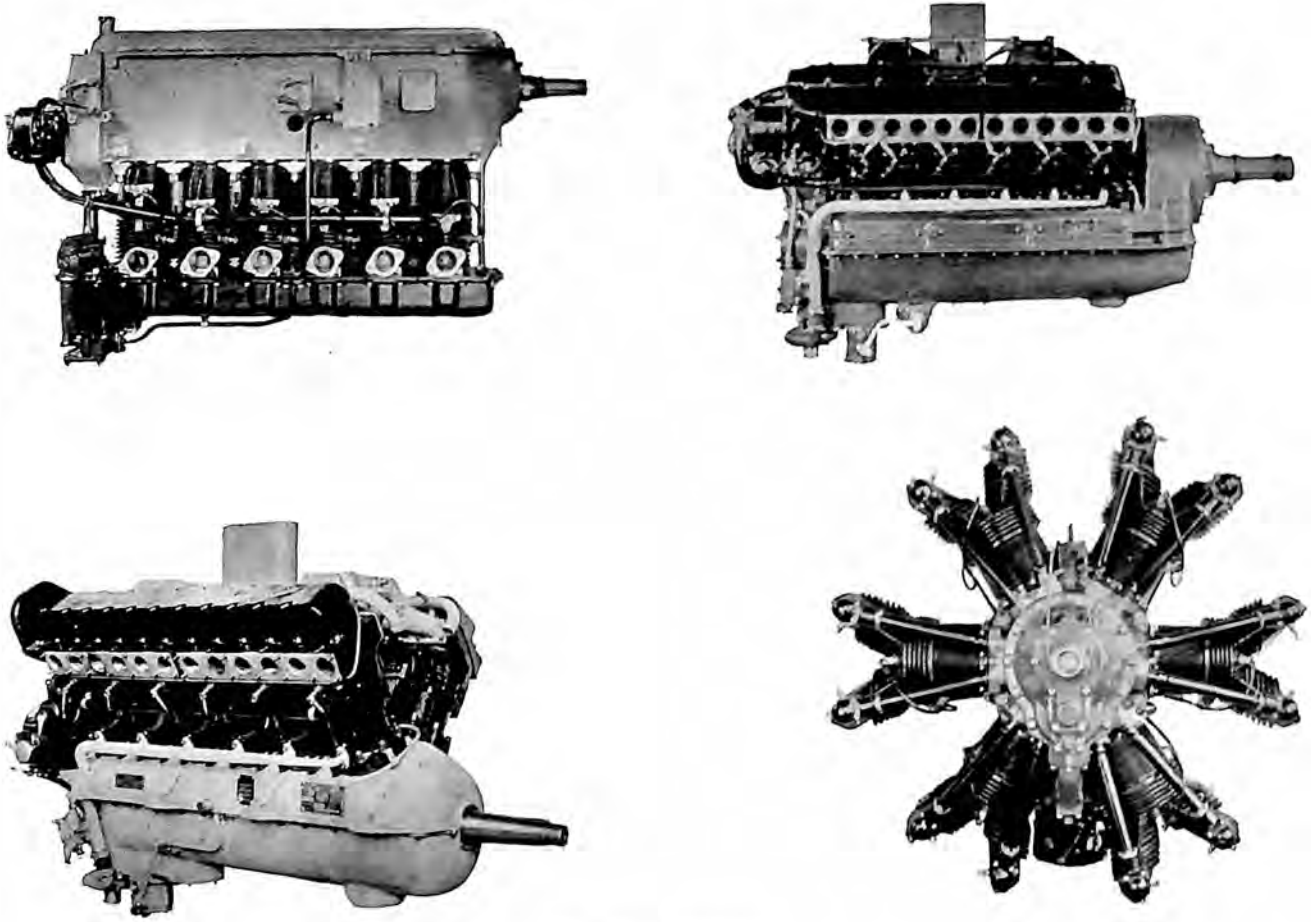
R-266, a five cylinder, radial, air cooled type rated at 90 horsepower at 2375 revolutions per minute.

Le Blond Aircraft Engine Company of Cincinnati, O., produced two current models, the 60-5-D, a five cylinder radial, air cooled engine rated at 65 horsepower at 1950 revolutions per minute; and the 90-7-D, a seven cylinder, radial, air cooled engine rated at 90 horsepower at 1975 revolutions per minute.

The Lycoming Manufacturing Company of Williamsport, Pa., closely affiliated with the E. L. Cord interests, entered the aeronautical field during 1929. A new building with 105,000 square feet of floor space was completed and tool equipment installed for production in 1930 on a nine cylinder, radial, air cooled engine, Model R-645, rated at 185 horsepower at 2000 revolutions per minute. Other models were to be added as manufacturing facilities permitted.

Packard Motor Car Company directed most of its aeronautical activities during 1929 toward completion of a new aircraft engine factory and further testing and developing its Diesel type airplane engine. Production was continued on its 600 horsepower Vee type water cooled engines and its 1100 horsepower, 24 cylinder, water cooled, X type engine. The new Diesel type was a radial internal combustion engine, burning ordinary furnace oil, rated at 200 horsepower. Other sizes of the Diesel type also were being developed.

Pratt and Whitney Aircraft Company of Hartford, Conn., maintained a production schedule during 1929 almost three times that of 1928. The average payroll for the year included 1000 employees, an increase of 100 per cent over 1928. Ground was broken in July for a new $2,000,000 plant with 500,000 square feet of floor space, which was to be used for operations in 1930. In addition to producing approximately 200 Wasp and Hornet engines a month, as compared with 65 per month during 1928, a new 300 horsepower radial air cooled engine to be known as the Wasp, jr., was developed, tested and introduced late in the year. Production of the Series C Wasp, a development of its predecessor, the Series B, was started early in 1929. It was a nine cylinder, radial, air cooled engine rated at 450 horsepower at 2100 revolutions per minute for military purposes, and 420 horsepower at 2000 revolutions per minute for commercial work. The Series A Hornet was developed into the Series A-1, a nine cylinder, radial, air cooled engine rated at 525 horsepower at 1900 revolutions per minute. The Series B Hornet, a nine cylinder, radial, air cooled engine rated at 575 horsepower at 1950 revolutions per minute, was put into production after almost two years of test work and supplied in limited quantities to the Army, Navy and commercial field. All models were available in reduction gear drives: the Wasp in the 2:1 and 5:4 ratio; the series



CURTISS ENGINES

Crusader, 110 horsepower (upper left); Conqueror (Geared), 600 horsepower (upper right); Model D-12D, 435 horsepower (lower left); and Challenger, 170 horsepower (lower right).

A-1 Hornet in the 2:1 ratio and the series B Hornet in the 2:1 and 3:2 ratio. The 2:1 ratio gear is a six pinion planetary type while the other ratios are of a single internal pinion and ring type. Both of these gearings were developed by the company's engineers and were of patented design. Twenty-four authorized service and parts stations were established from coast to coast and from Canada to the Canal Zone during the latter part of the year.

Siemens and Halske Company of Berlin-Spandau, Germany, established an American sales and service agency under the direction of K. G. Frank of New York. Radial air cooled engines of five, seven and nine cylinder types, rated at 83, 113 and 128 horsepower respectively were produced in the German plant during 1929.

Szekely Aircraft and Engine Company of Holland, Mich., moved into a new factory with 37,000 square feet of floor space to produce two engine models during 1929. The SR-3 was a three cylinder radial air cooled engine rated at 40 horsepower at 1750 revolutions per minute, and the SR-5 was a five cylinder, radial, air cooled engine rated at 70 horsepower at 1750 revolutions per minute.

Warner Aircraft Corporation of Detroit, Mich., produced the Scarab, a seven cylinder, radial, air cooled engine rated at 110 horsepower at 1850 revolutions per minute.

Wright Aeronautical Corporation of Paterson, N. J., and St. Louis, Mo., a unit in the Curtiss-Wright Corporation, produced its new J-6 series in the New Jersey plant and added the Gipsy, a four cylinder, in-line, air cooled engine rated at 90 horsepower at 2000 revolutions per minute. It was produced in the St. Louis plant. Factory space was increased during the year from 630,000 square feet to 675,000 square feet, and more than 2600 employees were on the company's payroll when the year ended. The J-6 series included the R-540, R-760 and R-975 model Whirlwinds. The R-540 was a five cylinder engine with 165 horsepower rating at 2000 revolutions per minute. The R-760 was a seven cylinder type with 225 horsepower rating at 2000 revolutions per minute. The R-975 was a nine cylinder engine rated at 300 horsepower at 2000 revolutions per minute. The Cyclone, R-1750, was a nine cylinder type with 525 horsepower rating at 1900 revolutions per minute. These four engines all were of the radial air cooled type and were available with a reduction gear to improve their performance in transport operations. The Tornado, V-1460, a 12 cylinder inverted Vee type, air cooled engine also was developed for the Army Air Corps. A network of about 75 distributors and service stations were established throughout the country so that high class factory service might be obtained by private owners in every sections. They were equipped for major overhauls by expert mechanics with uniform factory fixtures and equipment.

Parts and Accessories

Greater efficiency in the operation of aircraft engines was responsible in no small degree to the development of better parts and accessories by the principal manufacturers contributing to the finished engine.

AIRCRAFT ENGINES

Kinner K-5, 110 horsepower (upper left); Comet, 150 horsepower (upper right); Szekely SR-5 Model L, 70 horsepower (lower left); and Szekely SR-3 Model B, 40 horsepower.

The Eclipse Aviation Corporation and Leece Neville refined the designs of their generators. The Electric Storage Battery Company paid particular attention to the manufacture of aircraft batteries according to new standards set up by the Society of Automotive Engineers and adopted by the industry. Spark plugs were improved through the

research of A. C. Spark Plug Company, the B. G. Corporation, and Champion Spark Plug Company. The Stromberg Motor Devices Company made refinements on its carburetors. The Scintilla Magneto Company and Splitdorf Electrical Company continued to supply a major share of the magnetos. The Eclipse Aviation Corporation, Leece Neville and Sky Specialties Corporation made improvements on their starters.

The principal purveyors of ignition cable included: A. C. Spark Plug Company, Acme Wire Company, Packard Electric Company, John A.

STUDY AXELSON ENGINES

The new Axelson Type B engine being examined by members of the aviation class of Huntington Park High School at the Axelson plant.

Roebling and Sons, and Western Electric. Motor instruments were improved by the A. C. Spark Plug Company, Consolidated Instrument Company, Motometer Gauge and Equipment Company, Pioneer Instrument Company, and Taylor Instrument Company. The Ex-Cell-O Aircraft and Tool Corporation provided various motor parts for the principal engine manufacturers.

CHAPTER VIII

AIRSHIP DEVELOPMENT

NO year since Count Ferdinand von Zeppelin began the construction of his first airship has seen more varied or intensive activity in the lighter-than-air field than 1929. Progress was particularly brilliant in the field of the rigid airship. The Graf Zeppelin justified man's faith in airships for extended flights in her 21-day round-the-world cruise. Work on the first of the two new U. S. Navy dirigibles, designed to be the largest in the world, was started by the Goodyear-Zeppelin Corporation at Akron. The world's first all-metal airship, ZMC-2, developed for the U. S. Navy by the Aircraft Development Corporation at Detroit, was completed and successfully flown. The two British dirigibles, R-100 and R-101, under construction for five years, were completed and ready for extended flights in 1930. The U. S. Navy dirigible Los Angeles crowded her log with numerous flights to add to the world's knowledge of lighter-than-air navigation.

In the non-rigid airship field the fleet of six commercial "blimps" owned by the Goodyear-Zeppelin Corporation piled up a formidable record for flights, while the U. S. Navy continued its experiments with the J-3 and J-4, and the U. S. Army Air Corps kept its lone airship, the TC-5, busy on training missions.

Lay Ring for ZRS-4

The master ring for the first of the two Navy rigid ships was laid November 7 when Rear Admiral William A. Moffett, chief of the Navy Department Bureau of Aeronautics, drove a golden rivet in the uppermost portion of the ring. The ceremony was staged in the huge new airship hangar at Akron in the presence of national and state officials, representatives of aeronautical and allied industries, and prominent figures in public life. The new ships have been temporarily designated the ZRS-4 and ZRS-5, pending the selection of appropriate names, and when completed will be the largest airships in the world. Each is designed for a capacity of 6,500,000 cubic feet of helium, the non-inflammable, non-explosive lifting gas on which America has a monopoly.

The new ships are to have a more curved profile than previous types, making them appear slightly shorter and fatter. Among new features

incorporated in their design is an airplane hangar compartment for housing five scout planes, which may be lowered from the hull and released, or taken aboard again, during flight, by means of a trapeze device. Use of helium gas permits installation of the engines inside the hull instead of suspending the engines in gondolas outside the hull, as when hydrogen was used.

Propellers will be operated by means of a drive shaft extending through the hull. A bevel gear device will permit the propellers to be tilted on their axes through an arc of 90 degrees, making it possible to use them in a vertical direction as well as horizontal, which will greatly aid in starting and landing maneuvers. A new water recovery system, embodying longitudinal cooling fins extending from the side of the hull, an improvement over existing designs, will be used.

The new airships will be 785 feet long, nine feet longer than the Graf Zeppelin and almost twice the German dirigible's capacity. Comparative data on the characteristics of the two new American airships, showing the outstanding differences between them and their foreign predecessors, can be studied most easily from the table below, which shows the relation between the ZRS-4, Graf Zeppelin, Los Angeles, R-100 and R-101.

World's Six Rigid Dirigibles

Name or Designation	*Los Angeles*	*ZRS-4 (two)*	*Graf Zeppelin*	*R-100*	*R-101*
Nationality	American	American	German	British	British
Nominal gas volume, ft.	2,470,000	6,500,000	3,708,000	5,000,000	5,000,000
Length over-all, ft.	658.3	785	776.2	709	724
Maximum diameter, ft.	90.7	132.9	100.1	133	131.8
Height over-all, ft.	104.4	146.5	110.6	141	139
Kind of gas	Helium	Helium	Hydrogen & fuel gas	Hydrogen	Hydrogen
Gross lift, lbs.	153,000	403,000	262,000	343,000	340,000
Useful lift, lbs.	60,000	182,000	140,000	160,000	154,000
Number of engines	5	8	5	6	5
Total horsepower	2,000	4,480	2,550	3,600	3,250
Kind of fuel	Gasoline	Gasoline	Fuel gas & gasoline	Gasoline	Oil
Maximum speed, knots	63.5	72.8	69.0	69.5	65.0
Range at 50 knots (naut. miles)	3,500	9,200	9,000	6,200	6,000

The airship factory and dock, which will house construction of the Navy ships, was practically completed as the year came to a close. The building is approximately a semi-paraboloid in shape, a design approved after many wind tunnel tests showed that it created the least practical

GIANT DIRIGIBLE HANGAR

The world's largest building without structural supports constructed at Akron to house the new navy dirigibles, ZRS-4 and ZRS-5, as seen on the day the first ring for the new air leviathan was laid.

LAYING THE RING

Ceremonies in the huge Goodyear-Zeppelin hangar at Akron for the laying of the first ring for the new navy dirigible, ZRS-4, which will be larger than any zeppelin ever built.

interference with normal wind currents, thus eliminating to a great extent cross currents which would interfere with launching and docking operations. The structure is 1,175 feet long, 325 feet high, without any interior support. It could house the Woolworth Building and Washington Monument lying horizontally and have room to spare for a battleship.

The interior floor area is 364,000 square feet, the cubical content of the structure is 45,000,000 cubic feet, while the sheeting covering the dock, if spread out flat, would cover 18 acres. Docking rails 200 feet apart, for moving ships in and out, extend 1,600 feet from each end of the building, eliminating danger of the hull striking sides of the dock.

ZMC-2 Delivered to Navy

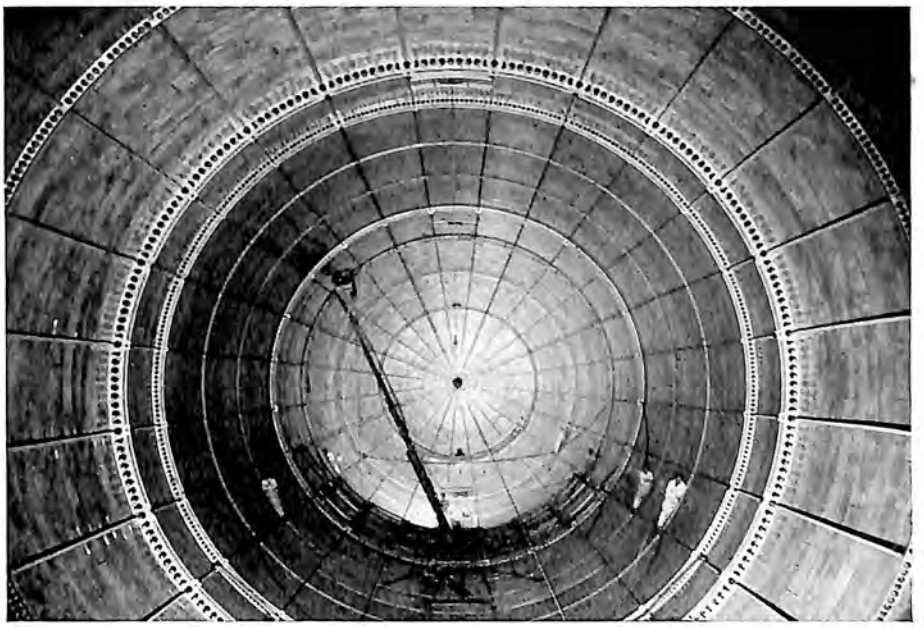
The successful demonstration and delivery of the metal-clad airship, ZMC-2, to the U. S. Navy marked one of the year's most interesting technical developments in the dirigible field. The world's first all-metal airship, the ZMC-2, was designed and built by the Aircraft Development Corporation, the lighter-than-air division of the Detroit Aircraft Corporation. Six years of research and experimental engineering work preceded the actual construction of the ship. The first rivet was driven in the alclad metal hull March 7, 1928, and on August 10, 1929, the ZMC-2 was completed, inflated with helium and ready for shed tests.

The first trial flight of 49 minutes and 55 seconds was completed August 19 at Grosse Ile Airport, Detroit, with Capt. William E. Kepner, pilot; Carl B. Fritsche, Edward J. Hill, Arthur G. Schlosser and Joseph H. Bishop aboard. The ship was delivered to the Naval Air Station at Lakehurst, N. J., after a 600-mile non-stop flight from Detroit. The final trials were completed September 25 under the direction of the Navy survey board: Comdr. Garland Fulton, Lt. Comdr. William K. Harrill, Lieut. C. E. Bauch, Lieut. George V. Whittle, Lieut. H. J. Duggan and Lieut. C. V. S. Knox, who was inspector for the Navy during construction of the ZMC-2.

It was considered significant that each test required in the Navy contract was completed on the first attempt with a safe margin and without the necessity of making any changes whatsoever in the ship. The weight estimates made in 1926, on which the design of the metal-clad was based, were 127 pounds in excess of the actual completed dead weight of the structure. It indicated the precise engineering which entered into the success of the dirigible. Credit for engineering successes was given jointly to Ralph H. Upson, chief designer, and his associates, W. A. Klikoff, S. A. U. Rasmussen, V. Pavlecka, and to Edward J. Hill

METAL CLAD AIRSHIP

Embodying many new principles in design, the new metal clad dirigible, ZMC-2, built for the U. S. Navy by the Aircraft Development Corporation in Detroit, is seen as it was delivered at Lakehurst.



ZMC-2 INTERIOR

An unusual interior view of the new metal clad dirigible ZMC-2 showing internal framework with men working along the sides.

and Arthur G. Schlosser, construction engineers in charge of the actual fabrication and erection of the ship.

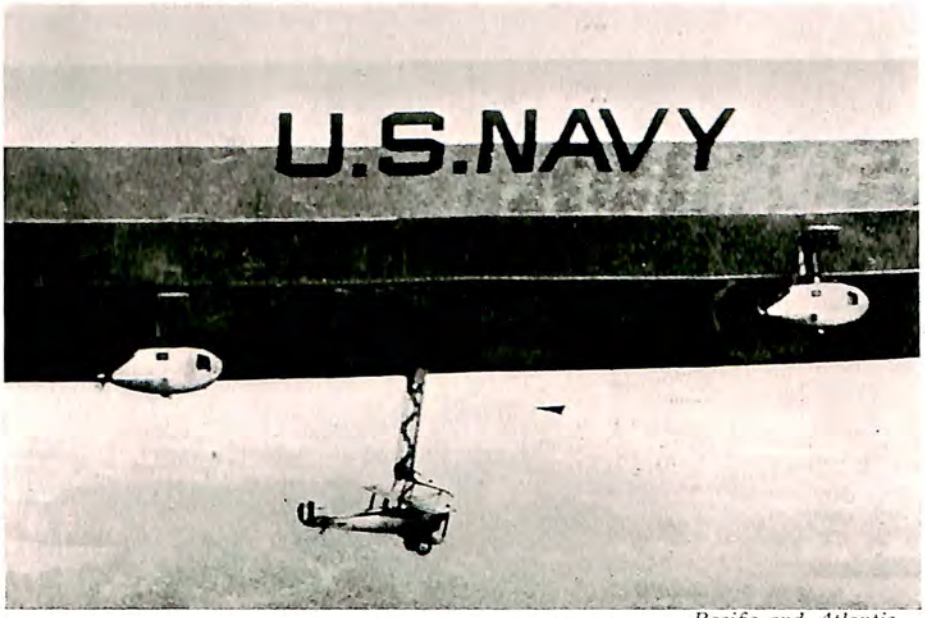
The ZMC-2 is too small for commercial use but is amply large for naval training purposes. In load capacity it is similar to the non-rigid fabric blimp, but in performance characteristics it was found to be superior. Its displacement is 200,000 cubic feet, this figure being set as sufficient to fulfill government experimental requirements. Its hull is 149 feet 5 inches long and has a maximum diameter of 52 feet 8 inches, with a fineness ratio of 2.83. It is powered with two Wright Whirlwind engines, has eight fins for elevator and rudder control surfaces as contrasted with four on conventional dirigible types. Its gross lift when inflated with 92 per cent helium at 60 degrees Fahrenheit was found to be 12,242 pounds. It weighs 9,115 pounds empty and has a useful load of 3,127 pounds, with a crew of three and 707 pounds of passengers or cargo. The ship's possible maximum range, in still air, is 1,000 miles, but at cruising speed of 50 to 52 miles an hour it has a range of 680 miles on 250 gallons of gasoline. Its maximum speed is between 62 and 70 miles an hour.

Paralleling the scientific work on the ZMC-2 was the mechanical development and finally the completion and successful demonstration of the Hill automatic riveting machine, considered an economic necessity in the production of large size metal-clad airships. The machine drove 3,500,000 rivets .035 of an inch in diameter in the ZMC-2 with only one-third of 1 per cent defective rivets. In its operation three strands of wire are punched through the sheets of metal and the revolving cams head up the rivets. The spacing of rivets also is automatic. The machine, manned by two workers, can accomplish the work of 128 men working by hand. It inserts and completes 5,000 rivets an hour.

The ship was built under a special appropriation of $300,000 passed by Congress in 1926. According to its builders, the ship's cost, including engineering development and research, was approximately $750,000. The engineers who developed it say that in larger sizes not only can airships be built possessing the advantages of all-metal construction, but that it can be done without adding any considerable weight in excess over fabric-covered ships. The metal hull plating itself carries the tensile and shear stresses and thereby reduces the design weight requirements of the internal framework.

Los Angeles' Log Crowded

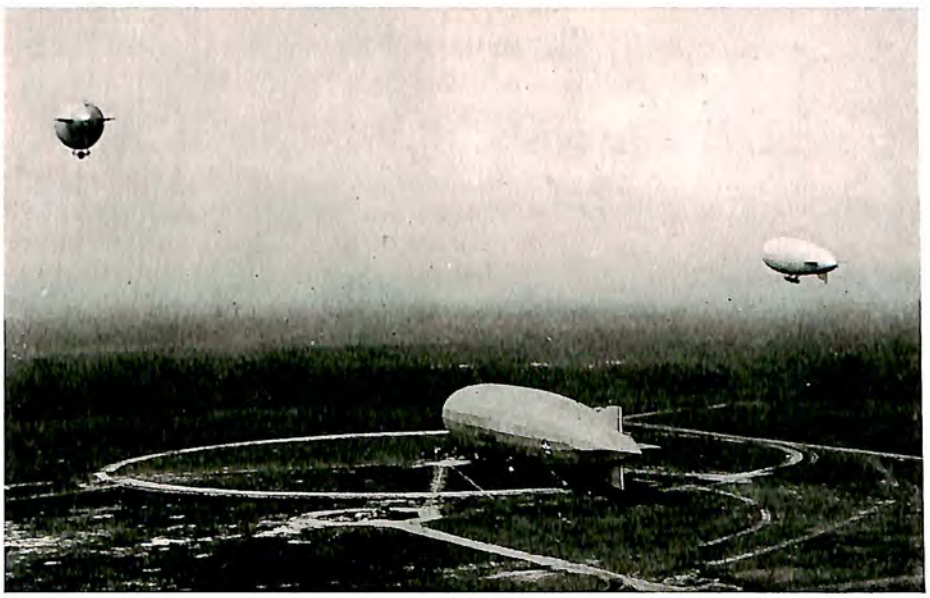
The U. S. Navy dirigible Los Angeles spent a busy year with more than a score of training flights and several long cruises on her log,



Pacific and Atlantic.

HOOKS ON DIRIGIBLE

Vought (Pratt and Whitney Wasp) Corsair of the U. S. Navy hooks on the dirigible Los Angeles while both are in flight to transfer a passenger.



LOS ANGELES AND BLIMPS

Two Navy semi-rigid airships, J-3 and J-4, hover over Lakehurst base, while the giant "Los Angeles" swings at the stub mast.

totaling approximately 425 hours in the air. Studies in the handling and mooring of large airships, experiments in attaching and launching airplanes from dirigibles, and the training of personnel to man the new giant ships under construction were the chief projects on the Los Angeles' program.

The Navy dirigible made 25 flights during the year and carried 1,112 passengers. During the fiscal year 1929 the Los Angeles carried 1,562 passengers on 35 flights and was in the air 558 hours and 52 minutes. Its total time in the air during the 18 months ending Dec. 31, 1929, was 702 hours, 47 minutes, carrying 1,952 passengers on a total of 43 flights.

During the calendar year the flights varied from training trips as short as 4 hours and 35 minutes to an extensive Florida tour, during which the dirigible was in the air 108 hours and 32 minutes. The Los Angeles started the Florida flight January 8 with 47 persons aboard and, after bucking severe headwinds on a 40-hour flight, moored to the U. S. S. Patoka in St. Joseph's Bay, Fla. After refueling the airship left the Patoka January 10 and headed toward Miami, but warnings of a severe storm brought her back to the ship's mooring mast 15 hours later. The flight to Miami was made January 12, the airship returning to the Patoka for further tests of the mooring mast after a flight of 39 hours and 31 minutes. A speedy return to Lakehurst was made in 13 hours and 50 minutes with the log showing as high as 100 knots an hour ground speed. The southern flight was considered very important since it made possible study of mooring operations to a stub mast mounted on a ship at sea under varying conditions.

In March the Los Angeles carried its largest passenger list—fifty-three—during the Hoover inaugural celebration in Washington. The flight was made under very unfavorable weather conditions and lasted 10 hours and 45 minutes. February was the only month during which the big airship did not make a flight. Flights west to Cleveland for the National Air Races August 27 and to Akron November 7 for the ring laying of the new ZRS-4 were included among her longer flights. The dirigible was moored to a mobile mast overnight at Cleveland during the National Air Races.

Successful tests in attaching an airplane to the Los Angeles in flight and again launching it from the dirigible were climaxed with the first public demonstration during the National Air Races. Lieut. A. W. Gordon of the U. S. Navy, flying a Vought (Pratt & Whitney Wasp) observation plane, attached his heavier-than-air craft to the Los Angeles while in flight, and after taking a passenger aboard from the airship flew safely to earth. It was the first time in history that a passenger had been transferred from an airship in flight to an airport by airplane.

LARGEST COMMERCIAL BLIMP

"Defender," largest of the Goodyear fleet, landing at the private airship base near Wingfoot Lake in Akron.

"DEFENDER" INTERIOR

Cabin of the commercial airship "Defender," the largest of the fleet of Goodyear blimps.

"The experiments open up larger possibilities for the use of airplanes with airships, thereby extending the usefulness of the airship," Rear Admiral William A. Moffett said following the tests. "Aside from such military values as the airplane affording protection to the airship and the dirigible serving as a refueling base for airplanes at sea, the use of airplanes for delivering and discharging mail and passengers can have an important bearing on commercial airship operations."

The tests were carried out to perfect a trapeze apparatus to be used

International Newsreel.

DIRECTS WORLD FLIGHT

Dr. Hugo Eckener (right), commander of the Graf Zeppelin, talks with Sir Hubert Wilkins, explorer, in control cabin of the huge ship which circled the globe.

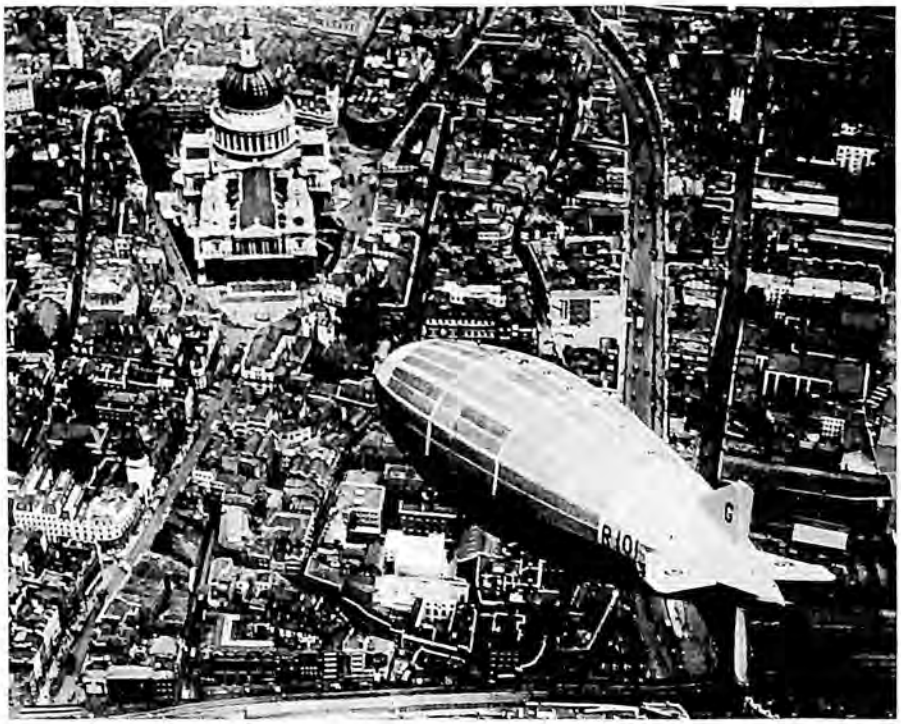
on the new ZRS-4 and ZRS-5, which will carry five scout planes in a "marsupial" hangar, ready to be launched from the airship or taken aboard during flight.

Three Times Around World

While the globe-circling flight of the Graf Zeppelin and its other important tours are reviewed at length in the chapter on "History-Making Flights of 1929," it is worthy to note that the German dirigible

had flown a distance equal to three trips around the world at the equator from the time she was commissioned in 1928 until the end of 1929.

During 50 trips it covered 72,648 miles, carrying a crew and 1,574 passengers, $20,000 worth of letters and postcards, and a useful load of 876,434 pounds. On these flights the dirigible consumed 307,465 cubic yards of fuel gas, 80,507 quarts of benzine and 14,933 quarts of oil, an average of 359 quarts for every 62.1 miles.



BRITISH SKY QUEEN

British dirigible, R-101, the largest yet developed, flying over London on an early test.

Great Britain's New Airships

The two new British dirigibles, R-100 and R-101, were completed late in the year, and the world awaited their first extensive flights in 1930. The R-101 was first to be test flown, making several flights late in the year. The two airships were approved in 1924 under a program laid down by the Labor Government with Lord Thomson as Air Minister. Their construction required five years and found Lord Thomson again in office when the first flight of the R-101 was made.

The R-100, designed and built by the Airship Guarantee Company at Howden, Yorkshire, is slightly shorter and a bit fatter than the R-101, built by the Air Ministry at the Royal Airship Works at Cardington, Bedfordshire. However, both ships built for the Air Ministry have a capacity of 5,000,000 cubic feet, which is larger than the Graf Zeppelin and smaller than the new Navy airships under construction at Akron. The R-100 used gasoline in her engines, while the R-101 is equipped with oil-burning Diesel engines.

DRIVING GOLDEN RIVET

Rear Admiral William A. Moffett, strong supporter of lighter-than-air development, drives the golden rivet in the first ring of the new navy dirigible, ZRS-4, at Akron.

While luxurious passenger accommodations for 100 persons were included in the design of the R-101, it was reported that no more than 52 passengers could be carried because of changes in the calculations of the engines' power. The promenade decks, comfortable lounges and beautiful dining salons are some of the outstanding features of the new airship, which embodies several new principles in design. A study of the characteristics data included in the table accompanying this chapter

BLIMP IN NEW ENGLAND

Airship "Mayflower" over historic whaling ship at South Dartmouth, Mass.

TRAINING BLIMP

"Vigilant," one of the fleet of Goodyear airships, landing at Miami, Fla., where a new municipal airship base is being established.

will provide a more complete knowledge of the new British airships as compared with the world's other rigid ships.

Non-Rigid Fleet Active

The Goodyear-Zeppelin Corporation's fleet of small airships, which had its inception in the construction and operation of the Pilgrim in 1925, consisted of the Pilgrim, Puritan, Volunteer, Mayflower, Vigilant and Defender at the close of 1929.

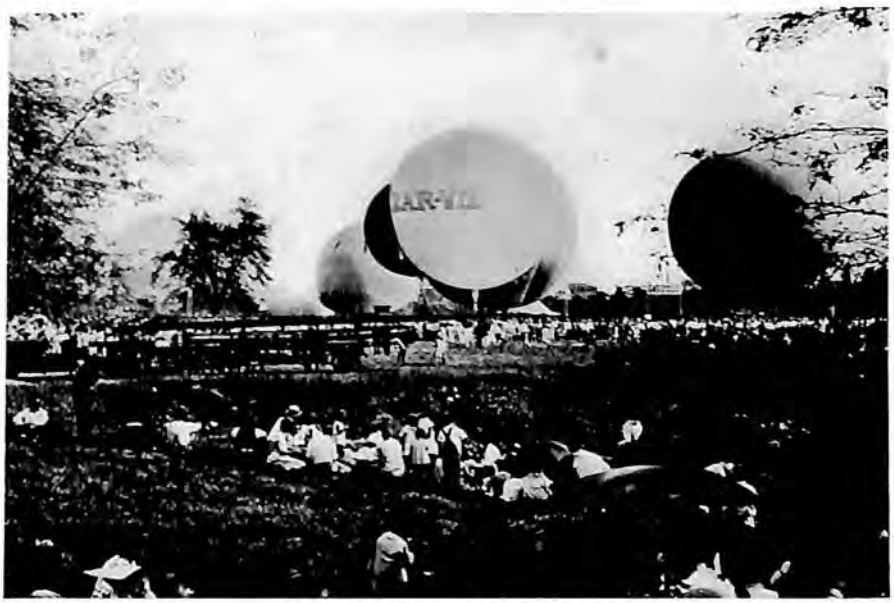
The Pilgrim is of 54,000 cubic feet capacity, 110 feet long and powered by a 60-h.p. motor. The Volunteer, Vigilant and Mayflower are of 86,000 cubic feet capacity, 128 feet long, and are powered with two Siemens-Halske 70-h p. motors, giving them a top speed of 58 miles an hour. The Puritan, with a gas capacity of 100,000 cubic feet, is 138 feet long and is powered with two Warner Scarab 110-h.p. motors.

The Defender, which is the most recent of the small ships built by Goodyear, was designed especially for passenger-carrying service and has a seating capacity of nine in addition to a crew of three. The car is carried by an internal suspension system which consists of two catenary curtains extending longitudinally along the top of the envelope. Cables attached to the points of the catenaries converge to three points near the axis, from which other cables extend to the point of attachment on the car.

Horizontal forces, such as propeller thrust, are transferred from the car to the envelope by a series of catenary curves attached to the envelope adjacent to the car. Power is provided by two Wright Whirlwind engines of 165 h.p. each, one mounted on an outrigger on each side of the car. The speed at full power is 65 miles per hour and the range, carrying six passengers, is 500 miles.

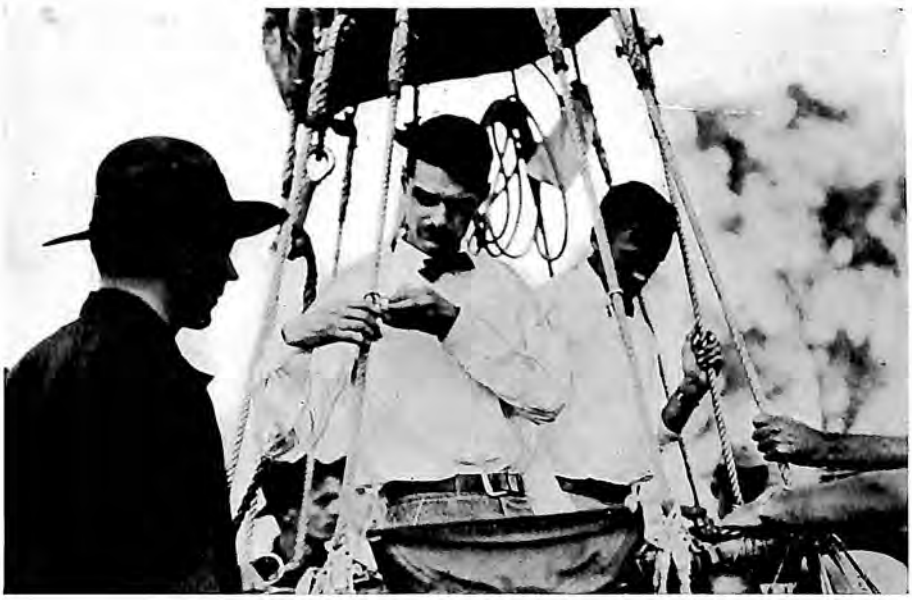
During the summer Goodyear's fleet of airships was in the air a total of 3,228 hours on training, experimental and demonstration missions. The Volunteer was permanently based at Los Angeles, and during the summer the Mayflower was based in New England, where it was used in radio experimental flying in co-operation with the research staff of the Massachusetts Institute of Technology. Other ships of the fleet made extended tours throughout the eastern seaboard and mid-western states.

Late in November several of the ships were sent to Florida, where bases had been established at Miami and St. Petersburg, and a training and experimental program was to be followed throughout the winter. The company also had an airship based at its southern tire plant at Gadsden, Ala.



INTERNATIONAL RACE

Start of the International Balloon Race for the Gordon Bennett trophy at St. Louis, Mo. Goodyear VIII, in foreground, won.



GORDON BENNETT WINNERS

Ward T. Van Orman, pilot, and Alan MacCracken, aide, in basket of Goodyear VIII, winners of 1929 Gordon Bennett Balloon Race.

The Goodyear-Zeppelin Corporation operated the only civilian lighter-than-air school in the United States. Complete ground school work was handled by the University of Akron in a six-months course while practical flight training was given at the company's Wingfoot Lake air station near Akron. Each student must be a qualified free balloonist before he can secure recognition as an airship pilot.

Helium Resources

One of America's greatest assets for the development of lighter-than-air craft lies in the fact that the nation has a monopoly on the world's helium supply. The government operated plant near Amarillo, Tex., continued operations during the year extracting helium gas for use in the airships of the Army and Navy, while the Helium Company, Inc., of Louisville, Ky., produced the gas commercially.

The Helium Company added a new plant at Thatcher, Colo., to supplement the output of its Dexter, Kan., plant, and developed a new and highly efficient method of removing carbon dioxide from gas prior to the extraction of helium. The company also designed and constructed a small portable helium plant for the removal and purification of helium gas from airships after contamination by infusion of air. The portable plant is mounted on a truck trailer and is self-contained with the exception of the motor drive.

The Helium Company also developed and designed a plant for the removal of sulphur from natural gas, minimizing injury to pipe lines and parts in gas fields where the motive power is by gas engine. A careful and systematic geological survey of the United States to locate and determine the size of helium bearing natural gas supplies was made. The company opened up a new helium bearing gas field whose helium content is 8 per cent, the highest that has so far been reported anywhere in the world.

Activity in the lighter-than-air field was along so many lines in 1929 that it promised to provide unprecedented achievements for 1930.

CHAPTER IX

HISTORY MAKING FLIGHTS OF 1929

MAN flew faster, higher, longer and farther during 1929 than he did during any year since he acquired "wings," 26 years ago. The Atlantic Ocean was spanned four times; New York and Los Angeles brought closer together in record non-stop flights; Alaska linked with New York in 38 hours elapsed time; India brought within 50 hours of London; the globe girdled by airship in 21 days; 169 passengers carried on a single flight of one hour duration, and the South Pole reached by air.

While man's record achievements in the air overshadowed all previous years, the list of spectacular flights alone could not be taken as a complete chronicle of his success, because so many flights which had become commonplace would have been considered almost superhuman a few years ago.

Graf Zeppelin Girdles Globe

The Graf Zeppelin, Germany's giant dirigible, figured in a series of brilliant flights during 1929, which were climaxed by a trip around the world in 21 days. The flight set a new record for the globe-girdling trip and brought renewed confidence in the possibilities of lighter-than-air craft for long trips. It provided Americans with a demonstration of what might be expected when the Goodyear-Zeppelin Corporation completes its two faster and larger dirigibles for the U. S. Navy.

Leaving Lakehurst, N. J., shortly before midnight August 8, Comdr. Hugo Eckener and his globe-cirling crew flew over New York City and the Statue of Liberty before heading out across the Atlantic for Friedrichshafen on the first lap of the journey. While the big dirigible was not built for speed, she reached Germany in 55 hours and 22 minutes, taking only 46 hours and 52 minutes from New York to Paris. Lindbergh's time was 33 hours and 30 minutes, and Byrd took 43 hours and 21 minutes from New York to the French coast.

On the greater part of the trip the Graf Zeppelin carried 61 persons, 20 of them passengers, including Lady Grace Drummond Hay, the only woman passenger; Sir Hubert Wilkins, explorer; Comdr. Charles E. Rosendahl of the U. S. Navy, and naval and scientific representatives of the Russian and Japanese governments.

After four days in Germany the big ship pointed her silver nose into the east again with Tokio as her second stopping place. The 6,800-

mile trip was ended at Kasumigaura Airport 101 hours and 53 minutes later. Four more days of rest followed, while the crew prepared the ship for its crossing of the Pacific Ocean—the first ever attempted by an airship. Leaving Tokio August 23, Commander Eckener brought the dirigible into the Los Angeles Airport 78 hours and 58 minutes later, completing a hop of 5,500 miles.

The following day, August 27, he started the United States transcontinental flight over a circuitous route through the Southwest and then north into Wisconsin before heading east to Detroit, Cleveland and finally New York. The great ship passed the Statue of Liberty again just 21 days after she had headed eastward on the globe-circling flight. The official time for the 19,500 mile flight was 21 days, 7 hours and 26 minutes.

Immediately upon his arrival at Lakehurst, Commander Eckener turned the ship over to Capt. Ernst Lehman, who made the necessary arrangements for continuing the flight to Germany as soon as possible. Commander Eckener received a public ovation in New York, equaled only by the demonstration staged for Lindbergh. He was received by President Hoover in Washington and returned September 1 to see the dirigible he had flown around the world take off for Friedrichshafen. Two weeks of daily conferences with the United States bankers on the possibilities of financing regular commercial airship travel across the Atlantic and Pacific followed for Commander Eckener.

In the meantime the Graf Zeppelin took a southerly course from Lakehurst over the Azores and the coast of France, reaching Freidrichshafen the morning of September 4, 67 hours from Lakehurst.

Throughout the world flight the German dirigible did not exceed a speed of 70 miles an hour, and the average for the whole journey was estimated at 50 miles an hour. While Commander Eckener had favorable weather on most of the trip, he was forced to ride out two severe storms, one of them in the uncharted regions of Siberia.

Graf Visits Near East

The Graf Zeppelin started its year's activities with a 5,040-mile flight from Friedrichshafen to the Near East, completing the trip in 81 hours and 30 minutes. It left its hangar March 25, flying over Marseilles, Genoa, Rome, Naples, Palestine, Syria and Constantinople, returning to Friedrichshafen March 28.

The second flight was a cruise of the Mediterranean, leaving Germany April 23 and flying over Chalon-sur-Saone, Bordeaux, France; Portugal, Seville, Spain; North Africa and the Rhone Valley before

International Newsreel.

FLYING OVER SIBERIA

The Stanowei mountains as they were seen from the salon of the globe-circling Graf Zeppelin, on its way from Friedrichshafen to Tokio.

International Newsreel.

CHECKING GRAF'S POSITION

Sir Hubert Wilkins (right) and Karl von Wiegand aboard the Graf Zeppelin plot their position on the Hearst-Zeppelin world tour.

returning to Friedrichshafen. The cruise covered 3,400 miles and lasted 57 hours.

Commander Eckener made an attempt to cross the Atlantic May 16, flying by way of Lyons, Barcelona and the Mediterranean, but was forced to return when serious engine trouble developed. The ship made its way back over Lyons and Valence to Cuers, 15 miles from Toulon, where it was badly crippled Commander Eckener finally brought the dirigible back to her hangar May 18 after about a 1,500-mile flight.

The next flight came July 31, when the airship left Friedrichshafen for Lakehurst, going by way of Switzerland, Lyons, Nimes, Gibraltar and the Azores. The 5,000-mile trip took 95 hours and 23 minutes because of unfavorable headwinds.

The round-the-world feat was the fifth flight for the Graf Zeppelin during the year. After returning to Germany a 50-hour flight was made through the Balkans, October 15 and 16, and then on October 23 and 24 a jaunt to Barcelona, Spain, was completed in 38 hours of flying.

The series of spectacular flights staged by the Graf Zeppelin during 1929 not only increased public interest and confidence in lighter-than-air craft, but made it possible to collect a wealth of data on meteorological and flying conditions, as well as to increase man's experience in handling large airships. The details of these advances are considered more fully in the chapter on "Airship Development."

Yellow Bird Flies to Spain

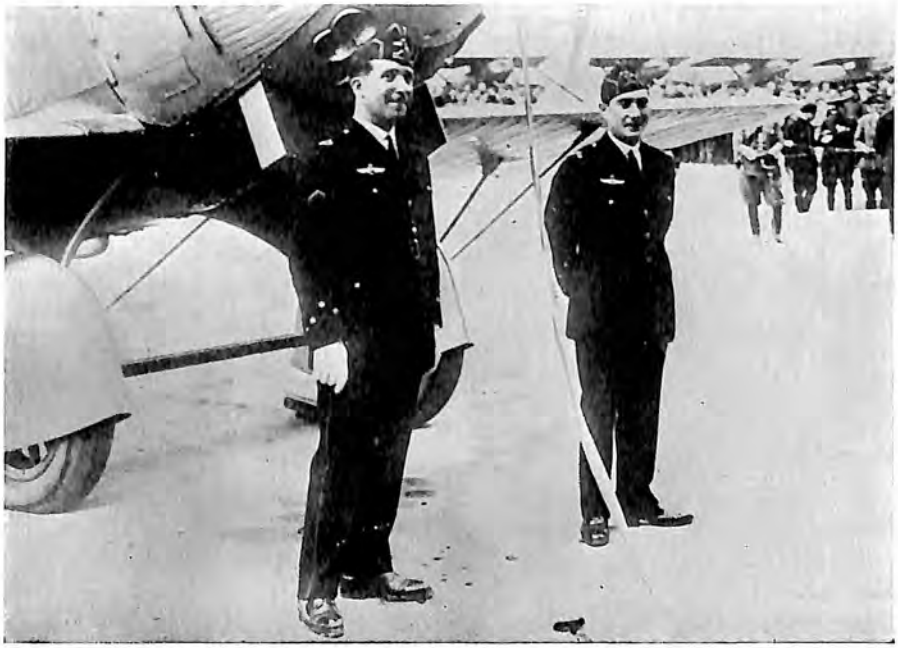
Perched high on the sands at Old Orchard, Me., in early June, two monoplanes—one French and one American—awaited good weather which would start them on the first trans-Atlantic flight attempt from the United States in almost two years.

The French plane Yellow Bird, a Bernard (Hispano-Suiza) monoplane, was headed for Paris with Jean Assolant, Rene Lefevre and Armeno Lotti, Jr., as the members of her crew. The American plane Green Flash, a Bellanca (Wright Whirlwind) monoplane, represented the hopes of Roger Q. Williams and Capt. Lewis A. Yancey, American fliers, with Rome set as their goal.

June 13 brought what the weather bureau meteorologists described as the "best trans-Atlantic flying weather since Lindbergh flew to Paris." The two ships were quickly made ready for their trans-Atlantic adventure. The Yellow Bird was first to thunder along the natural beach runway and get into the air, heading away from the Maine coast with 1,000 gallons of gasoline and benzol, a crew of three and

PARIS-BOUND *Associated Press.*

The "Yellow Bird" leaves the beach at Old Orchard, Me., on its successful trans-Atlantic flight with three French fliers and an American stowaway.



CROSS SOUTH ATLANTIC

Capt. Ignacia Jiminez (left) and Capt. Francisco Iglesias successfully crossed the South Atlantic by air from Seville, Spain, to Bahia, Brazil.

an uninvited stowaway passenger, Arthur Schreiber of Portland, Me. Then the Green Flash started down the beach with its heavy load, but the landing gear collapsed and the ship lay broken and twisted on the sands as the French ship continued her eastward journey.

The S. S. Wytheville was first to report the Frenchmen's progress late in the afternoon of the first day, indicating that they had chosen the course by way of the Azores. The next report came from the S. S. Niagara the following morning when the plane had passed the Azores and was headed toward the coast of Portugal. Clouds, wind, rain and cold, together with the added weight of their stowaway passenger, hampered the fliers.

They landed on the beach near Comillas, Spain, 34 miles from Santander, 29 hours and 52 minutes after they left Old Orchard. They had covered 3,128 miles of their flight to Paris and, while short of their goal, were the first Frenchmen to make the Atlantic crossing by air.

The inhabitants of the Spanish village received them warmly, covered them with flowers and feted them during their brief stay before departing for Paris the following day. Thousands awaited them at the Paris Aerodrome, but observers reported a lack of the excited enthusiasm which made Lindbergh's reception such a vivid spectacle two years before.

Yancey and Williams Span Atlantic

Undaunted by the mishap to their first plane, Green Flash, Capt. Lewis A. Yancey and Roger Q. Williams returned to Old Orchard later in the month with the Bellanca (Wright Whirlwind) monoplane Pathfinder in which they prepared to make another attempt to take off for Rome.

They got into the air on the morning of July 8 and soon the big monoplane disappeared in the bleak fog which hung over the Maine coast. They had been told that favorable weather conditions awaited them over the ocean and that the Maine fog was local. They carried 440 gallons of gasoline, oil and supplies, enough to remain aloft 45 hours if they did not face unusual headwinds.

An anxious world awaited word of their progress from ships at sea, but none came until the two fliers landed at the Albericia Aerodrome, about four miles from Santander, Spain, and not far from the spot where the Yellow Bird was forced to land. They said they had seen the open sea during only two hours of their flight and were forced to fly high because of heavy mists which hung close to the ocean, consuming their gasoline

International.

HEADED FOR ROME

Bellanca monoplane "Pathfinder" (Wright Whirlwind) in which Capt. Lewis A. Yancey and Roger Q. Williams flew from Old Orchard, Me., to Rome.

International.

TRANS-ATLANTIC HEROES

Italian government officials lead acclaim for American fliers, Capt. Lewis A. Yancey (left center) and Roger Q. Williams, upon arrival in Rome.

supply faster than they had expected. They landed after 31 hours and 30 minutes of flying over a 3,400-mile course by way of the Azores.

The Pathfinder continued its flight to Rome the following day, gliding gracefully onto the Littorio Civil Airport, bathed in floodlights, at night. Thousands, who had waited hours for the first New York to Rome fliers, gave them a rousing reception. Italo Balbo, Italian Under-Secretary for Aeronautics, sprinted across the field to be the first to reach the fliers, who crawled from the Pathfinder cabin, grinning but tired from their long flight. Premier Mussolini went to the airport on an early report that the fliers were near Rome, and after waiting hours left only three minutes before they glided in for a landing.

Carried from the field on the shoulders of their enthusiastic Italian celebrants, the American fliers were feted in Rome by high government officials, visiting the King, Premier and Pope.

SEVEN MILES HIGH *Associated Press.*

Wasp-powered Wright Apache plane in which Lieut. Apollo Soucek, U. S. Navy, set a world altitude record for seaplanes at 38,565 feet. He ascended to 39,140 feet with the same plane equipped with wheels.

Spaniards Fly South Atlantic

While the attention of American fliers remained riveted to the North Atlantic, two Spanish airmen completed a brilliant flight across the South Atlantic from Seville, Spain, to Bahia, Brazil, barely falling short of their goal in Rio de Janeiro and a new record for distance flown. They were Captains Francisco Jimenez and Ignacio Iglesias in the Breguet (Hispano-Suiza) plane Jesus del Gran Poder (Jesus of the Great Power).

SIX MILES A MINUTE

Squadron Leader Augustus Orlebar rises out of the tiny cockpit of the Supermarine (Rolls-Royce) S-6 in which he set a new world record of 357 miles an hour at Calshot, England.

MERCURY RACER

Seaplane built for Lieut. A. J. Williams, U. S. Navy speed king, to fly in Schneider Cup Races, but never tested to its maximum capacity.

The Spanish fliers took off from Seville, Spain, late in the afternoon of March 24, with 1,100 gallons of gasoline and 50 gallons of oil. They winged their way across the deserts of Northern Africa and the great expanse of the South Atlantic unsighted after they left Cape Blanco in the African Spanish province of Rio de Oro. They landed at Bahia, 4,100 miles from Seville, 43 hours and 48 minutes after the take-off, completing the third non-stop crossing of the South Atlantic. Dieudonne Costes and Joseph Le Brix were the first to make a non-stop crossing, in 1927, and the Italians, Arturo Ferrarin and Carlo del Prete, made the second hop in 1928, flying from Rome. Lack of gasoline forced the Spaniards to land at Bahia.

The South Atlantic has been considered by many experts to be better adapted to commercial trans-oceanic flying than the North Atlantic, attaching a special significance to flights linking the nations of Europe with South America.

The Spanish fliers continued their flight to Rio de Janeiro, their goal, and later made an extensive tour of South American countries in their trans-Atlantic plane.

Two Others Span Atlantic

The South Atlantic was again crossed on a non-stop flight December 15-16, when Maj. Tadeo Larre-Borges of Uruguay and Lieut. Leon Challe of France flew from Seville, Spain, to Brazil.

They took off from Spain shortly after noon December 15 with Montevideo, Uruguay, as their goal and high hopes of breaking the world's record for distance flying. They fell short of their goal late the following day when they were forced to land their Breguet biplane on the outskirts of San Antonio, near Natal in Brazil. Headwinds encountered on most of the journey cut down their gasoline supply and forced them to fall short of their goal. The plane turned over in landing and was wrecked, but Major Larre-Borges was uninjured and Lieutenant Challe sustained only slight bruises.

The two fliers continued their journey to the Uruguayan capital in a mail plane, receiving a tremendous ovation from South American officials. They completed their 3,600 mile flight across the South Atlantic in about 39 hours.

Trans-Atlantic Attempts

Along with the year's list of successful flights came attempts which fell short of their goals. While Maj. Ramon Franco and his three companions, starting a round-the-world flight with a trans-Atlantic hop

International Newsreel.

ENDING WORLD FLIGHT

Graf Zeppelin salutes the Statue of Liberty at the end of her history-making journey around the world. The air leviathan circled the statue at midnight just 21 days before as she headed east.

from Spain to New York, were forced to land in the open sea, their ability to ride out storms for seven days in their Dornier Wal seaplane before being picked up testified to the seaworthiness of their craft. The British aircraft carrier Eagle found the plane only slightly damaged and the four fliers uninjured.

The trans-Atlantic attempt of the Polish fliers, Majors Leon Idzikowski and Kasimir Kubala, ended when their Amiot (Dietrich-Lorraine) plane Marshall Pilsudski made a forced landing at the Azores, killing Idzikowski. They left Paris headed for New York. Dieudonne Costes and Maurice Bellonte had left Paris for New York on the same day, but returned to France after flying 3,100 miles over the ocean in bad weather.

The Chicago Tribune's Sikorsky (Pratt & Whitney Wasp) amphibion 'Untin' Bowler, making a Chicago-Berlin flight by way of Greenland and Iceland, was caught in an ice floe and sank in Hudson Straits July 14, but its crew was safe. The three young Swiss fliers, Oscar Kaeser, Kurt Luescher and Alfred Tschopp, flying from Paris to New York in a Farman airplane, were last seen over the Azores. Three Swedish airmen, Capt. Albin Ahrenberg, Lieut. Axel Floden and Robert Ljunglund, made many valuable meteorological observations on the Iceland-Greenland airways on their attempted flight from Stockholm to New York, which ended at Ivigut, Greenland, after five attempts to reach the Labrador coast. They were flying a Junkers low-winged seaplane. U. F. Diteman, former Montana ranchman, made an attempt to cross the Atlantic in a Barling low-wing monoplane, not built for such a feat. He was not heard from after leaving the Newfoundland coast.

Moscow to New York Flight

Four Russian fliers linked Moscow with New York October 31 when they completed a 13,300-mile flight in 142 flying hours. Flying a new Tupolev (twin BMW-6) all metal monoplane Land of the Soviets, the Russians left Moscow August 23 on a good-will flight to test the capabilities of the big plane.

The flight covered great stretches of forbidden territory, the vast, uninhabited marshy forests of Siberia, and the stormy North Pacific Ocean, particularly dangerous at that time of the year. Dense smoke from forest fires in the Siberian taiga and frequently heavy storms were encountered.

The crew of the Soviet monoplane consisted of Semyon Shestakov, first pilot; Philip Bolotov, second pilot; Boris Sterligov, navigator, and Dimitri Fufaev, mechanic. From Moscow they flew to Kurgan,

Novosibirsk, Irkutsk, Verkhneudinsk, Chita, Blagovestchensk and Khabarovsk, where pontoons replaced the wheels for the sea flight. Cyclones in central Siberia further endangered the lives of the fliers and delayed the plane.

From Nikolaevsk they flew to Petropavlovsk in Kamchatka; Attu in Aleutian Islands; Dutch Harbor, Unalaska, and on to Seward, Alaska. Sitka, Waterfall, Seattle, Vancouver, San Francisco, Salt Lake City, North Platte, Neb., Chicago, Detroit and New York completed their itinerary.

MOSCOW TO NEW YORK

The Russian metal monoplane Land of the Soviets is refueled at Oakland, Cal., airport on its successful flight from Moscow to New York City.

The flight was made across the United States with the permission of the Federal Government, and the fliers were honored upon their arrival in New York with a public demonstration at the airport and a banquet given by the Russian American Chamber of Commerce and the Aeronautical Chamber of Commerce of America.

New Speed Record

Squadron Leader Augustus H. Orlebar of Great Britain raised the world airplane speed record to 357.7 miles an hour September 15 at

Calshot, England, bettering his own brilliant two-day-old record in the Supermarine (Rolls Royce) S6 seaplane which won the Schneider Cup Race. His speeds for the four flights over the three-kilometer (1.863-mile) course were 354.6 miles an hour, 358.7, 352.5 and 365.1.

After a perfect take-off in his blue and silver seaplane, Orlebar roared six times around the three-kilometer course on Southampton Water. Hurtling like a meteor over the water, it was difficult for throngs on the shore to judge whether he had exceeded his spectacular performance of two days before. When all instruments were checked it was announced that he had averaged 1.9 miles an hour more than on the previous occasion, when his speeds for the four laps were: 368.8, 345.3, 365.5 and 343.7, for an average of 355.8.

Orlebar's record was more than 39 miles an hour faster than the old world record for a three-kilometer course held by Major Bernardi of Italy, and 25 miles an hour faster than the fifty-kilometer (31-mile) record of Flying Officer Richard Atcherley made in the 1929 Schneider Cup Race a few days before.

Schneider Cup Race

One million persons saw two British airmen in the Schneider Cup Races fly at about two-fifths the speed of sound to win the famous trophy for Great Britain September 7. Their speeds were the greatest attained before Orlebar's record performance.

Flying Officer H. R. D. Waghorn won the 217-mile race, seven times around an enclosed course, at an average speed of 328.63 miles an hour, but Flying Officer Richard Atcherley shared honors with him by beating Waghorn's record for a single lap when he averaged 332.49 miles an hour for the 31-mile spurt.

Atcherley had averaged three miles an hour more than Waghorn for the whole course, but was disqualified for cutting the wrong side of the pylon when the wind blew off his goggles and he swerved before he could reach for another pair.

Warrant Officer Tomason Dal Molin, flying the seaplane which set the world record in 1927, was the only Italian to finish. His relatively slow average of 282.11 miles per hour gave him second place. Lieut. d'Arcy Grieg, former holder of the world's speed record, was third in his two-year-old Napier, flying an average of 282 miles an hour.

France and the United States had scratched their entries in the race. Italy, although weakened by the loss of its specially built plane, offered the only competition for the Britons. Lieut. Alford J. Williams, U. S. Navy speed ace, with the aid of private backing and the advice of Navy aeronautical engineers, constructed the Mercury (Packard)

seaplane which was to have been America's entry in the famous race. When complications of bad weather and minor mechanical disorders made it impossible for Lieutenant Williams to test his machine properly in America, David S. Ingalls, assistant secretary of navy for aeronautics, refused to permit Williams to compete abroad. It was expected that the plane would be completed and its capabilities fully tested in 1930.

Record Altitude Flights

Lieut. Apollo Soucek set a new world altitude record for landplanes May 8 when he ascended to 39,144 feet over the Anacostia Naval Air Station in the Wright (Pratt & Whitney Wasp) Apache plane, which led the previous world record. He exceeded by 726 feet the record of 38,418 feet set by Lieut. C. C. Champion of the U. S. Navy in 1927.

However, Lieutenant Soucek's record was short lived. Eighteen days later, on May 26, Willi Neuenhofer of Germany ascended to 41,794 feet in a Junkers (Bristol Jupiter) monoplane. The German flier reached a height of almost eight miles above the earth. Lieutenant Soucek's record stood as the official American altitude mark.

The Navy altitude ace later set a new world altitude record for seaplanes when he flew the Wright (Pratt & Whitney Wasp) Apache, equipped with pontoons, to a height of 38,560 feet above Anacostia, D. C. Lieutenant Soucek's flights were sponsored by the Navy to further its study of supercharged engines for fighting planes and the use of oxygen to sustain life at high altitudes.

Duration Records

Martin Jensen, trans-Pacific flier, set a new world's solo duration record March 28 at Roosevelt Field, L. I., when he stayed aloft 35 hours, 33 minutes and 20 seconds in the Bellanca (Wright Whirlwind) Green Flash, but his record was shattered again and again. Lieut. Herbert Fahy, flying a Lockheed (Pratt & Whitney Wasp) monoplane at Los Angeles, raised the record to 36 hours, 36 minutes and 36 seconds; and then Vern Speich boosted the mark to 38 hours and 48 seconds at Long Beach, Calif. Thomas D. Reid surpassed all three records during the National Air Races at Cleveland in an Emsco (Wright Whirlwind) monoplane, but fell asleep in the thirty-ninth hour of his solo flight and crashed.

The greatest interest in duration records during 1929 lay, however, in the field of flights with the aid of refueling. America witnessed

nearly two-score such flights, starting January 1 with the 150-hour record of the Question Mark and climaxed with the 420-hour mark set by the St. Louis Robin in July. These endurance flights, which fired the imagination of fliers and the general public alike, are reviewed in the chapter devoted to "Refueling Endurance Flights."

Record Distance Flights

Men not only flew faster, higher and longer in 1929 than in any previous year, but they set a new record for non-stop flight without the aid of refueling. Capt. Dieudonne Costes and Maurice Bellonte in their Breguet (Hispano-Suiza) sesquiplane Question Mark flew from Paris to Tsitsihar, Manchuria, a distance of 4,877 miles, in 51 hours and 39 minutes for a new world's distance record.

It was more than 400 miles farther than the 4,448-mile record set by the Italian fliers Ferrarin and Delprete on their flight from Rome to Brazil in 1928. Coste and Bellonte estimate they flew 5,592 miles, but the airline distance was established at 4,877 miles. They had enough fuel to fly two hours and a half longer and believed they could have reached Tokio, but strong winds and a driving snowstorm caused them to pick out a landing spot as the second night of their flight began to close in on them.

They took off from Paris on the morning of September 27 and headed eastward, although observers at the field said the fliers were still tempted to try a trans-Atlantic flight. The plane was loaded with 1,850 gallons of gasoline, 60 gallons of oil and a good stock of food. They were last reported over Cologne, and were not heard from for a week, when reports from Manchuria told of their success and the suspicion of Chinese who thought their big red plane might have been owned by the Bolsheviks. After flying from Mukden to Hanoi, where they were delayed weeks by international red-tape, Coste and Bellonte made a speedy return to Paris through Calcutta, Karachi, Aleppo, Athens and Rome. The return flight from Hanoi to Paris was made in 4 days and 18 hours.

The French fliers had used the same plane on an attempted trans-Atlantic flight July 14, which ended after they flew more than 3,100 miles over the Atlantic and were forced back by headwinds to Villacoublay, France.

Again using the same plane, Captain Costes and Paul Codos set a new world record for distance flown over a closed course December 17 after flying 8,026 kilometers (4,987 miles) in 52 hours and 30 minutes. The record exceeded by 224 miles the former mark of Capt. Arturo Ferrarin and Maj. Carlo Del Prete.

The French fliers flew a closed course over southern France, chiefly between Istres and Avignon. Although hampered by storms and heavy winds on the last 24 hours of the flight, the plane surpassed by 75 miles its performance in a straight line made in September between Paris and Manchuria.

Hawks Cuts Trans-continental Records

Capt. Frank Hawks, superintendent of aviation for the Texas Company, brought New York and Los Angeles within 17½ hours of each

SHATTERS NON-STOP RECORDS

Capt. Frank Hawks and the Lockheed Air Express (Wasp) in which he set new East to West and West to East transcontinental non-stop records, completing the round trip New York-Los Angeles flight in 36 hours 46 minutes elapsed time.

other on the third of his record-breaking non-stop flights during the year. He made the round trip flight from New York to Los Angeles and return with one stop in 36 hours, 46 minutes and 48⅗ seconds.

He started his year of record-breaking flights in the Lockheed Air Express (Pratt & Whitney Wasp) Texaco with a west to east non-stop flight in 18 hours, 21 minutes and 59 seconds, February 3 and 4. This cut 37 minutes from the record made for the 2,700-mile flight by Arthur Goebel and Harry Tucker in 1928. Oscar Grubb, mechanic, made the February flight with Hawks.

Storms forced them to fly almost the entire distance above a floor of clouds. They lost sight of the ground in New Mexico and next saw what they believed to be West Virginia. Flying from 10,000 to 15,000 feet most of the way, it was a supreme test for their instruments, plane and navigating skill.

Not satisfied with this west to east record, Hawks took off from Roosevelt Field, L. I., June 27, on a solo non-stop flight to Los Angeles. He landed on the west coast 19 hours, 10 minutes and 32 seconds later, cutting five hours from the previous record made by C. B. D. Collyer and Harry Tucker in 1928. Turning his plane over to a ground crew, he rested for a few hours and returned to the field to take off for New York on another non-stop solo flight to break his own record and set a record for the round trip.

Captain Hawks roared out of the West to land in the floodlights of Roosevelt Field shortly after midnight, 17 hours, 38 minutes and 16⅗ seconds, bettering his former record by more than 43 minutes and setting a new record for the round trip with one stop. The plane had been seen at Albuquerque, N. M., and St. Louis, Mo., on its eastward flight. Captain Hawks stepped from the plane clad in the same white trousers he wore on the westward trip, admitted he was a bit tired but "by no means worn out."

Capt. Roscoe Turner made a speedy trip from Los Angeles to New York with four passengers, August 22, in a Lockheed Vega (Wasp) monoplane, but failed to break Hawks's record. Captain Turner made the trip to New York in 19 hours and 35 minutes. Making four stops on his return flight to Los Angeles, he completed the trip in 23 hours, 59 minutes and 42 seconds after a battle with fog and storm.

New York to Nome Flight

Capt. Ross G. Hoyt of the U. S. Army Air Corps blazed a trail from New York to Nome, Alaska, flying his Curtiss (Curtiss Conqueror) "Hawk" pursuit plane across plains and lakes, over snow-capped mountains, fog and clouds, to span the 4,500 miles in 38 hours elapsed time. But for a few drops of water in his gasoline tanks, a record round trip flight of from 70 to 80 hours might have been made.

With 250 gallons of gasoline in its tanks and the throttle wide open, the Newlaska sped down the runway at Mitchel Field July 18 and was in the air within 800 yards, bound for Minneapolis, the first stop. Despite storms and strong headwinds, the plane reached Minneapolis in seven hours, refueled and headed for Edmonton, Alta., 1,100 miles away. Captain Hoyt reached Edmonton before dawn and

breakfasted there. He winged his way between the towering snow-capped peaks of the Canadian Rockies from Edmonton to Whitehorse, flying on to Fairbanks and finally into Nome. The Alaskan city was reached in 38 hours elapsed time, or 34 hours and 20 minutes flying time.

Seventeen minutes after arriving in Nome, Captain Hoyt took off for Fairbanks, which he reached in three and a half hours. After a four-hour rest he took off for Whitehorse, which also was reached in three and a half hours. About half way between Prince George and

Wide World.

GIANT OF THE SKIES

Dornier DO-X (12 Siemens-Jupiters), world's largest flying boat, soars over Lake Constance in Switzerland on test flight.

Jasper, B. C., the Newlaska engine sputtered. Captain Hoyt looked for a landing field and spotted a clearing within gliding distance below him. The field proved to be of soft sand with mounds two or three feet high. The right wheel struck a mound in landing, throwing the left wing into the ground and damaging the plane. Captain Hoyt blamed the condensation of water on the interior of the gasoline tanks for the engine's failure.

The flight was considered of extraordinary military significance and was said by military experts to prove that squadrons of pursuit planes could be moved over long distances from one part of the continent to another in short time.

Southern Cross Flies to England

The trans-Pacific Fokker (3 Wright Whirlwinds) monoplane Southern Cross added to its laurels July 10 when it arrived in London, setting a new record for the 12,000-mile flight from Australia to England. The plane was flown in 1928 from California to Australia and on a round trip between Australia and New Zealand.

When Capt. Sir Charles Kingsford-Smith and his three companions—two of them Americans—landed at Croydon Aerodrome they had bettered by more than two days the England to Australia record held by Capt. Harold (Bert) Hinkler, who made the flight in a light plane. Capt. Kingsford-Smith's crew included Capt. Charles T. P. Ulm, co-pilot; H. A. Litchfield and T. H. McWilliam, navigator and radio operator. Their elapsed time from Derby, on the Australian coast, to England was 12 days, 21 hours and 18 minutes. They flew 1,400 miles from Sydney on the day before their start from Derby.

London-India Non-Stop Flight

Attempting to set a new world's distance record, two British Air Force fliers linked London, England, with Karachi, India, in the first non-stop flight between England and India. The 4,130-mile flight was completed in 50 hours and 48 minutes. It was considered to have great military significance in that it demonstrated how planes of the Royal Air Force might make speedy flights to Britain's far-flung possessions.

A heavy headwind down the Persian Gulf reduced the Fairey (Napier) monoplane's speed, and although Squadron Leader A. G. Jones-Williams and Flight Lieut. N. H. Jenkins passed Karachi, they decided to return owing to the shortage of gasoline. They were less than 300 miles short of their goal, but added a brilliant non-stop flight to the records of British aeronautics. The new air mail service between England and India, inaugurated this year, requires seven and a half days to complete the same trip. It was believed that the flight might have some commercial significance.

Dornier Carries 169 Persons

For the first time in the history of aviation, a flying boat took off with 169 persons and remained in flight for an hour. This milestone in the story of flight's progress was established October 21 by the giant Dornier (12 Siemens Jupiters) DO-X, flying over Lake Constance

between Switzerland and Germany. The largest dirigibles had not carried half this number of passengers on a single flight.

The DO-X was reported to have carried a fuel load sufficient for a 750-mile flight in addition to the 17-ton passenger load. The giant flying boat, propelled by twelve engines above the wing, lifted a total weight of 52 long tons from the water in 50 seconds.

SOUTH AMERICAN FLIER

Capt. Carlos Martinez de Pinillos, Peruvian flier, and G. M. Bellanca (right), designer, in front of the Bellanca monoplane flown by de Pinillos over the Andes on 6,000 mile South American tour.

While the flying boat ordinarily was fitted with accommodations for 72 passengers, basket benches and chairs were put in on the upper decks and all of the 159 passengers had seats when the plane took off.

After circling Lake Constance along the German side over the cities of Meersburg, Friedrichshafen and Lindau, as well as the Austrian town of Bregenz, at a speed of 110 miles an hour, the DO-X descended

in front of the hangar at Altenrhine so smoothly that many of the passengers were said to be unaware of the landing.

The giant flying boat, the largest developed in the world during 1929, made about forty test flights with moderate loads before the record passenger list was taken aloft. Two sister ships of the DO-X were under construction at the Dornier plant when the year ended. General Motors had completed a contract with Dr. Dornier, placing facilities at his disposal for the building of Dornier planes in the United States. Dr. Claude Dornier arrived in New York in November to complete plans for the American-built Dornier planes.

Byrd Flies to South Pole

The year's long series of spectacular achievements in the air was climaxed with Comdr. Richard E. Byrd's flight to the South Pole November 28 and 29. With Bernt Balchen, pilot, Harold June, radio operator and co-pilot, and Capt. Ashley McKinley, photographer, as his companions, Commander Byrd took off from his base at Little America at 10:29 o'clock (New York time) on the night of November 28 and headed the big Ford monoplane, powered with a Wright Cyclone and two Wright Whirlwind engines, toward the pole.

Radio messages from the plane to the station at Little America, later relayed to New York, unfolded a brilliant story of the plane's progress across the Ross Ice Shelf, then up through passes flanked by towering peaks of the polar mountain ranges until the pole itself was reached at 8:55 o'clock the following morning. A radio message sent out from the plane gave the world the first news that the South Pole had been reached by airplane.

"My calculations indicate that we have reached the vicinity of the South Pole, flying high for a survey. The airplane is in good shape, crew all well. Will soon turn north. We can see an almost limitless polar plateau. Our departure from the pole was at 1:25 a. m.—Byrd."

The party later reached the supply base which had been laid at the foot of the mountains November 18, and the plane was refueled before its return flight to Little America, which was reached at 5:10 o'clock (New York time) November 29. The Floyd Bennett, as the plane was called, made the circuit to the pole from Little America in 18 hours and 59 minutes elapsed time, an hour being spent in refueling at the mountain base. The distance was estimated at 1,600 miles and Commander Byrd reported being forced to fly at from 11,000 to 13,000 feet.

The flight added a new chapter to the history of aviation and another brilliant achievement to the career of Commander Byrd, the only man to circle both poles and span the Atlantic by air.

CHAPTER X

REFUELING ENDURANCE FLIGHTS

WHILE the year saw all records for speed, altitude and distance shattered, no airplane flights during 1929 captured greater public attention or fired the imagination of fliers seeking new laurels more than the endurance flights with the aid of refueling in the air.

To refuel a plane in the air was not a new feat. Lieutenants Lowell Smith and Paul Richter demonstrated that fuel, food and supplies could be transferred from one plane to another while in flight during their 37-hour test over San Diego, Calif., with a Liberty-powered DH-4B in August, 1923. American fliers gave little attention to the possibilities of bettering that record from 1923 until 1929, preferring to concentrate their efforts on endurance flights without the aid of refueling. Two Belgian fliers, Louis Crooy and Victor Groenen, boosted the Smith-Richter record to 60 hours and 7 minutes in a refueling flight during 1928. The technique of endurance flying advanced so rapidly that the world record for airplanes without the aid of refueling was 65 hours and 25 minutes. Johann Risticz and Wilhelm Zimmerman reached that mark in Germany during 1928.

But 1929 was to see a series of brilliant flights for duration records almost inconceivable to technician and layman alike. Two men were to remain aloft in the confines of a cabin airplane for seventeen and one-half days, fly a distance greater than that of the earth's circumference at the equator, and return to earth without being forced down due to the weakening of man or machine. Their plane, a Curtiss (Curtiss Challenger) Robin, passed a test more severe than any ever devised for a locomotive machine before on land or water or in the air.

Nearly forty attempts to set new endurance records with the aid of refueling were made during the year, as the wave of enthusiasm swept the country. The year closed with man still unsatisfied with his record achievement. Several manufacturers reported work on ships for new refueling record seekers, laying plans for 1930.

The Question Mark, a Fokker (3 Wright Whirlwinds) monoplane, set a record for all fliers to shoot at with its achievement of more than 150 hours in the air during the opening days of 1929. That mark was surpassed nine times during the year and the record changed hands no less than five times. The "record holders," two of whom enjoyed the honor but a few days, traveled 82,110 miles—nearly

three and a half times around the world at the equator—on their five flights, remaining aloft an aggregate of 1,164 hours, or almost seven weeks. The Army Air Corps had again shown leadership in an important field of aeronautical experiment.

Question Mark

Cloudless skies and a gentle seven-mile breeze furnished ideal flying conditions for the tri-motored monoplane Question Mark when it took off early New Year's morning on the most elaborately planned endurance test in history. Capt. Ira C. Eaker of the Army Air Corps was piloting the big ship as it started its monotonous cruise back and forth above Southern California's shore line.

There were less than 100 gallons of gasoline in the tanks at the take-off and yet the Army Air Corps experts expected the plane to stay aloft 100 hours, or until the engines refused to function or the men were too weary to continue their flight. It was to be a supreme test for man and machine. Aircraft engines had been run "to destruction" on laboratory test blocks before, and the data carefully compiled, but never before had they been tested to their maximum capacity in the air under actual flight conditions.

The gasoline taken aloft at the start of the flight soon dwindled as the motors droned on carrying the crew of five in the cabin of the big monoplane. A signal for the first refueling in the air was given. Lieut. Odas Moon, piloting a Douglas transport refueling ship, took off. He maneuvered above the Question Mark. A signal for the contact was given. A hose was lowered from the refueling ship. Maj. Carl Spatz, commander of the flight, grasped the swaying hose and poked its nozzle into the Question Mark's tanks. Another signal. Gasoline rushed through the hose from the refueling plane above. One hundred gallons were transferred in 1½ minutes. The first refueling contact had been made, but days and nights filled with similar maneuvers were to follow. Forty-three contacts were made during the flight, nine of them at night. The refueling planes, piloted by Capt. Ross G. Hoyt and Lieutenant Moon, brought 5,660 gallons of gasoline and 245 gallons of oil to the Question Mark, to say nothing of meals, water, batteries and other supplies. Approximately 40 tons of gasoline, oils and supplies were transferred in the course of the flight.

The "nurse" planes kept up their end of the work in all kinds of weather, night and day, and at various altitudes. The big monoplane flew on, passing the marks set by Smith and Richter, then Crooy and Groenen, then Risticz and Zimmerman; and with all heavier-than-air

records for endurance behind it, looked ahead to the honors boasted by the Graf Zeppelin and Dixmude. One by one they fell, with the Dixmude's record for 118 hours and 41 minutes of sustained flight the last to be surpassed. It was not until the seventh day of the flight that the engines faltered, the left one "cut out." Major Spatz then directed that the plane be headed into the Los Angeles Municipal Airport, where it took off nearly seven days before, and the flight was

FIRST TO PASS 150 HOURS

U. S. Army Air Corps Fokker (3 Wright Whirlwinds) transport which set an endurance refueling record early in 1929, only to have it shattered numerous times.

ended. The plane had been flown about 11,000 miles in 150 hours, 14 minutes and 15 seconds.

The press of the world recognized the achievement as one of the greatest flights in aviation history. The nation acclaimed the five members of the Question Mark crew as heroes, and the War Department awarded them Distinguished Flying Crosses. The crew so honored were: Maj. Carl Spatz, commander of the flight; Capt. Ira Eaker, Lieut. Elwood R. Quesada and Lieut. Harry A. Halverson, pilots; and Staff Sergt. Roy Hooe, mechanic.

An "autopsy" performed on the engines after the flight showed that they were not "dead," but had stood up under nearly seven days of ceaseless duty with only trivial wear. The rocker arm bushings and rocker arms, which could not be oiled properly in flight, were worn in the left engine, together with valve push rods in two of the cylinders. Plugged grease outlets in the left engine, cutting off the pressure-fed lubrication to the valves, were held responsible for the trouble which ended the flight after the Army Air Corps fliers had set a brilliant record.

420 HOURS IN AIR

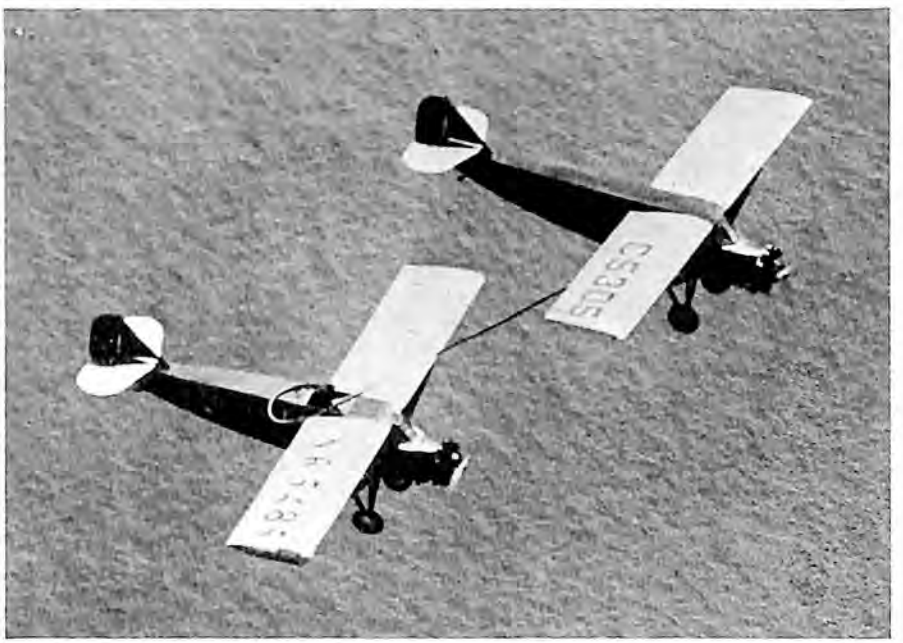
Curtiss St. Louis Robin (Curtiss Challenger) being refueled during its flight to a new world's endurance record, by Dale Jackson and Forrest O'Brine.

Fort Worth

While an amazed world attempted to comprehend the meaning of a week in the air without touching ground and the suggested possibilities of non-stop globe girdling flights, fliers in the commercial field became fired with enthusiasm for duration flights.

In contrast to the elaborate preparations made for the Question Mark flight, two Texas commercial fliers, James Kelly and Reginald L. Robbins, reconditioned a Ryan brougham monoplane that already

had flown 50,000 miles and was equipped with a a Wright Whirlwind engine bought second hand two years before and run 500 hours since they bought it. They had never refueled a plane until their flight actually was under way, and had practiced the making of contact, without transfer of gasoline, only three times on the day before taking off. Kelly was a 23-year-old ex-cowboy with little flying experience, and Robbins, three years his senior, had been a railroad mechanic who never took a flying lesson in his life.



"CITY OF CLEVELAND"

Stinson (Wright Whirlwind) Detroiter in which Byron K. Newcomb and Roy L. Mitchell set a refueling endurance record of 174 hours and 59 seconds at Cleveland, O.

With 250 gallons of gasoline in their tanks, they left Meacham Airport at Fort Worth, Tex., on Sunday morning, May 19. The first refueling contact was not made until almost 24 hours later. Through the remainder of the flight the plane was refueled three times each day with the exception of one day when the pilots decided the reserve supply was so large that only one contact was necessary. Seventeen times the plane was refueled; the last, early on the following Sunday morning, was accomplished in a driving rain.

Robbins and Kelly had studied the experiences of the Question

Mark fliers, who showed the way for succeeding flights, and had devised a method of attaching the refueling hose to a pipe at the side of the ship instead of on top. They also profited by the experiences of the Question Mark, which proved that proper greasing of the rocker arms was important to the continuance of the flight. They rigged up an 8-inch catwalk to the single engine in the nose of the plane. Kelly crawled out on his precarious perch twice each day to grease the rocker arms. During one of these operations on the second day of the flight, the buckle of Kelly's safety belt nicked the whirling propeller.

The crack in the wooden blade widened during a heavy rain on the sixth day of the flight, causing considerable annoying vibration. The wings' fabric began to fray under the impact of wind and rain, but the Texas fliers flew on to surpass the brilliant record of the Question Mark and remain aloft 172 hours, 32 minutes and 2 seconds, flying approximately 12,900 miles before they landed at the Fort Worth port, May 26.

City of Cleveland

Robbins and Kelly led other commercial pilots to seek endurance honors, and preparations were started for new flights. Bryon K. Newcomb and Roy L. Mitchell, with their Stinson "Detroiter" (Wright Whirlwind) monoplane City of Cleveland, were among those to get into the air during the next month. They took off from the Cleveland airport, June 28, with their eyes set on the 172-hour record of the Texas fliers.

Few thought that they would surpass the record held by the Fort Worth, but as they continued in the air, hour after hour, day after day, public interest in the flight grew. Thousands crowded the Cleveland Municipal Airport to watch the fliers as they continued their monotonous journey. The Flying Milk Wagon, the name given the refueling plane piloted by E. E. Basham, experienced no hitch in its operations except one night in refueling contact when the exchange of gasoline was made in an electrical storm of hurricane proportions. The refueling plane was forced down after the contact was completed, but a new plane was rigged up in time to fly more gasoline to the City of Cleveland a few hours later. After passing this crisis, the monoplane flew on until it had passed the record set by Kelly and Robbins little more than one month before.

At midnight of the eighth day the Stinson monoplane glided to earth at the Cleveland Airport, bathed in brilliant floodlights, to receive the acclaim of 50,000 enthusiasts for setting a new record of 174 hours and 59 seconds.

Angeleno

The Angeleno, a Buhl "Airsedan" with 17,000 miles to its credit before the flight started and powered with a Wright Whirlwind engine that had seen 450 hours of service, was in the air over Culver City, Calif., when the City of Cleveland fliers landed. It had taken off July 2 after the Cleveland plane was in the air five days.

Loren W. Mendell of Los Angeles and Roland B. Reinhart of Salem, Ore., its pilots, heard of the Cleveland flyers' success through a message sent them during a refueling contact. They kept their plane droning close to the airport as they completed one refueling contact after another and continued their flight toward the new record set by the City of Cleveland. The Curtiss "Carrier Pigeon" (Liberty) refueling ship carried 4,085 gallons of gasoline and 105 gallons of oil to the Angeleno during the flight. The 174-hour Cleveland record was passed and the pilots set their eyes on 200 hours of continuous flight. With that mark equaled and still in high spirits, they dropped a message to tell the crowds which milled about the airport to "wait another week" for their return to earth.

The flight was finally ended when the tail group was damaged by litter thrown from the plane, but not before the Californians had flown approximately 19,760 miles and remained aloft 246 hours, 43 minutes and 2 seconds—more than ten days—for a new record.

St. Louis Robin

While the pilots of the Angeleno were being feted on the day after their record flight, two quiet, unassuming fliers of the Curtiss-Robertson Airplane Manufacturing Company took off at St. Louis to test the capabilities of a newly perfected Curtiss engine, the Challenger, installed in a Robin cabin monoplane built by the Curtiss-Robertson company. They were Dale Jackson and Forest O'Brine.

Their flight was not announced as an endurance test for a new record, but rather as an experimental test flight with no goal set. Public interest in the feat grew as the hours and days piled up and officials of the Curtiss-Robertson company announced that "Red" and "Obie," as the world came familiarly to know the endurance fliers, would try to break the formidable record of the Californians.

Food, oil and mail were passed down to them in metal containers on a rope from the refueling plane. Gasoline was passed through a rubber hose two inches in diameter and 35 feet long. They slept on a

pneumatic mattress on top of the gasoline tank in their cramped quarters. During the long flight, which extended into the third week, 3,500 gallons of gasoline were consumed and 158 gallons of oil used, relayed to the plane in forty-eight contacts for refueling purposes. Seventy-three contacts were made for all purposes, including the relay of messages, food and supplies.

Jackson crawled out on a catwalk, four inches wide, twice a day, within four inches of the whirling propeller to inspect the engine and make minor magneto and spark plug adjustments. The 246-hour record of the Californians was passed and the engine showed no signs of wear. The goal was set at 300 hours, then boosted to 400, and finally with their greatest expectations exceeded they put their endurance mark at 500 hours.

It was not until the eighteenth day of the flight that Maj. William B. Robertson, president of the company sponsoring the flight, sent up a message asking the fliers to land sometime during the day, and promising them a computation of their bonus on the basis of 500 hours of flight. The fliers did not want to come down from their queer abode in the sky. They advised their chief that the engine was running smoothly, both were in good spirits and they saw no reason for giving up the attempt to pass the 500-hour mark.

Major Robertson explained that the "objects of the test flight have been fully accomplished, as the Curtiss Challenger motor has more than proved itself, the Robin airplane has proved itself, and the technical data that was wanted has been secured."

The St. Louis Robin glided to earth under its own power shortly after 7 o'clock that night, with its pilot smiling and the engine turning over as perfectly as it had at the start of the flight. Thirteen thousand enthusiasts stormed over the ropes drawn by police to keep the crowd off the field as the plane landed, and a cheering crowd surrounded the fliers. They had remained away from the earth longer than any two men in the history of the world, and had flown 25,500 miles—a distance greater than the circumference of the earth at the equator. Their total time in the air was 420 hours, 21 minutes and 30 seconds—about 17½ days.

"We felt like the Robin had landed on another planet after flying around up there more than two weeks," Jackson said when the fliers landed. When they were weighed, it was learned that Jackson had not lost an ounce and O'Brine had gained a pound and a half. After a brief rest, receptions and parties, the two fliers began a tour of the country with their plane so that thousands might see the ship that had surpassed all endurance records for sustained flight.

Spokane Sun God

The numerous record-breaking endurance flights had proved conclusively that man and his machine could remain in the air almost an unlimited length of time, but all of the flights had been conducted within close range of the airport from which the plane took off. They had weathered storms and varying weather conditions, but they had not hurdled mountains and crossed plains on the regular airways flown by the air mail and passenger transport routes.

"THE ANGELENO"

Buhl (Wright Whirlwind) in which L. W. Mendell and R. B. Reinhart set an endurance refueling record of 246 hours and 44 minutes at Culver City, Cal.

Lieut. N. B. Mamer and Art Walker decided to test the capabilities of a plane on an extended non-stop, coast-to-coast and return flight with the aid of refueling. The flight was to test the performance of plane and engine under varying conditions of altitude, weather and terrain and to test the uniformity of the aviation gasoline supply and refueling apparatus throughout the country. The experiment was inaugurated by the Texas Company as a "possible forerunner of the aerial filling station."

Refueling planes were stationed at several points throughout the

country, but the pilots had not practiced the tricky operation with the endurance fliers or had they ever met to agree upon plans. It was hardly fifteen days after the St. Louis fliers had established their record that the Spokane Sun God, a Buhl (Wright Whirlwind) sesquiplane, took off August 15 from Felts Field at Spokane, Wash.

The plane rode through clouds of smoke from forest fires and hurdled the peaks of the coastal range as it headed down the Pacific coast to San Francisco, where the fliers leisurely waited for their refueling plane to meet them shortly after dawn. Their plane refueled, they headed east flying over Elko, Nev.; Rock Springs, Wyo.; North Platte, Neb., and Cleveland, Ohio, on their flight to New York. The return trip took them over Bellefonte, Pa.; Cleveland, Ohio; St. Paul, Minn.; Aberdeen, S. D., and Missoula, Mont., finally bringing them over the airport from which they had taken off at Spokane. They dropped notes asking their sponsors if they might stay aloft to continue the flight. They were ordered down with their engine still functioning perfectly.

The flight ended after 115 hours and 45 minutes in the air with 7,200 miles of varying terrain traversed on the longest non-stop transcontinental flight in history. They had exceeded the longest non-stop trip of the Graf Zeppelin, Friedrichshafen to Tokio.

Other Endurance Attempts

While the year's five record-breaking duration flights and the Spokane Sun God's test for distance received the major share of national public attention, no record of the 1929 endurance flights would be complete without mention of some of the attempts which fell short of setting records but which by their performance contributed to the flight-laboratory experiences of airplanes and engines.

Nine planes surpassed the Question Mark's record of 150 hours during the year. Four of them received nationwide attention because they held the record, at least for a time. The other five received only scant attention outside their home area, as nearly two-score attempts to set endurance records were made during the year.

Jack Little and Merle A. Moltrup at Buffalo, N. Y., flew their Stinson "Detroiter" (Wright Whirlwind) monoplane Buffalo Evening News 197 hours and 50 minutes before being forced down when the refueling hose caught in the vertical stabilizer fin and wrenched it loose. Dale Dryer made a sensational transfer from another plane to repair the broken stabilizer but was unsuccessful.

A New Standard (Wright Whirlwind) endurance plane, piloted by Ive McKinney and Aaron Kranz, was flown 177 hours at Syracuse,

N. Y. Rechristened the Empire State Standard, the same plane was flown later by Clyde Panghorn and Carl A. Dixon at Syracuse, and remained aloft 178 hours and 40 minutes before a broken oil line forced them down.

While the St. Louis Robin was setting its record, the Stinson (Wright Whirlwind) monoplane Billion Dollar City, piloted by Joe Glass and Glenn L. Loomis, passed the 200-hour mark at Houston, Tex., but was forced down later. At the same time, Owen Haughland

International Newsreel.

"SUN GOD" REFUELS

Buhl (Wright Whirlwind) cabin monoplane piloted by Nick Mamer and Art Walker is refueled by Texas Company over Roosevelt Field on non-stop flight from Spokane to New York and return.

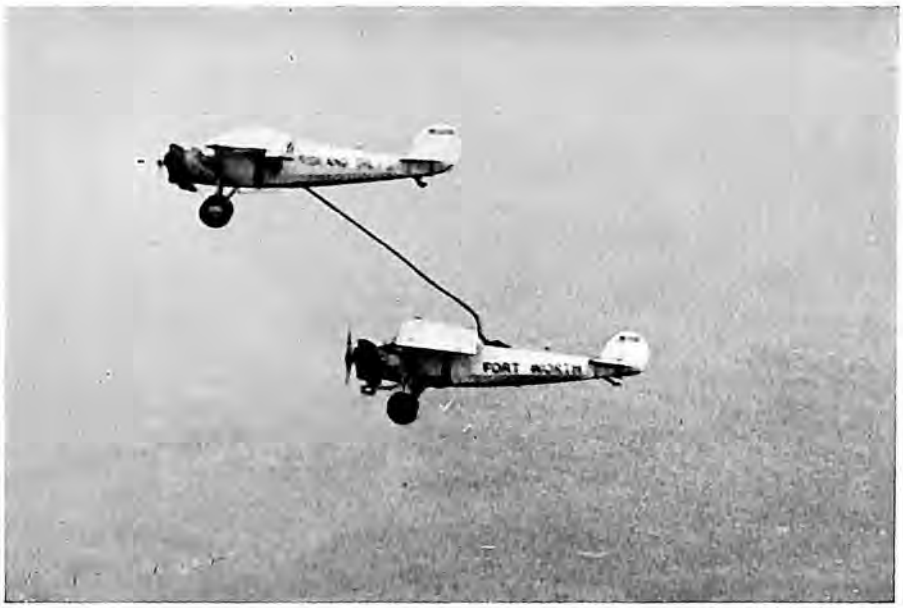
and Capt. Preston Crichton were headed for a record at Minneapolis. Haughland and Thornwald Johnson had reached 149 hours and 32 minutes on a previous flight, and with Captain Crichton, Haughland was in the air 154 hours and 45 minutes before their fatal accident.

The Indianapolis Flamingo, a single-engined metal monoplane, piloted by Lieutenants Walter Peck and Lawrence Genaro, started an endurance flight September 20 which ended 149 hours and 36 minutes later. Fog forced the pilots down with the engine functioning per-

fectly. These were the outstanding attempts which came near to the Question Mark record or surpassed it.

Significance to Military Aviation

Maj. Carl Spatz, commander of the Question Mark flight, reported to his chief that he believed regular refueling of bombers and other planes during military operations was not only practicable but an important forward step in the development of long range military opera-



Associated Press.

FIRST CIVILIAN RECORD

Ryan (Wright Whilwind) Monoplane "Fort Worth" piloted by Reg Robbins and James Kelly shatters army refueling record.

tions. Planes could take off with heavier bomb loads and less gas, increasing their effectiveness in operations against an enemy. Under old conditions, bombers had to split their load evenly between fuel and explosives.

"In view of the lessons learned, it now is possible to take off with the same degree of safety with almost twice the bomb load and a very light gasoline load, and refuel in the air," Major Spatz reported. "With existing fueling arrangements, bombers have a cruising radius of from 1,200 to 1,500 miles. With the aid of refueling, this mileage could be doubled. The greatest hazards with explosives are on the

NEW METAL CABIN PLANE

Cunningham-Hall (Wright Whirlwind) PT-6 six-place cabin biplane has an all metal structure and a metal covered cabin. Paul D. Wilson, chief test pilot, in front of plane.

ALL METAL FIGHTER

Hall Aluminum (Pratt and Whitney Wasp) XFH-1 is an all-metal flotation fighter, built with detachable landing gear which can be dropped in an emergency.

take-off and the new refueling arrangement would remove these dangers. We are convinced that refueling can be applied successfully to pursuit, attack and observation aircraft."

Realizing the extended range of bombing operations made possible with the aid of refueling in flight for planes capable of cruising at speeds well above 100 miles an hour, the Army Air Corps experts pointed out that the so-called "slowest" arm of the air force was now capable of outdistancing the other branches. Experiments were planned immediately to investigate the possibilities of keeping the pursuit, observation and attack planes up with the bombers by extending their range of non-stop operations.

DOUBLE HULLED SAVOIA

Fourteen passenger Savoia-Marchetti (twin Wright Cyclones) double hulled seaplane gets up flying speed near its base at Port Washington on Long Island Sound.

The endurance flights were generally looked upon by military experts as having a far-reaching effect upon the design and operation of military aircraft.

Value to Commercial Aviation

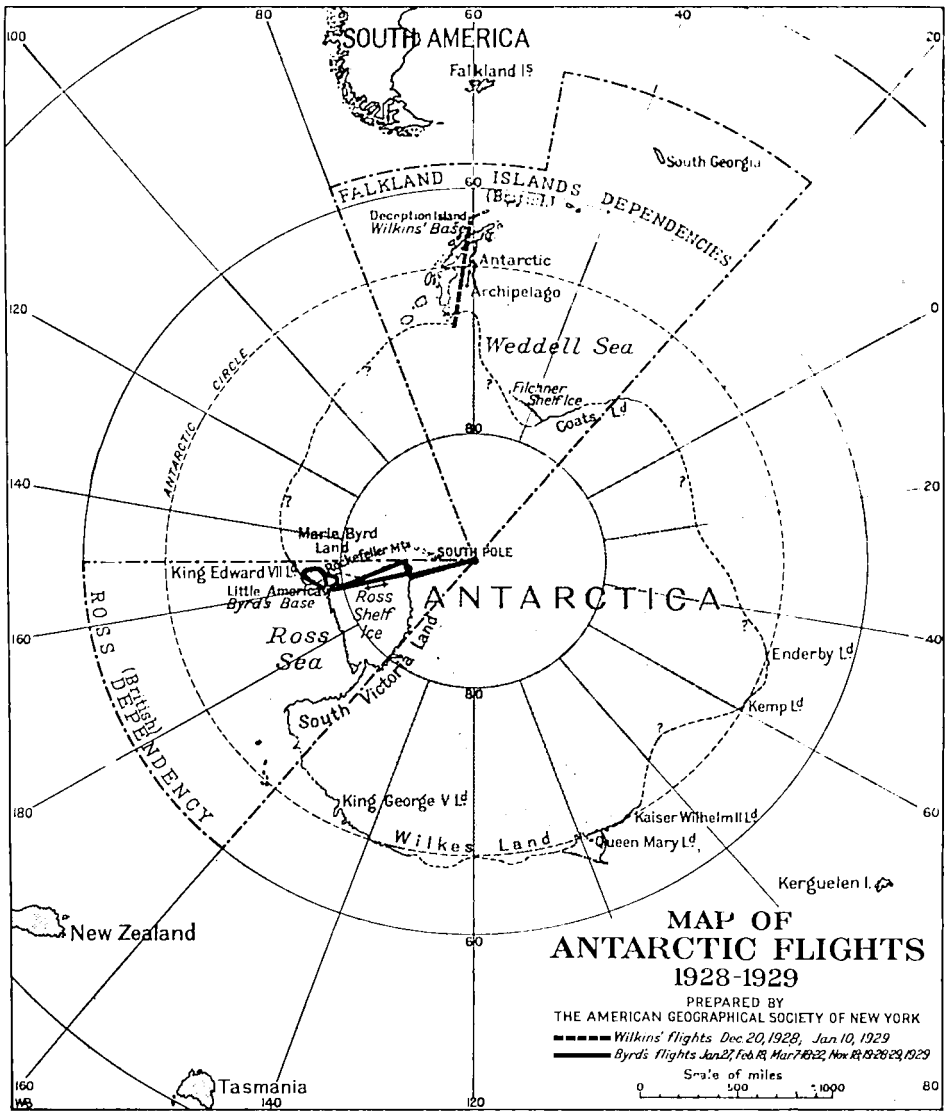
If the numerous endurance flights during the year did no other thing for commercial aviation, they would have justified themselves upon the basis of widening popular conception of the airplane's capabilities, and inspiring greater confidence in the perfection of its engines. While it may still be too early to evaluate properly the significance of the endurance flights, it is safe to say that they have widened the

possibilities for the operation of commercial aircraft on long non-stop flights, which may later prove profitable to extended transport operations.

Following the long series of brilliant flights, it is easily conceivable that an express transport mail or passenger service could be operated between the Atlantic and Pacific coasts with the aid of refueling at regular points along the airway. Such a practice might first be adapted to the transcontinental air mail route, and later applied to passenger transportation if the traffic should warrant such a specialized service. It is estimated that the transfer of transcontinental mails might be speeded up six hours through the employment of refueling in the air.

The possible application of refueling in flight to transport operations on shorter hops is also conceivable. The greatest danger in operations is at the take-off with heavy loads from small fields. Loads of mail, express and passengers might be taken into the air from a relatively small field if the plane were refueled over the airport after the take-off, thereby removing the necessity for lifting a heavy load of gasoline into the air.

The flights, possibly, had their greatest significance in the field of technical engine development. They demonstrated to the engine designers that their products were far more nearly perfect than they had ever dreamed, and pointed out minor defects which provided further subject for study and investigation.


SOUTH AMERICA
Falkland Is
South Georgia
FALKLAND ISLANDS DEPENDENCIES
Deception Island
Wilkins' Base
Antarctic
Archipelago
Weddell Sea
Filchner Shelf Ice
Coats Ld
ANTARCTIC CIRCLE
Marie Byrd Land
Rockefeller Mts
SOUTH POLE
King Edward VII Ld
Little America
Byrd's Base
Ross Shelf Ice
ANTARCTICA
Ross Sea
South Victoria Land
ROSS (BRITISH) DEPENDENCY
Enderby Ld
Kemp Ld
King George V Ld
Kaiser Wilhelm II Ld
Wilkes Land
Queen Mary Ld
Kerguelen I.
New Zealand
Tasmania
MAP OF ANTARCTIC FLIGHTS
1928-1929
PREPARED BY
THE AMERICAN GEOGRAPHICAL SOCIETY OF NEW YORK
Wilkins' flights Dec 20, 1928, Jan 10, 1929
Byrd's flights Jan 27, Feb 18, Mar 7 1929, Nov 12, 1928-29, 1929
Scale of miles
0 500 1000

CHAPTER XI

EXPLORATION BY AIR

WHILE airplanes had been employed previously on flights of scientific importance, 1929 witnessed the most extensive and highly organized use of aircraft for exploration yet undertaken. The value of airplanes for aerial surveys, mapping and photography had been established, but never had they been employed in a more brilliant record of scientific achievement.

From the inaccessible, treacherous wastes at the "bottom of the world," Commander Richard E. Byrd and his companions unfolded a brilliant story of discovery and exploration from their base at Little America, while Captain Sir Hubert Wilkins, working on the opposite side of Antarctica, achieved a record equally fascinating.

Out of the Far North, just inside the Arctic Circle, came the stories of success mingled with hardships for two large expeditions seeking vast mineral deposits in Canada's promising, but little explored northern territory. The roar of the airplane was replacing the howl of the malamute, and the "29ers" substituted a geologist's expert opinion for the prospector's guess. American-built planes were used by the two Canadian expeditions: Dominion Explorers, Ltd., and Northern Aerial Minerals Exploration, Ltd.

Fliers of the U. S. Navy Alaskan Aerial Survey flew to the nation's far northern possession and spent several months in exploring, photographing and mapping one of Alaska's most promising sections. They reported the discovery of vast timber and power resources worth millions of dollars and added to the world's knowledge of one of the least explored territories.

Col. Charles A. Lindbergh and Mrs. Lindbergh turned their aeronautical talents toward the field of scientific exploration and made two extended expeditions to aid archæologists, delving into the remains of early American civilizations—the first, among the prehistoric Pueblo peoples of the Southwest, and the second, in the fascinating but treacherous Maya region of Central America.

O. G. S. Crawford, chief archæology officer of the British Royal Air Force Ordnance Survey, also aided in bringing the value of aerial photography forcefully to the attention of the world through his aerial surveys of ancient Sussex earthworks in England.

The use of airplanes in exploration contributed in no small way to the stimulation of popular interest in geographical, geological and

archæological investigations. It brought the achievements of scientists, who work quietly and with little publicity, before the masses of newspaper readers and resulted in a greater appreciation of their problems and lifetime-efforts to increase the world's scientific knowledge.

Byrd Antarctic Expedition

Twenty thousand square miles of the grim, threatening, ice-clad land were explored from the air by Commander Byrd on three extended flights early in the year, achieving a scientific task which would have required months of arduous travel by sledge and dog team under old methods.

For the first time a new land was discovered and surveyed from the air and landed upon for scientific investigation. The Rockefeller Mountains were discovered and named by Byrd on his January 27 flight; an aerial survey of the range was made with photographic equipment by Capt. A. C. McKinley February 18; and L. M. Gould, chief geologist of the party, was landed March 7 at the base of one of the mountains in the range for geological investigation.

New Year's Day found the expedition at the Ross Barrier in the Bay of Whales, which they had reached only four days before. As contrasted with the ease with which the exploration flights were made, the party had to travel 12,500 miles—four times the distance from New York to San Francisco—with dog sleds to carry stores from the ships to their new base in Little America.

The Fairchild (Pratt & Whitney Wasp) monoplane "Stars and Stripes" was set up January 14 and its engines tuned for the first flights on the Antarctic continent proper January 15. Seven flights were made the first day, the last being an exploration flight by Commander Byrd to the west toward Discovery Inlet, on which he saw 1,200 miles of virgin territory and found a new, deep inlet to the great ice barrier.

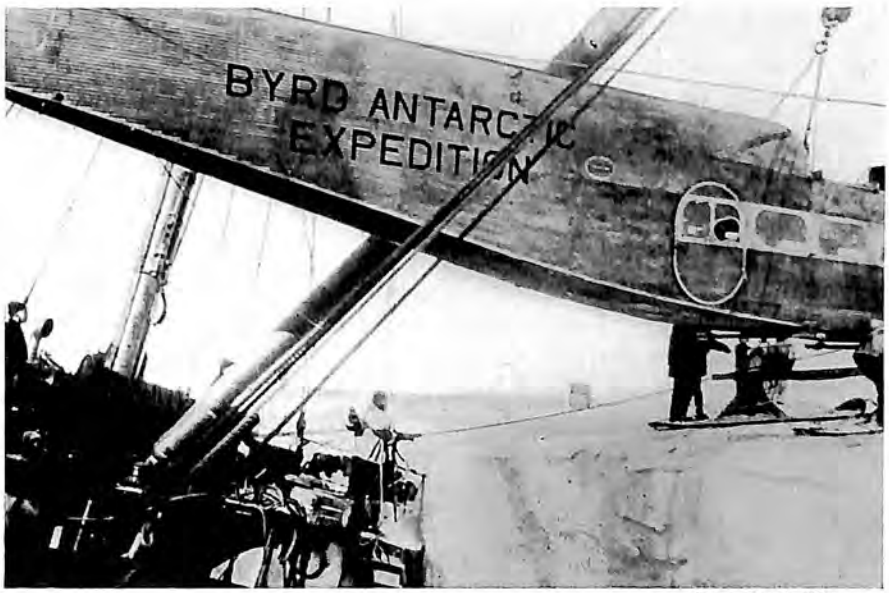
The "Stars and Stripes" again rose into the air, whirling the snow behind its skiis on the take-off January 27. The plane was in constant communication with its ground base by radio, and it was through this medium that the story of Byrd's brilliant successes in aerial exploration reached the civilized world. The accomplishments of the early part of the day's flight were recorded in New York before the plane radioed its most important find of the day, a range of mountains which Byrd named for John D. Rockefeller.

With Bernt Balchen piloting the plane they flew over King Edward VII Land, reaching Scott's Nunataks and the Alexandra Mountains. A new island and three new mountain peaks reaching into the clouds were reported by radio from the plane.

New York Times.

BALCHEN IN ANTARCTIC

Bernt Balchen, famous pilot, sitting near the Fokker monoplane used by the Byrd Expedition in the Antarctic.



New York Times.

BYRD'S TRI-MOTORED FORD

The fuselage of the Ford tri-motored plane used by the Byrd Antarctic Expedition in its exploration work is unloaded on the Ross ice barrier.

"Discovered 14 mountain peaks sticking up above the snow. Solid rock looked good after so much ice and snow. We are now headed back to Little America," a second message from Commander Byrd read.

Capt. A. C. McKinley, photographic expert with the Antarctic Expedition, found that the range consisted of some forty peaks and ridges, only half of which pushed bare rock up through the ice and snow. He surveyed the area with aerial cameras February 18, completing another step in the expedition's attempt to wrest the secrets of the Antarctic from the air.

The season's final step in the scientific exploration of the new discovery was accomplished when Gould, the geologist, was flown in the Fokker (Pratt & Whitney Wasp) monoplane "Virginia" to the base of the mountains and landed there. Bernt Balchen and Harold June were the other members of the party sent out to study the geology of the new range. Gould found the formation to be a very old one, not allied with land on either side of the barrier.

Two days after the party landed at the foot of the mountains a 150 mile an hour gale wrenched the ship from its anchorage, carried it into the air and crashed it half a mile away. Days of anxiety followed until March 20, when Commander Byrd with Dean Smith at the controls of the "Stars and Stripes" flew to the mountains and glided to a safe landing. Commander Byrd sent Balchen and June back in the plane. Two days later the other members of the party were flown back to the base.

The combination of radio with the airplane in the exploration of the world's least known continent provided a spectacular record of achievement for the expedition. No less fascinating than the stories of the discoveries themselves were the methods used by Russell Owen of the New York Times to send the accounts back to the civilized world, 10,000 miles as the crow flies from Broadway.

No one ever had a stranger, vaster or more exclusive beat than Owen, who kept the world informed through daily radio dispatches on the expedition's progress. Even during the long winter months when the party "resembled a family of moles, who scuttle through glittering snow tunnels with lanterns," radio communication was maintained with the outside world and the simple, striking accounts of Byrd's plans rolled into New York on the ether.

The year's most spectacular demonstration of the use of aviation radio was furnished January 25 when the Fairchild (Pratt & Whitney Wasp) monoplane "Stars and Stripes" maintained two-way communication with the New York Times from 3,000 feet above the Bay of Whales in Antarctica. The plane was equipped with a short wave transmitter, capable of operating on from 20 to 90 meters wave length. The

distance which the messages traveled was approximately 10,000 miles.

The long winter night, from May to October, held the expedition in check for several months, but October saw the first dog teams leave for the "interior" to lay bases for further explorations.

Commander Byrd made his first flight of the second season, November 18, when he flew with Harold June and Dean Smith as pilots and

New York Times.

BYRD'S FIRST PLANE

The Fairchild monoplane (Pratt and Whitney Wasp) Stars and Stripes was the first used by Commander Byrd for exploration in the Antarctic.

Ashley McKinley as photographer, to the Queen Maud Mountains, 440 miles from Little America, to lay a base for the South Pole flight. It was the first time that the big Ford (3 Wright Whirlwinds) monoplane had been used on a flight in Antarctica.

After flying an hour it was discovered that the gasoline consumption was unusually high and a small leak was found by June in the hand

fuel pump. He packed it with chewing gum and taped it to reduce the flow considerably.

They saw the crevassed pressure area, 200 miles from Little America, while they were still 100 miles away. After passing the 200 mile depot they flew over the geological party plodding along in the snow beneath them, making ten to fifteen miles a day while the plane was flying 100 miles an hour. Mail was dropped to the party from the plane, constituting one of the most unusual deliveries in history.

Not long after passing the crevassed area great mountains were sighted on the starboard bow. The mountains, many of them said to be previously uncharted peaks, were photographed from the air by Captain McKinley and a motion picture record of the entire flight made. The plane was landed at the foot of the Queen Maud range and the American flag planted beside the gasoline and food cache, half way from Little America to the South Pole.

The loss of gasoline from the leaky fuel pump forced the plane down on its return trip 95 miles from Little America. Bernt Balchen in the "Stars and Stripes" flew gasoline to the aid of the marooned party, and both planes returned safely to their base. While these preliminary flights proved of great scientific value, they were but laying the ground work for a greater flight—the dash to the pole.

The successful flight to the pole November 28-29, reviewed in the chapter on "History Making Flights of 1929," climaxed the year's activities of the Byrd expedition. The 1,600-mile flight was made in 18 hours and 59 minutes in the Ford monoplane "Floyd Bennett," powered with a Wright Cyclone and two Wright Whirlwind engines. One hour of the elapsed time was spent in refueling the plane at the mountain base laid down November 18. As on previous flights, radio messages from the plane unfolded a brilliant story of the fliers' experiences. Bernt Balchen piloted the plane, Harold June acting as radio operator and Capt. Ashley McKinley as photographer, while Commander Byrd spent his time navigating and making notes on scientific aspects of the flight.

Wilkins-Hearst Antarctic Expedition

In a flight of 10 hours' duration, Capt. Sir Hubert Wilkins photographed, mapped and described 100,000 square miles on the opposite side of the Antarctic continent from the Byrd expedition. The one flight contributed more than could have been constructed from the records of all explorers who had previously traversed the region.

He was able to determine definitely that Graham Land is not a peninsula but an island, separated from the main polar continent by an ice-filled channel, thereby completely upsetting the belief held by geog-

raphers for almost a century. He established the true coast of the Antarctic continent which he named Hearst Land.

Setting out from his operations base on Deception Island in a Lockheed (Wright Whirlwind) monoplane, piloted by Lieut. Carl Ben Eielson, Captain Wilkins flew southward along the east coast of Graham Land. During the flight he secured a large number of excellent photographs of areas of the land and sea upon which man had not previously looked.

International.

WILKINS IN ANTARCTIC

Lockheed (Wright Whirlwind) monoplane of the Wilkins-Hearst Antarctic Expedition on Deception Island before Sir Hubert Wilkins' extensive flight.

In describing his flight, Captain Wilkins said:

"Because of the early break-up of the ice areas, we found that we could not take off on skiis as we had planned but would have to equip our plane with the regulation wheeled landing gear. We therefore had to construct a runway 2,500 feet in length across the bare surface of Deception Island. On the morning of December 20, 1928, the weather was perfect. The thermometer stood at 38 degrees Fahrenheit. At 8:20 o'clock we were in the air, heading southward. The hazardous take-off had been, with Eielson's skill and courage, successfully accom-

plished. We directed our course a little west of south, taking the peak of Trinity Island as a landmark. Even though we were climbing, our ground speed averaged better than 125 miles an hour. By 8:40 we were up 6,000 feet and were beside Trinity Island. The plateau of Graham Land we marked on our charts as being from 4,000 to 6,000 feet altitude. The plateau continued as far as we could see. We were above it by 9:50.

"To the west were long, ice-filled fiords almost severing Graham Land, and we were soon flying above the Weddell Sea ice pack. The surface beneath us was broken by huge crevasses into which our machine could have fallen and left no trace. Setting down in that section would have meant almost certain death for the members of our party.

"Continuing south we passed a deep inlet which at first appeared to cut completely through Graham Land, but later I made out mountains at the end of the level ice. From there the land trended southwestward in a series of rugged mountains. On our way south we passed between the coast and C. A. Larsen's 'Foyn Land,' and somewhat farther on we saw what we believed to be a circuitous channel dividing Graham Land. We named it Crane Channel.

"South of Crane Channel we came near the coast. A mighty mass of mountains stretched far to the southwestward from the channel, and opposite was an island not marked on the charts till we named it Robinson Island. The most easterly point of the large island, which we concluded was South Graham Land, we called Cape Northrop, and the mountains we named the Lockheed Mountains. From there a large bay, which we named Mobiloil Bay, extended deeply to the west. In the middle was a deep indentation. When crossing this we felt, for the first time, a disturbance of the atmosphere.

"By 12:30 we were opposite the high, steep mountains which seemed to terminate the big island which we had labeled South Graham Land. The largest of these peaks we named Mt. Ranck. A channel which narrowed at its center, but which appeared to hold only level ice, widened again, and we felt sure that the ice in the channel rested upon land below the sea level. We named it Casey Channel and the rather large island to its south we called Scripps Island. Photographs which we secured at this point have since tended to confirm our impression that Graham Land was again severed from the main polar body.

"South of South Graham Land we located six small islands, hitherto uncharted. Beyond these islands there extended a strait; and farther on a smooth slope, wide and unbroken, stretched away to the south. It was not marked by even a speck or a shadow and would not show on a photograph. We called the strait Stefansson Strait, and the region

beyond it Hearst Land. Hearst Land, we believe, is the edge of the vast Antarctic continent.

"We had then consumed about half of our gasoline supply of 370 gallons. We had definitely determined that Graham Land was separated from the continental regions to the south. Storm clouds which had been developing behind us were threatening to cut us off from our base, so we turned about and hurried homeward. Our trip to the north, aided by a little wind from behind, was made on an average of about 130 miles an hour. Our motor had functioned perfectly throughout the flight."

International.

WHAT WILKINS SAW

A glimpse of Graham Land taken by Sir Hubert Wilkins on his Antarctic flight.

On January 10, 1929, Captain Wilkins made another flight of 250 miles over portions of his original course and confirmed observations he had previously made. Because of the unseasonable break up of the ice from which Captain Wilkins had expected to make his take-offs, it was deemed advisable to postpone further activities for the season, return home and make an earlier start the following fall. The two Lockheed (Wright Whirlwind) planes, together with other equipment, were stored in an iron-sheathed, hangar-like structure on Deception Island and the party returned to America early in the spring. Captain Wilkins and his party

sailed from New York City again in September, 1929, and took up the exploratory work at the point where it was left off the preceding season.

Lindbergh Pueblo Survey

Col. Charles A. Lindbergh's attention to the possibilities of aiding archæologists through aerial surveys was first attracted during his Central American trail-blazing flight for Pan American Airways, Inc. As the jungle panorama of Yucatan unrolled beneath him, he saw, half hidden amid tropical foliage, the ruins of a great temple.

Upon his return to Washington he asked the secretary of Smithsonian Institution to suggest books which would tell him about the ruins he had seen. The request was turned over to President Merriam of Carnegie Institution of Washington, who invited Lindbergh to spend an evening with him examining examples of Mayan art. Lindbergh then learned what Carnegie Institution was doing to penetrate the mystery which envelops the early American peoples in both Central American and Southwestern United States. He showed an unusual interest in the work and suggested that aircraft might be found valuable in photographing districts believed archæologically important.

Flying over the route of Trancontinental Air Transport, Inc., which traverses the heart of the Pueblo region, Colonel and Mrs. Lindbergh made a rapid flight across a section plotted out for them by Dr. A. V. Kidder, chief archæologist of Carnegie Institution, who had spent fifteen years in the Southwest under the auspices of Phillips Andover Academy. They photographed the ruins and topographical features suggested by Dr. Kidder on their hurried flight westward and later returned for a more careful exploration of the region.

On the eastward flight from California they passed over Canyon de Chelly, several hundred miles west of Dr. Kidder's Pecos camp, and sighted a number of small ruins perched high up among the cliffs under a rim of rocks. They were so situated that they could not be seen from the canyon bottom. Flying on they sighted the camp of Earl Morris, also of the Carnegie staff, in Canyon del Muerto. Picking out a flat place on the mesa several days later, Lindbergh landed his Curtiss Falcon (Curtiss D-12) biplane, and with Mrs. Lindbergh spent the night at Morris' camp to report their discovery. The party climbed the cliffs the next day and examined the ruins which, so far as it is known, were never before visited by white people.

More than 100 photographs testify to the thoroughness with which the Lindberghs conducted their several days' survey in the Pueblo region. They show vividly how the airplane can be used profitably to aid

PLANE AIDS ARCHÆOLOGISTS

Colonel and Mrs. Lindbergh land at Flores, Guatemalan outpost town, in their Pratt and Whitney Wasp-powered Sikorsky amphibion while aiding archæologists in their Mayan survey.

LINDBERGHS PHOTOGRAPH RUINS

Ancient Mayan temples photographed from the air for the first time by Colonel and Mrs. Lindbergh. The Ball Court, El Castillo and Temple of the Warriors are seen in the rear, with the Caracol, a tower-like structure, in the center.

archæologists in their work to piece together the facts of an earlier civilization. Some of the photographs show clearly the relation that existed in ancient times between water supply, land available for farming, and easily defensible house sites, matters which are of the greatest importance to scientists as they try to picture the conditions under which prehistoric peoples lived.

Lindbergh-Carnegie Maya Survey

Although archæologists have been pushing their way into the Maya region of Central America for years, they have been so buried in the welter of forest, their outlook has been so stifled by mere weight of vegetation, that it has been impossible to gain a comprehensive understanding of the real nature of this territory, once occupied by America's most brilliant civilization. Since all people, ancient and modern, are largely products of their environment, scientists point out that this understanding is highly essential.

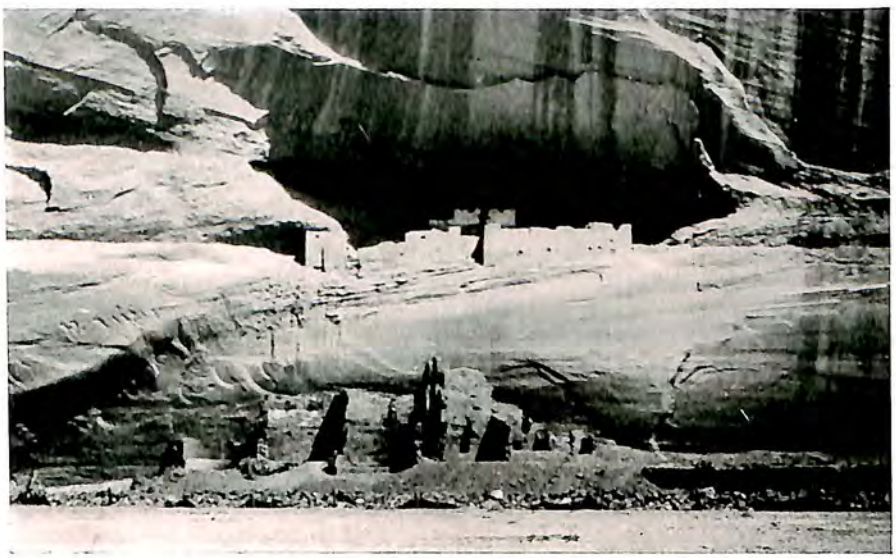
The labors of many explorers and scientists have made clear that long before the time of Christ there arose in the New World an independent civilization which culminated in the great cities of the Maya Old Empire. The cities were built and occupied while Europe was in the Dark Ages, but they, like Rome, fell, and their high tower-temples and many-chambered palace-monasteries were engulfed by the jungle.

It was to gain the first comprehensive view of this country from the air that the Lindbergh-Carnegie Maya Expedition was organized, with Pan American Airways, Inc., and the Carnegie Institution of Washington co-operating with America's best known flier. Finishing their swing around the Caribbean in a Sikorsky (2 Pratt & Whitney Wasps) amphibian, Colonel and Mrs. Lindbergh met the other members of their party October 5 at Belize, the capital of British Honduras. Oliver Ricketson, Carnegie Institution archæologist, had come down from his headquarters in Guatemala City. Dr. Kidder and W. I. Van Dusen of Pan American Airways had flown to Belize from Miami.

Taking off from the Belize harbor the following morning, Colonel Lindbergh and his party headed up the Belize River, cutting straight across its thousand loops and bends, high above the rapids and shallows that make boat travel so slow. A hundred miles inland the plane turned northward into the Peten region. In a few minutes the roof-combs of the great temples of Tikal, queen of Old Empire cities, became visible. After circling low for photographs a straight shot was made for Uaxactun, the oldest known Mayan city. It was discovered in 1916 by Dr. S. G. Morley and had been the site of Ricketson's excavating work for four years.

LINDBERGHS DELVE INTO PAST

"White House" ruins (in circle), the remains of a pre-historic Pueblo cliff dwelling in Canyon de Chelly, photographed by the Lindberghs on their southwestern flight.



"WHITE HOUSE" RUINS

One of the Pueblo cliff dwellings investigated by the Lindberghs in Arizona and New Mexico, examined at close range.

From Tikal to Uaxactun is a long day's journey by mule train, a journey that is made possible only after the trail has been cleared. The Sikorsky did it in exactly six minutes! Ricketson's clearing and camp, and the strange, squat, grotesquely sculptured pyramid he has laid bare, were photographed as Colonel Lindbergh flew close above the tree tops.

Beyond Uaxactun lay unknown, uninhabited country, and Merida was still 400 miles away, so no deviation could be made from a direct northward course. The sea of jungle proved to be unbroken. Hour after hour the green floor of the tree tops flowed back under the speed-

SIGHT MAYAN PYRAMID

Colonel and Mrs. Lindbergh, working with archæologists of Carnegie Institution, photographed this ancient Maya ruin at Uaxatun, Guatemala.

ing plane. Ninety miles beyond Uaxactun there appeared a flat-topped pyramid surmounted by two temples, the culminating structure of a forgotten and forest-swallowed city. It was believed that this was new or might be a site called Rio Becque, discovered in 1912 by R. E. Mervin of Peabody Museum.

Northward again the plane sped, over vast stretches of green, until the palm-thatched huts of the first small frontier settlements of Yucatan were reached. Then the town became larger; finally Merida came into sight and soon the amphibian plane settled down on a landing field.

The first objective of the next day was Chichen Itza, largest of New Empire cities, whose temples and pyramids, cleared by the Mexican government and Carnegie Institution, showed snow white against the green foliage. The party then turned southward and laid a course for Belize, somewhat to the east of the course followed the day before. The plane passed over country hitherto untraveled; country so densely overgrown that no trace of ruins could be discerned. Flights of the first two days covered about 1,000 miles, much of it over regions never traversed by white men, and none of it ever before seen from the air.

The party struck out on October 8 for Peten, searching for ruins whose general location was known. The cities of Yaxha and Nakum were picked up, then Tikal and Uaxactun, and eastward to a small ruin, possibly new, which could be seen on the skyline. The plane was landed in Lake Peten, where the Guatemalan outpost town of Flores crowds an island in the lake, and after a short rest rose to fly southward over a vast, flat stretch of alternating savanna and woodland, toward the northern tributaries of Pasion River. The night was spent on a little key miles out in the Gulf of Honduras.

On the fourth day, October 9, the region inland from the coast between Belize and Coba was surveyed and two previously unknown Maya ruins discovered, one of which was said to be of considerable magnitude. Another large site over which the plane passed was believed to be new. The night was spent at Cozumel Island, where Pan American Airways, Inc., has a base. On the following morning the party revisited Coba to recheck observations and headed for Cuba, Miami and home.

While Carnegie Institution scientists reported the value of the discoveries made on the trip to be great, the expedition would have been considered successful if it did no more than call the attention of the world to the richness of the Maya civilization, and educate the general public to a better understanding of the archæologist's work in the region. Undeniably, Lindbergh's flight accomplished this. It also demonstrated the possibilities of photographing unexplored regions from the air to aid scientists in their search for undiscovered ruins.

Alaskan Aerial Survey

A power site of more than 20,000 horsepower was discovered in the Tongass National Forest, southeastern Alaska, by planes of the United State Navy Alaskan Aerial Survey, which mapped more than 10,000 square miles of the little explored American territory. Four Loening (Pratt & Whitney Wasps) amphibians were used by the Navy fliers to photograph and map the territory.

Flying from California May 15 the expedition, headed by Lieutenant Commander Radford, spent the summer in completing a survey of the Tongass National Forest begun three years ago by a similar Navy aerial expedition. The forest covers practically all of southeastern Alaska which is the panhandle between Skagway and Ketchikan. The first expedition surveyed approximately 10,000 square miles, and the second group completed about the same amount of territory in the national forest, and in addition about 3,000 square miles outside the forest in Glacier Bay. About 5,000 square miles of the forest remain to be photographed from the air for map and resource-estimating purposes.

The great power site discovered was on the east side of Taku Inlet near Greely Point. Lakes, streams and other important topographic features of the Tongass forest, the existence of which had not been known previously, were revealed by the survey.

During the course of the flight to and from the surveyed area and during the photographic flights over the forest, four planes of the expedition were flown 800 hours or about 640,000 miles. The flying was completed with but one forced landing, which occurred at Fresno, Calif., and no damage whatever was incurred.

Before the aerial survey expedition began its work, none of the greater part of the land surface of southeastern Alaska had ever been surveyed. The shore lines of the islands and the mainland had been delineated, but farther inland the maps were largely blank, even within one mile of tidewater.

The need for accurate maps of southeastern Alaska was considered imperative to the success of the mining, fishing, lumbering, power and industrial development of the territory. The extended investigation of timber and power resources made by the U. S. Navy expedition was made as a preliminary step to the establishment of the paper-making industry in Alaska. The Tongass National Forest, according to the survey estimates, contains enough pulp timber to supply 25 per cent of the newsprint needs of the United States daily in perpetuity. The survey was made by the Navy fliers in co-operation with the Geological Survey, Bureau of Public Roads and Forest Service.

While the Alaskan survey was in progress two other Loening (Pratt & Whitney Wasps) amphibians, attached to the West Indian Aerial Survey Expedition sponsored by the U. S. Navy, completed the photographing of a large section of Cuba's coast line for use in the development of new hydrographic maps. The two Navy expeditions furnished excellent examples of how airplanes can be used to advantage in carrying on scientific exploration and mapping.

THROUGH THE HOLE

Loening amphibians of the Alaskan Aerial Survey spot a hole through the clouds as they head into the Oakland airport in California.

MAPPING ALASKA BY AIR

Another important section of Alaska was mapped from the air with these cameras of the Second Alaskan Aerial Survey. Lieut. E. Burkett, Lt. Com. A. W. Radford and Lieut. R. J. Whitehead, officers of the expedition, are in the background.

Dominion Explorers, Ltd.

Recognizing the value of aircraft for exploration purposes through minor scale operations in previous years, "big business" winged its way into the barren lands of northern Canada in search of precious metals, new water power sites, and oil in 1929. They found success but with it some of the same hardships that the "mushers" of another generation endured.

Dominion Explorers, Ltd., a subsidiary of the Thayer Lindsey mining interests of Canada, organized a $2,000,000 expedition to push inside the Arctic Circle and determine the truth of fabulous gold deposits passed down through Indian legends. Capt. Charles Sutton, pilot for one of the company's planes, took delivery in March on Fairchild (Pratt & Whitney Wasp) monoplanes to be used in the far north. He described some of the expedition's plans for a survey of 60,000 square miles in a fleet of planes.

One plane demonstrated its ability to do as much work in a day, Sutton said, as a hundred prospectors using the old methods of canoe and pack. The prospecting planes fly over an area under survey with the expedition's chief geologist in the cabin. He marks promising rock formations on his map as he sees them from the air, and then has prospectors of the old school sent out in other planes to work the site. Five or six valuable gold claims were staked in this way.

Radio brought regular reports of the expedition's activities back to the mining interests' headquarters in Winnipeg until the party pushed northward from Baker Lake—2,000 miles north of Winnipeg. In two airplanes they sought a rich copper deposit described by prospectors of another generation. They left Baker Lake September 8 and were not heard from until November 4. During that time one of the greatest aerial rescue searches in history was organized, with a dozen planes combing the northern wastes on flights totaling 12,000 miles. Col. C. D. H. McAlpine, president of Dominion Explorers, Ltd., and his party of seven finally reached the outpost at Cambridge Bay, within the Arctic Circle, and told one of the most thrilling stories of adventure, hardship and rescue ever to come out of the far north.

Lost in the Arctic wilderness the two planes spent their gasoline supply in wandering flight and were forced to land. Slowly making their way back across snow and ice, the party scarcely escaped drowning when the ice in Dease Strait broke up, delaying their return. They reached Cambridge Bay November 8, and the extensive aerial search was ended. Planes refueled, they headed toward Winnipeg to end the year's adventures. The expedition plans to spend four years in the northern dominion.

CHECKING ALASKA'S RESOURCES

Three Loening Amphibians (Pratt and Whitney Wasps) of the U. S. Navy Alaskan Survey Expedition fly over Twin Lake near Juneau, Alaska, during their investigation of Alaska's vast resources from the air.

Northern Aerial Minerals Exploration, Ltd.

Another Canadian commercial company organized to carry on extensive prospecting for minerals in Northern Canada, Northern Aerial Minerals Exploration, Ltd., continued the operations started in 1928, when the company flew 100,000 miles without a single casualty to prospectors or loss of supplies.

John E. Hammell, president of the company, reported the staking of five miles of iron ore claims on Belcher Island in Belcher Bay, said to be an extraordinarily rich deposit. Gasoline, oil and food were cached by the expedition at 26 bases and plans for extensive operations laid out. Planes were used for geological surveys and for packing supplies and prospectors from the nearest civilized outposts to the claims.

Future Use of Aircraft

The 1929 exploration flights took the use of airplanes as aids to scientific research out of the "novelty" field and demonstrated the possibilities of mapping and exploring the world's "blind spots" from the air in a fraction of the time that man might hope to complete his work by ordinary methods.

It opened up a new field of interest for scientist and pilot alike, and brought a new touch of romance to a field of study, rich in the lore of the past, but little regarded by the rising generation.

CHAPTER XII

MILITARY AVIATION

PLANES of the United States military establishment flew a distance equal to 1,955 times around the world at the equator during 1929, shattering all previous records for hours flown by military planes in a single year. All branches of the Army, Navy and Marine Corps piled up a total of 46,918,885 miles flown.

The Army Air Corps and Air Corps Reserve flew a total of 27,405,790 miles, an increase of 7,859,340 miles more than 1928. The Navy and Marine Corps turned in logs for the year aggregating 19,513,095 miles, an increase of 5,377,605 miles more than 1928. Although thousands of landings and takeoffs were made by Navy planes on aircraft carriers at sea and both services flew millions of miles in wing-to-wing formations, diving, looping and executing acrobatics necessary only in military aviation, more than a half million miles were flown for each fatality recorded during the year. It was a brilliant record of performance, worthy of tribute to the high type of personnel trained by the military services and the excellence of their equipment.

The Five Year Program, approved by act of Congress in 1926, required, at the conclusion of the second increment, 1,237 regular officers. On June 30, 1929, there were 1,143 officers commissioned and detailed in the Army Air Corps. The second increment called for 220 reserve officers on extended active duty with the Air Corps. Though funds were available for the assignment of but 110 reserve officers to extended active duty with tactical units of the Air Corps, 192 were ordered to duty.

A survey made for the Assistant Secretary of Navy for Aeronautics revealed that the Navy and Marine Corps had 829 airplanes of their quota of 1,000 planes authorized by the Five Year Program.

"Naval aviation progress during the past year has continued to demonstrate the wisdom and soundness of the Navy's Five Year Building Program," Admiral Moffett said in his report. "Progress toward the accomplishment of this program is continuing satisfactorily and it is important that this program be completed as authorized, on time and without material changes.

"Developments of the past year also have conclusively shown the immense value of aircraft carriers and it is considered that the most important requirement of naval aviation at the present time is to secure as soon as possible the additional carriers necessary to give the Navy

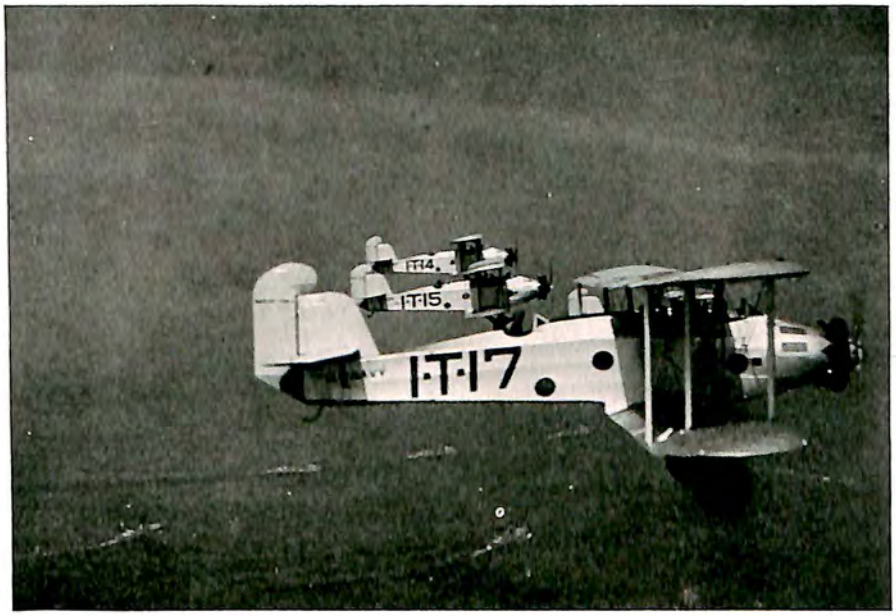
the authorized carrier parity of tonnage allowed under the Washington Limitation of Armament Treaty."

Both F. Trubee Davison and David S. Ingalls—experienced fliers themselves—carried out the duties of their offices in a way that brought commendation from leaders interested in the proper development of military aviation. Mr. Davison continued as Assistant Secretary of

PERFECT FORMATIONS

Precision flying is routine work for fighting planes of the Battle Fleet seen over San Diego.

War for Aeronautics, a position he has held since it was created in 1926, after President Hoover requested him to retain a place in the junior cabinet. Mr. Ingalls, the Navy's only ace in the World War and a flier of wide experience, was appointed Assistant Secretary of Navy for Aeronautics by President Hoover to succeed Edward P. Warner, who resigned to enter editorial work in the aviation field.



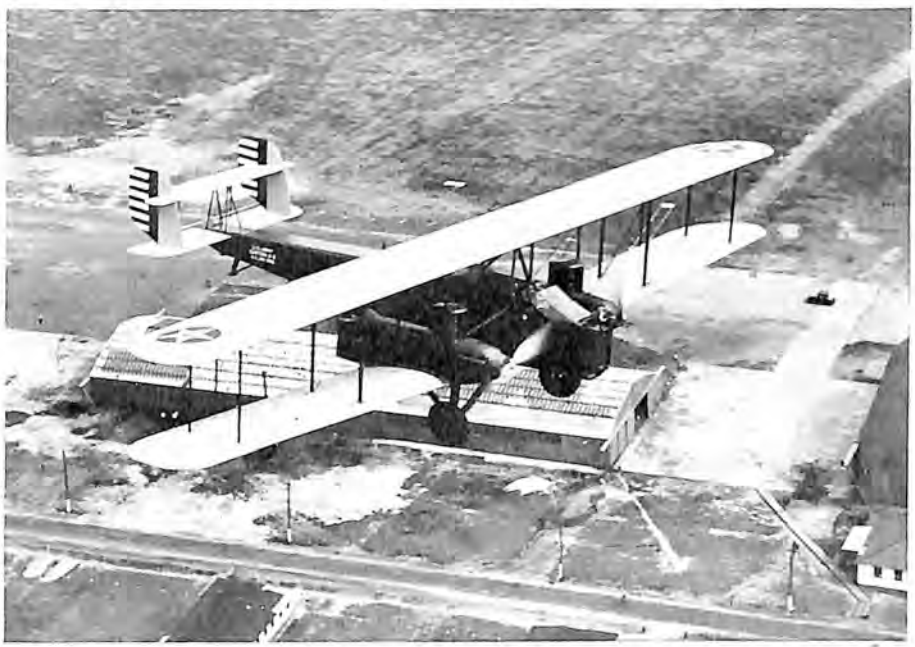
TORPEDO PLANES

Martin torpedo and bombing planes (Pratt and Whitney Hornets) in formation over the Battle Fleet

PIERCING SMOKE SCREEN

U.S.S. Lexington pierces an aerial smoke screen in winter maneuvers at Panama; planes on her deck waiting to take off.

Admiral Moffett was reappointed Chief of the Navy's Bureau of Aeronautics when his term expired soon after President Hoover was inaugurated in March. Admiral Moffett built up and directed the fortunes of naval aviation since the Bureau of Aeronautics was established in 1921. Maj. Gen. James E. Fechet continued as Chief of the Army Air Corps, a position to which he was appointed upon the retirement of Maj. Gen. Mason M. Patrick.



CURTISS B-2 BOMBING PLANE

Curtiss (2 Curtiss Conquerors) Condor bomber is a veritable fortress of the air, carrying heavy defensive guns and a huge load of explosives. It is the largest in use by the U. S. Army Air Corps.

Army Air Corps Developments

Experiments in extending the range of military planes, carried on during the year by the Army Air Corps, were successful and considered exceptionally significant in their influence upon tactical maneuvers.

The year was opened with the breaking of all duration records for heavier-than-air craft when the Army transport "Question Mark" remained aloft 150 hours. This flight and the commercial endurance refueling flights which followed it are reviewed in detail in the chapter on "Endurance Refueling Flights." The "Question Mark" flight led to

AIR CORPS PURSUIT

The first Pursuit Group from Selfridge Field flying in formation at the National Air Races, making letters "A C."

HEADED FOR PANAMA

Capt. Ira Eaker flies over Kelly Field in the new Boeing P12 (Pratt and Whitney Wasp) on his speed trip to Panama.

other experiments by the Army Air Corps designed to carry out tactical missions with the aid of refueling in the air. During the extensive Air Corps maneuvers in Ohio in May, a Keystone bomber successfully carried out a bombing raid on New York City from Dayton, O., without touching its wheels to the ground on the round trip flight.

Capt. Ross G. Hoyt's flight from New York to Alaska and Capt. Ira C. Eaker's dash from Brownsville, Tex., to Panama, reviewed in other chapters, were staged as further experiments to determine the

CATAPULTED TO SEA

Vought (Pratt and Whitney Wasp) Corsair being catapulted from one of the U. S. Navy battleships while in maneuvers in Panama.

range of pursuit planes with the aid of efficient ground refueling devices. These flights and others staged in the series of tests proved conclusively to the Army Air Corps chiefs that the range of bombers could be doubled through the aid of refueling in flight, and that the unusually high speed of these heavily laden planes threatened to enable them to outdistance their protecting pursuit planes. Experiments also were planned to test the capabilities of two-place pursuit planes.

More than 200 planes were concentrated at Columbus and Dayton, O., during the Army Air Corps maneuvers in May. Tactical problems were carried out in a mythical war between two armies, represented by

PASS IN REVIEW

Keystone bombers (twin Pratt and Whitney Hornets) of the Second Bombardment Group roar across the field in front of the stands at the National Air Races.

AIR CORPS MANEUVERS

Lieut. Odas Moon (left) and Lieut. Eugene Eubanks prepare to take off in a Keystone Bomber (twin Pratt and Whitney Hornet) on their sucessful non-stop bombing raid on New York City from Dayton, O., during maneuvers.

units based at Columbus and Dayton. The maneuvers were the most extensive carried out by the Air Corps during peace time and demonstrated the value of aircraft as an arm of the national defense.

Capt. A. W. Stevens of the Army Air Corps carried out extensive experiments in the development of super-cameras for long distance aerial photography. The results of his work in the Rocky mountains demonstrated the practicability of photographing objects on the ground more than 200 miles away, invisible to the naked eye.

Tables containing detailed information on the strength of the Army Air Corps, equipment, flying time, planes and engines purchased during

GIANT BOMBER

General W. E. Gillmore, assistant chief of U. S. Army Air Corps, is dwarfed beside the huge Curtiss Condor (twin Curtiss Conquerors), with its 4,000 pound demolition bomb beneath the fuselage. The bomb could wipe out a whole community with one strike.

the year, appropriations, and other statistics are included in the Appendix. A complete directory of officers commanding the various branches and units in the Air Corps also is included.

Navy Bureau of Aeronautics

Naval aviation opened its year with the fleet's annual cruise in southern waters, participated in for the first time by the two aircraft carriers, Saratoga and Lexington. Approximately 285 airplanes were operated with the fleet during the year. Scouting, torpedo and bombing, observation and fighting planes were carried on the Lexington, Saratoga and Langley; and fighting and observation planes were operated from

SEEING 200 MILES

New U. S. Army Air Corps long-distance camera photographs mountains 200 miles distant, totally invisible to the naked eye. Mt. St. Helens, Wash.; Mt. Washington, Ore.; Mt. Jefferson, Ore.; Mt. Rainier, Wash.; Mt. Hood, Ore.; Mt. Adams, Wash.; and Three Sisters Mt., Ore. (foreground) are grouped in this shot taken with 500 millimeter lens.

catapults on the battleships, while each light cruiser carried two observation planes.

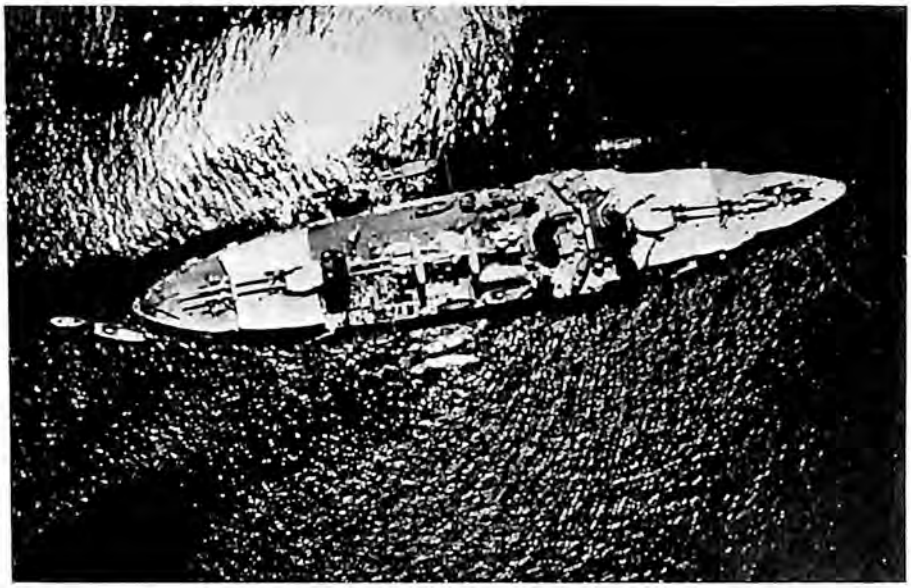
Together with the battleships and cruiser planes, pilots from the Lexington and Saratoga demonstrated every possible form of offense against surface craft and shore bases during the Panama maneuvers. Torpedo planes delivered attacks through smoke screens, fighting planes attacked surface vessels and shore stations, while radio-equipped observation planes kept the ships constantly informed of all phases of the "war."

SUPER-HUMAN "EYE"

Capt. A. W. Stevens (right), with Lieut. J. D. Corkille, using the new K-6 camera, capable of photographing objects more than 200 miles distant.

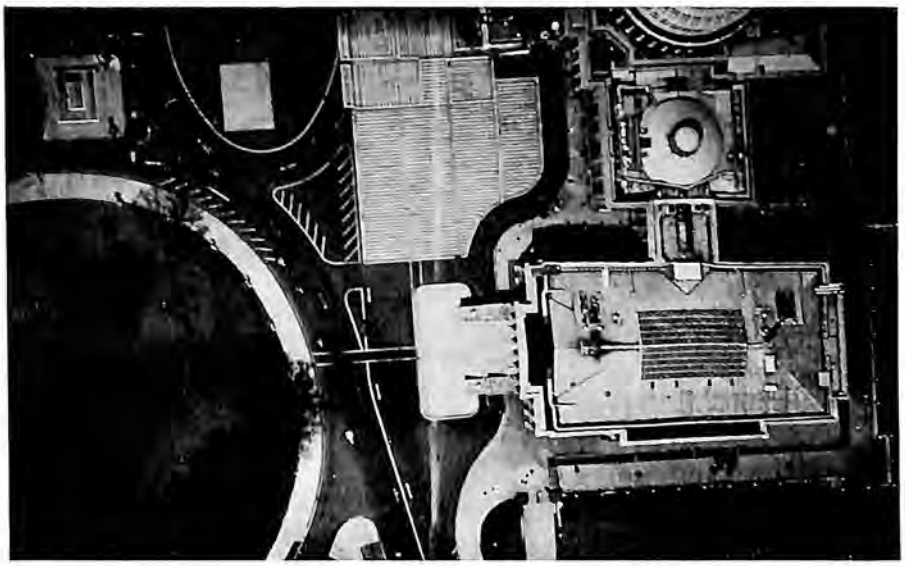
A night raid sent out by one of the carriers while she was yet 150 miles off the coast of Panama, theoretically destroyed the locks of the canal. Nearly a half million miles were flown by 247 planes in every kind of weather and other varying conditions without a single serious accident during the maneuvers.

At the end of the year, the Navy had on hand or in production aircraft suitable for carrying out any mission which the forces afloat might be called upon to accomplish. Two new types of fighters were in production and a third type was under experimentation; deliveries



A NIGHT ATTACK

An Army Air Corps photographer flying over the Battleship "Wyoming" in Hampton Roads, Va., made this picture from 1,200 feet altitude at 9:30 o'clock at night. The ship is 560 feet long.



TURNING NIGHT INTO DAY

The use of night photography by the Army Air Corps was spectacularly demonstrated on the eve of President Hoover's inauguration when Capt. A. W. Stevens took this view of the national capitol at 10 o'clock.

were being made on a large order of observation planes, while two new experimental types were under tests; a modification of the standard torpedo and bombing plane was in production and several experimental types were being tested. Development of a patrol boat program, along

WING TO WING

Boeing fighters (Pratt and Whitney Wasp) leave the aircraft carrier and fly in perfect formation over Coronado, Cal.

both monoplane and biplane lines, was proceeding satisfactorily. Fifty-five of the biplane type known as the PN-12 were under contract, and a small production order had been placed for the monoplane patrol boats similar to the XPY-1.

To provide all types of planes with suitable power plants, aircraft engine development was stressed to obtain increased reliability along

FIGHTING PLANES

Boeing fighters (Pratt and Whitney Wasp) of the Battle Fleet in formation over San Diego, Cal.

"HIGH HATS" MANEUVER

Three planes of the Navy "High Hat" Squadron take off and maneuver tied together on west coast.

with further reductions in weight, factors considered mandatory in the design and construction of naval aircraft because of the limitations imposed by shipboard operating conditions. The aircooled engine, ranging in power from 200 to 600 horsepower, was standard in all types of navy planes.

The Marine Detachment in Nicaragua and the Naval Aerial Survey Detachment in Alaska provided a spectacular demonstration of how aircraft can be used. In Nicaragua, six tri-motored transport planes were in daily use transporting personnel, food, ammunition and other supplies in every kind of weather over wild country. The work of

COUNT THEM

More than 100 planes on the flight deck of the U.S.S. Saratoga, aircraft carrier, during maneuvers at Panama.

the Alaska Survey planes is reviewed in the chapter on "Explorations by Air."

Progress on the Navy's lighter-than-air program was marked by the beginning of actual construction on the first of two new giant dirigibles, ZRS-4 and ZRS-5, and the completion of the metal clad airship, ZMC-2. The achievements in airship development and the navy's part in the program is considered in the chapter on "Airship Development."

Tables containing detailed information on the strength of the Navy and Marine Corps aviation units, their equipment, flying time, planes and engines delivered from contractors during the year, appropriations, and a directory of commanding personnel is included in the Appendix.

CHAPTER XIII

GOVERNMENT CIVIL AVIATION

INCREASED activity in aviation during 1929 heaped new burdens upon the Aeronautics Branch of the Department of Commerce, but the Government kept pace and continued to be a prime factor in stimulating public confidence in aviation. The efficiency with which Government officials continued their program for the promotion and regulation of civil aeronautics under the Air Commerce Act of 1926 brought a measure of governmental protection to users of air transport found no other place in the world. The Aeronautics Branch, by providing airworthy aircraft, competent pilots, adequate airways and standard air traffic rules, was insuring the protection of the flying public.

Under the leadership of Maj. Clarence M. Young and William P. MacCracken the Aeronautics Branch expanded its facilities within the limits of appropriations to care for the increased burdens. Major Young succeeded Mr. MacCracken as Assistant Secretary of Commerce for Aeronautics October 1, when the latter resigned to enter the aircraft industry after he had served in the President's junior cabinet since the formation of the Aeronautics Branch in 1926. Major Young had been Director of Aeronautics in immediate charge of the branch since it was formed and had the background, training and experience necessary to carry on the work without interruption. He served with the American air force in Italy during the World War and maintained his active qualification as a pilot, flying his own plane on government business to all parts of the country. Early in 1929 he made an extensive tour of Europe for the government, flying an American airplane which he transported with him.

Col. Harry H. Blee, who had served as chief of the division of airports and aeronautic information, was made Director of Aeronautic Development. Gilbert G. Budwig, who had been chief of the inspection section, was appointed Director of Licensing and Inspection. The two new directors shared the duties formerly held by Major Young under the reorganization arrangement.*

The work of the Aeronautics Branch included: inspection and licensing of aircraft; examination and licensing of pilots; identification of aircraft; establishment and enforcement of air traffic rules and regulations; investigation of aircraft accidents; establishment and maintenance

*Complete directory of officers of the Department of Commerce, Aeronautics Branch, included in the Appendix.

of civil airways; equipment of airways with intermediate landing fields, beacon lights, radio apparatus and other aids to aerial navigation; maintenance of a comprehensive airways weather service; charting of airways; publication of air maps; conduct of scientific research; rating of flying schools; publication of air commerce bulletins; encouragement of municipal airport construction; rating of airports, and the collection and dissemination of air commerce information.

The rating of flying schools* was a new duty added to an already lengthy list through an amendment to Air Commerce Act of 1926 passed February 28, 1929. It gave the Secretary of Commerce power to examine and rate civilian flying schools giving instruction in flying upon the request of the owners or representatives of the schools. The importance and value of this work in raising the standards of flying schools is discussed in greater detail in the chapter on "Aerial Service."

Plans for rating all airports in the United States on the basis of their facilities were forwarded another step during the year when inspectors began the actual work of examining ports which had applied for ratings. A list of airports and their ratings was to be published early in 1930 as the work progressed.

Perhaps the heaviest portion of the new burdens fell upon the section charged with inspection and licensing of aircraft, pilots and equipment. New students planning to take flying instruction heaped more than 12,000 requests for student permits on the section. The section had issued 29,000 student permits since it began its work in 1926. More than 4,000 pilots were licensed during the year, bringing the total licensed to 9,472. A total of 3,021 mechanics were licensed to raise the total to 7,404. Aircraft licenses were issued on 2,490 planes, making a total of 6,646 in force, while 3,060 others were identified.

Two hundred and eighty-two airplanes had received approved type certificates at the close of 1929, while 157 had been approved for license without requiring an approved type certificate.† Thirty-five engines had received approved type certificates and 11 others were approved without certificates. Fourteen foreign engines had been approved without issuing certificates, and 134 propellers had been approved with certificates after exhaustive engineering tests to insure their airworthiness.

The work of the medical section, charged with examining pilots and students to determine their physical fitness to fly airplanes, increased more than 250 per cent during the year. More than 30,000 physical examinations were given by the corps of physicians associated with the

*List of approved flying schools in Appendix.
†Complete list of approved type certificates for airplanes, engines, propellers and pontoons included in Appendix.

medical section in all parts of the country and the proper forms filed in Washington. The number of medical examiners was increased from 366 to more than 700 to care for the heavy burdens imposed upon the section.*

The progress made by the airways and airports divisions in building up a nationwide network of civil airways with adequate landing facilities, and the work of the Weather Bureau which has been co-ordinated with

COLLIER TROPHY AWARDED

President Coolidge presents famous trophy to Aeronautics Branch of the Department of Commerce for meritorious work. (Left to Right) President Coolidge, Maj. Clarence Young, Senator Hiram Bingham, Dr. G. M. Lewis, and William P. MacCracken.

these divisions, is reviewed in the chapter on "Airports and Airways."

While appropriations of the Aeronautics Branch during the fiscal year 1929 increased only 45 per cent over the previous year, the burdens of increased work were doubled. Realizing that the next year may mean another doubling of these burdens, Major Young requested increased appropriations which would remove the handicaps of inadequate equip-

*Complete list of medical examiners for pilots included in the Appendix.

ment and insufficient personnel. The request was made in his annual report to the Secretary of Commerce.

Notwithstanding the possible handicaps of inadequate appropriations, the Aeronautics Branch carried on its work creditably and continued to make a major contribution to the development of civil aeronautics. Close co-operation with the industry was maintained on all questions of regulation arising, and a profitable liaison built up between the Aeronautics Branch and the industry's trade association, the Aeronautical Chamber of Commerce.

National Advisory Committee for Aeronautics

An extensive program of research investigation based upon problems presented to it by the Army, Navy and commercial industry was carried on by the National Advisory Committee for Aeronautics at its Langley Field, Va., laboratories. The committee's Fourth Annual Aircraft Engineering Research Conference was held May 15 at Langley Field to review the work of the past year and outline a new research program for the new year.

Considerable attention was focused on the problems of aerodynamic safety, and a series of research projects were carried out in the wind tunnels at Langley Field. The possibility of developing an airfoil having a flat-top lift curve as a means of preventing accidental stalls in landing or taking-off was considered in the experiments. Other research problems included studies of autorotation, ice formation, slots and flaps, landing gear loads, pressure distribution on control surfaces and spinning.

The committee made the results of its investigations available to the industry through technical reports and notes. Aircraft Circulars, describing interesting foreign planes, and Technical Memoranda, providing translations of valuable foreign technical articles, also were issued by the committee to everyone interested.*

Technical aspects of some of the most important research investigations carried by the Committee are considered in the chapter on "Trends in Design."

Patents and Design Board

The Aeronautical Patents and Design Board, created to inquire into the value and possible use by the government of aeronautical inventions submitted to it, considered several hundred designs passed on to it by the National Advisory Committee for Aeronautics.

*Complete list of publications of the National Advisory Committee for Aeronautics with directory of its officers included in the Appendix.

The Assistant Secretaries for Aeronautics in the Departments of War, Navy and Commerce were members of the board. Assistance of the National Advisory Committee in eliminating the least valuable inventions lessened the burdens formerly imposed upon the board.

United States Coast Guard

The Coast Guard maintained its enviable record of thousands of miles flown without a single forced landing. The five airplanes operated

OFF THE LEXINGTON

Vought Corsair (Pratt and Whitney Wasp) taking off the flight deck of the U.S.S. Lexington, aircraft carrier.

by the Coast Guard were used in scouting vast areas off the shore, averaging 100 miles but occasionally extending as far as 350 miles out.

A new plan designed to have every Coast Guard station along the coast serve as a checking station for airplanes was put into execution during the year with satisfactory results. The system served as a combined observation and message relay service. As an airplane bound along an established coastal airway passed a Coast Guard station, the man on duty telephoned a description of the plane to the next station. If the plane was not sighted within a reasonable length of time, a tele-

phone call was sent back and an immediate search started. Fifteen stations from Charleston, S. C., to Rockaway, N. Y., were named as checking stations.

The Coast Guard planes responded to many calls to search for lost, stolen or overdue vessels, and were particularly active in seizures of vessels attempting to smuggle contraband into the United States.

WITH FLEET ON MANEUVERS

Planes aboard a U. S. Navy aircraft carrier with the fleet on winter maneuvers at Panama.

Helium Board

The Helium Board continued to act as the co-ordinating and advisory body of the Army, Navy and Bureau of Mines departments interested in the non-inflammable lifting gas used by lighter-than-air craft. Representatives of each department were on the board, while actual control and production of helium remained in the hands of the Bureau of Mines.

During 1929 approximately 5,557,000 cubic feet of helium was produced at the Amarillo, Tex., plant maintained by the government. All of the helium produced was used or held in reserve by the Army and Navy. New apparatus installed in the plant made possible marked economies in production of the gas.

Discovery of the richest natural deposit of helium the world has ever known was announced May 30 by the Helium Company of Louisville, Ky. The deposit was reported so rich that the Helium Board anticipated a revolutionary influence on the development of dirigibles in the United States. Fifteen thousand acres of the gas were discovered in the Sinbad area near Government Helium Reserve No. 1, Colorado.

Since the Amarillo plant was in production on gas for the Army and Navy, the Helium Company was to operate the Sinbad field for commercial purposes. The deposits would be taken over by the Government only in case of a natural emergency.

FOR ANTI-AIRCRAFT

New type glider target attached to an army observation plane preparatory to taking off on maneuvers.

The Aeronautical Board

Continuing its important work of eliminating the possibilities of duplication of effort in the Army Air Corps and Navy Bureau of Aeronautics, the Aeronautical Board brought about a greater degree of co-ordination between the services.

The board prevented competition in the procurement of material when the chiefs of the two services were unable to agree on procurement. It also ascertained, before arranging to purchase aircraft, whether equipment of the type desired could be obtained from the other service.

Board of Surveys and Maps

The Board of Surveys and Maps co-ordinated all map-making and surveying activities of the government, investigating the needs for new

maps and settling questions so far as possible when duplication of effort was threatened.

The work of preparing air maps was delegated to the U. S. Coast and Geodetic Survey under the Air Commerce Act of 1926. Fifteen

Associated Press.

AWAITING STARTER'S SIGNAL

Some of the 18 starters in the University of Pittsburgh stadium for the National Elimination Balloon Race.

maps, giving detailed information to pilots planning to fly the major airways, were issued by the end of 1929, and 27 other projects were under way.* Plans for preparing sectional maps rather than strip maps of the airways alone were under way, with the first sectional maps due to be issued in 1930.

*Complete list of airway strip maps in Appendix.

CHAPTER XIV

AIRPORTS AND AIRWAYS

AMERICAN airways in operation at the close of 1929, if placed end to end, would have extended one and a half times around the world at the equator. Almost one-third of this great aerial highway was lighted for 24 hour transport operations, setting a pace unequaled by any nation in the world.

Sixty-two airways within the boundaries of the United States provided a network of 25,197 miles—more than the circumference of the earth—and linked practically every city with a population over 100,000 as well as scores of towns less populous. Fifteen foreign airways, flown by American transport planes, added 11,541 miles to the total routes developed.

Along 30 of the principal domestic airways, 10,358 miles were lighted adequately to permit 24 hour operations for mail, express and passenger planes.* The lighted "boulevard of the sky" extended from the Atlantic to the Pacific, along both coasts and through the great Mississippi valley to provide night service between cities where overnight hops were considered an economic advantage in the transportation of mail, express and passengers.

Equipment along the principal airways included 277 lighted intermediate landing fields with 1,352 rotating beacons or flashing beacon lights. Nearly 2,000 additional miles of airways were under contract for night lighting equipment.* Forty-six upper air observers and 207 weather reporting stations disseminated information to pilots and provided radio telegraph, radio telephone, land telephone and radio beacon direction service to insure the safety of operations.

While the Aeronautics Branch of the Department of Commerce, charged with the equipment and maintenance of all airways, forwarded this program during the year, municipalities and private interests turned an attentive ear toward the needs of transport operators and aided in the development of adequate ground facilities. They recognized that while aircraft uses the air as its medium for navigation, aviation can advance only so fast as the ground facilities—airports and airways—are properly developed. Mindful of the flow of traffic to those cities which provided facilities for the railroads in their early days, municipal chambers of commerce and civic organizations backed the movement for municipally owned ports.

*Complete airway marking and lighting table in Appendix.

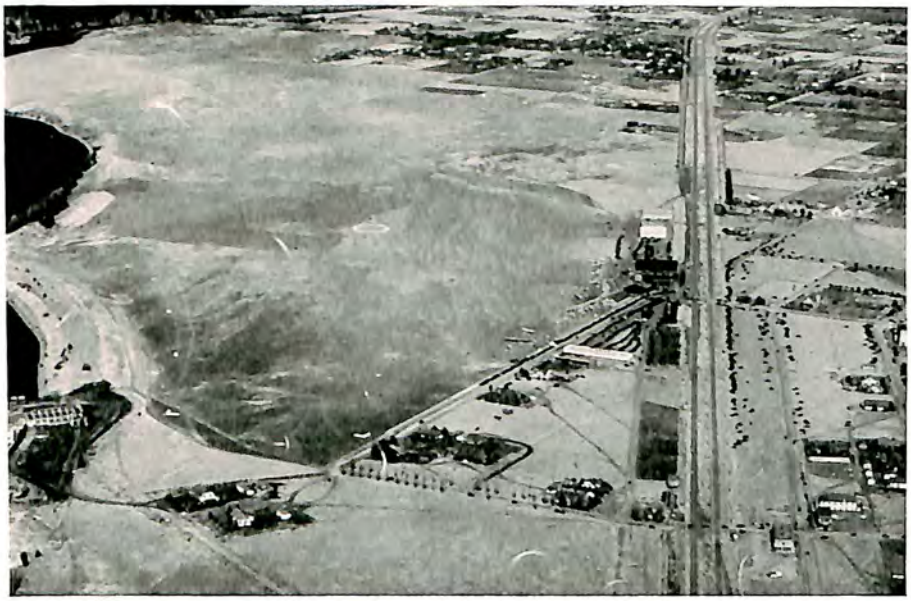
Municipalities owned 448 of the 1,527 existing airports in the United States. This indicated the development of 34 new municipal airports during the year, but did not present a complete picture of the year's progress in the field of municipal airport building. New equipment was added, lighting facilities provided, or the size of the field increased in almost every city, town and village owning and operating an airport. There were almost twice as many municipal airports in 1929 as there were two years before.

Possibly no single factor had a greater influence on the co-ordination of effort in the field of airport building than the forum for exchange of ideas and experiences provided through the national and regional meetings of the Airport Section of the Aeronautical Chamber of Commerce of America. Five meetings held in widely separated sections of the country served to bring engineers, architects, city officials, airport managers and others concerned with airport development together for an exchange of data on airport design, construction and management.

The National Convention of the Airport Section, May 15 to 17, in Cleveland, Ohio, brought more than 300 persons charged with airport construction and management throughout the country together for the first time. The minutes of the meeting and records of the papers read constitute a compendium of thought and experience on airport development from the best minds in the field. Regional meetings at Boston, September 21; Atlanta, October 14; Los Angeles, November 7 to 9; and Bridgeport, December 16, served to bring 300 other engineers, architects and airport executives together to consider the problems of co-ordinating airport building programs within their particular section.

Airport managers in cities of 100,000 persons attending the national and regional conventions estimated that they must build their ports to care for a traffic of at least 100 planes a day if they are to meet the demands of aviation expansion within the next five years. The Airport Section, with Maj. Clarence M. Knox as its chairman, continued the work discussed at the conventions through constant contact with members in all parts of the country and through recommendations by the Department of Commerce.

Commercial interests devoted greater attention to the development of airports during 1929, and several large corporations were formed for the sole purpose of constructing adequate land and seaplane bases near the principal cities from coast to coast. New York Air Terminals, Inc., and the Curtiss-Wright Airports Corporation, both subsidiaries of the Curtiss-Wright Corporation with William F. Carey as their president, were organized during the year to carry out a gigantic program of airport development throughout the country. United Airports



SPOKANE AIRPORT

Improvements on the airport at Spokane, Wash., have made it one of the best equipped in the country.

AIRPORT CLUBHOUSE

Reception room of the well-furnished Montgomery Airport Clubhouse at Montgomery, Ala.

Company of California, Ltd., a division of the United Aircraft and Transport Corporation, was formed to develop a new airport at Burbank, Calif., and operate the Hartford, Conn., port used by Pratt & Whitney Aircraft Corporation, with possible plans for other developments later. Fairfax Airports, Inc., an interest of Wood Brothers, developed a new port at Kansas City, Kan., and included several other midwestern projects in its program.

Transcontinental Air Transport, Inc., and Western Air Express, two of the principal transport operators, also undertook to develop their own ports where municipal or public facilities were not available, including weather reporting systems, radio communication and lighted airways.

Besides 446 municipal airports and 470 commercial fields, there were 526 Department of Commerce intermediate landing fields and marked auxiliary fields along the nation's airways. Sixty-eight army airdromes, 14 naval air stations and three unclassified fields raised the total airports in use to 1,527.* This represented an increase of 303 over 1928, and 625 more than 1927. The Department of Commerce reported 1,353 additional airports proposed for construction in 1930.

California continued to lead all other states in the number of airports with 154. Texas had 101; Pennsylvania, 85; Ohio, 76; Illinois, 67; New York, 56; Oklahoma, 50; Iowa, 45; Michigan 44; and Florida, 41.

Oakland Municipal Airport, Grand Central Air Terminal at Glendale, Los Angeles Metropolitan Airport, Alameda Airport, San Mateo Airport and the Los Angeles Municipal Airport were representative of the general development in California.

A 37 room hotel, with a restaurant capable of serving 185 persons at one time, was completed at the Oakland Municipal Airport. A channel 300 feet wide and 16 feet deep was dredged direct to the airport from the deep waters of San Francisco Bay and a dock constructed at the airport terminus of the channel. A new building, combining hangar facilities with administrative offices for air line operators, was added to four in use, and the field drained to provide an operating area 4,500 feet long and from 2,500 to 1,800 feet wide.

Eighty-five thousand landings were made on the Oakland port during the year; 4,000 air transport passengers handled; 47,000 aerial service passengers carried from it; 15,000 hours of student instruction given; 780,000 pounds of mail and 8,500 pounds of express handled. Five transport operators, 11 aerial service operators, and several flying clubs used the field, which was fully equipped for night flying.

*Complete list of airports and landing fields in Appendix.

CALIFORNIA PORT

Grand Central Air Terminal, a Curtiss-Wright airport, at Glendale, Cal., western terminus of several transport lines.

INDIAN MODE

Interior of the Transcontinental Air Transport, Inc., passenger station at Albuquerque, N. M., is decorated in an Indian motif.

Grand Central Air Terminal at Glendale, Calif., a Curtiss-Wright port, added a new passenger station and administration building as well as new hangars. The field was completely equipped for night flying and included all communication facilities and five huge hangars.

Three new factories, four hangars and three oil service stations were added to the Los Angeles Metropolitan Airport during the year, with all facilities for night flying, communication and repairs available. Seventy thousand landings were made on the field during the year, with 4,307 hours of student instruction alone reported.

NEW UNITED AIRPORT

The new $2,500,000 air terminal at Burbank, Cal., being developed by a division of the United Aircraft and Transport Corporation, serves as the Los Angeles terminus of the Boeing system.

The Alameda Airport at Alameda, Calif., a Curtiss-Wright port, had complete night lighting facilities, repair shops, two hangars and a passenger restaurant. Telegraph and radio were to be installed on the 250-acre field.

On the Los Angeles Municipal Airport a take-off strip 2,100 feet long and 100 feet wide was constructed of decomposed granite and asphalt rolled hard. The same surfacing was used for roadways to the field, and an auto park with curbing provided. Landscaping around all

ROOSEVELT FIELD AT NIGHT

Famous New York airport on Long Island throws a strong flood of light from its Sperry-AGA equipment on a Department of Commerce plane several hundred feet distant.

"ON THE DOTTED LINE"

A night view from the air of the Grosse Ile Airport near Detroit equipped with the Donaldson automatic lighting system, which provides a "dotted line" of lights buried in the ground for the pilot to land upon. The lighted runways are controlled automatically by a wind vane.

buildings was completed. Approximately 50,000 landings were made on the port during the year.

In Colorado, Denver completed a new municipal airport, dedicated in October, consisting of 630 acres and equipped for night flying and repairs. One hangar and an administration building with passenger handling facilities were completed.

In Connecticut, both the Bridgeport Airport and Hartford's Municipal Airport, Brainard Field, were equipped for night flying and had

OIL RUNWAY

East Beach Naval Air Station at San Diego, Cal., showing the construction of a new oil runway.

complete facilities for transport and aerial service operations. A new administration building was added to the Hartford port, which had six hangars.

In Florida, Miami completed a new municipal dirigible field, one of the first in the country, equipped with a 3,000-foot runway, steel hangar, restaurant and swimming pool. On the Miami Municipal Airport rolled rock runways were widened, additional acreage sodded, a weather bureau installed and construction started on a $50,000 passenger terminal. New hangars, ramps and passenger facilities were provided at the Miami Seaplane Base, also municipally owned. Curtiss-

Wright Flying Service had developed a private seaplane base and Pan American Airways, Inc., continued the improvement of its private passenger terminal.

In Illinois, Chicago's Municipal Airport kept its record for extensive major operations, reporting 45,340 landings; 18,397 air transport passengers; 19,216 passengers in non-scheduled planes; 3,065,573 pounds of mail and 59,581 pounds of express handled. A new administration building and two new hangars were added. It was equipped for 24 hour

CENTRAL AIRPORT

New Philadelphia-Camden airport, showing take-off and landing strips designed and constructed by the Airport Development and Construction Company.

operations, with complete shop facilities. At the Pal-Waukee Airport, privately owned, complete night lighting equipment was installed, aprons constructed, and repair and drainage facilities extended. Newspapers aggregating 108,000 pounds were flown from the field during the year. Reynolds Airport, a Curtiss-Wright port near Chicago, was completed and dedicated late in the year. It was fully equipped with lighting facilities, repair shops, hangars and passenger conveniences for a first class port.

In Kansas and Missouri, Fairfax Airports, Inc., was active in developing new fields at Kansas City, Kan., Atchison, Kan., Weston,

Mo., and St. Joseph, Mo. The Fairfax Airport at Kansas City, Kan., was in full operation at the end of the year, while considerable development work in 1930 was planned for the other three ports. The mile square Wichita Municipal Airport added two hangars, floodlights, beacons, boundary lights, grading, taxi strips, fences and communication facilities.

In Kentucky, Bowman Field at Louisville added a $30,000 administration building, new $55,000 hangars and parking space for 3,000

FAIRFAX AIRPORT

Developed by Woods Brothers, the Fairfax Airport at Kansas City, Kan., is used by Universal Air Lines on its transcontinental service.

automobiles. In Louisiana, a new administration building, shops and four 3,000 foot runways were completed in New Orleans on the Menefee Airport of Southern Air Transport, Inc., while work went ahead on the new field at Shreveport for which $300,000 was voted in May. The Shreveport field, located in a horseshoe bend of the Red River, was to become the home of the U. S. Air Corps Third Attack Wing, which plans a $6,500,000 construction program.

In Maryland, two new airport projects were under way in Baltimore, one a municipal venture and the other a Curtiss-Wright airport. Logan Field, with six hangars and night flying facilities, continued to

THE LINE IN LOS ANGELES

The new Los Angeles Metropolitan Airport, showing the administration building in the background with a dozen planes on the line.

INTERNATIONAL AIRPORT

Following the lines of Spanish design, the International Airport at Brownsville, Tex., is well equipped to handle passengers.

be the center of operations, while construction, fill and drainage of the new municipal airport were under way. The Curtiss-Wright Airport has two hangars on a 260 acre tract, with night lighting and restaurant facilities under construction.

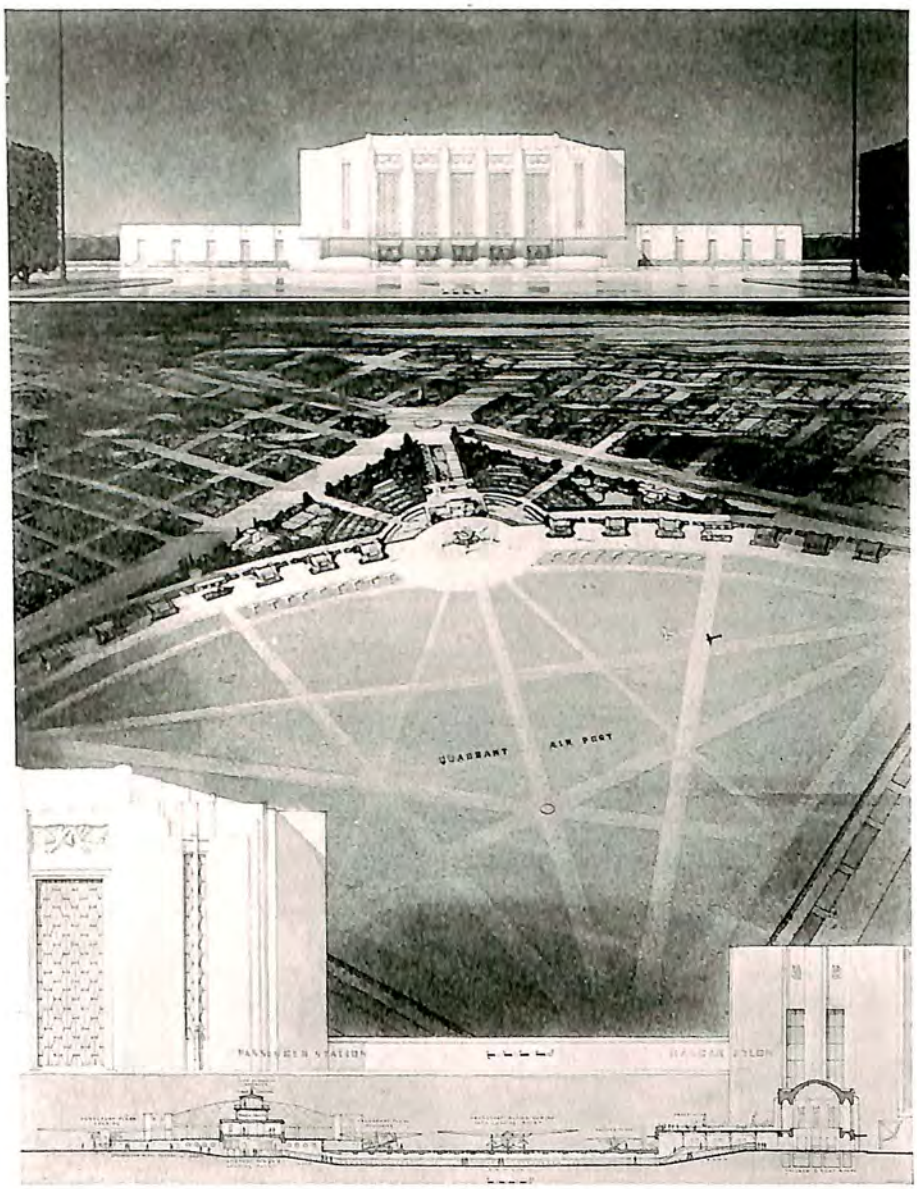
In Massachusetts, the ports at Boston, Agawam and Marlboro provided a representative and interesting example of New England development. The Bowles Agawam Airport, a commercial project, saw 300 acres in a triangle cleared, drained and graded for use, with fireproof hangars completed late in the year. Macadam take-off strips were finished, while night flying facilities were to be installed by June, 1930. Nine hangars were in use on the Boston Municipal Airport, five of them being built during the year at a cost of $500,000. New floodlights and a $200,000 administration building also were completed in 1929. At Marlboro, landing areas were smoothed and sodded and fences erected, but night lighting equipment had not yet been installed.

In Michigan, the Detroit City Airport, Grosse Ile Airport, Ford Airport and the Pontiac Municipal Airport provided a glimpse of representative development in that section. The Detroit City Airport, the new municipally owned field, built two hangars, one capable of housing 175 airplanes and costing $1,000,000, and the other of 12 plane capacity built at a cost of $55,000. Half million yards of fill were put in, asphalt and concrete runways 100 feet wide and costing $250,000 constructed, and 17 miles of drain tile installed. Night lighting equipment was under contract, with full operation scheduled for 1930. New buildings and field facilities were added at the Ford Airport, which handled the major share of Detroit transport operations during the year.

The Grosse Ile Airport, a division of Detroit Aircraft Corporation, saw the installation of the first automatic night lighting equipment under the Donaldson patented design of Airport Lighting, Inc. The runways, lighted by beams buried in the ground and controlled automatically by a wind vane, provided a "dotted line" for pilots to follow in landing. The project was watched with interest by engineers and airport executives. The Pontiac Municipal Airport added to its equipment and facilities to care for increased traffic.

In Minnesota, St. Paul and Minneapolis increased their facilities to meet a greater volume of traffic. St. Paul completed the expenditure of $600,000 on its municipal port, with $200,000 available for further improvements. An additional 298 acres were to be developed for seaplane base, when present work on the 300 acre landing field is completed. Construction on a new $90,000 hangar was started and $80,000 authorized by the city for another additional hangar. Grading, runways and lighting facilities were improved during the year.

In New Jersey, New York Air Terminals, Inc., took over the



WINNING AIRPORT DESIGN

Modern metropolitan airport as conceived by two Los Angeles architects, who won first prize in the airport design competition sponsored by Lehigh Portland Cement Company.

operation of Hadley Field and completed the major portion of the fill for the new $10,000,000 Secaucus Airport on the Hackensack Meadows, while Central Airport at Camden was developed to serve Philadelphia and Camden. A swimming pool and complete recreational facilities were included on the Central Airport as a feature expected to be adopted generally by other airports. Two hangars were completed, complete lighting installed, take-off strips and aprons laid, and the field put into operation. Full night lighting equipment and transport facilities were provided at the Newark Metropolitan Airport, owned by the city of Newark. An elevated highway leading directly from the airport 11 miles to the Holland Tunnel, connecting New Jersey with New York, was opened. The Newark port reported 28,000 landings, 6,000 transport passengers, 17,000 aerial service passengers, 482,000 pounds of mail and 2,000 pounds of express. The Essex Airport at Caldwell, N. J., a Curtiss-Wright port, had one hangar completed and night flying equipment was being installed.

In New York, Roosevelt Field and Valley Stream Airport provided interesting developments in the metropolitan district, while Albany, Elmira, Schenectady and Utica were representative of up-state progress. Roosevelt Field, a division of the Aviation Corporation, improved an additional area, constructed eight new fireproof hangars with concrete aprons, and laid plans for building a new administration building, restaurant, ground school building, dormitories and an apartment hotel in 1930. Its manager reported 25,000 landings in 1929 with 15,000 passengers carried in aerial service operations. Three hangars were completed on the new 320 acre Curtiss-Wright Valley Stream Airport on Long Island, with lighting and repair facilities. Future plans embrace the construction of nine hangars, a hotel and dormitories.

Albany incorporated a weather station, receiving reports from 29 New York cities, one in New Jersey, Montreal and Massachusetts. Available landing space was extended and a new hangar constructed on the Elmira Airport, operated by General Aviation Company, a division of Eastern Aeronautical Corporation. Grading was completed for the Schenectady Airport, a private field, with two hangars, administration building and machine shop on a 195 acre tract. In Utica, the municipal airport put 140 acres in excellent condition for all way landing purposes, lighted the field, installed new fueling equipment and built a new hangar.

In Ohio, Port Columbus, Cleveland Municipal Airport, Herrick Airport, Lunken Field and Thompson Airport at Lima were representative of the progress made. Port Columbus was developed by the City of Columbus from an $800,000 bond issue and used as the eastern terminus of Transcontinental Air Transport, Inc. The project was started in April and operations were under way in July as construction

NEW PORT FOR CHICAGO

Reynolds Airport, a new Curtiss-Wright airport, at Chicago, Ill., built at a cost of $3,000,000.

OAKLAND AIRPORT HOTEL

Lobby of the Airport Inn on the field at Oakland, Cal., built at a cost of $55,000.

went ahead in record time. Three hangars, costing $100,000 each, two runways of asphalt macadam costing $120,000, a $65,000 administration building, $90,000 railroad train sheds, $75,000 drainage project, $40,000 lighting equipment and grading were completed. New hangars and an administration building were completed on the 1,000 acre Cleveland Municipal Airport, with an additional acreage made available for landings.

Lunken Field at Cincinnati, municipally owned, saw the erection of three new hangars, 300,000 yards of grading, new streets and night lighting equipment completed. Herrick Airport at Cleveland, another Curtiss-Wright project, was started with plans for installing night lighting equipment, repair shops and hangars. Dirt and cinder runways were improved on the Thompson Airport at Lima, a 40 acre privately owned field.

In Oklahoma, Tulsa added three new steel hangars, a concrete taxi strip, seven electric gasoline pumps, a barber shop and restaurant to its municipal airport.

In Pennsylvania, the Philadelphia Municipal Airport, Pittsburgh-Greensburg Airport and Bettis Airport were examples of the trend in construction. The Pittsburgh-Greensburg Airport, owned by the Main Aeronautics Company of Pittsburgh, completed the development of 200 acres on a 712 acre tract and opened it in September with complete operating and passenger facilities. Work had not been started on night lighting, although an appropriation had been provided. Two hangars were constructed on the Bettis Airport at Pittsburgh, a Curtiss-Wright project, involving a 185 acre tract. Plans included equipment for night flying and repair facilities. Four hangars and complete repair facilities were provided on the 105 acre Philadelphia Municipal Airport.

In Rhode Island, the privately owned Providence Airport extended its runways, installed a drainage system and built a new hangar.

In Texas, the municipal airports at Beaumont and Brownsville and the Curtiss-Wright port at Houston included new developments. A splendid international airport on the Texas-Mexico border with passenger accommodations, shops, four hangars and an all way field were provided in the Brownsville Municipal Airport, constructed almost wholly during 1929. Two runways, an administration building, and two metal hangars were constructed on the Beaumont Municipal Airport, while work was under way on the Curtiss-Wright port at Houston with night lighting and other facilities to be added.

In Washington, the city of Spokane added 30 acres of land to its municipal airport, Felts Field, constructed a new hangar and installed night lighting equipment.

In Wisconsin, Milwaukee saw the beginning of construction on the

new Curtiss-Wright Milwaukee Airport, a 132 acre tract to include complete facilities, and the grading of the private field of the Holterhoff Flying Service.

A glance at the complete list of airports in each state will indicate how widespread the development of municipal and commercial airports has been.* The trend in construction has been toward permanent structures, with an eye toward utility without losing sight of opportunities to beautify the ports and incorporate pleasing architectural features in the building designs. Airport engineers, with expert knowledge of air-

CLEVELAND AIRPORT

One of the largest municipal airports in the world, new construction work has changed the complexion of the Cleveland Municipal Airport.

port design and construction, were being employed by municipalities and private interests to eliminate the remnant of earlier haphazard developments. B. Russell Shaw of St. Louis, Black and Bigelow of New York, Ford, Bacon and Davis in New York, Leonard Macomber, Inc., in Chicago, Airport Development and Construction Company in Philadelphia, Airport and Engineering Construction Co. in Fort Worth, and American Airports Corporation in New York were among the most active airport engineers and consultants.

*Complete list of airports and landing fields in Appendix.

In the field of airport lighting equipment, the American Gas Accumulator Company, B. B. T. Corporation of America, Sperry Gyroscope Company, Westinghouse Electric and Manufacturing Company, General Electric Company, Airport Lighting, Inc., Rainbow Light, Inc., and the Pyle-National Company were active in the refinement of their lighting equipment. The Rome Wire Company developed Trenchlay cable for lighting equipment, the S. F. Bowser Company, Inc., Gilbert and Barker Manufacturing Company and Aqua Systems, Inc., continued their construction of refueling devices, while the Austin Company and H. H. Robertson Company contributed to the progress of hangar design and construction. The Automatic Sprinkler Corporation manufactured a fire extinguisher system for hangars.

Lehigh Airports Competition

The Lehigh Airports Competition, sponsored by the Lehigh Portland Cement Company, brought out a host of elaborate plans for airports designed to care for increased air traffic. The winning design, submitted by A. C. Zimmerman and William H. Harrison, two Los Angeles architect-engineers, was chosen from a field of 257 entered by architects, engineers and city planners in all parts of the country.

The Zimmerman-Harrison design concentrated all buildings in one corner of a rectangular field, leaving a quadrant-shaped flying area with appropriate runways and taxi strips. A fine passenger terminal building with underground access to loading and unloading points was flanked by hangars at the edge of the flying area, with automobile parking spaces, a hotel, recreation building, shops and amusement concessions arranged in a triangular park. The first prize was $5,000. Three other prizes and 12 honorable mentions were awarded, with cash prize money totaling $10,200 distributed to the winners. The winning design is reproduced as a plate in this chapter.

CHAPTER XV

PRIVATE FLYING

FROM Maine to Southern California, mountain lakes, seaside resorts, fishing haunts, regattas, football games and dozens of other events and places lured hundreds of airplane owners away from the big cities in their private craft. The week-end trips and extended jaunts of these sportsmen-pilots piled up a formidable total of miles flown during 1929 for pure joy of the thing.

Hundreds of other private and industrial owners of aircraft put their planes to work in every day business pursuits. Judges, doctors, insurance brokers, ranchers, salesmen, and executives of nationally expanded businesses were numbered among the owners of private craft. The total mileage flown by these planes was even more impressive than that of the sportsmen-pilots.

It can be conservatively estimated that 25,000,000 miles were flown in the United States during 1929 in planes owned by individuals or corporations on business or pleasure missions. This does not take into account the mileage flown by aerial service operators or air transport lines employed by individuals or industrial houses to meet their daily needs.*

Members of the Long Island Aviation Country Club at Hicksville, L. I., alone bought new planes aggregating $584,540 during 1929. The manufacturers were quick to recognize the needs of this field and contributed in no small way to the rapid expansion of private and industrial flying. Nearly two score types of airplanes, ranging in price from $1,900 to $7,000, were on the market at the close of 1929 to fill the needs of the private owner. Many of these were designed for the pilot just past the solo stage. Some manufacturers called them training planes and others classed them as sport planes. However, many of the ships purchased by private owners were comparable to the sportsman's fine yacht, with prices ranging from $15,000 to $60,000.

J. M. Patterson, the Chicago publisher, and his daughter, Mrs. Alicia Simpson, toured the West Indies early in the year on a 3,500 mile cruise in their Sikorsky amphibion, powered with two Pratt and Whitney Wasps. Van Lear Black, the Baltimore publisher, continued his extensive tour of Europe, Africa and India in a Fokker monoplane, increasing his air log to 120,000 miles since he started to fly several years ago. He planned an extensive tour of North and South America for 1930.

*Chapters on "Aerial Service" and "Air Transport Progress" review these two classifications.

Baron von Warthausen of Germany and the Vicomte Jacques de Sibour, with the Vicomtesse de Sibour, of England completed jaunts around the world in light planes during the year, flying leisurely over land and shipping their craft across the seas. It demonstrated the uniformity of service that could be obtained for planes in all parts of the world, and added a new chapter in the records of aerial sportsmen. They sought no records and made the flights "just for a lark."

AMERICAN BUILT AVIAN

Whittelsey Avian (American Cirrus) flying along New England coast. It is built on patents of the British Avro Avian.

Baron von Warthausen left Berlin for Moscow on a non-stop flight in a light Klemm-Daimler (Gipsy) monoplane. With his goal reached, the Baron decided he would extend his flight to Persia. Then he planned the world jaunt, continuing the 18,750 mile journey to reach Berlin November 21.

The Vicomte de Sibour and the Vicomtesse flew a D. H. Moth

HICKSVILLE AVIATION CLUB

Clubhouse and hangars of the Aviation Country Club at Hicksville, L. I., the first of a nation-wide chain of private clubs planned.

AVIATION COUNTRY CLUB

Interior of the club house at Hicksville, L. I., where elite of New York fly from their private airport. Colonel Lindbergh taught Mrs. Lindbergh how to fly within the privacy of the club field.

(Gipsy) biplane on their 17,000 mile jaunt across Europe, North Africa, Asia Minor, Persia, India, Siam, Indo-China, and finally from Seattle to New York. They arrived in New York in June and stored their plane on a liner for the return to London, after a leisurely trip that included big game hunting in Indo-China and other sporting side trips.

The 63-year-old Duchess of Bedford set out from London during August in her private Fokker monoplane, the "Spider," headed for India. She made the trip to Karachi and return in seven and one-half days, covering 10,000 miles. The Duchess took the controls periodically on the long journey. Earlier in the year, Lady Bailey completed an 18,000 mile tour from London around the continent of Africa in a De Havilland Moth (Cirrus) plane.

Colonel Charles A. Lindbergh kept up his record for extensive flights to all parts of the United States, Central and South America, taking Mrs. Lindbergh, on most of them after their marriage in May. Lindberg's log showed a total of more than 325,000 miles flown since he learned to pilot a plane. He made a break in his record of never having used a railroad since his flight to Paris in May, 1927, when he accompanied the body of Ambassador Myron T. Herrick from New York to Cleveland as a member of the funeral party in April. After the funeral, he returned to New York by air and, with this one exception, has never used a train to reach a destination. Mrs. Lindbergh, formerly Anne Morrow, daughter of the American Ambassador to Mexico, also learned to fly during the year and was piling up solo hours as 1929 ended.

The 1929 flying record of Harry H. Culver, president of the National Association of Real Estate Boards, was without equal among private fliers who used planes in carrying out their business missions. Culver made five tours during the year, totaling 100,000 miles and including 650 cities in which he addressed real estate boards or civic organizations. He emphasized the importance of aviation as an aid to developing new property values for suburban lands, and generally demonstrated how the airplane could be used to good advantage in every day business. He used two Stinson-Detroiter (Wright Whirlwind) monoplanes, and hired a private pilot to fly him to all parts of the country. His flights were, without doubt, the most extensive ever made in a single year by a business man in a private plane.

A New York hotel, preparing to open its doors to the public for the first time, sent two salesmen out in a Curtiss (Challenger) Robin to tell the world of the hostelry's merits on a 15,000 mile tour including 56 cities. Dr. Walter M. Cross, consulting chemist of Kansas City, testified in the United States District Courts of both St. Louis and Kansas City on the same day by using his Lockheed (Pratt and Whitney

BULLET TAKES OFF

Alexander Eaglerock (Kinner) Bullet, piloted by Edith Foltz of Portland, Ore., takes off from Santa Monica, Cal., in women's air derby.

COMMAND-AIRE BIPLANE

Carroll Cone beside the Command-Aire 5C3 biplane.

Wasp) monoplane. Physicians serving widely separated communities used private planes; and a professional medical journal urged more doctors to take up flying and go into the sparsely separated villages which need medical aid. One-third of the communities under 1,000 population were without doctors, and the airplane offered a solution to better distribution of physicians.

Oil companies used the airplane extensively for their executives and employees throughout the fields, especially in Texas and Oklahoma where

LAND, WATER AND AIR

Ireland (Wright Whirlwind) amphibian is equipped for land or water landing, with easily adjustable gear.

many of the privately owned planes were in the hands of the major oil companies. Insurance companies, contractors, attorneys, express companies, power interests, advertising agencies, newspapers, roofers, department stores, publishing houses, automobile, accessory and tire manufacturers were added to the daily users of private planes for industrial purposes.

The following is a list of a few industrial concerns which used private airplanes during 1929: A-C Spark Plug Company, Flint, Mich.; Allen

Company, Chicago; American Railway Express Company, New York; Anheuser-Busch Company, St. Louis; Antelope Valley Farms, Los Angeles; Arkansas Power and Light Company, Pine Bluff, Ark.; Associated Oil Company, San Francisco; Auer, Inc., Milwaukee, Wis.; Auto Electric and Radio Equipment Company, Fort Wayne, Ind.; Automatic Washing Machine Company, Newton, Iowa; Automotive Service, Inc., Phoenix, Ariz.; Earl W. Baker Company, construction engineers, Oklahoma City, Okla.; Beardsley and Piper Company, Chicago; Becker Roofing Company, Chicago; Austin F. Bement Company, Detroit; Berry

OFF THE FRONT PORCH

New Loening (Wright Whirlwind) "Commuter" brings a home on a mountain lake within a short distance of the city. It lands on land or water.

Brothers, paints and varnishes, Detroit; Charles V. Bob, mine operator, New York; Boghosian and Lewis, Oklahoma City, Okla.; Lutheran Mutual Aid Society, Des Moines, Ia.; Brock and Weymouth, Inc., Philadelphia; Burrell Engineering and Construction Company, Chicago; Canvas-Leather Specialty Company, Trenton, N. J.; Cardiff and Peacock, Bakersfield, Cal.; Carlson and Johnston, Kansas City, Mo.; Daniel Carver, newspaper editor, Veblen, S. D.; Celotex Company, Chicago; Central Electric Company, Fort Wayne, Ind.; Chestnut and Smith Corporation, Tulsa, Okla.; Chicago Daily News, Chicago; Cleveland News,

Cleveland; Cleveland Pneumatic Tool Company, Cleveland; Cleveland Tractor Company, Cleveland; E. B. Cole, Inc., Peoria, Ill.; Continental Motors Corporation, Detroit; Continental Oil Company; W. H. Cox, hosiery store chain, Tulsa, Okla.; Curtis Publishing Company, Philadelphia, Pa.; Curtiss Candy Company, Chicago; Daily Times, Davenport, Ia.; Des Moines Register-Tribune, Des Moines, Ia.; Detroit News, Detroit, Mich.; Duplex Printing Press Company, Battle Creek, Mich.; Eugene Dynner, real estate, New York; Elliott Core Drilling

LINDBERGH'S NEW PLANE

Lockheed (Pratt and Whitney Wasp) Sirius low-wing monoplane, with N.A.C.A. cowling and perfect streamlining, the first of which was delivered to Col. Charles A. Lindbergh for his private use.

Company, Los Angeles; Fred Ellis, insurance, Milwaukee; Farquhar and Company, Greenville, S. C.; Farrell and Blake, New York; Firestone Tire and Rubber Company, Akron, O.; Flex-O-Glass Manufacturing Company, Chicago; John J. Fox and Sons, undertakers, New York; F. F. Garside, newspaper owner, Tonopah, Nev.; General Electric Company, Schenectady, N. Y.; Globe-Wernicke Company, Cincinnati; B. F. Goodrich Rubber Company, Akron, O.; W. H. Goodrich Oil Company, New Haven, Conn.; Hart's Cafeteria Company, Sacramento, Cal.; R. M. Harwood, farm operator, Donaldson, Ill.; Arch

NEW FLYING BOAT

Eastman (Curtiss Challenger) flying boat developed by Eastman Aircraft Corporation, a division of Detroit Aircraft Corporation, to carry three or four persons.

DERBY WINNER

Davis VR3 (LeBlond) monoplane in which Lewis Love, pilot, won the All Ohio Derby staged in connection with the National Air Races.

Haynes Drilling Company, Shreveport, La.; Henderson Iron Works, Shreveport, La.; Henshaw Oil Company; Heyer Products Company, Newark, N. J.; Heyman and Brothers, New York; Hillison and Etten, Chicago; Holbrook Grocery Company, Keene, N. H.; Jell-O Company, New York; Kirkly, Watts and Company, Chicago; Land Petroleum Company, Warrensburg, Mo.; Lane, Piper and Jaffry, insurance, Minneapolis; "Life" Magazine, New York; Line Material Company, South Milwaukee, Wis.; Loomis Oil Well Control Company, Long Beach, Calif.; P. Lorillard Company, New York; Los Angeles Times, Los

THREE PLACE SPARTAN

Spartan (Wright Whirlwind) C3-165 now in production.

Angeles, Cal.; Love, Bryan and Company, securities, St. Louis; "Magazine of Business," Chicago; Manning and Company, Chicago; Markham Machinery Company, Keene, N. H.; Marshall Field Company, Chicago; Marmon Motors, Inc., Kansas City, Mo.; May Department Stores, Los Angeles; R. P. McCutcheon, Bakersfield, Cal.; McFadden Publications, New York; A. M. McMullen, Inc., Tampa, Fla.; Mead Bros., Inc., Tulsa, Okla.; Michigan Artificial Ice Products Company, Detroit; Missouri Pacific Railroad, St. Louis; C. E. Moram and Company, Inc., Washington, D. C.; Morgan Company, paints and varnishes, Peoria, Ill.; Murphy Motors, Inc., Indianapolis; National Battery Com-

pany, St. Paul; Naturaline Oil Company, Tulsa, Okla.; Frank Neeley, department stores, Atlanta, Ga.; Nemmers Brothers, Dell Rapids, S. D.; Noble-Olson Drilling Company, Tulsa, Okla.; Pacific Mining Company, Los Angeles; Packard Electric Company, Warren, O.; Pampa Refining Company, Pampa, Tex.; Lewis W. Parker, real estate, Greenville, S. C.; Parker Pen Company, Janesville, Wis.; Pennzoil Company, Oil City, Pa.; Perfection Ice Scoring Machine Company, Waco, Tex.; Phillips Petroleum Company, Bartlesville, Okla.; Pittsburgh Plate Glass Company, Pittsburgh, Pa.; Prairie Farmer Publishing Company,

SPORT TRAINING PLANE

Two place Great Lakes (American Cirrus) biplane used for training purposes.

Chicago; Prest-O-Lite Storage Battery Company, Indianapolis; Quackenbush Company, Cleveland; William H. Rankin Company, advertising, Chicago; Reid-Murdock and Company, groceries, Chicago; Remington-Rand Company, New York; Richfield Oil Company, Los Angeles; Roper Gas Range Company, Rockford, Ill.; Royal Typewriter Company, New York; St. John's Insurance Company; San Antonio Drug Company, San Antonio, Tex.; Schulze Bakeries, Kansas City, Mo.; Shaeffer Oil and Refining Company, Chicago; Shell Petroleum Corporation, St. Louis; Skelly Oil Company, Tulsa, Okla.; Sparks-Withington Company, Jackson, Mich.; Sprague-Warner Company, Chicago; Otto

Stahl, provision merchant, New York; Standard Oil Company of California, San Francisco, Cal.; Standard Oil Company of Indiana, Chicago; Standard Oil Company of New Jersey, New York; Standard Oil Company of Ohio, Cleveland; Standard Oil Company of Louisiana, New Orleans; Standard Roofing Company, Oklahoma City, Okla.; R. C. Stanfield, druggist, Rockford, Minn.; Stoody Welding Manufacturing Company, Whittier, Cal.; Tanner Motor Livery, Pasadena, Cal.; Texas Company, New York; Texas Oil and Land Company, Fort Worth, Tex.; Texas Pacific Coal and Oil Company, Fort Worth, Tex.; Topper-Knewbow Company, Los Angeles; Tulsa Boiler and Machinery

FLEET TRAINER

Equipped with pontoons, the Fleet (Kinner) training plane takes its place in the yacht harbor.

Company, Tulsa, Okla.; D. H. Tyron, wool merchant, San Francisco, Cal.; Union Gas and Electric Company, Cincinnati; Union Oil Company, Los Angeles; Union Trust Company, Detroit, Mich.; United Cigar Stores of America, New York; Utah Oil and Refining Company, Salt Lake City; Wadhams Oil Company, Milwaukee, Wis.; Walgreen Drug Stores, Chicago; Waverly Oil Company, Pittsburgh; West Drilling Company, Tulsa, Okla.; Wichita "Eagle," Wichita, Kan.; and Wood Brothers Corporation, Kansas City.

In the field of private flying for sport, the movement for the development of flying clubs in all parts of the country began to materialize during 1929 and promised a brilliant future for both aviation enthusiast and airplane manufacturer.

The National Aeronautic Association introduced an elaborate plan for developing flying clubs, which would provide planes for their members on a near-cost basis and make possible group ownership of ships.

The National Glider Association also was active from a little different angle, promoting glider clubs to interest youths in the primary stages of flying and thereby developing interest and enthusiasm for powered flight.

Perhaps the most unique club plan for the encouragement of private flying became a reality when the Long Island Aviation Country Club, the first of a nationwide chain of organizations under Aviation Country

GAR WOOD'S LATEST

Fokker F-11 (Pratt and Whitney Hornet) amphibian owned by Gar Wood of Detroit prepares to take off from the water with eight passengers.

Clubs, Inc., was opened at Hicksville, L. I. More than $300,000 was invested in the club's facilities, which included a private hangar, club house, and sixty acre turf flying field. Planes of 40 members and four club-owned ships were housed in the large hangar.

The aviation country club was developed after a study of light plane clubs in England, where 20 clubs embracing memberships of approximately 400 each were in operation. The English clubs, however, received a subsidy from the government which the American organization did not enjoy. Fifteen light plane clubs, also aided by subsidy, were operating in Canada during 1929.

The Long Island Aviation Country Club had 71 member pilots, 11 student pilots, and an affiliated membership of 180 society leaders

in the New York area. Nineteen different makes of airplanes were purchased by the members during the year, with an aggregate cost of $584,540.

Among the members of the Long Island club and the planes they owned were: Hubert C. Bennett, Moth; Charles V. Bob, Avian and Bellanca; William T. Brown, Travel Air; Joseph W. Brooks, Travel Air; Hayes Browning, Waco; Donald D. Cook, Avian; Merion C. Cooper, Fleet; Felix Dupont, Moth; Alex P. deServersky, Stearman; Amelia Earhart, Lockheed; Harry F. Guggenheim, Vought Corsair; J. G. Hall, Travel Air; Harry E. R. Hall, Waco; Miss Eleanor Hoyt, Moth; Richard F. Hoyt, Loening Air Yacht; Miss Betty Huyler, Moth;

SEVEN PASSENGER SEAPLANE

American Marchetti S-62 (Isotta Fraschini) manufactured by American Aeronautical Corporation.

William B. Hardin, Travel Air; George E. Kent, Laird and Stearman; Mrs. George F. Kunz, Travel Air; Charles L. Lawrance, Avian; Charles A. Lindbergh, Lockheed Sirius; Grover Loening, Robin and D. H. Moth; Luther Martin, Travel Air; Arthur B. Mencken, New Standard; Thomas Neelands, Travel Air; James M. Patterson, Laird and Sikorsky; George B. Post, Spartan; J. Roy Prosser, Stearman; R. Barto Reed, Stearman and Loening; Judge R. D. Silliman, Fokker; Mrs. James Simpson, Laird; Hamilton J. Starke, Moth; Croker Snow, Moth; F. H. Taylor, Stinson; James B. Taylor, Jr., Avian; Lawrance Turnure, Stearman; Miles Vernon, Travel Air; Chance M. Vought, Vought Corsair; John H. Whitney, Sikorsky; Irwin W. Washaur, Aeromarine Klemm and W. J. Warburton, Moth. In addition, the club owned a

Travel Air, Moth, Avian and Curtiss Fledgling for general use of its pilot-members.

Miss Ruth R. Nichols and Robb C. Oertel made a 12,000 mile aerial survey tour to promote interest in the national movement for aviation country clubs, and reported the enrollment of members in 20 large cities. The second unit of the national club chain was to be completed early in 1930 near Greenwich, Conn., and was to be known as the Westchester Club. Other clubs were in the process of organization in Philadelphia; Newport, R. I.; Pittsburgh; Chicago; Los Angeles and San Francisco.

SPORT SPEED PLANE
Taper Wing Waco (Wright Whirlwind) owned by James B. Hall, New York broker.

Other Flying Sportsmen

Gar Wood, holder of the world's record for speedboats, had a Fokker F11-A (Pratt and Whitney Wasp) amphibian constructed for sport flying, and returned from Europe in the fall to announce that he had contracted with the builders of the Dornier Do-X, giant 100 passenger plane, to build him a huge private flying boat at a cost of $175,000.

Women took an increasingly important place among the nation's private fliers and dozen of their names were familiar to the general pub-

lic, because of their intensive activity in the race for new records. Amelia Earhart, Mrs. Louise Thaden, Lady Heath, Mrs. Phoebe Fairgrave Omlie, Evelyn B. "Bobby" Trout, Elinor Smith and Ruth Nichols were among the most prominent of the women private fliers. Their flights carried them to all parts of the country, and encouraged

SPORT AND TRAINING PLANE

Gypsy Moth (American Cirrus) is a light two-place sport and training plane equipped with Handley Page slots on the wings.

other women to enter aviation for the joy of the sport. Amelia Earhart alone flew 392 hours solo during 1929. The Women's Air Derby held in conjunction with the National Air Races gave the women an opportunity to show their sporting blood on a dash across the country from Santa Monica to Cleveland.*

*Winners of Women's Air Derby listed in Appendix.

CHAPTER XVI

AERONAUTICAL LEGISLATION

THE year's intensive activity in every phase of aeronautics was reflected in the legislative chambers of the states, where 314 bills affecting aviation were introduced. One hundred and eighty-two of them were enacted and 132 defeated.

The unprecedented legislative activity in this new field extended itself into 42 of the 48 states and indicated the state legislators' prompt response to the general interest in controlling aeronautical activity. This was evident from a general survey made by the Legal and Legislative Service of the Aeronautical Chamber of Commerce. Forty-seven states now have laws of some kind affecting aeronautics, Alabama standing alone without a statute concerned with aviation on her books. Prior to the 1928-29 legislative sessions, 35 states had statutes. Twelve others joined their ranks during the year, and Alabama—the lone state without such legislation—had no legislature in session.

In the 42 states which considered aeronautical legislation during the 1928-29 sessions, 41 enacted laws and one state, Utah, defeated a single measure. This serves to indicate how widespread the legislative activity was in the various states.*

Whether or not this activity has produced the results contemplated is a question for future experience to determine. That the separate and individual activities of 42 jurisdictions by 42 separate legislative groups did not produce a more chaotic condition is considered worthy of remark. The general effect of the statutes has resulted in a uniformity that is deemed commendable.†

While the major part of the legislation concerned regulation of aircraft and the establishment of airports, there was a manifestation of activity in other fields, more particularly in connection with the attempt to cope with new situations which had grown out of the unexampled activity in every phase of aeronautics. Many of these new problems were concerned with the maintenance and operation of airports.

Regulatory Laws

There was a marked tendency toward enactment of some statute regulating or licensing aircraft and pilots. Following the 1928-29 legis-

*Table showing number of bills introduced, enacted and defeated in Appendix.
†Check list of state legislation in Appendix.

lative sessions, 42 states had such laws in force. Twenty-nine had statutes on the subject prior to the sessions, and 13 states which had no such legislation previously followed the lead of the others. Alabama, Georgia, Kentucky, Louisiana, Oklahoma and West Virginia were the only ones without laws regulating aircraft and pilots.

Alabama and Kentucky were not in session during 1928-29; Georgia and West Virginia, in general session, and Louisiana, in special session, did not consider any bills on this particular subject. Oklahoma defeated two bills introduced to regulate and license aircraft. In the 36 states which considered licensing laws during the 1928-29 sessions, 67 bills were considered, 35 of which were enacted and 32 defeated. An examination of the bills showed a great divergence both as to form and substance.

The problem presented to the legislators in adopting the most desirable form of legislation was quite apparent, and in almost every instance the bills finally enacted were selected from, or were a combination of, parts of the several bills which had been introduced.

Uniform State Law for Aeronautics

The draft of the Uniform State Law for Aeronautics was prepared by the Committee on Aeronautical Law of the American Bar Association in co-operation with the Committee on Aeronautics of the National Conference of Commissioners on Uniform State Laws. It was drawn in anticipation of proposed federal legislation, and, as complementary thereto, was framed in conformity with the theory subsequently embraced in the Federal Air Commerce Act of 1926. The act, while including some provisions of a regulatory character, was designed to be more in the nature of a declaration of the rights of the states with regard to the control of aeronautical activity.

Apart from declaring the sovereignty in and ownership of space and jurisdiction over crimes, torts and contracts, etc., the draft provides: "The owner of every aircraft which is operated over the lands or waters of this state is absolutely liable for injuries to persons or property on the land or water beneath caused by the ascent, descent, or flight of the aircraft, or the dropping or falling of any object therefrom, whether such owner was negligent or not, unless the injury is caused in whole or in part by the negligence of the person injured. If the aircraft is leased at the time of the injury to person or property, both owner and lessee shall be liable, and they may be sued jointly, or either or both of them may be sued separately. An aeronaut who is not the owner or lessee shall be liable only for the consequences of his own

negligence. The injured person, or owner or bailee of the injured property, shall have a lien on the aircraft causing the injury to the extent of the damage caused by the aircraft or objects falling from it."

While six states enacted this uniform law during the 1928-29 sessions, many others considered it and found their chief difficulties in approving that part of Section 5 quoted above. Missouri, Montana and Pennsylvania substantially enacted this law but omitted the section quoted above from the act. These exclusions, together with the fact that so few of

GLIDING FOR SPORT

American interest in gliding for sport and training increased during the year. A primary glider is seen about to land at the Cleveland Airport.

the states which have considered the bill adopted it, were taken to indicate a decided tendency to repudiate the theory of absolute liability as expressed in the draft. In this connection it may be noted, however, that the application of Section 5 is restricted to injuries sustained by persons or property on land or water. In another provision, liability arising out of the collision of aircraft is declared to be determined by the rules of law applicable to torts on land. The Committee on Air Law of the American Bar Association was expected to consider this point in preparing its contemplated Code on Aeronautical Law.

The following states have adopted the Uniform State Law for

Aeronautics drafted by the Committee on Air Law of the American Bar Association: Arizona, Delaware, Idaho, Indiana, Maryland, Michigan, Minnesota, Missouri (omitting Section 5), Montana (omitting Section 5), Nevada, New Jersey, North Carolina, North Dakota, Pennsylvania (omitting Section 5), South Carolina, South Dakota, Tennessee, Utah, Vermont and Wisconsin.

Uniform State Air Licensing Acts

From the standpoint of uniformity, it was considered questionable whether the regulatory and licensing statutes in force, including those recently enacted, would produce desirable results. To promote uniformity in state aeronautical legislation, several drafts of "uniform laws" had been designed to serve as models or guides for the state legislative bodies.

All of the various uniform acts relating to the licensing of aircraft and pilots can be referred to one or the other of the two drafts which may be considered as charasteristic of all the proposals to promote uniformity. One draft was prepared by the Aeronautics Branch of the Department of Commerce and was commonly referred to as the Department of Commerce Draft. The other was prepared by the Committee on Aeronautical Law of the American Bar Association in co-operation with the Committee on Aeronautics of the National Conference of Commissioners on Uniform State Laws, commonly referred to as the American Bar Association Draft.

Under the Department of Commerce Draft, a federal license is required for all pilots and aircraft operating within the state. Under the Bar Association Draft either a federal license or one issued by a state agency would be required.

The Department of Commerce Draft is premised upon legislation enacted in New York and does not necessitate any additional personnel or increased cost to the state. Local police authorities would handle violations in the same manner provided for motor vehicles. Transgressions would be for violation of the state law requiring a federal license rather than a violation of a federal act.

Sponsors of the American Bar Association Draft, claiming that there may be some question as to the possibility of defining a state crime by reference to a federal statute and federal regulations alone under the principles of constitutional law, suggest that the superintendent of motor vehicles, or some other public official of the state, be designated as the officer to carry out the provision of the state law relating to non-commercial interstate and all intrastate flight.

In 18 states the legislation conforms in theory with that of the

Department of Commerce draft and requires federal licenses for all aircraft and pilots. Seven of the states conforming to the Bar Association Draft require either a state or federal license for all flights. In nine of the other states no licenses whatever are required when the craft and pilot are engaged in non-commercial pleasure flight. On the other hand, it appears that in seven states intrastate flight of any description is unlawful unless both aircraft and pilot have obtained state licenses regardless of federal licenses, at least in so far as intrastate commercial flight is concerned.*

Airport Enabling Acts

Turning to another field of state legislative activity, unprecedented attention was paid to general and specific bills pertaining to the establishment, maintenance and operation of airports by political subdivisions of the state. Prior to the 1928-29 sessions, 18 states had statutes authorizing the establishment and operation of airports. Twenty-one states which had no previous legislation on this subject enacted such general laws, making a total of 39 states which have statutes in force.

In other words, all states now have laws relating to airports except Alabama, Colorado, Delaware, Maine, Mississippi, Nevada, Rhode Island, Utah and Virginia. Alabama and Virginia were not in session; Colorado defeated two general bills; Maine defeated a single special bill, while Delaware, Rhode Island, Nevada and Utah considered no bills of this class.

In many jurisdictions the legislative policy at first apparently has been to authorize the establishment and regulation of airports with reference to particular cases as contradistinguished from general enabling acts authorizing all municipalities, or all municipalities of a class, to establish airports.

However, the general trend as evidenced by most of the recent state enactments has been to pass general acts authorizing political subdivisions as a class to establish airports. This was particularly manifest from the fact that many of the states which had passed or considered legislation conferring the power upon particular localities now have passed general laws.

An examination of the statutes in force would tend to indicate that all states will eventually enact general laws authorizing the establishment and operation of airports. In one state, at least, the power to establish airports has already been held to exist because of an implied power derived from the charter provisions of municipalities. In Missouri

*Lists of states and their licensing requirements in Appendix.

it was held that the cities of St. Louis* and Kansas City,† under their home-rule charters, had been granted the power to establish airports.

Miscellaneous Aviation Bills

Aside from the acts relating to regulation or licensing of aircraft and pilots or concerned with airports, 110 bills of a miscellaneous character pertaining to aviation were introduced in 32 states, 60 of which were enacted. They were of such a widely divergent character that they do not admit of classification by groups.

The importance of aeronautical development studies to serve as a basis for legislation was generally recognized. In six states temporary commissions for the study of aviation were authorized: California, New York, Illinois, New Jersey, Oregon and Wisconsin. Considerable attention was paid to the value of state administrative agencies, 11 new states creating or supplementing the powers of such special boards or agencies by conferring regulatory, licensing, enforcement and airport establishment powers and duties upon them. These states were: Arkansas, Connecticut, Idaho, Kansas, Maryland, Michigan, Ohio, Oregon, Pennsylvania, Rhode Island, South Carolina and Wisconsin. In the performance of these offices the state boards of Colorado, Idaho, Massachusetts, Nebraska, Ohio and Virginia issued orders or regulations pertaining to aeronautics during 1929.

That the railroads anticipate the value of the airplane as an auxiliary form of transportation was manifest in the enactment of statutes in Illinois, Iowa, Michigan, Missouri and Wisconsin authorizing railroad companies to own and operate equipment for aerial transportation.

Five states passed measures relating to aviation insurance. They were: California, Iowa, Michigan, New Jersey and Ohio. In Virginia the state corporations commission has issued regulations requiring liability and property damage insurance in commercial operations. Aside from the provision of the Uniform State Law for Aeronautics so providing, the states of Michigan, North Dakota and South Dakota enacted laws which make hunting from aircraft an offense. In Indiana and South Dakota the transportation of intoxicating liquor and in Nebraska the transportation of certain narcotic drugs in aircraft is prohibited, and the seizure and confiscation of vehicles provided for.

Connecticut has provided that all property owned by any town or city, which is located in another town and used for airport purposes, shall be exempt from taxation so long as it is used for such purposes

*See *Dysart* v. *City of St. Louis*, 11 S. W. (2nd) 1045.
†See *Ennis* v. *Kansas City*, 11 S. W. (2nd) 1054.

and is not a source of profit. Florida has proposed a constitutional amendment exempting aircraft manufacturers from industrial taxation for a period ending in 1948. Vermont provides that a town may vote to exempt for a period not to exceed five years real and personal estate used and occupied for airport purposes.

The increasing tendency on the part of the states to tax the consumption of gasoline has resulted in a divergence of application of such measures to aircraft. Arkansas, Colorado, Maine and New York provide for a refund of the gasoline tax. Kansas and Rhode Island exempt aircraft from the consumers' tax on gasoline. Idaho, Michigan and Pennsylvania apply the revenue derived by such taxes to airport purposes by means of administrative agencies.

SPORT AMPHIBIAN

Three-passenger American Marchetti S-56 (Walter) equipped for landing on water or land.

The realization that instruction in aeronautics generally is of great importance has resulted in the enactment of several statutes directed to this end. Tennessee passed a bill promoting the teaching of aviation in the state, and an aeronautical building for the state university was provided by Washington. Michigan has authorized the mapping of the state by aerial photography, and in California a precautionary measure against the possibility of the introduction of agricultural pests by aircraft was taken by requiring inspection of all aircraft entering the state.

Legal and Legislative Research

The unprecedented activity of recent sessions in the new field of aeronautical legislation and the obvious need of some central clearing

house for the collection and dissemination of information on laws introduced and enacted prompted the Aeronautical Chamber of Commerce of America to establish a Legal and Legislative Research Service.

The new service has proved invaluable to executives in the aircraft industry concerned with everything affecting the future of aviation, to universities and colleges attempting to keep pace with this specialized field, and to state legislators themselves who desire information on the trend in state legislation throughout the country.

FLYING DUTCHMAN

The Szekely Flying Dutchman (Szekely SR-3) is a low wing single place monoplane for sport purposes.

The research service supplemented the regular bulletins on week-to-week developments pertaining to aeronautics in both houses of the national congress sent out from the Washington office of the Aeronautical Chamber of Commerce. The special bulletins of the chamber kept its members abreast of the trends in both national and state legislation, and proved of great value to executives within the industry as well as an interesting study for lawyers, educators and legislators who were among the subscribers.

CHAPTER XVII

AERONAUTICAL EDUCATION

EVERY branch of the broad educational field was influenced during 1929 by progress in aviation and each in turn contributed its part to the further development of the new art. Universities, colleges, high schools, trade schools, elementary schools, newspapers, magazines, motion pictures, radio broadcasts, libraries, advertising, art and almost every other agency concerned with the education of mankind were brought into use to present the facts of the new industry before the general public and particularly the younger generation.

Sixty-one universities and colleges offering courses in aeronautics had 2,406 students enrolled in this specialized field at the end of the year. Twenty-one elementary school systems, 93 junior high schools, 130 senior high schools, 17 evening schools, 7 continuation schools, 3 trade schools and 1 vocational high school offered aeronautical training of some kind to tens of thousands of students interested in the industry. Millions learned the facts of the new science through radio broadcasts, educational motion pictures, institutional advertising campaigns, and specialized departments in the major newspapers and magazines.

It was estimated that 9,000 student permits issued by the Department of Commerce to enable prospective pilots to begin their flight training were in force at the end of the year, while more than 27,000 had been issued since 1926. The number of student permits in force, however, was not an accurate key to the number of future pilots since only about 15 per cent go beyond the student stage. The number was so high because a large group of persons, for technical or personal reasons, were interested in first hand information on the principles of flying but had no intention of becoming pilots or accomplishing more than a single solo flight.

Based upon figures contained in reports of flying school operators reporting to the Aeronautical Chamber of Commerce at the end of the year, 6,974 pilots were trained in American schools. Three hundred and twenty-four were given training toward a transport license, 2,399 toward a limited commercial license, and 4,251 toward a private pilot's license. More than 3,700 new pilots were licensed during the year. The work of some of the principal flying schools is reviewed in the chapter on "Aerial Service," the division under which the major portion of such operations logically fall.

Aeronautics in Universities

The widespread development of curricula in aeronautics for universities and colleges was manifest in a survey made by the Aeronautical Chamber of Commerce to determine the number of institutions of higher education offering courses, the scope and nature of such courses, number of instructors employed and students enrolled. Out of 650 institutions in the United States sent requests for information, 236 replied. One hundred and seventy-five reported no aeronautical instruction, although many indicated an interest in the field and several reported courses under consideration. Sixty-one universities and colleges, however, reported specialized courses in aeronautics, almost three times the number offering such courses at the end of 1928.

Thirteen institutions offered complete four or five-year courses leading to degrees in aeronautical engineering. Twelve of these universities and colleges reported a total enrollment of 1,352 in aeronautical engineering courses. The 61 institutions' total enrollment in aeronautical courses of all kinds was 2,406. One hundred and ninety instructors, 40 full time and 150 part time, were engaged in this specialized field of teaching. The full list of universities and colleges offering some kind of aeronautical education with the number of students enrolled and instructors employed by each is included as a table in the Appendix. It indicates that institutions of higher education in every part of the country are alive to the necessity of qualifying experts for this new field.

The Daniel Guggenheim School of Aeronautics at New York University reported the largest enrollment in the country for the first semester of the 1929-30 academic year, with 346 students registered in the four-year course leading to a Bachelor of Science degree or the one-year post graduate course leading to a degree in aeronautical engineering. Three instructors were engaged full time and three part time teaching the specialized aeronautical courses, while a faculty of 60 gave instruction in other engineering work included in the four-year curricula.

Massachusetts Institute of Technology at Cambridge, Mass., reported the second largest enrollment, 247 students, and the largest full-time faculty staff. Fourteen full-time instructors and one teaching part time offered courses in the four-year undergraduate curriculum leading to a degree of Bachelor of Science in Aeronautical Engineering, or to a Master's and Doctor's degree in aeronautical engineering.

Forty were enrolled in the four-year course leading to a degree of Bachelor of Science in Aeronautical Engineering at the University of Alabama. Seventy-two students were registered in aeronautical engineering and 62 in aviation ground mechanics at Carnegie Institute of

125,000 SEE AIR RACES

The stands at the National Air Races were jammed during the National Air Races at Cleveland; 125,000 were in attendance when the dirigible Los Angeles arrived.

CLEVELAND SHOW

General view of the arena during the National Aeronautical Exposition in Cleveland.

Technology, where a four-year course leading to a Bachelor of Science degree was offered.

University of Minnesota reported 220 students enrolled in the four-year course leading to a degree of Bachelor of Aeronautical Engineering. Besides the usual courses in aeronautical engineering, the classes at Minnesota were given instruction and practice in solving actual construction and maintenance problems in the aircraft industry. Close relations with the industry were maintained through teachers who had direct connections with industrial concerns. The senior class was given extensive training in aircraft manufacturing and airplane maintenance in the field.

Oregon State Agricultural College, offering a four-year aeronautical engineering course leading to a degree for the first time, had 57 freshmen enrolled. University of Pittsburgh with a similar four-year course had 100 students registered with 20 instructors, two full time and 18 part time, devoting their attention to the work.

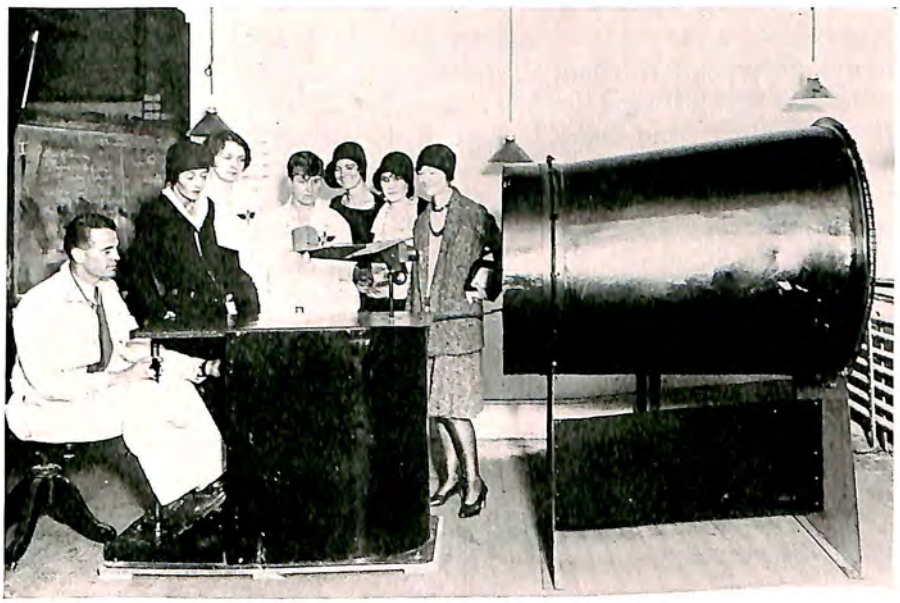
Stanford University had 14 students enrolled in courses designed primarily for graduate students who had completed the general engineering curriculum. The graduate work offered covered two years of study. Seventy-three students above the freshmen year were registered in aeronautical engineering courses leading to a degree at the University of Washington, where 30 per cent of all freshmen entering indicated a preference for aeronautical engineering. The far northwestern institution was to move into a new Aeronautics Hall, a gift of the Daniel Guggenheim Fund for the Promotion of Aeronautics, in January, 1930. Graduate research work was offered in addition to the complete undergraduate course. Worcester Polytechnic Institute had seven students enrolled in courses leading to qualification as junior aeronautical engineer in the industry or civil service. Only seniors in mechanical engineering with good records for the first three years were admitted to the course.

While the course was not intended in any sense as an aeronautical engineering course, a new curriculum in construction of topographic maps from aerial photographs at Syracuse University was one of the year's most interesting developments in the field of specialized education. The new course, offered 20 students beginning in February, 1930, was designed to include both practice and theory of aerial surveying and photographic work. The initial equipment for the course was provided through a grant of the Daniel Guggenheim Fund for Promotion of Aeronautics to the College of Applied Science at Syracuse.

Graduate courses in aerodynamics, involving wind tunnel experiments on new designs, were conducted in Washington by the Catholic University of America, where such work has been offered as graduate

SNOW DOESN'T STOP 'EM

Students in the Indianapolis, Ind., school of Capitol Airways learn a thing or two about the Ryan monoplane despite cold weather.



MINIATURE WIND TUNNEL

Curtiss students watching demonstration of miniature wind tunnel model at New York University ground school.

study since before the Wrights made their successful flights. Four students were engaged in the aerodynamic research work.

The more than two score other universities and colleges offering courses in aeronautical engineering included them as optional for advanced students enrolled in the civil, mechanical or industrial engineering courses. Several offered general courses in the history of aviation and in the economics of air transportation.

Courses in aerodynamics, airplane engines, airplane design, stress analysis, aeronautical engineering, aeronautical laboratory studies, airship construction, air transport, navigation and metallurgy were included rather uniformly in the curricula of these institutions.

The universities and colleges offering some kind of aeronautical education, but not designed to fulfill the requirements for a specialized degree, were: University of Akron, University of Arizona, Armour Institute of Technology, Birmingham-Southern College, Bradley Polytechnic Institute, University of Buffalo, University of California, Clarkson Institute of Technology, Colorado College, University of Delaware, College of City of Detroit, University of Florida, University of Idaho, University of Illinois, University of Iowa, Kansas State Agricultural College, University of Kansas, Marquette University, University of Miami, Morningside College, University of Nebraska, University of Nevada, North Carolina State College, University of North Carolina, North Dakota Agricultural College, Ohio State University, Oklahoma City University, University of Oklahoma, University of Oregon, Pennsylvania State College, Purdue University, Rensselaer Polytechnic Institute, University of South Dakota, University of Southern California, Swarthmore College, Temple University, Union College, University of Utah, Vanderbilt University, University of Vermont, Virginia Polytechnic Institute, State College of Washington, Washington University (St. Louis), University of Wisconsin, University of Wyoming and Yale University.

Educational Committees

The increasing importance of aviation prompted the Association of Land Grant Colleges and Universities to appoint a committee on aeronautics, headed by President E. O. Holland of the State College of Washington. The committee investigated the activity of land grant colleges in the new field and found that 22 of the 57 institutions were offering some work, and six were considering the addition of aeronautics. Four hundred and eight students were enrolled in 59 courses offered by the 22 universities and colleges.

The work of the Guggenheim Fund Committee on Elementary and Secondary Aeronautic Education, headed by Prof. Roland H. Spaulding of New York University, continued to be an important factor in the development of proper aviation training in elementary and high schools. Professor Spaulding also was chairman of the Committee on Education of the Aeronautical Chamber of Commerce.

The number of secondary schools reporting aeronautical subjects offered as such in 1929 had increased tenfold over 1928, while 226 school systems reported some kind of aeronautical instruction in 1929 as compared with 27 a year before.* These figures were based on a survey made by Professor Spaulding for the Guggenheim Fund.

One hundred and fourteen schools correlated the aeronautical instruction offered with other subjects, while 85 entertained some extra-curricular activity classed as aeronautical instruction. Flying clubs, model building and glider contests were included in the extra-curricular activities.

Where courses on the vocational level were offered, it was reported that the communities offering them could employ the students completing such work in their local aeronautical enterprises. There was but a single exception to this report, Galt, Calif., where graduates were placed in nearby cities or went on to college for which they were eligible.

The Boston Trade School offered a curriculum for training airplane and engine mechanics leading to a Department of Commerce license, which was typical of many vocational schools. Courses in airplane engines, airplane construction and repair, airplane welding, meteorology, air navigation and aerodynamics for foremen were offered by the Elm Vocational School in Buffalo, N. Y., in another model curriculum.

The Rindge Technical School of Cambridge, Mass.; Chicago, Ill., technical high schools; Morrill School of Mechanic Arts in Concord, N. H.; Cass Technical High School of Detroit, Mich.; Battin High School of Elizabeth, N. J.; Galt High School and Junior College at Galt, Calif., and public schools of Los Angeles, Seattle and Minneapolis were among the most active in the new educational field.

"Roads of the Sky" Radio Series

Radio played an increasingly important part in the education of the general public to the facts of aviation. Local stations throughout the country, fascinated by the novelty of the new art and anxious to aid in educating the public to its values, promoted special aviation

*Complete list elementary and secondary schools in Appendix.

programs, introducing local speakers qualified to talk on aviation. Station WRNY, owned and operated by the Curtiss-Wright interests, devoted a major share of its time on the air to some type of aviation program. Westinghouse, broadcasting a weekly program dedicated to some great industry, chose the second of its broadcasts to "salute" the new science of aeronautics. Other commercial companies and civic agencies participated in similar aviation radio broadcasts.

Perhaps the outstanding achievement in the broadcasting of aviation radio programs during the year was the series of programs sponsored by the Aeronautical Chamber of Commerce and broadcast over a nation-wide hookup by the National Broadcasting Company. The programs, known to millions of listeners as the "Roads of the Sky" series, brought an outstanding figure in aviation to the microphone for a 15-minute talk on some new phase of aviation each week. Hundreds of columns of news space and editorial comment were afforded the extended series, which opened July 2 and continued until November 21.

Secretary of Commerce Robert P. Lamont, introduced by Frederick B. Rentschler, president of the Aeronautical Chamber of Commerce, opened the series of half-hour programs. Other speakers whose messages on some phase of aviation were broadcast over a chain of nearly 30 stations from coast to coast included W. Irving Glover, assistant postmaster general in charge of air mail, "New Sky Speeds for Business"; Wesley Smith, National Air Transport pilot, "Flying the Mail: New York to Chicago"; E. Hamilton Lee, Boeing System pilot, "Flying the Mail: Chicago to Cheyenne"; Fred Kelly, Western Air Express pilot, "Hurdling the Sierras: Cheyenne to Los Angeles"; Capt. Frank Hawks, transcontinental record holder, "Vacations in the Air"; William P. MacCracken, then Assistant Secretary of Commerce for Aeronautics, "How America Protects Her Flying Public"; Herbert Hoover, Jr., radio expert for Western Air Express, "Radio: Magic Guide for Airplanes"; Lieut. Apollo Soucek, Navy altitude flier, "How High Can Man Fly?"; Erik Nelson, round the world flyer, "Around the World in Aviation"; F. Trubee Davison, Assistant Secretary of War for Aeronautics, "Seven League Boots for the Army Air Service"; Col. H. H. Blee, chief of the Department of Commerce Airport Section, "Airports: Nests for Our Planes"; David S. Ingalls, Assistant Secretary of Navy for Aeronautics, "Why I Fly"; John T. Trippe, president of Pan-American Airways, Inc., "Linking the Americas by Air"; Amelia Earhart, trans-Atlantic flier and assistant general traffic manager of Transcontinental Air Transport, Inc., "Woman's Influence on Air Transport Luxury"; Rear Admiral William A. Moffett, chief of the Navy Department Bureau of Aeronautics, "Dirigibles of Tomorrow"; Edward S. Evans, president of Detroit Aircraft Corporation, "Flying Without Motors"; William

TRAINING PLANE

A student gets his instruction in a Curtiss (Curtiss Challenger) Fledgling, designed especially for training purposes.

PARKS TRAINER

Parks (Wright Whirlwind) P-2-A, built by Parks Air College, in flight.

B. Stout, vice-president of the Stout Metal Plane Division of the Ford Motor Company, "Why Airplanes Fly"; Edward A. Stinson, president Stinson Aircraft Corporation, "Learning to Fly: Yesterday and Today"; Col. Paul Henderson, vice-president of Transcontinental Air Transport, Inc., and National Air Transport, Inc., "Lighting the Sky-roads for Airplanes," and Maj. Clarence M. Young, Assistant Secretary of Commerce for Aeronautics, "America's Place in the Air Today."

The stations in the nationwide network which broadcast this weekly aviation feature included: WEAF, New York; WPAG, Worcester, Mass.; WSAI, Cincinnati; WOW, Omaha; WIOD, Miami Beach, Fla.; WHAS, Louisville; WSM, Nashville; KVOO, Tulsa; WFAA, Dallas; WOAI, San Antonio; KOA, Denver; KSL, Salt Lake City; WCAE, Pittsburgh; WRC, Washington; WTIC, Hartford, Conn.; WCSH, Portland, Me.; WGY, Schenectady; WGR, Buffalo; WTAM, Cleveland; KSD, St. Louis; WHO, Des Moines; KSTP, St. Paul; WTMJ, Milwaukee; WAPI, Birmingham; WRVA, Richmond; WWJ, Detroit, and WFI, Philadelphia.

Publications Aid Education

Newspapers and magazines devoted more space to aviation events during 1929 than they did during previous years, approximately 200 major newspapers establishing specialized sections devoted to aviation and written by men qualified as aviation editors.

While newspaper treatment of aircraft accidents continued to be out of all proportion to their importance, the policies of the major metropolitan newspapers were directed toward a more accurate appraisal of news values. It appeared certain that as long as aviation accidents remained so few in number, they would occupy a sensational place in the public press out of proportion to their importance, but leaders in the aircraft industry pointed out that this condition might be viewed as healthy rather than devastating since the general public had been trained to consider front-page happenings as the exception rather than the rule.

There was a marked increase in the accuracy of statements concerning technical phases of aviation in the public press, which indicated a general gain in the knowledge of aviation terminology and more intimate contact with the new art.

Motion Pictures

The air transport lines developed motion pictures representative of scenes and activities along their lines for private and public showing.

Several flying schools and manufacturing concerns prepared similar films in their specialized fields. The general news reels and feature motion pictures continued to devote a major share of attention to aviation.

The seven-reel motion film, "Flying with Lindbergh," presented to the Aeronautical Chamber of Commerce in 1928 by the Motion Picture Producers of America, was used in an active educational program throughout 1929. The film was loaned by the Aeronautical Chamber of Commerce to dozens of civic organizations, flying schools, universities, colleges and similar institutions for showings at which no admission was charged. It was estimated that nearly a half million persons saw the film during 1929.

Advertising and Art

Aeronautical advertising represented a new standard in sales and artistic values. The institutional advertising done by some of the major units in the aircraft industry bordered almost on the poetic in its appeal, unusual art effects accompanying the copy. Aeronautical subjects also were in general use in the advertising of products outside the aviation field because of the romance, speed and newness associated with aviation.

While most of the advertising done during 1929 was of an institutional nature, with only a few organizations carrying out national programs, several corporations were planning larger and more direct sales campaigns through advertising in 1930. A committee of the Aeronautical Chamber of Commerce had plans for an extensive aviation institutional advertising campaign under consideration during most of 1929, but had not announced the adoption of any plan at the close of the year.

Three nationally know artists had made distinctive contributions in the portrayal of aeronautical subjects, and dozens of others were engaged in some kind of illustrating work related to aviation. John MacGilchrist, former officer in the Royal Air Force and nationally known artist, had completed ten etchings on aeronautical subjects, the latest of which was done for the Aircraft Year Book and is presented as the frontispiece of this edition. His etchings were exhibited at the National Arts Club, New York, Brooklyn Society of Etchers, and the Philadelphia Society of Etchers during the year. It was the first time that his completed work, three years in the making, had been brought together for exhibition.

Frank Lemon's water colors of noteworthy flights made for the Wright Aeronautical Corporation attracted attention in both aviation

and art circles, as did the aviation paintings and illustrations of Clayton Knight.

Libraries

Libraries, both public and private, were recognizing the importance of aviation and built up special collections on aeronautical subjects, many of them setting aside a special section for these works. The Library of Congress had some 1,200 titles in its collection of aeronautics. Sixteen hundred volumes and 700 pamphlets were included in the Langley Aeronautical Library of Smithsonian Institution. A small collection in the Aeronautics Branch of the Department of Commerce, another in the possession of the National Advisory Committee for Aeronautics, and a library in the U. S. Air Corps Washington offices were open to the general public.

While it was established as a private collection for the use of members in the aircraft industry, the Aeronautical Chamber of Commerce Library in New York was used extensively by newspaper and magazine writers and others interested in aviation research. It included approximately 1,000 bound volumes as well as 60,000 catalogues, reports, pamphlets, and other unbound material and was considered the largest library devoted exclusively to aeronautics in the United States.

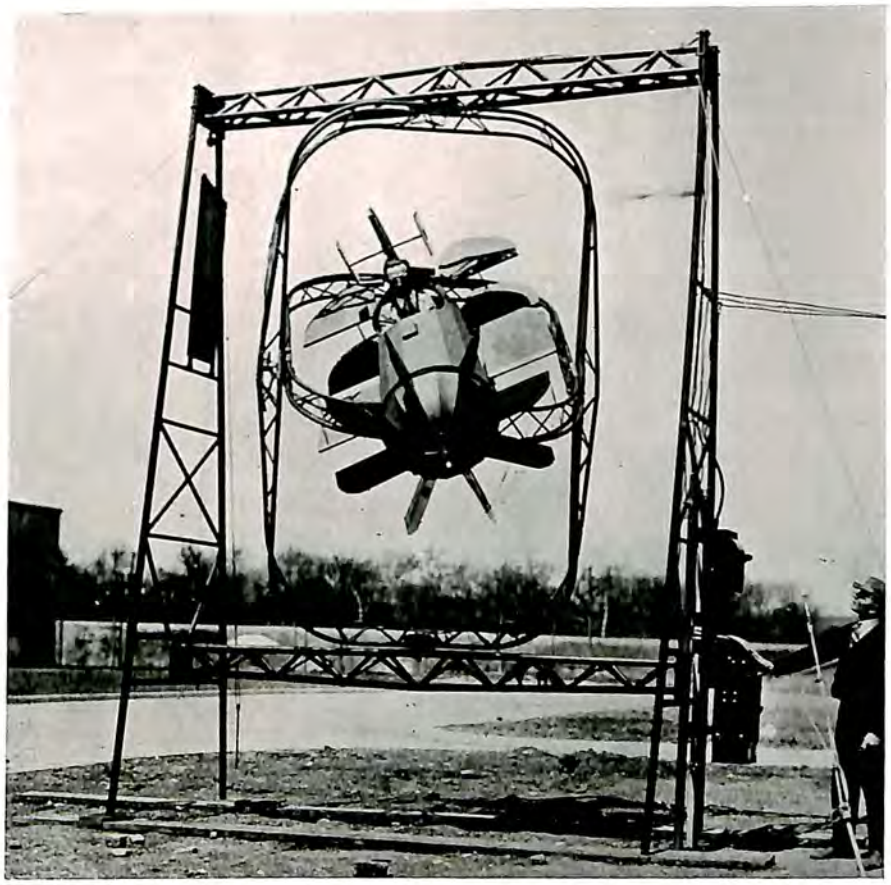
In the Aeronautical Chamber of Commerce Library, 14 newly established aviation magazines were received during 1929, bringing the total number of domestic magazines devoted to aeronautics up to 31, exclusive of house organs. Twenty-four issues of the Library Bulletin prepared by the Aeronautical Chamber of Commerce librarian were sent to members during the year, indexing 3,000 aviation articles in domestic and foreign periodicals. The Library Bulletin was used for reference in numerous colleges, universities, clubs and public libraries as well as by members of the chamber.

The Chamber's library reference service aided an average of 50 persons each day, many of them members of the organization, including banks, investment houses, newspapers, magazines, special writers, advertising agencies, insurance firms, and municipal chambers of commerce. Both mail and telephone requests were received for such service on a widely varying scale of subjects.

Aircraft Shows

Aircraft shows sponsored or sanctioned by the Aeronautical Chamber of Commerce in all parts of the country played an important part in educating millions of people, who obtained first hand information on

the airplanes, engines and equipment of the major manufacturers. The National Air Races and Aeronautical Exposition at Cleveland provided an opportunity for several hundred thousand persons to attend the show-



FLIGHT TUTOR

This new contraption perfected by the U. S. Army Air Corps to aid in the primary training of flying cadets provides all sensations of solo flight without getting off the ground.

ing of 100 different airplanes as well as to see them perform at the airport.

Other aircraft shows sponsored or sanctioned by the chamber during 1929 included the Second All-American Aircraft Show at Detroit; Pittsburgh Aircraft Show; Indianapolis Aircraft Exposition; Des Moines

Aircraft Show; Rochester Aviation Exposition; Second Annual Pikes Peak Show in Colorado Springs; Aircraft Exposition held in connection with the International Air Circus in Kansas City, Kan.; Baltimore

BLIMP AT CAPITOL

U. S. Army airship, TC-3, from Langley Field, Va., landing in the Capitol Plaza, Washington, with a senator aboard.

Aircraft Show, and the Western Aircraft Show in Los Angeles. The latter exposition was sanctioned by the Chamber and financed by the Aeronautical Expositions Corporation.

CHAPTER XVIII

WORLD AVIATION IN 1929

WHILE the United States led in every branch of aeronautic development during 1929, aviation's influence upon the economic and political life of the nations was felt throughout the world. Progress was marked on every continent and hardly a section of the most isolated countries was not affected in some way.

The great strides made during the year in the development of air transport were particularly evident in Mexico, China and Latin America, where few regular services were offered prior to 1929. Chile, Brazil, Argentina and the west coast countries of South America experienced unprecedented development.

The total distance regularly flown on civil air lines reached 110,000 miles in the summer of 1929, of which the United States and Germany each had services over more than 40,000 miles of airways. Latin America, including American and European owned lines, had about 25,000 miles of regularly flown routes, with the remainder in Australia and Asia.

While the manufacturing industry made its greatest progress in the United States, Germany led in the construction of large powerful land and seaplanes.

One of the notable trends in Europe was the increasing amount of co-operative services offered between rail and air lines, even second class rail passengers being provided for on through tickets and goods on through bills of lading.

Air mail services were made more extensive, with more than 50 countries authorizing their foreign mail to be flown over international routes. In China and Japan, where the risks of theft and delay through the older means of transportation were current, air mail was introduced to insure greater regularity of service. Two American companies, Pan American Airways, Inc., and New York, Rio and Buenos Aires Line, made remarkable progress in the development of a network of airways in Latin America. Further stimulation of traffic over these lines was expected through the cutting of the air mail rates between the United States and Latin American countries from 33⅓ to 50 per cent, effective January 1, 1930.

Flying clubs increased throughout the world, particularly in the British Empire. There were 300 private clubs in operation outside the United States, Russia and Turkey. In Russia and Turkey, numerous

aviation societies were formed but it was incorrect to classify their activities with those of the clubs commonly known in the British Empire. About 500 pilots had been trained in these clubs within a year, half of that number in Great Britain or her colonies.

There was some kind of aeronautic development during 1929 in sixty-three nations, widely distributed over every continent in the world. Some of the most important achievements in each of these countries will be described. The countries are listed alphabetically for convenience in future reference.

Argentina

Level terrain, good weather and great distances between the centers of population further stimulated the growth of Argentine aviation in 1929, ten new services being added during the year to increase the total mileage of air lines in operation at the end of the year to 5,606. The lines were not only intra-national, but linked the far southern republic with the rest of the world. Twenty fully equipped airports scattered throughout the country provided centers for air line and private operations.

Pan American Airways, Inc., inaugurated a new line between Buenos Aires and Montevideo and later extended the services from Buenos Aires to Santiago, Chile, across the Andes by way of Rufino and Mendoza. The New York, Rio and Buenos Aires Line established regular service between Buenos Aires and Montevideo, Buenos Aires and Mar del Plata, Buenos Aires and Asuncion by way of Concordia and Corrientes. NYRBA, as the American line was commonly known, opened mail and passenger service November 27 from Buenos Aires to Yacuiba, Bolivia, by way of Rosario, Cordoba, Santiago del Estero and Salta. Connections were made at Yacuiba with the Bolivian Air Service for La Paz, Bolivia. NYRBA also extended its service across the Andes late in the year from Buenos Aires to Santiago, Chile, by way of Rosario, Cordoba and Mendoza, carrying mails under contract with the governments of Argentina and Chile.

Aéropostale Argentina, the French line, opened new routes during the year between Buenos Aires and Asuncion, by way of Monte Caseros and Posados; between Buenos Aires and Santiago, Chile, by way of Rufino, Mercedes and Mendoza; and between Buenos Aires and Comodoro Rivadavia in Patagonia, the vast sparsely populated territory of southern Argentina.

The Latécoère Company continued its service between Buenos Aires and Brazilian ports to expedite the delivery of mail to Europe. Post office statistics showed that Argentina handled more mail per capita

than any other nation in the world. This fact served to indicate the general need for rapid communication and the future field for air line development. Argentina handled 224 pieces of mail per inhabitant as compared with 214 pieces in the United States; 147 in France; 143 in England; 121 in Germany; and 28 in Brazil. The German Luft Hansa announced plans during the year for the establishment of regular trans-Atlantic service between Germany and Buenos Aires by way of Pernambuco, using giant flying boats of the Rohrbach Romar type.

Australia

Government subsidy and increased public confidence played an important part in the development of aviation in Australia during 1929. There were 102 registered aircraft owners, 230 licensed private pilots and 153 licensed commercial pilots in the country. Twelve American planes had been registered.

Three large companies operated six regular air lines over routes totaling 7,858 miles, the oldest and longest of these services being from Perth to Derby, a distance of 1,467 miles. The newest and second longest was from Perth to Adelaide, South Australia. Joining this service a link from Adelaide to Cootamundra, New South Wales, 578 miles, was inaugurated. Other services between Mildura and Broken Hill and between Melbourne and Hay were operated twice weekly. A new service from Brisbane to Townsville in Queensland was announced for operation early in 1930. Ten tri-motored English monoplanes were to be imported for this service. An extension of the service to Cairns, Queensland, and Port Moresby, New Guiana, was being considered for 1930.

Six flying clubs, subsidized by the government, and flying schools operated by Western Australian Airways, Ltd., under federal support had trained 287 Class A pilots by the end of July. The eight training centers flew a total of 17,726 hours during the period. Eighty airports throughout the Commonwealth had been established by the government, and out of 27 requests for additional ones, 23 were approved. This was in line with the government's policy of fostering aviation through the provision of necessary facilities to stimulate private as well as air line operations. The route from Perth to Adelaide was lighted for night flying at a cost of about £17,000 ($82,620).

The Commonwealth closed down and dismantled its experimental aircraft construction plant at Sydney. A three Mongoose-engined plane known as the Lasconder, designed by an Australian to seat from four to six persons, was constructed during the year. Arrangements were entered into between the Clyde Engineering Company of Sydney and

Australian National Airways, Ltd., for the formation of a company, known as the Clyde Engineering-National Airways, Ltd., to manufacture four models of light planes.

Civil aeronautics in Australia was controlled by a Civil Aeronautics Department which was supervised by a director, and resembled in many ways the civil organization in England. The department had a small staff of personnel and a few planes for official use. It controlled every aspect of civil aeronautics from the large air lines to the private owner, setting up airworthiness requirements for aircraft and license tests for pilots. Between £300,000 and £400,000 ($1,458,000 to $1,944,000) were available to Australian operators and manufacturers in subsidies.

Austria

Austria, with six and a half million inhabitants living in 83,833 square kilometers (32,368 square miles) of territory, doubled its air traffic during the year, establishing new lines under government subsidy that radiated from Vienna like the spokes of a wheel. Air transport in Austria dates back only to 1927 when the Austrian Air Traffic Association received its first subvention of 1,000,000 schillings (about $140,000).

The German Luft Hansa operated regular air service from Vienna by way of Prague to Berlin, and by way of Salzburg to Munich. The Hungarian Air Transport co-operated with the German service. The Compagnie Internationale de Navigation Aérienne, a French line, linked Vienna, Prague and Strasbourg with Paris. A Polish line, the Polska Linia Lotnicza Aerolot, operated a service to Warsaw and the Italian border; and the Trans-adriatica Societa Anonima di Navigazione Aerea of Ancona provided a service from Vienna to Venice, with connections for other cities in Italy.

Fourteen routes were in operation during 1929, with connections for Berlin, Munich, Budapest, Bucharest, Constantinople, Cracow, Danzig, Bremen, Prague, Strasbourg, Paris, Copenhagen, Malmo, Cologne, Essen, London, Zurich, Geneva, Venice and Rome. The fares were low: from Vienna to Berlin, 306 miles, about $30; to Budapest, 140 miles, $10; to Zurich, 388 miles, $29; to Paris, $49; and to Rome, 510 miles, $50. An express route from Vienna to Berlin covered the distance in three hours and forty minutes.

From six airplanes, the Austrian air service had increased its fleet to twenty-four. Twenty per cent of the persons who used the air lines in Austria were Americans, Hungary being the only foreign nation which exceeded the United States in the use of the Austrian air lines.

The lines have been operated without a single accident in which passengers or members of the crew were injured. This record was maintained despite the fact that Austria is an Alpine country and it is necessary to fly over very mountainous territory.

Bahamas

The Bahamas were linked with the United States by air in January, 1929, when Pan American Airways, Inc., established regular mail service between Nassau and Miami. Operations were discontinued in August, but the company announced a resumption of the service for January, 1930.

Because of the nature of the country, all planes whether operated privately or by air lines in or out of the Bahamas, were amphibians or seaplanes. Two small British planes were imported by a company understood to be interested in a real estate development at West End, Grand Bahama. Irregular service was operated by several American planes during the winter season, but no scheduled operations other than those of Pan American Airways, Inc., were afforded the islands.

Belgium

Belgium continued operation of its mail and passenger lines radiating from Brussels to London and Cologne, added new services, and planned an ambitious program for developing a line between Brussels and the Belgian Congo, 7,500 miles away. The lines were heavily subsidized under an agreement with the government, which made available general subsidies amounting to 11,730,000 Belgian francs ($328,440) during the second quarter of 1929, and 3,150,000 francs ($88,200) in the first quarter.

A line between Brussels, Essen and Hamburg was inaugurated in May, and night air mail service between Brussels and London was established in September. Three new international lines were planned for 1930; Antwerp to Amsterdam; Antwerp to Essen and Berlin; and Brussels to Luxemburg. The latter was to be the first link in a projected route to Switzerland. Services also were planned for operation during the Antwerp Exposition in 1930, connecting London and Antwerp, Ostend and Antwerp, Antwerp and Leige, and Ostend, Brussels, and Leige.

An air line connecting Belgium with her African colony, Belgian Congo, was to be opened over the 7,500 mile route with an air mail service operated by the Société Anonyme Belge d'Exploitation de la

Navigation Aérienne, or S.A.B.E.N.A. company, which held the major operating concessions. Plans included lighting the 7,500 mile route by 1933 and the carrying of passengers on a three-day schedule after the experimental stage with air mail was passed.

The Sabena company also announced plans for the manufacture of airplanes of the Fokker type under an agreement with the Dutch inventor and builders. Ten planes were under construction, and the plans of the company included increasing the Belgian fleet to forty within a year. The company was capitalized at 20,000,000 Belgian francs ($560,000).

Foreign air lines flying over Belgium included: Imperial Airways from London to Cologne; Farman, connecting Paris, Brussels, Rotterdam, and Amsterdam; K.L.M., linking Rotterdam, Brussels and Basle; Farman, between Paris, Cologne and Berlin; and K.L.M., connecting Amsterdam, Rotterdam, and London. There were three schools for pilots which were subsidized by the Ministry of National Defense, although they trained both civil and military pilots.

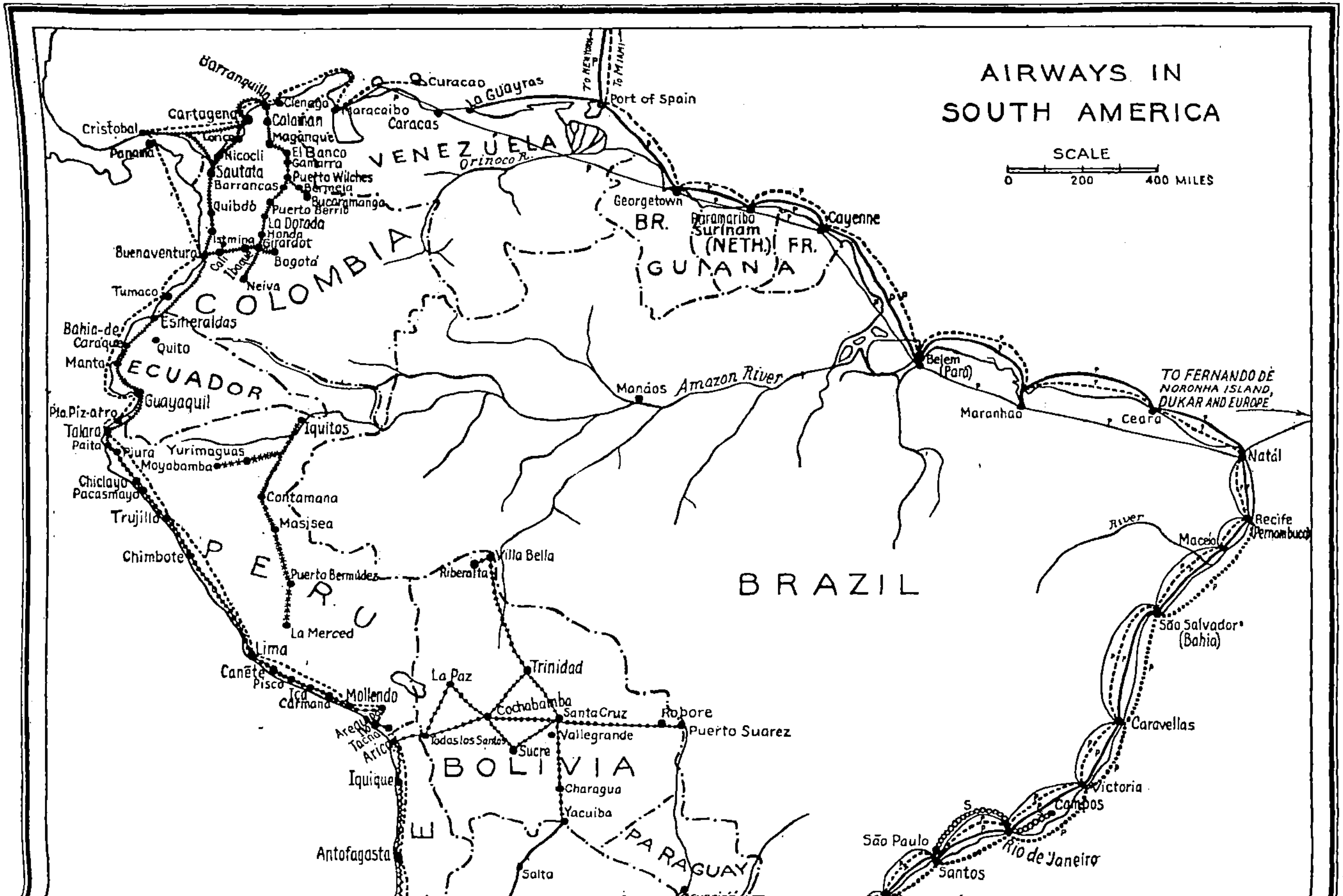
The government permitted the importation of airplanes without restrictions, but at the same time granted heavy subsidies to the national industry. There were 82 planes in the Belgian civil air service at the close of 1929. The government encouraged the purchase of light planes by individuals for training purposes by paying about one-half of the purchase price on a $10,000 two-place Belgian plane. Three public aerodromes were administered by the government: Brussels, Antwerp, and Ostend. Three other private aerodromes were available at St. Hubert, Gosselies and Le Zoute.

Bolivia

The Lloyd Aereo Boliviana (Bolivian Lloyd Air Line), a German operating company established during the centenary celebration of the founding of the German colony in Bolivia, had six routes in active operation during 1929, using six Junkers all-metal planes.

The lines connected Cochabamba-Vallegrande-Santa Cruz; Cochabamba-Todos Santos-Trinidad-Santa Ana-Guayaramerin-Villa Bella-Cachuela Esperanza-Riberalta; Santa Cruz-San Jose-Robore-Puerto Suarez; Santa Cruz-Charagua-Villa Montes-Yacuiba; Cochabamba-Sucre; Cochabamba-Oruru-La Paz-Arica.

The New York, Rio and Buenos Aires Line, an American operating company, linked Buenos Aires with Yacuiba in Bolivia, where connections were made with the Bolivian lines. The German company was awarded substantial subsidies for the continued operation of its lines.



AIRWAYS IN SOUTH AMERICA
SCALE
0 200 400 MILES
Barranquilla
Curacao
La Guayras
Port of Spain
To NEW YORK
To MIAMI
Cartagena
Cienaga
Maracaibo
Caracas
Cristobal
Calamar
Magangue
Panama
Lorica
Nicocli
El Banco
Gamarra
VENEZUELA
Orinoco R.
Sautata
Puerto Wilches
Barrancas
Barranca Bermeja
Bucaramanga
Quibdó
Puerto Berrio
La Dorada
Honda
Istmina
Girardot
Buenaventura
Cali
Ibague
Bogotá
COLOMBIA
Neiva
Tumaco
Esmeraldas
Bahia-de Caráquez
Quito
Manta
ECUADOR
Guayaquil
Pta. Piz-atro
Talara
Paita
Piura
Yurimaguas
Moyabamba
Iquitos
Chiclayo
Pacasmayo
Trujillo
Contamana
Masisea
Chimbote
PERU
Puerto Bermúdez
La Merced
Lima
Cañete
Pisco
Ica
Carmana
Mollendo
Arequipa
Tacna
Arica
Iquique
Antofagasta
Georgetown
BR.
Paramaribo
Surinam
(NETH.)
FR.
GUIANA
Cayenne
Belem (Pará)
Manáos
Amazon River
Maranhao
Ceara
TO FERNANDO DE NORONHA ISLAND, DUKAR AND EUROPE
Natál
Recife (Pernambuco)
River
Maceió
BRAZIL
Villa Bella
Riberalta
São Salvador (Bahia)
Trinidad
La Paz
Cochabamba
Santa Cruz
Robore
Puerto Suarez
Todos los Santos
Sucre
Vallegrande
BOLIVIA
Charagua
Yacuiba
PARAGUAY
Salta
Caravellas
Victoria
Campos
São Paulo
Rio de Janeiro
Santos

U.S. BUREAU OF FOREIGN AND DOMESTIC COMMERCE

Brazil

Two large transport companies, one German and the other French, operated regular air service in Brazil during 1929, and two American companies had obtained permits to operate through the country beginning regular service in 1930. There were about 45 privately owned planes in the country, which provided a rich market for airplane sales because of the great distances which had to be covered and the lack of other regular fast transport.

Wide World.

FLIES WITH 169 PERSONS

Some of the passengers and crew line up before the huge 12-motored Dornier DO-X preparatory to its record flight.

The Compagnie Générale Aéropostale, the French line which operated independent of Brazilian subsidy, was subsidized by the French government to the extent of about 39,000,000 francs ($1,550,000) and operated between France and North Africa. Its route in Brazilian territory extended 2,515 miles from Natal in the north to Rio Grande do Sul in the south, with intermediate stops for mail at the most important cities along the coast. French planes were used exclusively.

The Condor Syndikat, the German operating company, provided regular mail and passenger service over 1,011 miles in Brazilian territory, connecting Rio de Janiero with Rio Grande do Sul, with inter-

mediate stops at Paranagua, Sao Francisco, Florianapolis and Laguna, and a second line from Rio Grande do Sul to Porto Alegre via Pelotas. Flights were made twice a week in both directions. German planes were used exclusively.

Another operator, the Companhia Empreza de Transportes Aereos, established service in 1927 between the coast and interior points, but financial difficulties forced it to suspend operations during 1929. Late in 1929, however, they advertised regular service on a provisional basis between Rio de Janiero and São Paulo and Rio de Janiero and Campos, with two departures per week. The company was organized by Brazilian capital.

The first plane the New York, Rio and Buenos Aires Line granted permission to fly through Brazil, reached there in July on a trail blazing trip over the proposed line to be inaugurated in 1930. Pan American Airways, Inc., was granted permission to fly through Brazil and completed experimental work over its proposed route along the coast which was to be opened in 1930.

Bulgaria

Bulgarian air lines more than doubled their service during 1929. Air mail lines were operating from Bulgaria to Yugoslavia, Hungary, Austria, Czechoslovakia, Switzerland, Germany, Poland, France, Belgium, Denmark, Spain, Norway, Holland, Sweden, Turkey and England.

Passenger service between Belgrade and Sophia was maintained three times a week in Potez planes, while a merchandise service was operated on a similar schedule with Spad machines. Regular service also was maintained three times a week from Belgrade to Constantinople by way of Sophia. The line was operated by the French Compagnie Internationale de Navigation Aérienne through an arrangement with the Bulgarian government.

Canada

Aviation was stimulated by the federal government in Canada during 1929 through the extension of its policy to aid in the training of pilots enrolled in flying clubs and the granting of contracts to private companies for carrying air mail. The number of flying clubs assisted by the government increased during the year from 16 to 23, and the enrollment from 2,300 to well over 3,000. The government furnished airplanes to these clubs and paid $100 to them for each person trained for a private pilot's license.

Canada had no restrictions on the importation of aircraft and engines except to require regular import duties to be paid. During the year ended September 30, 52 aircraft valued at $575,703.67 were imported into Canada on which duties and taxes to the amount of $172,896.95 were collected. There were no engine manufacturers in Canada, but two American engine companies, Canadian Pratt and Whitney Aircraft, Ltd., and Canadian Wright, Ltd., were engaged in the assembling and servicing of engines from parts produced in the United States. Boeing Aircraft of Canada, Ltd., was established during the year at Vancouver to manufacture or assemble planes of the type made by the parent American company.

Toronto and Montreal were the chief centers of the manufacturing industry. The Curtiss-Reid Aircraft Company, Ltd., of Cartierville, Quebec, manufactured the Reid Rambler biplane, equipped with a Cirrus Mark II engine. Canadian Vickers, Ltd., of Montreal, manufactured the Vedette, equipped with a single engine; the Vancouver, a twin engine biplane; and an American type. The De Havilland Aircraft of Canada, Ltd., imported units from its parent company in Great Britain and assembled the planes in Toronto. It planned to manufacture the D. H. Moth when a new factory was completed and in operation. The Yarrow Aircraft Corporation, Ltd., was organized in Vancouver, but no planes had been manufactured.

There were 397 planes in Canada September 30; 313 private pilots; 279 commercial pilots; and 88 companies operating airplanes, including five air mail contractors. Canadian Airways, Ltd., operated daily air mail service between Montreal and Toronto under contract with the Post Office Department. Passengers and mail were carried by Canadian Colonial Airways, Ltd., between Montreal and New York on daily schedules. Canadian Colonial Western Airways, Ltd., operated a line between Montreal and Buffalo. Transcontinental Airways, Ltd., carried mail, freight and passengers throughout the provinces of Quebec and New Brunswick. London Air Transport, Ltd., provided a service between Leamington and Pelee Island in Lake Erie over a 22 mile route. Western Canada Airways, Ltd., operated regular services between Sioux Lookout and Red Lake; Lac du Bonnet, Bissett, and Wadhope; The Pass and Kississing; and Winnipeg, Regina, Calgary, and Edmonton, by way of Saskatoon. Sky View Lines, Ltd., provided a sight-seeing service over Niagara Falls from the Canadian shore. Winter service was established between Moncton and Magdalen Islands and Quebec, Seven Islands and Anticosti. Rimouski, Montreal and Ottawa were linked in a regular summer service. Approximately 400,000 miles were flown during 1929 on Canadian air mail routes alone. A saving of 20 hours was made on the new route opened in

January between Ottawa, Montreal, St. John and Halifax. It was estimated that 63 hours would be saved by the establishment of a projected air mail line across the Dominion paralleling the transcontinental route in the United States.

Airplanes were extensively used by private companies engaged in the mining and fur industries. The extensive work of two of the most prominent companies is reviewed in the chapter on "Exploration by Air."

There were 61 standard airports in Canada on September 30, with nearly a score of others planned or under construction. All airports and intermediate landing fields with the exception of the government-owned airports at St. Hubert, Montreal and Rimouski, Quebec, were owned either by municipalities or private operators. The government was installing lighting equipment on the Toronto-Detroit, Calgary-Regina, Regina-Winnipeg and Edmonton-Regina air mail routes. Radio beacons also were being installed on the principal routes. Weather reports were broadcast regularly to pilots by the Department of Marine and Fisheries.

Chile

While there was not a single air mail line operating in Chile at the opening of 1929, progress during 1929 was so rapid that four companies were flying on regular schedules at the end of the year. Santiago was the terminus of two of the longest air mail lines in the world, the Pan American-Grace Airways, Inc., route from Miami to Santiago and the line from Paris to Santiago operated by the Latécoère Lines.

Weekly eight-day air mail service was maintained between Santiago and Miami, and weekly ten-day service between Santiago and Paris. The National Air Lines, owned by the Chilean government and operated by the War Department, maintained service three times a week between Santiago and Arica, and the New York, Rio and Buenos Aires Line operated weekly service between Santiago and Montevideo, which was to be extended to New York in 1930 by way of the east coast of South America and the West Indies.

Owing to rather high railroad fares in Chile, travel by air was almost as cheap as first class trains, and was proving far more popular. The National Air Lines reported that it was unable to accommodate the flying public and was rapidly increasing its equipment and personnel. Six six-place planes and two tri-motored 20 passenger planes were delivered to the Chilean government for the Santiago to Arica service. During the month of September alone, the National Air Lines flew 442 hours, about 44,000 miles, with 100 per cent efficiency.

Passenger traffic between Santiago and Buenos Aires across the great Andes mountain wall was so heavy that the New York, Rio and Buenos Aires Line announced biweekly service starting late in 1929. Tri-motored Ford planes were used on the line. Passenger service on the Chilean section of Pan American-Grace Airways, Inc., had not been inaugurated, but passengers could fly to Arica in Chilean planes and continue on the American line. The government announced plans for air mail and passenger service between Santiago and Puerto Montt late in the year.

Early in 1929 there were not three airports in all Chile. At the end of the year there were that many in the city of Santiago alone. The government continued to develop its military forces, purchasing planes and equipment from the United States. Sixty-two military planes flew over Santiago in formation during a celebration late in the year. Private flying remained almost wholly unknown in Chile. There were less than a half dozen privately owned planes and not more than ten private civilian pilots in the country. The government had made no provisions for the registering and licensing of planes, making a census of aircraft very difficult.

China

Aviation became deeply rooted in China during 1929, both in its military and civil branches. A country of vast distances between great cities with an enormous population and less than 6,000 miles of railways, China found the airplane well adapted to its needs.

Aviation Exploration, Inc., a subsidiary of the Curtiss-Wright interests, was organized as a $10,000,000 enterprise to operate air mail lines in China under contract with the government. The first lines to be established were to connect Nanking with Peking, Canton with Hankow, and Shanghai with Hankow by way of Nanking. The company also planned to establish schools to train Chinese pilots. Plans were temporarily checked through some differences arising out of rivalry between the Ministry of Communications and Ministry of Railways as to which controlled the rights to grant mail contracts.

Five Ryan monoplanes were delivered to the Wuhan Civil Aviation Association in January to be used on a proposed line between Hankow and Canton, and the Yunnan Provincial Government bought five Ryan monoplanes. Five Waco three-place biplanes were purchased by the Kuangtung Provincial Government. These purchases of American equipment and others of German and British planes served to indicate the increased interests in aviation taken by the government.

A Loening amphibian was placed in service in November on a nine

hour schedule between Shanghai and Hankow, and a half dozen other services were projected or under survey. While the development of commercial air lines promised to have the most lasting influence on the country, the year witnessed continued fighting between rival factions with American planes figuring in the equipment of both forces. The Chance Vought Corporation sold a fleet of Vought Corsairs to the National Government late in the year. Because of the secrecy which surrounded the military operations, it was difficult to know how many planes were in actual military use, but it was known that more than a score figured in several raids.

Colombia

At the close of the year, there were 18 airplanes and 14 pilots in Colombia. Two closely affiliated companies, the "Scadta" at Barranquilla and "Cosada" at Bucaramanga, were organized under the Colombian law to operate regular mail and passenger lines. Early in September, Pan American Airways, Inc., opened a landing field ten miles from Barranquilla, and maintained a weekly service from Cristobal to Curacoa, but was not permitted to bring passengers into the country or take them out. Pan American-Grace Airways, Inc., an affiliated company, operated its planes through Colombia from Colon to Peru.

"Scadta" (Sociedad Colombo-Alemena de Transportes Aereos) with an authorized capital of $825,000 operated the Magdelena River Line, extending from Barranquilla to Girardot, 600 miles; the Trans-Andian Line from Bogota to Cali, 275 miles; the Pacific Line from Cristobal by way of Buenaventura to Guayaquil, Ecuador, 1,200 miles; the Inter-Ocean Line from Barranquilla to Quito and Buenaventura, 700 miles; and the Atlantic Line from Cristobal to Santa Marta, 500 miles.

The "Cosada" (Compania Santanbereana de Aviacion), a subsidiary, operated the Barranca-Bermeja-Bucaramanga Line, 80 miles; the Bacaramanga-Puerto Wilches Line, 80 miles; and Puerto Wilches-Barranca-Bermeja line, 15 miles.

"Scadta" had 14 seaplanes and two land planes, while "Cosada" had two land planes. There were four landing fields and two seaplane bases. "Scadta" had 12 pilots and 200 other staff men, while "Cosada" had two pilots and 25 other employees. There were no aircraft or engine manufacturers in Colombia and no aerial service operators other than those mentioned above.

Costa Rica

The Mexican Minister to Costa Rica presented the Costa Rican government with an airplane during 1929 as a good will gesture. The

plane was of Mexican manufacture. Pan American Airways, Inc., provided Costa Rica with its first regular air service during 1929.

Cuba

More than 1,000,000 miles were flown by airplanes operating into Cuba during 1929, and the military and commercial services were expanded. Mail and passengers were transported on a regular line between Miami and Havana operated by Pan American Airways, Inc., which expanded its service in January and added new airplanes to its fleet. Mails also were carried between Havana and Santiago by planes en route to and from Haiti and Porto Rico.

BELLANCA TANDEM

Bellanca (2 Pratt and Whitney Wasps) "tandem" built for long distance flights and owned by Chicago Daily News, showing tandem engine installation front and rear.

There were 15 commissioned officers and 138 enlisted men in the Cuban Air Force at the end of the year. The military establishment was divided into two observation and bombardment squadrons and one pursuit squadron. Army aircraft flew a total of 386,000 miles between July 1, 1928, and June 30, 1929.

The Cia. de Servicio Cubana de Aviacion was formed at Havana for the transportation of passengers and freight throughout Cuba. It was financed by Cuban and American capital. The Cia. Nacional Cubana de Curtiss, S.A., was formed at Havana to operate a sales and service agency for Curtiss-Wright products and carry on general aerial service operations including flying schools. No airplanes or engines were manufactured in Cuba.

Czechoslovakia

The Czechoslovak state controlled air lines continued operations in co-operation with the German Luft Hansa and Austrian Air Traffic Company in 1929, maintaining a good record for efficiency of operations and lack of accidents. On 7,000 scheduled flights with 13,000 passengers, no one was injured.

The Czechoslovak Air Traffic Company inaugurated a new line from Prague to Rotterdam April 2, and established a policy by which all passengers were insured and the premium included in the air ticket. The insurance provides for the payment of about $5,000 in case of death or serious injury.

There were four manufacturers of aircraft in Czechoslovakia and about 60 airplanes were registered in the country.

Denmark

Effective transport service by airplanes was continued between the many islands of Denmark and between Denmark, Germany and Sweden throughout the period of severe storms and ice-bound conditions which existed in February, when all other forms of transportation failed. Every available plane of the army, navy and private companies was pressed into service during the period, and regularly scheduled transport resumed when weather conditions returned to normal.

The Danish Air Transport Company, Ltd., was granted an annual subsidy of 250,000 crowns ($66,675) for two years, with the understanding that the Copenhagen commune would place an additional 100,000 crowns annually at the disposal of the company. The line from Copenhagen to Hamburg, 181 miles, bore the heaviest burden of the Danish traffic.

Dominican Republic

The Dominican Republic was served by the division of Pan American Airways, Inc., operating between Miami and San Juan, Porto Rico. Three passenger and mail planes were operated by the company on a tri-weekly schedule. The Republic had no military aviation and no civil aviation, either governmental or commercial. There were no aircraft or engine manufacturers.

However, an aviation school was established at Santo Domingo to carry on instruction. It also announced an intention to manufacture aircraft when it could expand its facilities.

Ecuador

Three air transport operating companies maintained service between Ecuador and nearby countries. Pan American Grace Airways, Inc., operating Sikorsky amphibions, the Peruvian Airways Corporation operating a Loening amphibian, and "Scadta," operating an all-metal Junkers plane, served Ecuador with their transport lines.

There were three lines being operated on a weekly service: Guayaquil to Panama, 850 miles; Guayaquil to Lima, 800 miles; and Guayaquil to Barranquilla, Colombia, 1,200 miles. No passengers were carried on the first; mail and passengers were carried on the other two. There were three planes and four pilots in the country.

Thirty thousand dollars were appropriated in 1930 for the Ecuadorian Air Force, which operated two observation planes and five training planes. There were seven officers and 70 enlisted men in the military establishment.

Egypt

Egypt was served by the Imperial Airways, Ltd., which maintained regular service between London, Cairo, Basra, and Karachi. Plans for a line between Port Said and Cyprus were announced during the year, and the Egyptian Ministry of Public Works approved a contract with the Air Survey Company, a British organization, for an aerial survey of the Upper Nile.

Estonia

Regular service between Tallinn and Helsingfors was resumed early in 1929 by the Finnish Air Service Company, which took over the operations of the Estonian Aeronaut Company. Four-passenger Junkers planes were operated on the 54 mile route, which connected with the line linking Berlin, Riga, Tallinn, and Leningrad, as well as Helsingfors and Stockholm. The timetable of the Finnish Air Service Company was co-ordinated with that of the German "Deruluft" company to insure adequate service for the country.

Finland

More than 9,000 passengers were carried by the Finnish Air Service Company on its three routes radiating from Finland during 1929. Due to the extensive coast line and the great number of inland bodies of water, seaplanes were used extensively in Finland. Passengers, mail and express were carried on the three routes: Helsingfors-Tallinn;

Helsingfors-Stockholm; and Abo-Mariehamn-Stockholm. There was a 50 per cent increase in the volume of mail and express carried on these lines during 1929 and an increase of about 1,000 passengers over 1928.

The Finnish Government maintained an aircraft construction plant for the manufacture of military planes. No engines were made in Finland, but were imported from England, Germany and Italy. No import duty was imposed upon airplanes intended for the transportation of passengers and mail. Five planes and five pilots were employed by the Finnish Air Service Company on its regular transport routes.

France

Government subsidies played an important part in the expansion of French aeronautics during 1929. Five operating companies received substantial subventions: Air-Union, 16,700,000 francs; Société Générale de Transports Aériens, 8,400,000 francs; C.I.D.N.A., 23,450,000 francs; Compagnie Générale Aérospostale, 55,550,000 francs; and the Air-Union Lignes d'Orient, 7,500,000 francs. The relative importance and extent of the five companies' operations were indicated by the relative amount of the subsidies.

Thirty-one manufacturers of aircraft or engines received government subsidies during the year. The 1929 budget contained an item for 172,300,000 francs for cash subsidies and another of 106,385,000 for the development of airways and airports. The appropriations proposed for 1930 were 210,150,000 francs and 139,417,000 francs respectively.

Aéropostale, the principal operator, maintained regular service between Toulouse and Casablanca; Marseilles and Perpignan; Casablanca and Dakar; France and South America; Toulouse and Bordeaux; and Marseilles and Algiers. The Aéropostale succeeded the Compagnie Générale d'Entreprise Aéronautique and Lignes Latécoère. The lines developed by the company in 1929 totaled 16,335 kilometers: Paris-Bordeaux-Madrid, 1,200; Marseilles-Perpignan-Palma-Algiers, 1,075; and Toulouse-Dakar-Buenos Aires, 13,980. Extensions projected for 1930 included a 6,200 kilometer line from Natal, Brazil, to French Guiana and the French West Indies. Plans embrace a later extension of the line to the United States. All planes of the company in use on the Continent were replaced in July, 1929, so that the flying time between Toulouse and Casablanca was brought down to nine hours as compared with the former schedule of 26 hours. The estimated distance flown by the company in 1929 was 3,280,000 kilometers. Night operations were made regularly across the Pyrenees from France to Spain and between Tangier and Casablanca. Seaplane traffic across the

South Atlantic was to be established not later than 1931. The company was capitalized at 20,000,000 francs without bonded indebtedness.

Air-Union operated lines between Paris and London; Paris and Marseilles; Antibes and Tunis; and Lyon and Geneva. Its main activity was on the London to Paris line in competition with Imperial Airways, Ltd. There was no understanding as to the sharing of traffic between these two lines, but their schedules were so co-ordinated that both lines were provided with substantial business. It encountered no competition on its other lines. The company operated a subsidiary known as Compagnie Air-Asie, which planned early operation of four lines in French Indo-China: Rangoon to Vinh; Nah-Trang-Vinh; Pinsanoulok-Saigon; Calcutta-Rangoon; and Vinh-Canton-Shanghai. From Rangoon, the present French project reached only to Canton, but with Japanese co-operation it was planned to extend the line to Shanghai and Tokio. Thirty-seven planes, half of them multi-motored ships, were in the active service of this company on its regular lines.

Compagnie Internationale de Navigation Aérienne, generally known as CIDNA, grew out of the Compagnie Franco-Roumaine established in 1920. In 1929, the company had 77 planes in active service on its lines. It has consistently doubled its traffic each year since the beginning of operations in 1920. Forty-three pilots were in the employ of the company, which received government subsidies from France, Czechoslovakia, Rumania, Jugoslavia, and Poland. The original capital in the enterprise was entirely Rumanian, but in 1929 it had changed to about 50 per cent French; 19 per cent Rumanian private capital; 20 per cent Czechoslovakian government participation; and one per cent unidentified. Its capital in 1929 was published as 8,250,000 francs, but was to be increased in 1930 to 20,000,000 francs.

The Société Générale de Transports Aériens, the SGTA or Farman lines, operated daily service between Paris and Amsterdam; Paris and Berlin; and Paris and Saarbrucken. It did not, however, exploit any line on its own account, operating joint service with the German Luft Hansa and alternative service with Dutch K.L.M. Passenger service was operated by planes of the company between Paris, Cologne and Berlin; freight service between Paris-Cologne-Essen-Berlin; Sunday passenger service between Paris and Berlin; passenger and freight service between Paris-Saarbrucken-Frankford-Berlin; and twice daily passenger and freight service between Paris-Brussels-Antwerp-Rotterdam. The incorporation of this company in the holdings of CIDNA was rumored during the year, but no announcement confirming or denying the merger was forthcoming from either concern.

The estimated value of products of the French aeronautical manufacturing industry in 1928 was 700,000,000 francs. It was further

estimated that this amount would be increased about 40 per cent in 1929. The following companies manufactured aircraft in France during 1929; Société Anonyme des Ateliers d'Aviation Louis Breguet; R. Caudron; Société des Chantiers Aéro-Maritimes de la Seine; Société Anonyme des Chantiers et Ateliers de Saint-Nazaire; Société des Avions H. and M. Farman; P. Levasseur; Etablissements Lioré and Olivier; Société des Aeroplanes Morane-Saulnier; Société des Aeroplanes Henri Potez; Société Provençale de Constructions Aéronautiques; Ateliers des Mureaux; Etablissements d'Aviation François Villiers; Les Avions Bernard; Société Blériot-Aéronautique; Ateliers et Chantiers de la Loire; Avions Dewoitine, Société Aéronautique Française; Société des Avions Hanriot; Société Anonyme Nieuport-Astra; Société des Chantiers Aéronavales E. Romano; Société d'Emboutissage et de Constructions Mechaniques; René Tampier; Avions Michel Wibault; Avions Legers Bourgois; E. Carton; Hydravions Schreck, F.B.A.; Société Anonyme des Hydro-Glisseurs Dumond-Galvin; and Société Industrielle d'Aviation Latécoère. There were seven manufacturers of engines.

Miliary aviation for service with the land forces was under the control of the Ministry of Air at all times, except when units were detached for service with major tactical units in war or maneuvers. There were approximately 2,000 planes in the military establishment of the country in 1929. A squadron of military planes made a complete circuit of France in 1929 as a part of the military maneuvers without an accident or failure to maintain a rigid schedule. Appropriations made directly for military and naval aviation in 1929 were 970,430,000 francs of which 612,132,000 francs were for material. However, the total appropriation for the Air Ministry was 1,769,653,000 francs of which 52.5 per cent was for construction. The government's proposals for the 1930 budget totaled 1,995,652,566 francs of which 870,169,000 or less than 50 per cent was for construction. Naval aviation was placed under the Ministry of Air for all theoretical purposes excepting tactical operations with the fleet or its units. Only one aircraft carrier, the Bearn, a converted battleship, was maintained.

The government further stimulated the development of civil aviation through the construction of airways with night flying equipment and other facilities necessary for operations. Airports were operated by the government throughout the Republic with the civil airport near Paris, Le Bourget, as the outstanding exception.

Air lines radiating to all of Europe centered at Le Bourget port. Reports for the months of July, August and September showed that from 4,000 to 7,000 persons embarked or disembarked from planes at Le Bourget.

Germany

German aviation continued to be identified chiefly with the principal operating company, the German Luft Hansa, although there was a small operating company in Bavaria known as the Nordbayerische Verkehrsflug. It was estimated that the Luft Hansa carried approximately 125,000 passengers during 1929, a world record for a single operating company.

Only the Luft Hansa received subsidies from the Reich government, the Bavarian company being subsidized by cities only. In former years

GUGGENHEIM CONTEST ENTRY

Cunningham-Hall Model X (Walter Vega 85) with peculiar Hall high lift wing is flown in the Guggenheim Safe Aircraft competition.

the Reich subsidies granted the Luft Hansa consisted of cash payments and materials, but beginning April 1, 1929, only cash subsidies were granted. The cash payments in 1929 were less than half the subsidies granted in 1928, when 22,500,000 reichsmarks were paid. The subsidies in 1929 totaled 10,000,000 reichsmarks, plus a guarantee given by the federal government for interest and redemption payments on a loan of 6,000,000 reichsmarks which the Luft Hansa proposed to take up.

The Reich laid out and maintained night lighting on three principal air routes and participated in the construction of airports. The Luft

Hansa paid a rental for use of the airports and the cost of illuminating the night routes. Other appropriations made by the federal government in its aviation budget included: scientific developments, 17,485,000 reichsmarks; navigation aids and airport wireless stations, 1,398,700; German Aeronautics Experimental Institute, 1,600,000; special researches 720,000; meteorological services, 1,270,000; training of personnel, 3,650,000; air mapping, 20,000; glider development, 450,000; air mindedness propaganda, 90,000; competitions, 10,000; free balloon development, 50,000; special flights for the Reich, 200,000; collection of aeronautic equipment, 1,500; furtherance of airports, 1,050,000; radio service, 50,000; and enlargement of aerodynamic test institute, 50,000.

Airports were maintained in all cities with populations of more than 200,000, with a total of about 100 in operation during 1929. The airways between Berlin and Koenigsberg, 600 kilometers; Berlin and Hanover, 250 kilometers; and Berlin and Halle, 150 kilometers, were equipped for night flying with full lighting facilities. Other airways were under construction for night flying between Hanover and Cologne and Halle and Munich. The city government of Halle was the only one to pay the cost of laying out an airway; the cost being borne in all other cases by the Reich government.

The German Luft Hansa, capitalized at 25,000,000 reichsmarks, employed about 2,500 persons throughout the year, 200 of them pilots or assistant pilots. Two hundred and twenty-five planes were in the company's service operating on lines throughout Europe and centering in Berlin. The company operated over more than 100 routes, with service throughout Europe aggregating 16,000 miles. About 25 per cent of the network of lines extended outside the borders of Germany. Some of the principal mail and passenger routes included: Berlin-Hanover-Amsterdam-London; Berlin-Danzig-Koenigsburg; Berlin-Hanover-Koln-Brussels-Paris; Berlin-Stettin; Berlin-Hamburg-Travemunde-Copenhagen-Malmo; Berlin-Leipzig-Nurnberg-Munchen; Berlin-Leipzig-Stuttgart-Zurich; Basel-Barcelona; Berlin-Gleiwitz; Berlin-Frankfurt-Mannheim; Heidelberg-Dusseldorf-Essen; Berlin-Dresden-Prag-Wien; Genf-Zurich-Budapest; Freiburg-Stuttgart-Munchen; Frankfurt-Darmstadt; Frankfurt-Koln; Dortmund-Koln; Frankfurt-Nurnberg; Dortmund-Hanover; Hanover - Magdeburg - Berlin; Bremen - Hanover - Leipzig-Prague; Hamburg-Kiel-Flensburg; and Essen-Dusseldorf. Two special air routes were inaugurated in 1929, one between Berlin and London and one from Straslund to Stockholm. Service was discontinued on the former November 15 and on the latter October 15, to be resumed in the spring of 1930.

The Nordbayerische Verkehrsflug, the Bavarian company with a capitalization of 600,000 reichsmarks, employed about 100 persons, including

15 pilots. Its activities were confined to connecting Bavarian towns and cities. The routes included: Plauen-Leipzig; Leipzig-Erfurt; Dresden-Leipzig; and Nurnberg-Dresden.

There were twelve manufacturers of aircraft, several of whom had products with world wide reputations. Development of three of the largest planes the world has yet seen was completed during the year by three different German companies. One of them—Dornier—built its giant liner on the Swiss side of Lake Constance, however. The 112 place DO-X was the product of the Dornier Metallbauten. It is described in the chapters on "Trends in Design" and "History Making Flights." The Junkers Fluzeugwerke developed the G-38, the world's largest land plane, and the Rohrbach Metallflugzeugbau produced the Romar, a giant flying boat. Other manufacturers of aircraft included: Albatros Flugzeugwerke; "Arado" Handelsgesellschaft; Bayerische Flugzeugwerke; Caspar Werke; Foche-Wulf Flugzeugbau; Ernst Heinkel Flugzeugwerke; Leichtflugzeugbau Klemm; Raab-Katzenstein Flugzeugwerke; and Wasser-und Luft Fahrzeug.

The manufacturers of aircraft engines included; Bayerische Motorenwerke; Daimler Motoren Gesellschaft; Junkers Motorenbau and Siemens and Halske. There were ten aeronautical magazines being published in Germany at the end of the year, and their wide circulations gave an indication of the general interest in aviation throughout the country. Aircraft imports to Germany were unrestricted. However, only engines had been imported, chiefly from England where a few types were obtained.

The Reich maintained solely the German Flying School at Berlin, which provided training for pilots who might be employed later in the services of the German Luft Hansa. Three subsidiary schools at Brunswick, Schleisheim and Warnemunde, were attached to the Berlin school. All other flying schools were privately owned institutions. There was a remarkable increase in private flying in Germany during the year, several light type planes being introduced into general use. The government lent its support to this movement by providing money for competitions and other promotional aids which would stimulate more general interest in private flying.

Under the terms of the Versailles Treaty, Germany was not permitted to develop army or navy air forces, thereby eliminating any developments in this field to parallel those in other countries.

Great Britain

Imperial Airways, Ltd., continued to operate the principal air lines from Great Britain to foreign countries with a virtual monopoly, flying

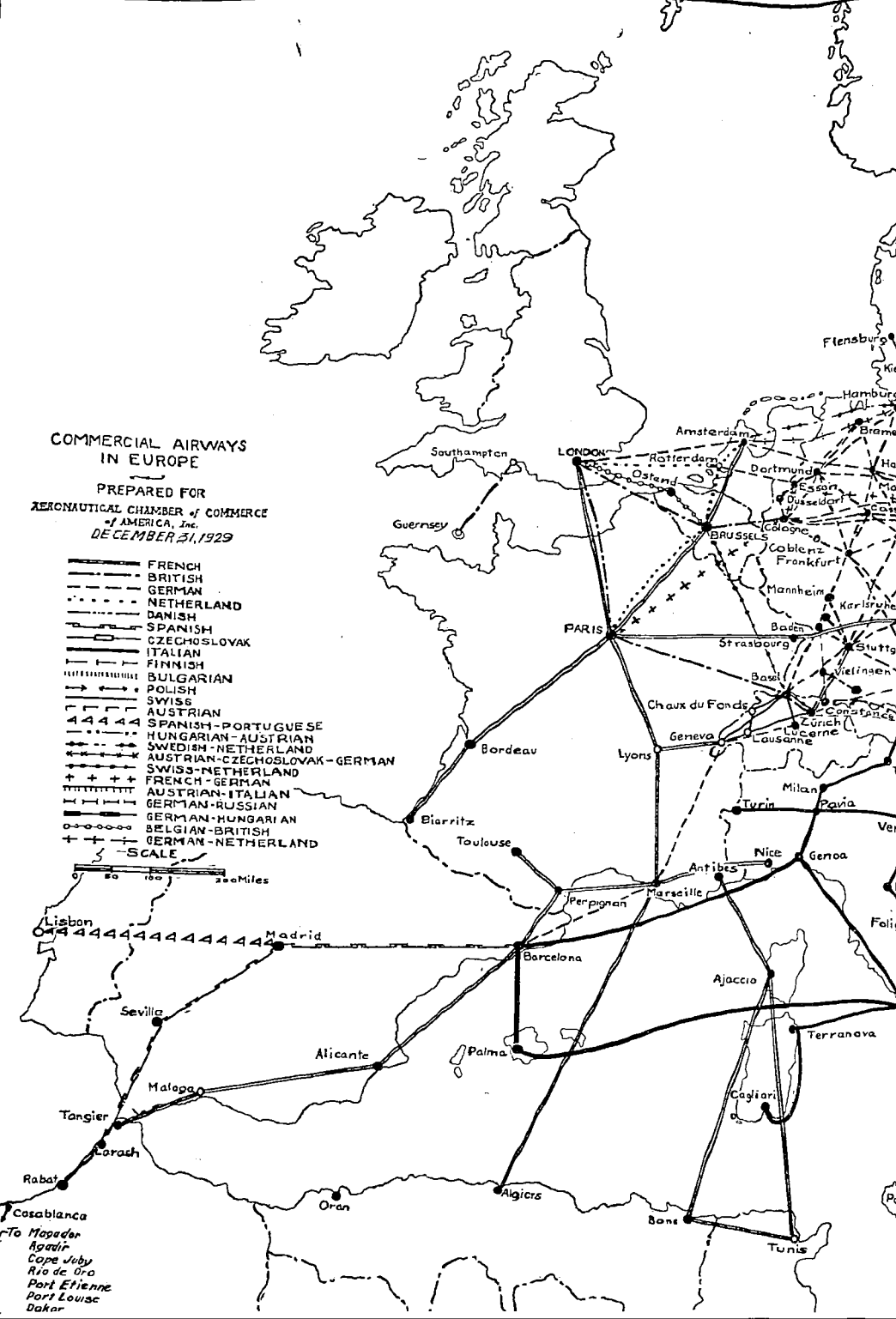
1,032,842 miles during the fiscal year 1929, ending March 31. During this period 34,757 paying passengers and 873 tons of mail, freight and excess baggage were transported over the lines of the company.

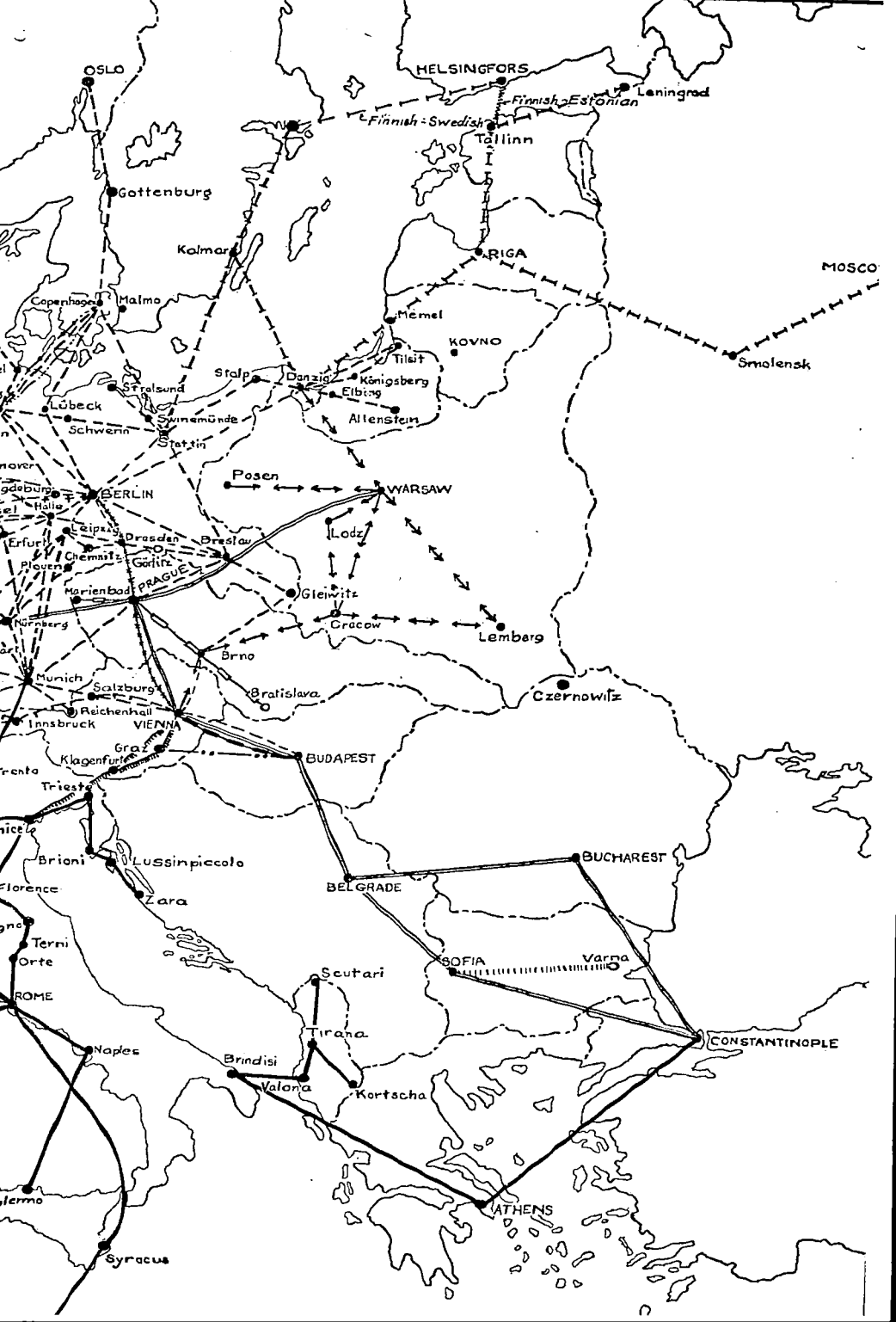
In Europe its planes averaged 74 per cent of their capacity pay load for the year, and in the Near East an average of 61 per cent of the capacity load was maintained. Traffic revenue for the year increased 29.5 per cent over the previous year. The turnover of the European services more than doubled during the three years commencing March 31, 1926. In the Near East on the Cairo-Bagdad-Basra route a 48 per cent increase in revenue was reported. The latter route became a link in the London to Karachi, India, service inaugurated in March, 1929. The profit for the fiscal year 1929 was £79,000, a ten per cent increase over 1928. The company flew 94 per cent more mileage than it was required to fly in order to earn its subsidy from the British government. This meant that about half the mileage flown during 1929 was unsubsidized and indicated that the company might expect to be capable of operation without subsidy within a few years.

Imperial Airways, Ltd., continued the operation of its London to Paris service with from two to five round trips a day varying with the season of the year and volume of traffic. Service was maintained daily between London, Brussels and Cologne, and between London, Paris and Basle. Regular service between England and India was inaugurated in March over one of the longest air routes in the world, stretching 5,000 miles across ten different countries which spoke seven or eight different languages and utilized nine different currencies. Eighteen hundred miles of the route were flown in seaplanes across the Mediterranean Sea. While the growth of traffic on the India route was steady and continuous, it was not as rapid as its promoters had hoped. It was important nevertheless from a military and economic standpoint because it linked England with her distant outposts in India through a seven day service. Plans included later extension of the line to Australia, adding another link in England's network of airways connecting her colonies. In addition to the services operated by Imperial Airways, Ltd., England was provided with direct air mail connections to practically every European country.

While Imperial Airways, Ltd., was responsible for the principal organized transport operations, other firms employed in air taxi work were Surrey Flying Service, A.D.C. Aircraft, Ltd., and Air Taxis, Ltd. Planes operated by Air Taxis, Ltd., alone covered 64,000 miles in special charter flying during the year ended August 1, 1929.

The strength of the Royal Air Force in 1929 was 3,423 officers, including the stores, accountant and medical branches; 27,500 enlisted men; and 14,700 civilians. The Air Ministry encouraged participation


COMMERCIAL AIRWAYS IN EUROPE
PREPARED FOR
AERONAUTICAL CHAMBER of COMMERCE of AMERICA, Inc.
DECEMBER 31, 1929
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
Southampton
LONDON
Amsterdam
Rotterdam
Ostend
Dortmund
Essen
Düsseldorf
Cologne
BRUSSELS
Guernsey
Flensburg
Hamburg
Coblenz
Frankfurt
Mannheim
Karlsruhe
PARIS
Baden
Strasbourg
Stuttg
Vielingen
Basel
Chaux du Fonds
Zurich
Lucerne
Lausanne
Geneva
Bordeaux
Lyons
Milan
Turin
Pavia
Biarritz
Toulouse
Nice
Genoa
Antibes
Marseille
Perpignan
Lisbon
Madrid
Barcelona
Ajaccio
Seville
Terranova
Alicante
Palma
Malaga
Cagliari
Tangier
Larash
Rabat
Casablanca
To Mogador
Agadir
Cape Juby
Rio de Oro
Port Etienne
Port Louise
Dakar
Oran
Algiers
Bone
Tunis


OSLO
HELSINGFORS
Leningrad
Finnish-Estonian
Finnish-Swedish
Tallinn
Gottenburg
Kalmar
RIGA
MOSCO
Copenhagen
Malmo
Memel
KOVNO
Tilsit
Smolensk
Stralsund
Stalp
Danzig
Königsberg
Elbing
Lübeck
Swinemünde
Allenstein
Schwerin
Stettin
Posen
WARSAW
BERLIN
Halle
Leipzig
Dresden
Breslau
Erfurt
Chemnitz
Görlitz
Plauen
Lodz
PRAGUE
Marienbad
Gleiwitz
Nürnberg
Cracow
Lemberg
Brno
Munich
Salzburg
Bratislava
Czernowitz
Reichenhall
Innsbruck
VIENNA
Graz
Klagenfurt
BUDAPEST
Trieste
Brioni
Lussinpiccolo
BUCHAREST
BELGRADE
Florence
Zara
Terni
Orte
SOFIA
Varna
Scutari
ROME
Tirana
CONSTANTINOPLE
Naples
Brindisi
Valona
Kortscha
ATHENS
Syracus

in contests through the construction of special machines for the Schneider Trophy Race, but announced a change of policy after the 1929 race to the effect that no more official entries would be made by Great Britain.

The winning of the Schneider Trophy at a speed of 328.63 miles an hour and the setting of a new world speed record of 355.67 miles an hour were hailed as outstanding achievements of the year. The evacuation of Kabul by the Royal Air Force using Vickers-Napier Victoria troop carriers and the non-stop flight of two Royal Air Force officers from England to India in a Fairey-Napier monoplane were listed among the outstanding feats of the Air Force during the year. They are reviewed in greater detail in other chapters.

The two government giant airships, R-100 and R-101, were completed and flown during the year. Their design details are considered in the chapter on "Airship Development." Exports of aircraft from England during the first nine months of 1929 exceeded the exports for all of 1928. Aircraft exports in 1928 totaled £1,334,576, while the first nine months of 1929 saw aircraft exported from Great Britain with a total value of £1,586,806.

The British government provided £415,000 during the fiscal year 1929 for expenditure in the stimulation of civil aviation. The sum represented a reduction of £49,000 as compared with the previous year, due to the decrease of capital expenditure at Croydon Aerodrome. Imperial Airways, Ltd., received £137,000 for maintenance of its European services and £93,000 for operation of its Cairo-Basra section of the Egypt-India air service. The remaining items included £16,000 for the financial assistance of light airplane clubs; £29,000 for staffing and maintaining civil aerodromes; £29,000 for aerial routes, services, and experimental projects; £8,000 for technical equipment; £93,000 for works including the reconstruction of Croydon Aerodrome; £14,364 for headquarters' staff and £2,000 for miscellaneous services.

The following companies constructed aircraft and engines during 1929: Armstrong Siddeley Motors, Ltd.; Sir W. G. Armstrong Whitworth Aircraft, Ltd.; Blackburn Aeroplane and Motor Company, Ltd.; Boulton and Paul, Ltd.; Bristol Aeroplane Company, Ltd.; Cierva Autogiro Company, Ltd.; Cirrus Aero Engines, Ltd.; De Havilland Aircraft Company, Ltd.; Desoutter Aircraft Company, Ltd.; Fairey Aviation Company, Ltd.; Glenny and Henderson; Gloster Aircraft Company, Ltd.; H. C. Hawker Engineering Company, Ltd.; D. Napier and Son, Ltd.; Handley Page, Ltd.; George Parnall and Company; A. V. Roe and Company, Ltd.; Rolls-Royce, Ltd.; Saunders-Roe, Ltd.; Short Brothers, Ltd.; Spartan Aircraft Company; Supermarine Aviation Works, Ltd.; Vickers (Aviation) Ltd.; and Westland Aircraft Works, Ltd.

Greece

Greece made a radical change in its attitude toward aviation in November when Premier Venizelos announced, after a conference with naval experts, that he would not purchase the cruiser, Salamis, ordered in Germany before the World War, but would devote the entire sum saved to the development of aviation. The Premier announced seven days later that he had decided to create a Ministry of Aviation with himself as its director and with sub-secretaries to handle the details. He said that municipalities would be compelled to provide flying fields, and stressed the importance of developing military aviation.

Previously, Greece had been served by one Italian air transport company operating between Brindisi and Constantinople which included Athens as a stop. One manufacturing company, the Blackburn Company, produced aircraft and was supported by British capital. About $4,000,000 was appropriated for the Army and Navy services during the fiscal year 1929.

Guatemala

The Guatemalan government operated a fleet of 19 passenger and mail planes on regular service between Guatemala City and San Salvador and between the Guatemalan capital city and the Department of Peten in the northeast. Flights are made over the latter route in two hours which previously required two weeks of muleback travel. Regular service between Guatemala City and Los Angeles was established by Pickwick Aviation Company, under a contract with the government of Guatemala. The company was known in Central America as Latin American Airways, Inc. Mail to the eastern portion of the United States was routed through Mexico over the lines of the Mexican Aviation Company, a subsidiary of the Pan American Airways, Inc., to Brownsville, Tex.

Haiti

The United States Marine Corps occupying Haiti under terms of the Treaty of 1915 operated six or more planes throughout the year for military purposes. The planes also were used for carrying American-Haitian governmental mail from Port au Prince, Cape Haitien, Hinche, Port de Paix and Jeremie.

Pan American Airways, Inc., which took over the West Indian Aerial Express Company early in 1929, operated tri-motored passenger and mail planes between Santiago de Cuba and Port au Prince, and San Domingo and San Juan. This division connected with another

branch at Santiago de Cuba, where mail and passengers were transferred to planes for Havana and Miami.

Comparative statistics on landings and departures from Port au Prince during the first nine months of 1928 and 1929 served to indicate the increase in traffic. There were 227 arrivals and departures in 1929 as compared with 64 in 1928. There were no private concerns operating entirely within the borders of Haiti. There were no individuals who owned or operated planes for their own use.

Hawaii

Inter-Island Airways, Ltd., established service between the principal islands of the American mid-Pacific territory during 1929 with two Sikorsky S-38-B amphibions and a Bellanca Pacemaker seaplane.

Hawaiian Airways, Ltd., operated a Kreutzer K-5 and ordered a Fokker F-10 for its aerial service operations. Hawaiian Aeronautical Industries, Ltd., had a Swallow and an American Eagle used in its flying school instruction work. Western Pacific Air Transport was using two Travel Air model 2000 biplanes in its training of student pilots, operating from Ward Airport, owned privately by the company.

John Rodgers Airport in Honolulu was owned and managed by the territory of Hawaii. Wheeler Field, 20 miles from Honolulu, was the center of the U. S. Army Air Corps operations, and Pearl Harbor was the scene of the Naval Air Station, 10 miles from Honolulu.

Honduras

The air service operated by the Tela Railroad Company for passengers and mail between Tela and Tegucigalpa by way of San Pedro Sula increased its schedule from one to two trips each week. When traffic warranted, however, almost daily trips were made.

Hungary

Three companies, one Hungarian, one German and one Austrian, operated air services over about 1,000 kilometers of routes in Hungary during 1929. Regular schedules were maintained between Budapest and Vienna, Budapest and Graz, and Budapest and Belgrade.

The Hungarian Air Traffic Company (Hungarian), International Air Traffic Company (Austrian), and German Luft Hansa (German) maintained jointly daily round trip service between Budapest and Vienna. The Hungarian company operated a daily round trip schedule on the

Budapest to Belgrade route, and one daily flight over the line between Budapest and Graz.

Hungary was forbidden by the Trianon Treaty of 1920 to maintain military services, but civil and commercial aviation were under the direct supervision of the Royal Hungarian Ministry of Commerce. Government subsidies for aviation activities in 1929 approximated the total expended in 1928, about $225,000.

The Manfred Weiss Aeroplane and Motor Manufacturing Company of Csepel was organized during 1928 to produce aircraft under licenses of the Fokker, Caproni, and Heinkel companies, and aircraft engines under licenses of the Gnome Jupiter and Siemens and Halske, A.G. The Sporting Flights Club of the Hungarian Technical University undertook the production of training planes and airplane engines for its own use constructed exclusively by members of the club.

Iceland

The Icelandic Aviation Company leased two Junkers F-13 planes from the German Luft Hansa in 1929 and announced plans for the establishment of weekly air mail service between Seydisfjord, Siglufjord, Akureyri, and Reykjavik. The planes also were to be used in scouting for herring during the fishing season.

India

Air mail service between England and Karachi, India, was established in 1929 when the first plane, a De Havilland Hercules, arrived in Karachi April 6 after a flight requiring approximately eight days. The flight was to be made in six days and six hours, but last minute changes in the schedule due to difficulties with the Italian and Greek governments increased the time required. The service was operated weekly in both directions throughout the year without interruption after the inaugural flight.

There was increasing agitation for the establishment of a local Indian air mail service, and in June a daily mail and passenger service was inaugurated between Calcutta and Siliguri, 350 miles. The service was maintained by the Bengal Air Transport Company employing two British planes.

The National Airways, Ltd., announced plans for service between Calcutta and Shillong. Eastern Airways, Ltd., contemplated service between Bombay and Karachi, Karachi and Delhi, Bombay and Calcutta, and Bombay to Madras. Imperial Airways, Ltd., operators of

the London to Karachi route, planned an extension across India through a subsidiary, the Indian Airways, Ltd., and finally to Australia.

There were seven light airplane clubs active in India during the year at Delhi, Karachi, Bombay, Calcutta, Madras, Rangoon, and Allahabad.

Irish Free State

The Irish Air Transport Company was formed during 1929 with Col. James Fitzmaurice, the trans-Atlantic flier, as its managing director. The company reported its capitalization at $2,500,000. It laid plans to enlist further aid from the Irish government through a subsidy for the operation of its contemplated service between Galway and London, where connections would be made with lines radiating to all parts of Europe. Plans included the speeding of passengers from steamships arriving off the coast of Ireland to London by air and then to their destinations on the continent with a saving of from several hours to several days.

The government also had under consideration during the year a plan for the pooling of its commercial and military aviation so that about $500,000 a year now available for military aviation might be used partially for the stimulation of commercial aviation. President William T. Cosgrave of the Irish Free State used airplanes on numerous business trips during the year as a part of the government's program to stimulate general interest in aviation.

Italy

Seven Italian air lines employed 700 aircraft, mostly seaplanes and flying boats, on nearly a score of lines throughout Italy and stretching into western and northern Europe through connections with the important German, French and British systems. Services to the Near East, Northern Africa and Spain also were in operation by the Italian lines or through connections at terminals outside Italy.

The rapid development of commercial aviation during the year was due primarily to encouragement given private initiative by the government in the form of subsidies, the exemption of aviation concerns from certain kinds of taxes, and occasionally through the acquisition of desirable private property through expropriation for the purpose of establishing landing fields.

The Societa Italiana Servisi Aerei (S.I.S.A.), with its base at Trieste, operated lines between Turin and Trieste and Trieste and Zara along the Dalmatian coast. Nineteen persons, including seven

pilots, were employed by the line which carried more than 4,000 passengers during the year.

The Societa Anonima Navigazione Aerea at Genoa operated over routes from Genoa to Rome, Naples and Palmero; Rome to Barcelona; and Rome to Tripoli. More than a score of pilots were employed by the company, which carried in excess of 5,000 passengers over its routes.

The Societa Anonima Aero-Espresso Italiana, with a base at Rome, maintained service between Brindisi, Athens, and Constantinople. Nearly a score of pilots were in the employ of the company.

The Societa Anonima Transadriatica with headquarters at Venice operated a line between Rome, Venice and Vienna, Austria. More than 3,500 passengers were carried over the line during the year.

The Societa Anonima Adria Aero Lloyd at Tirana, Albania, also an Italian company, operated solely within Albanian territory between Tirana and Koritza; Tirana and Scutari; and Tirana and Valona.

The Societa Aerea Mediterranea with its base at Rome operated two routes: Rome to Cagliari, Sardinia, and Brindisi to Valona. The Societa Anonima Avio Lines Italiane maintained regular service between Rome, Milan, Trento, and Munich. On September 2, a line between Rome, Milan and Turin was inaugurated with three round trips a week, using Fokkers on a four hours flight. A new line between Milan and Rimini with two hour service was opened, and plans for a land plane service over the Rome to Naples route, already covered by flying boats, was announced late in the year. Three other commercial air lines: Rome to Tunis, Cagliari to Tunis and Palmero to Tunis were to be opened in September, but the inauguration of these lines was postponed until 1930.

Italy's air lines looked to further international expansion and the Treaty concluded between Italy and France, signed at Turin, March 10, 1929, was taken as an indication that the long planned international projects would take form in 1930. Under terms of the Treaty, the French government obtained the right to fly commercial planes over the compartment of Calabria, Italy, in order to operate a direct line from France to Syria and the right to land commercial planes at Naples and Castelrosso. In exchange, the Italian government secured the right to land commercial planes at Marseilles, France, and at Tunis.

Italian government appropriations for civil aviation in 1929 were nearly 100 per cent higher than 1927. In 1927, 35,000,000 lire ($1,842,100) was appropriated. The amount was increased to 50,000,000 lire ($2,631,580) in 1928, and to 68,000,000 lire ($3,578,950) in 1929.

The government continued the development of its military aviation during the year, working on new types of planes and carrying out

extensive tactical maneuvers. Statistical material on strength of the military establishment and other information was held confidenial.

Japan

To draw the outposts of the empire closer to the political and industrial capitals, the Japanese government inaugurated an ambitious passenger, mail and freight air service between Tokio and Dairen in April. The service was operated by the Japan Air Transportation Company, a semi-official organization, to be subsidized to the extent of 20,000,000 yen ($10,000,000) for the first ten years of its operation. The company was formed in 1928 and immediately laid plans for connecting the centers of the island empire. It was designed to amalgamate the interests of the Tokio government, the Korea government, and Kwantung leased territory in which Dairen was located. Intermediate stops included Osaka, the great industrial centers, Fukouka, the jump-off point in Japan proper for the 120 mile ocean crossing to Korea, and Seoul, the capital of Korea.

Twelve Fokker monoplanes, purchased in the United States and Holland, were used on the routes.

The new aerodrome at Joito, constructed by the government, was completed and opened with a formal celebration May 5. The Japanese Department of Communications undertook the construction of six aircraft radio stations along the principal route to aid pilots in navigating their course.

Latvia

The German-Russian "Deruluft" company resumed service between Koenigsberg, Riga and Moscow as well as Riga, Tallinn and Leningrad May 15, using Junkers metal planes, but was forced again to discontinue the service October 31 because of unfavorable weather conditions. Aside from the activities of the German-Russian line, which merely solicited traffic in Latvia, the republic had no civil or commercial aviation of its own.

The Latvian army under the supervision of the War Department operated from a single base at Riga and had 45 airplanes in service during the year. The navy under the supervision of the Coast Defense branch of the War Department had 12 airplanes in use. The most notable achievements of the services during the year were the army's cross country flight from Riga to Warsaw, and the navy's flight from Libau to Stockholm to Helsingfors and back to Stockholm.

Mexico

Mexico's commercial air lines experienced a period of expansion during 1929 greater than during any similar period in their history. New mail and passenger routes were established between Mexico City and Ciudad Juarez, August 17; Mexico City and Torreon, October 1; Guadalajara and San Luis Potosi, October 1; Mexico City and Tia Juana, with stops at Guadalajara, Tepic, Mazatlan, Navajoa, Empalme, and Nogales, August 21; San Luis Potosi and Torreon, October 1; and Vera Cruz and Guatemala, October 9.

All air mail routes were operated on contract by private companies, two of them American, except one official route between Mexico City and Nuevo Laredo. Other private routes in operation in addition to the new ones opened included: Mazatlan and Matamoros; Mexico-Tampico to Matamoros; Tampico to Tuxpan; and Ciudad del Carmen to Merida, Yucatan. Lines between Ensenada and Mexico City, Manzanillo and San Luiz Potosi, Mexico City and Suchiate, and Acapulco and Mexico City were to be opened in 1930.

The Mexican Aviation Company, a subsidiary of Pan American Airways, Inc., owned by American capital, inaugurated air-rail service between Mexico City and New York September 9, in co-operation with S. A. T. Flying Service, Missouri, Texas and Kansas Railway, Universal Aviation Corporation and New York Central Railroad. The trip north was made in 49 hours and the southern schedule provided for 57 hour service. The two American companies, Mexican Aviation Company and Pickwick Latin American Airways, Inc., operated the principal routes throughout Mexico although another company, the Corporacion Aeronautica de Transportes, operated aerial service out of Mexico City.

The government designated Matamoros, Nuevo Laredo, Piedras Negras, Ciudad Juarez, Nogales, Mexicali, and Tijuana as international airports of entry. Immigration, sanitary and customs officers were stationed at these points.

The government continued the development of its military air force, purchasing equipment from American manufacturers. The Chance Vought Corporation sold a fleet of Vought Corsair observation-fighting planes to the government while revolutionary disturbances were in progress in the country. The military planes of the Mexican Air Force figured in several of the skirmishes against the rebels.

Netherlands and Netherlands East Indies

The Royal Air Navigation Company (K.L.M.) opened fortnightly service between Amsterdam and Batavia in the Netherlands East Indies

over one of the longest air routes in the world. The schedule provided for from 10 to 14 day service by way of Irak, India, Siam, Sumatra and Java. A fleet of four tri-motored Fokker monoplanes were used in the service, which was supported by government subsidy.

During the six months ended May 1, 1929, aircraft employed by the K.L.I.M. in the Netherlands Indies flew 119,000 miles and carried 6,002 passengers. The flights were made over the Batavia-Semerang and Batavia-Bandoeng routes. K.L.M. inaugurated a new service between Berlin, Rotterdam and London May 15 in direct competition with the German Luft Hansa. Fifteen-passenger Fokker monoplanes were used on the route. Previously the route had been operated by the K.L.M. in co-operation with the Luft Hansa.

Other routes operated by K.L.M. during the year included: Amsterdam-Rotterdam-London; Amsterdam-London; Amsterdam-Rotterdam-Brussels-Paris; Amsterdam-Rotterdam-Paris; Amsterdam-Rotterdam-Brussels; Amsterdam-Hamburg-Copenhagen-Malmo; Brussels-Paris; Lympne-Ostende (newspapers only); and Amsterdam-Bremen-Hamburg.

New Zealand

While there were no regular air line services operating in New Zealand during 1929, sufficient capital was subscribed for the formation of the New Zealand Aerial Services, Ltd., which planned services for 1930.

The New Zealand government encouraged the development of light airplane clubs and 21 organizations were formed during the year. The outstanding clubs were at Blenheim, Auckland, Christchurch, Hastings and Wellington. Many of the clubs had their own landing fields, hangars and other facilities. The government provided each club of 30 members or more with two light airplanes of the Moth type and provided for the payment of $150 for each private pilot trained. It further stipulated, however, that no club should collect such a subsidy to exceed $2,500 per year.

Nicaragua

Nicaragua was afforded regular air mail service through Pan American Airways, Inc., which touched Managua on its route between Miami and the Canal Zone. Three planes weekly left Managua for the south, and two for the north. Plans for passenger service over the route were included in the company's 1930 program.

The government of Nicaragua owned no aircraft for military pur-

poses. Two small planes owned by the government and used largely for military purposes during 1926, 1927 and 1928, were decommissioned in the latter year and were accidentally destroyed by fire. The Aircraft Squadron attached to the Second Brigade of the United States Marine Corps was on duty in Nicaragua throughout the year. There was no aircraft owned by commercial or private interests in Nicaragua.

Norway

Air mail service between Oslo and Malmo was inaugurated May 30 with two Moth airplanes operated by Halle and Peterson, contractors to the government. The service connected with the Stockholm-Malmo-Western European routes, but was discontinued after an experimental period of one month.

The regular passenger service between Oslo and Malmo was maintained by the German Luft Hansa in co-operation with the Norske Luftruter of Oslo. An air mail route between Oslo and Stavanger (Norway) was proposed to cut the time for transportation of mails from 24 hours to five hours.

The German Reichstag approved an air traffic agreement between Norway and Germany May 29 which laid down the regulations for all traffic between the two countries.

Panama

Pan American Airways, Inc., served the Republic of Panama and the Panama Canal Zone with regular mail service during 1929, carrying 644 pounds of mail originating in the Republic of Panama between January and October and 2,941 pounds of mail originating in the Canal Zone. Connections were made with all South American cities on the Pan American route as well as the United States.

The Isthmian Airways, Inc., operated two Hamilton eight place seaplanes (Pratt & Whitney Wasps) and a Travel Air biplane (Wright Whirlwind) seaplane on regular service across the isthmus between Balboa and Panama and Cristobal and Colon. The company was capitalized at $100,000 and planned an extension of its service in 1930. Two pilots and a ground staff of ten maintained the service, which afforded transportation for 3,500 passengers over a total of 62,000 miles during the year. Express totaling 85,000 pounds also was carried.

The United States Army and United States Navy both operated bases in the Canal Zone, which was the scene of the navy's winter maneuvers described in the chapter on "Military Aviation."

Paraguay

The Compania Aéropostale Argentina inaugurated regular air mail service between Buenos Aires and Asuncion, Paraguay, on March 22. The firm planned the development of mail and passenger lines within Paraguay to link the capital with such remote cities as Concepcion, Bella Vista, and the ports of the Chaco.

The New York, Rio and Buenos Aires Line inaugurated regular service between Buenos Aires and Asuncion, November 29.

Persia

The progress of aviation in Persia during 1929 was signalized by three important events: extension of the air service between Teheran and Kasr-i-Shirin, on the Iraq frontier, directly to Bagdad; inauguration of the British Imperial Airways route across South Persia from Baghdad to Karachi with stops at Bushire and Jask; and the passing of the one million kilometer mark in the total mileage piled up by the Junkers Luftverkehr Persien, the German company holding a monopoly on civil aviation in Persia.

Expansion of air traffic in Persia was retarded until 1929 by refusal of the Iraq authorities on the one hand to grant Baghdad as a terminus for the Teheran service, and of the Persian officials on the other to allow British planes to land in the south. In April, negotiations were concluded which revealed mutual concessions, with immediate and significant results.

The flight from Teheran to Baghdad took but six hours as compared with three and a half days by train and motor; while India is within easy reach of Baghdad—and thus of Europe—via the Persian coast. At both Baghdad and Bushire, the planes of the Junkers service and the Imperial Airways connect on schedule, forming the ground work for a system of communications which was destined to play a leading part in those lands of magnificent distances and slow transport.

It was exceedingly difficult to obtain any accurate information on the air strength of the Persian army, since such data was guarded as a secret. However, it was known that at least six Junkers monoplanes were in use during 1929, two of which were used for training, two for observation purposes, and two as transport planes.

Peru

The Peruvian Army and Navy Air Services were provisionally combined into one service February 22, 1929, the final consolidation to take

effect January 1, 1930. The combined service was under the direction of the Minister of Navy and Aviation. The army section was located at Las Palmas and the naval section at Ancon. The latter was under the direction of Commander Ben H. Wyatt, a member of the American Naval Mission. All air service in Peru—military, naval and commercial—was under the supervision of Capt. Harold B. Grow, a member of the American Naval Mission. The army had five airplanes and the navy eighteen. The Bellanca monoplane flown by Capt. Carlos Pinillos from Lima to Para and later from New York to Lima was also in use in Peru.

The Peruvian naval aviation operated a passenger and mail service in the interior between San Ramon and Iquitos. Five Keystone planes carrying two passengers each were used in this service. The schedule called for bi-weekly flights over the 650 mile route.

The Peruvian Airways Corporation, a subsidiary of the Pan American-Grace Airways, Inc., and the Fawcett Aviation Company, controlled by the American Curtiss interests, operated regular service in Peru during 1929. The former had eight planes and six pilots in the country, and the latter had three planes and three pilots. Pan American Grace Airways, Inc., carried mail from the United States down the coast of South America through Peru to Santiago and then across the Andes to Buenos Aires, affording Peru the benefits of this service. The Fawcett Aviation Company operated over virtually the same interior routes maintained by the Peruvian airways.

With the exception of two obsolescent planes of British manufacture and two German planes held in reserve at Las Palmas, all aircraft operated in Peru was of American origin.

Philippine Islands

The Public Service Commission of the Philippine Islands granted the newly formed Aviation Corporation of the Philippine Islands a certificate of public service and convenience during 1929 and removed the last barrier to the carrying out of an extensive program of air lines of the islands.

Officials of the company announced that 4,000,000 pesos would be expended for the purchase of a fleet of 20 planes, 12 of which were to be of the land plane type, two flying boats and six amphibians. The first line planned for operation would connect Manila, Iloilo, Cebu and Davao. Plans included later extension of the lines to China and Australia.

Poland

Several semi-private air transportation companies were in operation in Poland until January 1, 1929, when the government decided that an all-government organization should be formed to replace the subsidized companies. The concessions to the semi-private companies were annulled January 1 and the new organization known as the Linje Lotnicze "Lot" was formed taking over the lines formerly covered by Aerolot, Aero, and lesser concerns. Paid in capital of "Lot" amounted to 8,000,000 zlotys (zlotys equal to 11.2 cents) of which 60 per cent was controlled by the Ministry of Communications and the remainder divided among autonomous community governments.

The new organization maintained service throughout 1929 between Warsaw and Danzig; Warsaw-Poznan; Warsaw-Katowice; Warsaw-Lwow; Krakow-Katowice; Katowice-Brno-Vienna; Katowice-Vienna; Katowice-Poznan; and Poznan-Bydgoszcz-Gdansk. Aside from these, "Cidna" operated a line from Warsaw to Paris by way of Prague. The largest airports were at Warsaw, Lwow, Poznan and Katowice.

While the Polish government kept statistics on military aviation secret, some conception of the size of the Polish military establishment for air can be obtained from the expenditures provided in the budget for the fiscal year, ending March 31, 1931. The total military aviation expenditures were 21,854,147 zlotys. There were approximately 150 pilots in the military service.

Porto Rico

Porto Rico was served during 1929 by a regular mail and passenger line from the United States operated by Pan American Airways, Inc., which took over the West Indian Aerial Express, Inc. San Juan was used as the terminus of one of the Pan American Airways divisions.

Portugal

The Servicos Aereos Portugueses, affiliated with the German Junkers interests, operated the only air line in Portugal, between Lisbon and Madrid. Two French lines, Aéropostale and the Gnome Aerodrome Company, sought concessions for the establishment of air lines into Portugal. The competition between these three companies for exclusive rights to operate within the country somewhat retarded the natural development of new lines, pending a settlement of the problem. In September, the Portuguese government advertised for bids offering a thirty year exclusive concession for the transport of goods by air.

Announcement of the outcome of the request for bids had not been made when the year closed.

Rumania

New passenger and mail air services were inaugurated in Rumania during 1929 between Bucharest and Galatz, one hour and fifty minutes; Galatz and Issay, one hour and fifty-four minutes; Issay and Czernowitz, one hour and thirty minutes; Bucharest and Sibiu, two hours and five minutes; Sibiu and Cluj, one hour and five minutes. Army planes and pilots were used exclusively and fares slightly lower than first class railway fares were in force.

Lines connecting Bucharest and Constantza, Cluj and Oradea Mare, Chisinau, Galatz and Constantza, and Galatz and Chisinau were contemplated.

El Salvador

Pan American Airways, Inc., provided tri-weekly service for passengers and mail to Guatemala, Mexico and the United States in the north and Honduras, Nicaragua, Costa Rica and Panama in the south. Pickwick Latin American Airways maintained irregular passenger service during the year between El Salvador and Guatemala.

There were eight officers and twenty enlisted men in the military aviation establishment of the country, which operated six planes, three of which were of an obsolete type. The government appropriated $28,150 for military aviation in the fiscal year ending June 30, 1930.

Siam

The interior of Siam, unpenetrated by roads or railroads, has been served by airplanes for six years. During that period, 244,184 miles were flown, 3,697 passengers carried, 17,086 bags of mail transported and 64,711 tons of merchandise carried. The services were maintained principally in the northeast provinces.

The Siamese army maintained an air service branch and sent representatives to America during the year to study methods in the United States and consider the purchase of American equipment. Two Curtiss Hawk pursuit planes were purchased for the army during the year and a contract was made providing for the manufacture of Curtiss Hawks in Siam under license, using American water cooled engines.

Spain

Mail for international air transportation was accepted in Spain during the latter half of 1929 for dispatch to the following countries: Austria, Belgium, Bulgaria, Czechoslovakia, Denmark, England, France, Germany, the Netherlands, Hungary, Poland, Rumania, Sweden, Switzerland, Turkey and Yugoslavia. The service was started by the postal authorities June 1, 1929, following authority contained in a Royal Decree of December 31, 1928.

The Union Aerea Española air service was continued between Madrid and Seville, Madrid and Lisbon, and Seville and Lisbon. The government made available national subsidies July 17, 1929, providing 1,000,000 pesetas for the promotion of airport construction in Madrid, Barcelona, Valencia, Mulaga, Burgos, Irun, and Vigo.

A new service between Seville and Grenada was inaugurated March 24 by the Union Aerea Española. The construction of aircraft in Spain was stimulated considerably during the year. In 1923, 40 domestic planes were produced and 280 purchased abroad. In 1929, 113 planes were manufactured in Spain and only two purchased in other countries.

Plans for a dirigible service between Spain and South America were carried a step farther through the issuing of a new decree providing a subsidy for the operation of a route between Seville and Buenos Aires. Reports from Madrid during the year described the construction of a monoplane carrying fifty passengers by the Aeronautical Construction Company of Getafe. The planes, to be powered by six engines of 750 horsepower each, were not ready for test flights when the year ended.

Straits Settlements

There was no regular air service in the Straits Settlements during 1929, but plans were made for a service over a 1,000 kilometer course between Meester Cornelis in Java to Tel. Betong on the Sumatra coast, and over water to Singapore. Tri-engined Fokkers were to be used in carrying passengers and express over the route.

An airplane club was established during the year in the Federated Malay States to encourage the development of aviation among sportsmen.

Sweden

The Aktb. Aerotransport (Swedish Air Transportation Company) continued to be the only commercial aviation company in Sweden during 1929. The Royal Swedish Government maintained a subsidy fund from

which this company was entitled to receive up to 500,000 crowns per year. From January 1 to October 12, 1929, 300,490 kilometers were flown, 6,200 passengers carried, 59,400 kilograms of mail transported, and 80,000 kilograms of baggage and freight carried.

In co-operation with the Finnish commercial aviation company, Aero O/Y, the German Luft Hansa, and the Dutch K.L.M. lines, the Swedish Air Transportation Company operated lines from Malmo to Amsterdam, Stockholm to Helsingfors, Stockholm to Berlin, Stockholm to Abo, Malmo to Berlin, Kalmar to Danzig, and Kalmar to Lubeck.

Switzerland

Basel, Geneva, Zurich and Berne became the centers of Swiss aeronautic activity in 1929, the first mentioned city being a stop on most of the principal airways which crossed and recrossed Europe. The new London to Karachi, India, service made Basel a regular stop. Mail could be sent by air to practically every country in Europe.

The principal international routes in which Swiss air companies actively participated included: Geneva to Budapest; Basel to Breslau; Zurich to Amsterdam; Zurich to Copenhagen; and Basel to Barcelona. At each of these terminals connections were made with other companies offering service on regular schedule to all parts of Europe.

The number of licensed civil airplanes in Switzerland increased from 43 January 1, 1929, to 55 on July 1. Interest in aviation among private individuals and commercial concerns was growing rapidly.

The Swiss Military Department submitted a project to the government calling for the appropriation of $5,000,000 to make possible a complete reorganization of the military air service, including the purchase of 105 airplanes of the latest type, 60 for bombing and 45 for observation purposes.

Trinidad

Pan American Airways, Inc., provided air mail service for Trinidad as a part of its route between Miami and the British and Dutch Guianas on a tri-weekly schedule. Passenger service was to be added in 1930.

There were no other airplanes in Trinidad and no other contemplated aeronautic activity, commercial or private.

Turkey

Non-military aviation in Turkey during 1929 was confined to the operation of two air lines, the Societa Anonima Aero Espresso Italiana

which maintained a semi-weekly service between Constantinople and Brindisi by way of Piraeus, Greece; and the other the Compagnie Internationale de Navigation Aérienne (French) which operated a service between Constantinople and Paris by way of either Sophia or Bucharest and Belgrade, Budapest, Vienna, Prague, Nuremberg, Frankfort, and Strassburg.

There were no privately owned planes in Turkey. Numerous sections of the country had been marked off as forbidden military zones and this fact had no small influence upon the curbing of private aeronautical activity.

Military aviation in Turkey was under the supervision of the Ministry of National Defence. The government maintained a rigid censorship on all matters pertaining to the conduct of its affairs. A Turkish Mission was sent to the United States during 1929 to study American methods and to make recommendations for the purchase of American equipment.

Union of Socialistic Soviet Republics

The total length of Soviet airways was increased during 1929 from 11,971 kilometers to 18,461 kilometers. Three new lines were started during the summer, of which the Moscow-Irkutsk line, 4,500 kilometers long, inaugurated what will eventually be a direct service from Moscow to China and Japan.

Thirteen air lines provided passenger, freight and mail service in the Soviet Union during 1929. Most of the lines operated throughout the year with the exception of the Moscow-Berlin, Leningrad-Riga, and Moscow-Irkutsk lines which were in service only from May until December. Although several radiated from Moscow, the capital, most of them provided service to the outlying regions such as the Caucasus and the Central Asiatic Republics. The Moscow-Berlin line was operated by a joint German-Russian company, "Deruluft," on daily schedule.

Other important lines starting from Moscow connected the capital with Piatigorsk in the Caucasus, and Baku, the Soviet oil center in the Transcaucasian Republics. Both lines were operated by the Ukranian Airways Company, Ukrvozdukhput, and made flights daily beginning in May. Flights from Baku to Pekhlevi in Persia were made once a week. The Moscow-Irkutsk line was operated by the third Soviet airways company, the "Dobrolet," which confined itself mainly to Siberia and Central Asia.

Plans for 1930, according to the Amtorg Trading Corporation in the United States, included new lines totaling 7,000 kilometers. It was

estimated that 11,200 passengers were carried by the air lines in the Soviet Union during 1929, and plans for 1930 were laid on the basis of more than double that passenger traffic.

The Moscow to New York flight carried out by four Russian fliers stirred public enthusiasm for aviation in the Soviet Union and was responsible for increased traffic on the air lines.

Uruguay

Three companies served Uruguay with air service during 1929. New York, Rio and Buenos Aires Line and Pan American Airways, Inc., maintained mail and passenger service between Montevideo and Buenos Aires, while Aéropostale operated a line from Buenos Aires to Natal, Brazil, stopping in Montevideo en route.

A request for authorization to establish an air mail service in Uruguay with a government subsidy of one-third of the expenses was made by the Aéropostale Uruguata, a Uruguayan corporation capitalized at two million pesos and closely affiliated with the French operating company.

Venezuela

Military aviation in Venezuela was under the control of the Ministry of War and Marine and under the direct supervision of the Director of Military Aviation. The government's policy favored the development of only a small flying corps. Colonel Charles A. Lindbergh made a second visit to Venezuela during 1929, covering a route over which the Pan American Airways, Inc., later plan to establish regular service. Aèropostale made some trial flights during the year with a French plane between Caracas and Maracaibo, and between Maracay and Ciudad Bolivar.

Yugoslavia

The Yugoslav Air Transportation Company operated a mail, passenger and express service between Belgrade and Zagreb, 235 miles, during 1929 and the Compagnie Internationale de Navigation Aérienne maintained daily service from Belgrade to Paris, and three times a week between Belgrade and Constantinople. The Yugoslav government made provisions during 1929 which would exempt aviation companies from taxation for 25 years.

CHAPTER XIX

TRENDS IN DESIGN

WHILE the major trend during 1929 was toward the refinement of established designs, there were some interesting departures from the conventional which possibly forecast the direction of future development.

The phenomenal growth of the air transport lines brought increased activity in the building of super-transports and in the design of flying boats and amphibians. Safety devices, employing changes in design or instrument navigational aids, were perfected. Researches for strong metal alloys were productive, and had an important influence on the trend of both aircraft and engine designs. The aircraft engine and propeller fields witnessed some marked advances which were certain to aid in bringing out the full capabilities of the airplane. The major portion of this chapter will be devoted to these lines of activity rather than to a detailed review of the changes made by each manufacturer on his product.

The greater attention paid to the planning of fine interiors for both private and transport planes has already been mentioned in the chapters on "Air Transport Progress" and "Private Flying." Engineers sought to develop craft for specific purposes, building planes especially for mail carrying, light transport, heavy transport, or other specific needs. It reversed the old order in which the operator adapted what planes were available to his specific use.

The chapter on "Aircraft Manufacturing" indicates clearly the large number of manufacturers producing planes for specific purposes, and the section immediately following this chapter provides three view drawings of airplanes produced in each classification as a graphic illustration of this trend. In the light transport, mail transport, aerial service and private craft fields, the trend in design was along established lines generally familiar to the public. An attempt will be made, therefore, to include in this chapter only those developments which marked a departure from familiar practice.

Perhaps the most spectacular achievements in heavier-than-air design during 1929 were to be found in the super-transport field, where planes doubling, tripling and even quadrupling the size of those in general use on the air lines, were successfully produced and flown. From an economic standpoint, the developments in this field were of the utmost significance. They pointed the way to even larger planes of greater

efficiency, capable of carrying huge loads at a lower unit cost. Air transport economists agreed that the super-transport should remove the one obstacle in the way of extensive air line development—necessarily high tariffs.

While the 20 to 100 passenger transport meant a larger outlay of capital at the beginning of operations, there were other compensating factors which promised to justify its use and ultimately result in the lowering of tariff rates. Operating costs per mile were necessarily higher. The giant plane required greater relative horsepower per pound of load, but had the advantage of being able to carry greater useful loads because higher wing loadings were made possible. The additional pay load, especially when utilized over long distances with a reasonably large volume of traffic, increased the earnings of the plane and offset the additional outlay of capital at the beginning of operations and the necessarily higher operating costs.

Seven giant transports, four of them produced in the United States, were developed during 1929, undergoing extensive tests which proved their capabilities for regular operations. They weighed from seven to fifty-six tons when fully loaded, veritable liners of the air, exceeding the most fanciful dreams of a decade ago.

Fokker Aircraft Corporation of America produced a 32 place monoplane weighing more than eleven tons fully loaded, known as the F-32. It was the largest land plane yet to be developed in America. Consolidated Aircraft Corporation perfected the Commodore, a 32 place flying boat weighing nearly nine tons when loaded, the largest plane of its class to be produced in the United States. Boeing Airplane Company developed the Boeing 80-A; Curtiss Aeroplane and Motor Company, the Condor Transport; and Keystone Aircraft Corporation, the Patrician. These were 21 place land transports, weighing from seven and one-half tons to nearly nine tons when fully loaded.

In Europe, the Dornier Works introduced the 112 place DO-X, the world's largest heavier-than-air craft to date; while Junkers developed the G-38, the world's largest land plane, Rohrbach brought out the Romar, a giant flying boat. A better conception of the comparative sizes of these air leviathans can be gained by studying the table on an accompanying page, which shows the approximate specifications of these seven planes and their performance characteristics. It shows clearly the greater aerodynamic efficiency that has been gained in the super-transport and the resulting higher wing loadings made possible. While statistical information on these planes has been compiled in the table for quick reference, it is interesting to consider some of the unique features in design, construction and accommodations of these new giants.

The DO-X, built in accordance with the theories of Dr. Claude

SUPER-TRANSPORTS PRODUCED IN 1929

The following table gives the approximate comparative specifications and performance characteristics of eight huge airplanes developed during 1929

Information was furnished by manufacturers or taken from technical journals

Name of Plane	*DO-X*	*G-38*	*Romar*	*Commodore*	*F-32*	*Condor*	*Patrician*	*Boeing 80-A*
Overall Span (feet)	157	147.5	121	100	99	91.67	88	80
Overall Length (feet)	131	75.5	72	61.75	69.8	57	63	55
Height (feet)	31	16	28.8	16	16.5	16.5	13	15.2
Wing Area (square feet)	5,034	....	1,850	1,100	1,350	1,271	930	1,250
Weight Empty (pounds)	56,557	28,600	22,000	9,700	13,800	11,352	8,925	10,417
Useful Load (pounds)	56,843	24,200	15,000	7,900	8,700	6,026	6,390	7,083
Gross Weight (pounds)	113,300	52,800	40,000	17,600	22,500	17,378	15,315	17,500
Wing Loading (lbs./sq. ft.)	22.6	....	....	15.8	17.92	11.50	16.3	14.
Power Loading (lbs./h.p.)	....	22.	....	15.1	10.73	14.47	9.8	11.6
Fuel Capacity (gallons)	4,230	2,930	2,000	650	700	278	325	500
High Speed (m.p.h.)	150	150	130	118	157	139	151	138
Cruising Speed (m.p.h.)	115	125	112	110	120	118	125	115
Landing Speed (m.p.h.)	65	70	74	55	50	49	55	55
Take-off (seconds)	28	10	....	55	15	15	13	11
Rate of Climb (ft. per min.)	800	....	....	750	1,200	870	1,450	850
Service Ceiling (feet)	17,000	10,000	9,000	17,000	18,000	17,000	17,400	14,000
Cruising Radius (miles)	2,600	2,170	2,175	1,000	480	507	750	518
Number of Engines	12	4	3	2	4	2	3	3
Total Horsepower	6,000	2,400	1,650	1,050	2,100	1,200	1,575	1,575
Place (Pass. and Crew)	112	....	23	32	32	21	21	21

Dornier, who came to the United States late in the year to become associated with General Motors in the building of flying boats, demonstrated itself to be a radical improvement in efficiency. It was said to carry one pound of useful load for every pound of its own weight. It had a high speed of 150 miles an hour and a cruising speed of 115. It was a semi-cantelever high-wing monoplane with stump wings projecting from the hull, bracing the wings with three oblique struts of high tensile steel. The wing covering was not attached permanently to the spars and ribs, but consisted of stiff self-contained metal plates which were attached to the wing frames in such a way that they could be easily detached. The hull had a total volume of 14,000 cubic feet and was divided into three decks. Fuel, freight, baggage, provisions, tools, accessories and equipment were stored in the lowest. The middle or main deck, 64 feet long, was reserved for passengers' parlors, entertainment rooms, and sleeping compartments. The upper deck contained the pilots' and navigation rooms. Twelve Siemens and Halske Jupiter engines, producing 6,000 horsepower, were mounted in tandem pairs above the high monoplane wing. All motor control units could be inspected and repaired in flight. Starting of the engines, regulation of the revolutions, oil pressure and temperature were controlled by an engineer assisted by four mechanics in the engineer's room. The pilot controlled all engines by a single throttle. A commander and first officer directed the course of the ship and gave orders to the crew, including the pilot. While designed to accommodate 100 passengers and a crew of 12, the DO-X carried 169 on a one hour test flight during the year.

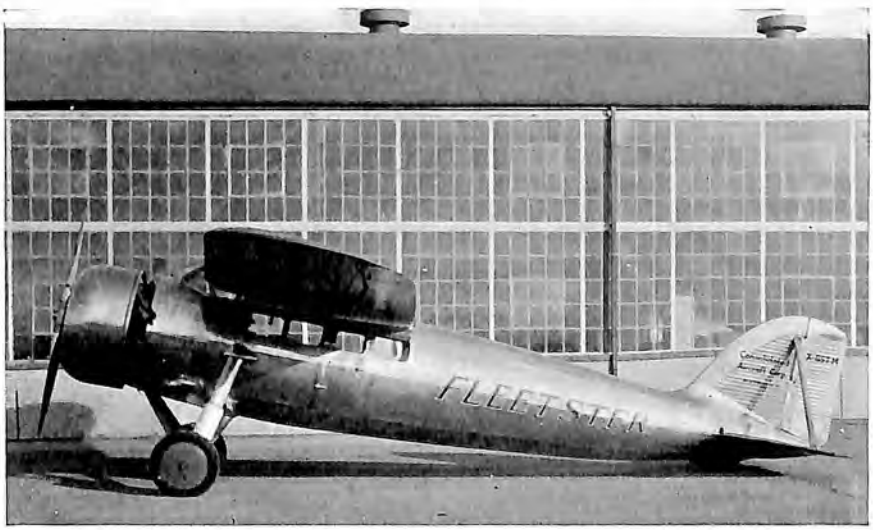
The Junkers G-38, of all-metal duralumin construction, was of the type known to German engineers as the "shoulder decker," deriving its name from the fact that the wing is attached near the top longerons. Passenger accommodations were partly in the fuselage and partly in the inner wing roots. Four Junkers engines developing 2,400 horsepower were faired into the monoplane wing.

The Rohrbach Romar, an all-metal flying boat, demonstrated the possibilities of the super-transport in carrying greater payloads when it established a new world record by climbing to 6,500 feet with a seven ton load, which could be likened to 86 passengers or 322,500 ordinary letters. It was a monoplane of characteristic Rohrbach construction powered with three 550 horsepower engines.

The Fokker F-32 followed the lines of standard Fokker designs, but included some new features in the mounting of four Pratt and Whitney Hornet engines in double tandem on either side of the fuselage. The monoplane wing was all wood, veneer-covered, and of the full cantilever type. The fuselage, tail surfaces and landing gear were of tubular steel construction. The front engines were equipped with two bladed

240 MILES AN HOUR

Travel Air (Wright Whirlwind) "Mystery Ship," perfectly streamlined and equipped with N.A.C.A. cowling, was one of the sensations of the National Air Races. Its best time was 240 miles an hour.



ALL METAL MONOPLANE

The new Consolidated (Pratt and Whitney Hornet) Fleetster is constructed of metal and carefully streamlined to increase its speed. It accommodates eight.

adjustable metal propellers and the rear engines with three bladed adjustable metal propellers. Its spacious cabin was divided into four sections, the interiors of which were finished in mahogany and light pile fabric, with four glass windows in each section. Two fully equipped lavatories, compartments for mail and baggage, and galleys for the steward by day and the porter by night were provided. As a day plane carrying 30 passengers, the F-32 had a cruising range of four hours, 480 miles. As a night plane sleeping sixteen passengers in full size berths, its cruising range was seven hours, 850 miles. Running at full throttle on its first public flight, the F-32 flew 157 miles an hour, although it was designed for 140 miles an hour. Its landing speed, designed for 60 miles an hour, was found to be 47 on the test flight. The landing gear was of the divided type, with axles hinged to the bottom of the fuselage. Its roller bearing wheels with internal expanding brakes were fitted with 58 by 14 inch tires. The ship was placed in production with a fleet of five to be delivered to Western Air Express on its western transport routes.

The Consolidated Commodore, a 20 to 32 passenger flying boat, was developed from the Navy patrol boat, XPY-1. The hull, floats, wings and empannage were constructed of extruded duralumin shapes and duralumin sheets. The wing-hull bracing consisted of dural tubular struts, with the exception of the horizontal front struts which were heat treated alloy steel. The engine mounts, carrying two Pratt and Whitney Series B Hornets rated at 575 horsepower each, were constructed of welded alloy steel tubing. All fittings at critical points were made of heated alloy steel. The wings and empannage pieces were covered with fabric. Passengers were carried in three compartments, the two forward ones accommodating eight people each and the aft compartment accommodating four. Each seat was individual, richly upholstered, and provided with life preserver cushions. The compartment immediately aft of the control cockpit comprised a lavatory, radio room, and store room for mail and baggage. The Commodore was being manufactured on a production basis to provide a fleet of the giant flying boats for the seven day service between New York and Buenos Aires, planned for the New York, Rio and Buenos Aires Line.

The Curtiss Condor, a 21 place land transport, was developed from the Condor B-2 bombing plane to meet the demands for larger transports on the major air lines. It was powered with two Curtiss geared Conqueror water cooled engines faired into nacelles between the biplane wings on either side of the fuselage, and was designed to support its total weight on either power unit. It demonstrated its ability to climb and maintain altitude of more than 5,000 feet in a test flight with a full load

of 17,378 pounds. Two three bladed propellers were driven by the engines. The spacious cabin provided luxurious chairs for 18 passengers in rows of three opposite large windows. Soundproofing and vibration dampening of the cabin were made possible by leaving a three inch air space between the inner and outer walls, which was double lined with sound and shock absorbing material. For night flying, the Condor could be converted into a sleeping plane with twelve full size berths. All baggage was carried in two metal-lined compartments, one in each outboard engine nacelle aft of the gas tanks. The huge wing surfaces of the biplane gave it an unusually low landing speed of 49 miles an hour, or less. The first two Condor Transports were placed in service by Transcontinental Air Transport, Inc., on its eastern division.

The Boeing 80-A also was a biplane equipped for 18 passengers and a crew of three. It was powered with three Pratt and Whitney Hornet engines of 525 horsepower each, two carefully streamlined into nacelles on either side of the wing and one on the nose, equipped with N.A.C.A. cowling to increase the speed to 138 miles an hour. It included such modern travel conveniences as hot and cold running water, heating and ventilation, reclining chairs, individual electric lights and soundproofed walls and ceiling, made of Honduras mahogany plywood with a core of Balsawood. The plane had an actual pay load of 4,057 pounds and weighed 17,500 pounds fully loaded. It took off in eleven seconds and climbed at the rate of 850 feet per minute. A fleet of twelve of these huge transports was produced during the year, the majority of which were to be used on the twenty-hour Boeing Air Transport passenger service between Chicago and San Francisco in 1930.

The Keystone Patrician, developed from experience gained in the production of giant bombing planes, was first introduced in 1928, but it underwent extensive tests during 1929 in service on regular transport routes and on experimental flights. Some refinements were made in the last units of this model produced for use by Transcontinental Air Transport, Inc. Another one had been in service between New York and Boston on the Colonial Air Transport line. It was a semi-cantilever type monoplane, with fuselage members, tail surfaces, and wing section structures including the outboard engine mounts of chrome molybdenum tubular steel welded to form rigid truss work without wire bracing. All fittings were alloy steel, welded and heat treated. Outer wing panels had box spars and wood ribs. Compression ribs were built up of welded alloy steel. The power plant consisted of three Wright Cyclone engines, each furnishing 525 horsepower, to give the ship a rated top speed of 151 miles an hour. Low power loading, 9.7 pounds per horsepower, was designed to enable a quick takeoff and high rate of climb.

Flying Boats and Amphibians

Development of flying boats and amphibians for both commercial transport and private operations took on a new aspect in the United States during 1929. Commercial aviation had been slow in utilizing the nation's natural airways—rivers, bays, lakes and seas—principally because it had not adapted the flying boat and amphibian to its purposes. However 1929 saw unprecedented activity in this field.

The flying boat, and its closely related type, the amphibian, offered many advantages to the designer. To take-off quickly from relatively small fields, the land plane must preserve a balance between horsepower and surface loading which results in a rapid increase in structure weight after a certain size is reached. The flying boat escapes this difficulty by increasing the minimum speed and decreasing the angle of climb. Because waterways offer almost unlimited room for maneuvering before and after taking-off, the flying boat could be designed with a higher landing speed than was possible with land machines of the same size, which must consider the possibility of climbing into and out of restricted airports and emergency fields. There was no need to design the flying boat to climb quickly or attain great altitudes, thereby making possible higher wing loadings—the proportion of weight to wing area—and greater weight per horsepower. The high efficiency of the types perfected during the year was worthy of remark. Increased carrying capacity meant more profitable operation.

In the transport field, the 20 to 32 place Commodore has already been described. The American Aeronautical Corporation was building a 16 place double-hulled flying boat under its rights to the Savoia-Marchetti patents of Italian design. The S-55, as the huge boat was called, had a span of 78 feet 9 inches, an overall length of 54 feet, and was 16 feet 5 inches high. Its maximum speed at sea level was 134 miles per hour, with a cruising speed of 106 miles per hour. It landed at 62 miles an hour, and had a service ceiling of 9,900 feet. The wing load was 13.4 pounds per square foot and the power loading 15.55 pounds per horsepower. Two Wright Cyclone or Isotta Fraschini engines, with a total of 1,050 horsepower, were used in the power plant.

Sikorsky Aviation Corporation continued the production of its S-38 sesqui-plane amphibion with some refinements. It was a 10 place ship, powered with two Pratt and Whitney Wasp engines mounted in nacelles above the cabin. It had a span of 71 feet 8 inches, length of 40 feet 3 inches, and weighed about five tons fully loaded. Its wing loading was 13.88 pounds per square foot and its power loading 12.5 pounds per horsepower. It had a high speed of 125 miles an hour and cruising

CURTISS TANAGER

Equipped with "slots" and "spoilers," the Curtiss (Curtiss Challenger) Tanager was entered in the Guggenheim Safe Aircraft Competition.

LIKE A TIRED HEN

Cierva (Genet 100) Autogiro settling to earth like a tired hen as its "windmill" revolves during National Air Races at Cleveland.

speed of 110 miles per hour, landing at 55. Retractable landing gear could be raised or lowered in a few seconds.

Fokker Aircraft Corporation developed the F-11A, an eight place cabin monoplane amphibian with all wood veneer covered wing of the full cantilever type. It had an aluminum alloy hull, with tail surfaces and engine mounting of tubular steel construction. It was powered with a single Pratt and Whitney Hornet or Wright Cyclone engine, providing a high speed of 125 miles an hour and cruising speed of 110 miles an hour. Retractable landing gear made possible land and water landings.

Boeing Airplane Company put its model 204, a six place flying boat powered with a Pratt and Whitney Wasp engine, into production. It had a high speed of 133 miles an hour and landing speed of 59 miles per hour. Weighing 3,352 pounds empty and 5,000 pounds loaded, the boat had a pay load of 913 pounds.

Loening Aeronautical Engineering Corporation, a division of Keystone Aircraft Corporation, improved its Air Yacht, an eight place amphibian biplane, designed for both transport and private operations. It was powered with a 525 horsepower Wright Cyclone engine, and had a power loading of 11.25 pounds per horsepower. The wing load was 11.4 pounds per square foot. It had an overall span of 46 feet 8 inches and a length of 34 feet 8 inches. It weighed 3,950 pounds empty and had a payload of 1,100 pounds, with a gross weight of 5,900 pounds. The XO-10 of similar construction and design was produced for the Army Air Corps with a retractable monowheel landing gear. The single wheel was drawn into a pocket in the main float for water landings.

The Keystone-Loening Commuter proved one of the year's most interesting models introduced to meet the needs of the private owner. It was a four place amphibian biplane powered with a 300 horsepower Wright Whirlwind engine, with a sturdy duralumin hull. Wing spars were of straight-grained spruce with "alclad" ribs, an aluminum alloy developed during the year. The retractable wheels were raised and lowered by a small lever operated pump. It was designed with a turtle deck for the sportsman-pilot, from which the owner might fish or swim, and with a cabin equipped to carry sporting provisions.

Ireland Aircraft, Inc., made marked refinements on its five place amphibian model powered with Wright or Pratt and Whitney engines of 300 and 420 horsepower respectively. It, too, was developed for the sportsman pilot who planned hops to the seashore or mountain lakes, and planned to use the waterways for his airports. Eastman Aircraft Corporation, a division of Detroit Aircraft Corporation, introduced a three place flying boat designed to appeal to the private owner and fly 12 miles on a gallon of gasoline, with a cruising speed of 85 miles an

hour. Cadillac Aircraft Corporation developed the Voyageur, a cabin amphibian for private operations. American Aeronautical Corporation placed its model S-56, an open cockpit biplane amphibian for three persons, in production following the Italian Savoia Marchetti designs. It was powered with a 100 horsepower Kinner engine, with a cruising radius of four and one-half hours, 400 miles, on 29 gallons of gasoline.

The year's development of both giant flying boat transports and small amphibians for private operations forecast even greater activity in this field during 1930, with several established manufacturers planning the design of new ships or improvements on designs in production.

Safety Devices Developed

Engineers continued to devote their attention to new ways of incorporating a greater degree of "foolproof" safety in their designs. The Guggenheim Safe Aircraft Competition had an important influence upon stimulating attention in this field during 1929. The major projects of research centered around fundamental changes in wing design or the perfection of instruments to eliminate the hazards of fog flying.

"Slots," "spoilers" and "flaps" were used on wings to obtain greater efficiency, and at least two attempts were made to perfect a variable camber for wing structures. Each of these devices sought to delay the stalling angle and to maintain maneuverability at extremely low speeds. The "wing slot," which was nothing more than a little airfoil housed in the leading edge of the wing so pivoted that its own forces caused it to move forward when the incidence of the main wing approached 10 degrees, made spins impossible. High speed air forced itself through the opening formed between the little wing and the mother wing, delaying the burble-point of the air along the surfaces until the wing incidence was merely double that of the normal stall. They either opened automatically or were controlled manually by the pilot.

While slots delayed the stall, they made the controls sluggish. To recapture maneuverability interceptor slots or "spoilers" were used to destroy the lifting power of one wing temporarily in order to let it drop level with the other when lateral stability was upset. "Flaps" had a slightly different use. Hinged to the trailing edge of the wings, they resembled ailerons except that they extended the entire length of the wing. They were either automatic or manually controlled, and in some cases were divided with one part automatic and the other manually controlled. Their effect was to pile up pressure beneath the wings, making slower and safer landings possible. The Curtiss Tanager, Handley Page, Fleet, Brunner-Winkle, Ford-Leigh, and McDonnell entries in the Guggenheim contest employed one or all of these aids to increase

stability and maneuverability at low speeds. The Curtiss Tanager was later awarded the $100,000 Guggenheim prize for the "safest airplane." The U. S. Navy under an arrangement with Handley Page carried on extensive experiments with slot wings during the year with marked success. Lieut. Carl B. Harper demonstrated that a Vought Corsair equipped with locked slots could be spun ten times and then brought out of the spin in half a turn after the slots were unlocked.

Experiments with "variable camber" were designed to increase the efficiency of wing structures. Panels in the wings could be operated so that they extended beyond the leading and trailing edges at the will of the pilot, making possible a high camber on the upper wing in taking off, and a reduction of the camber after flying speed was attained. The Vincent Burnelli, Wentworth-Schroeder, and Cunningham-Hall entrants in the Guggenheim contest incorporated some modification of this principle in their design.

While experimentation on the autogiro prior to 1929 was confined to Europe, the year saw considerable improvements made on three American-built autogiros, which convert all the functions of fixed wing flight into moving wing flight in the same way that boat propellers utilize the propulsive principles of the oar. Four vanes revolving around the mast and turned by the force of the air stream bore the burdens of lift. They made possible take-offs in short distances and landings in even smaller areas. The autogiro was able to retain flying speed after its power was cut off, making possible landings at a steeper angle with a minimum forward speed. The Pitcairn-Cierva Autogiro Company with Harold F. Pitcairn as its backer placed great confidence in the possibilities of the autogiro for general, private and commercial use.

Turning to the second field in which engineers sought to find aids to safety, namely, the development of adequate instruments, marked progress was made. Some of the chief developments related to radio have been described in detail in an earlier chapter on "Aviation Radio." It should be interesting to consider here the fog flying experiments carried on by Lieut. James H. Doolittle under the sponsorship of the Guggenheim Fund and the Army Air Corps' test of a "gyroscopic robot" to guide planes in flight without human attention.

With the aid of three instruments not already included on the boards of most planes, Lieut. Doolittle took off from Mitchel Field in a covered cockpit, flew away from the field and returned to it without seeing the ground. An "artificial horizon," a small instrument indicating to the pilot the longitudinal and lateral altitude of the plane with relation to the ground at all times, was substituted for the natural horizon enjoyed in good weather. The direction-finding radio and highly

sensitive altimeter, described in the earlier chapter, completed the additional instruments necessary to accomplish the feat.

The Pioneer Instrument Company, Sperry Gyroscope Company, Consolidated Instrument Company, Taylor Instrument Company, Kollsman Instrument Company, and Bureau of Standards all contributed to developments in the instrument field during 1929 which brought a new measure of safety to flying under all conditions.

The gyroscopic stabilizer or "robot" developed by the Sperry Gyroscope Company was tested by the Army Air Corps on a flight from Dayton to Washington, during which the pilot did not touch the controls. It employed the same principles of the gyroscopic control which pilot ocean liners over long distances of their journey. It automatically compensated for lateral, longitudinal, or horizontal changes in flight. The "robot" kept the plane in level flight on its course without varying to the slightest degree. Weighing less than fifty pounds and easily fitted under the pilot's seat, it opened up great possibilities for increased safety and reliability of operations in fog and all kinds of varying weather conditions.

Metals and Alloys

The metallurgist contributed substantially to the field of aircraft technical development during 1929, his researches into the refinement of light metals and their application to airplane construction influencing the trend in design.

Manufacturers generally had adopted the use of metal tubing for fuselage construction, many used it for rib and empennage structures, and all considered its possibilities for effecting further economies in the construction of other parts. Many considered general use of metals or alloys as necessary to attain mass production, which is of vital importance to the progress of the manufacturing industry. The automobile industry was able to achieve its greatest success only after it used machines for almost every operation and employed metals throughout.

The problems of the aircraft designer, however, were far more complicated than those which faced the automobile designer when he sought methods of speeding up production through the use of metals and machines. In the airplane, unusual strength and exceptional light weight were the qualities which must be combined in any metal or alloy adopted for use. For some time it was believed that the drawbacks and structural weaknesses accompanying the use of metals more than displaced the saving of bulk and weight.

Recent developments, however, have produced newer and better alloys which can be compared favorably with the finest steels. Copper,

manganese, magnesium and silicon when combined with aluminum produce alloys which can be wrought into various shapes and heat-treated to possess many of the qualities of steel with about one-sixth its weight. Braces, control arms, pedals, hinges, and other parts have been manufactured from these alloys—principally duralumin, which is a four per cent copper alloy of aluminum. Where castings for tanks and crankcases were made, the compositions were more intricate. Zinc was found to be important as an adulterant in casting, and iron and copper were incorporated in various grades to complete the compositions.

One of the latest and most promising alloys to be produced is known as alclad. It can be forged quite readily and was used in the manufacture of propellers, connecting rods, and other parts which move at high speed and are subject to crystallization. Alclad has a core of the strong alloys and a surface layer of aluminum of very high purity.

For wing construction, various minor departures from the original duralumin were made. The ribs or lateral members were sometimes cast or forged, although riveting was the dominant method of joining. Welding, though partially successful, had not been generally adopted because it had not yet been adapted to the lighter alloys. New electric welding devices being perfected by several equipment manufacturers, promised to make welding generally possible, even for vital parts.

For fuselage construction, alloys were developed having a larger percentage of adulterants, making them somewhat heavier, but keeping the unit weight well under that of the lightest and strongest steel. Tail surfaces, control wires, aileron arms and similar parts were made largely of aluminum alloy forgings.

The Ford, Hamilton and Thaden planes were continued in production of all-metal construction, using duralumin even for wing and fuselage skin covering, instead of fabric. The Consolidated Commodore employed all-metal construction, and the Fleetster, another Consolidated product, was introduced with a smooth metal fuselage covering instead of the corrugated metal. The Cunningham-Hall Aircraft Corporation used metal to cover the forward part of the fuselage on a new cabin plane introduced during the year. Atlanta Aircraft Corporation reported progress on a new all-metal low wing monoplane, and Lenert Aircraft Corporation used metal throughout its small cabin plane.

The Aluminum Company of America, Bohn Aluminum and Brass Company, Summerill Tubing Company, Aerotrus Products Corporation, and International Nickel Company continued extensive researches into new methods of employing metals in aircraft construction.

Alloys of magnesium, which metallurgists have looked upon as the ultimate in the field of strong light alloys, were reported abroad in engine cylinder construction. Electron, one of the most successful alloys

produced in this classification, was said to have practically all the casting and machining qualities of good iron and steel, and weighed about one-third its iron and steel equivalents.

Continued research in the field of metallurgy was looked upon by many aircraft designers as certain to have some of the most far reaching effects on aircraft design and construction.

Engine Development

The numerous endurance flights with the aid of refueling and other spectacular feats of the year were a greater testimony to the increasing efficiency of the aircraft engine than to any other unit in the airplane. Employment of light metal alloys, refinements in design, improved accessory units, and the development of devices which cut down frontal resistance, contributed to the improvement of engine designs. While the radial air cooled engine held its predominant place in the field, the development of water cooled types continued to keep their possibilities before those designers faced with the problem of employing huge power plants in super-transports or racing planes.

The Curtiss Aeroplane and Motor Company considered the general trend in engine design toward air cooled in-line engines for small, light power plants, and toward liquid cooled Vee types for high powered engines. In both cases, reduced head resistance was the principal consideration. The Curtiss Crusader, an inverted six cylinder in-line air cooled engine developing 120 horsepower, was perfected during the year for the light engine class, and the 600 horsepower Vee Type Conqueror was adapted to the use of Prestone cooling.

The Packard Motor Car Company continued development of its 600 and 1100 horsepower water cooled engines, and concentrated considerable attention on its Diesel type engine. On May 13, the latter engines were flown from Detroit to Old Point Comfort, Va., 700 miles, in six hours and forty minutes with $4.68 worth of furnace oil consumed. It is an internal combustion engine, resembling in outward appearance the gasoline radial type, except that it is simpler and smaller. The engine weighs less than three pounds per horsepower as contrasted with about 100 pounds per horsepower in the ordinary stationary Diesel engine. The reduction of several hundred mechanical parts was effected by eliminating electrical ignition systems, and the hazards of fire reduced through the injection of the oil fuel into each cylinder separately. The Packard Company planned production of the engine by the summer of 1930 in a new plant especially erected for it.

The Pratt and Whitney Aircraft Company improved its Series C Wasp engine, a nine cylinder radial air cooled engine developing 450

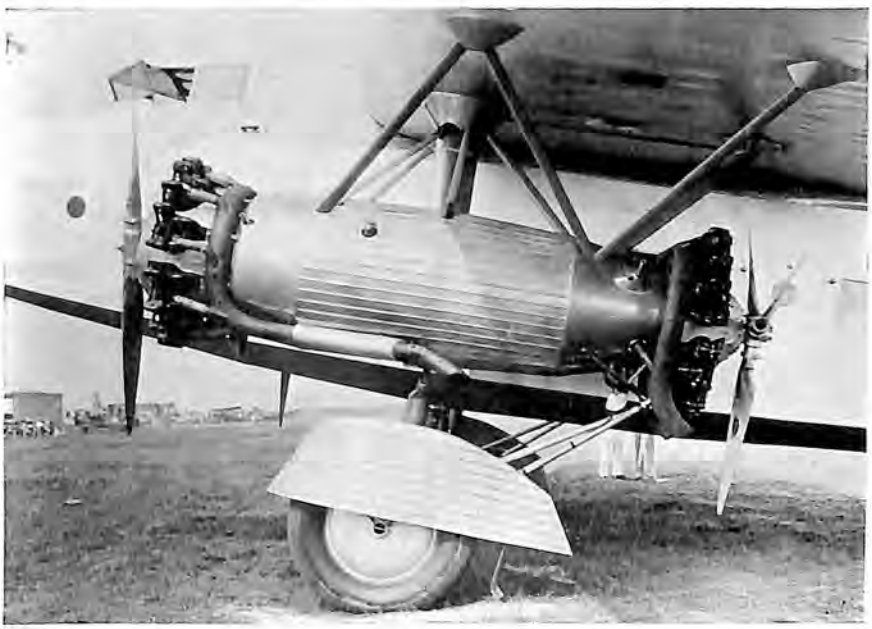
TAIL SKID LAST

Handley Page entry in the Guggenheim Safe Aircraft Competition, equipped with wing slots, takes off.

AMERICAN BUILT AUTOGIRO

Three-place Pitcairn Cierva (Wright Whirlwind) Autogiro with Harold F. Pitcairn in the cockpit, the third machine built in America.

horsepower, by making possible the installation of a supercharger effective to 6,000 feet on stock models. This was achieved by increasing the gear ratio of the induction fan drive. The drive ratio was increased from 7:1 to 10:1. The Series C, which superseded the Series B early in 1929, incorporated an improved cylinder head design, greater rigidity and strength in the crankshaft, a new rocker arm design, and a multiple disc clutch, which relieved the induction fan drive of accelerating and decelerating stresses through the addition of more plates. Steel forgings



DOUBLE TANDEM ENGINES

A departure from the common engineering practice, the double tandem Pratt and Whitney Hornet engines of the new Fokker 32-passenger plane represented one of the year's most interesting developments.

were used for all gears. A nose section, formerly cast, was made from a duralumin forging to increase its strength and decrease the weight. Considerable attention also was paid to the development of cowling adaptable for air cooled radial engines.

The Wasp, Jr., a 300 horsepower nine cylinder radial air cooled engine, was developed by Pratt and Whitney late in the year to supplement its line. It employed 80 per cent of the same parts used in the larger Wasp engines and was essentially the same as the larger engine in its design features.

The Wright Aeronautical Corporation made many improvements in its three new Whirlwind engines of the J-6 series having five, seven and nine cylinders respectively. Each engine was provided with a front exhaust manifold of the collector ring type; and a nose cowling with shutters operated from the pilot's seat was used. The shutters permitted the flow of air around the crankcase and cylinders to be regulated so that the maximum engine efficiency could be obtained under varying climatic conditions. These new features enabled manufacturers to clean up their designs and streamline the planes, adding to their speed. A new type carburetor intake air heater was developed which eliminated fire hazard to a great extent and permitted the transfer of any desired amount of heat to the intake air, straining it of dust particles and sand. All leads containing hot exhaust gases were kept from passing in the vicinity of the carburetor. Reduction gears were developed for both the Cyclone and Whirlwinds, improving their performance for transport operations.

The products of other manufacturers in regular production or in various stages of experimentation are described fully in the chapter on "Engine Manufacturing." The developments just described serve to show the trend in engine design prevalent throughout the manufacturing field.

Cowling Adds Speed

The principal technical objection to the use of air cooled engines was overcome with the further development and employment of streamlined cowling for the radial type engines. The cowling was studied in 1928 by the National Advisory Committee for Aeronautics and its benefits described to the manufacturers, many of whom were quick to take advantage of the possibilities of adding speed to their planes by cutting down the wind resistance.

The cowling, which amounted to no more than the covering of the projecting radial cylinders so that the air would flow more smoothly along the side of the fuselage after passing the engine, added from five to twenty miles an hour to the speed of the ships upon which it was successfully installed. The principal difficulties of the designer were to provide perfect streamlining and at the same time insure cooling of the engine at all temperatures and altitudes.

Manufacturers undertook further experimentation with the cowling during the year, and many of them were employing it on standard designs. The Lockheed Vega, Lockheed Air Express and later the new Lockheed Sirius, all striving for greater speed, were cowled to increase their efficiency. The Travel Air "Mystery Ship," which attained a

speed of 240 miles an hour, was cowled similarly. Boeing was first to employ the cowling on a standard production tri-motored transport, when the engines of the new 80-A, 21 place transport, were covered and faired into nacelles. Stinson employed it on a special endurance ship; Stearman used it on mail and passenger planes; and Davis Aircraft Corporation provided its sport plane, the Moth, with this speed aid. Others experimented with it during the year and planned to employ it as soon as their individual problems of providing proper cooling and aerodynamic efficiency could be solved.

Prestone Engine Cooling

The development of a new cooling process for water cooled engines through the use of ethylene glycol or Prestone was announced during the year by the Army Air Corps, after both the Army and Navy had made extensive experiments in search of a high-temperature cooling fluid which might replace heavy water in general use. A Curtiss P-6 pursuit plane was equipped to use the ethylene glycol fluid, with a 65 per cent reduction in the surface of the radiator exposed to the air and a 10 per cent saving in fuel consumption.

Exponents of the water cooled type engine looked upon the new high-temperature cooling fluid as a certain indication that water cooled engines would return to general use because they would insure greater efficiency with decreased fuel consumption and higher speed. Only four and one-half gallons of the chemical cooler were needed to replace 18 gallons of water, a reduction of 84 pounds of weight and a reduction of the engine's frontal area sufficient to show a marked decrease in the drag.

Propellers

While propeller manufacturers continued to use wood, micarta, steel and aluminum alloys for their products, the metals held a dominant place over wood. Adjustable, variable pitch propellers, equipped with a detachable blade which might be adjusted to any desired pitch on the ground, were available for general use; although fixed-pitch propellers, with hub and blades as integral parts, were continued in production. The controllable-pitch propeller, with blades mounted in the hub so that they could be turned around their radial axes during flight at the will of the pilot, provided one of the most interesting fields of propeller research during the year.

The controllable-pitch propeller was looked upon by many aeronautic engineers as a vital necessity to the development of the airplane's full

capacities. In the fixed-pitch propeller, whether its blades and hub were integral parts or the blades were detachable to make possible changes of pitch on the ground, the designer had to choose some condition of flight upon which to base his calculations. This was usually top speed when flying level at low altitude. When using the controllable-pitch propeller, he had the advantage of obtaining the maximum engine power by increasing or decreasing the pitch of the propeller blades in flight. In the take-off for instance, when the propeller is heavily loaded, a decrease in pitch of from three to four degrees below normal made possible an increase in power necessary to take-off loads which could not otherwise he lifted.

The principal disadvantages were in added weight to the propeller, but manufacturers experimenting with this type declared the drawback would be offset many times by the great performance advantages accruing from the use of a propeller possessing good efficiency at all conditions of flight and permitting full engine power when most necessary. While still in the experimental stage, the controllable-pitch propeller was considered a very promising development.

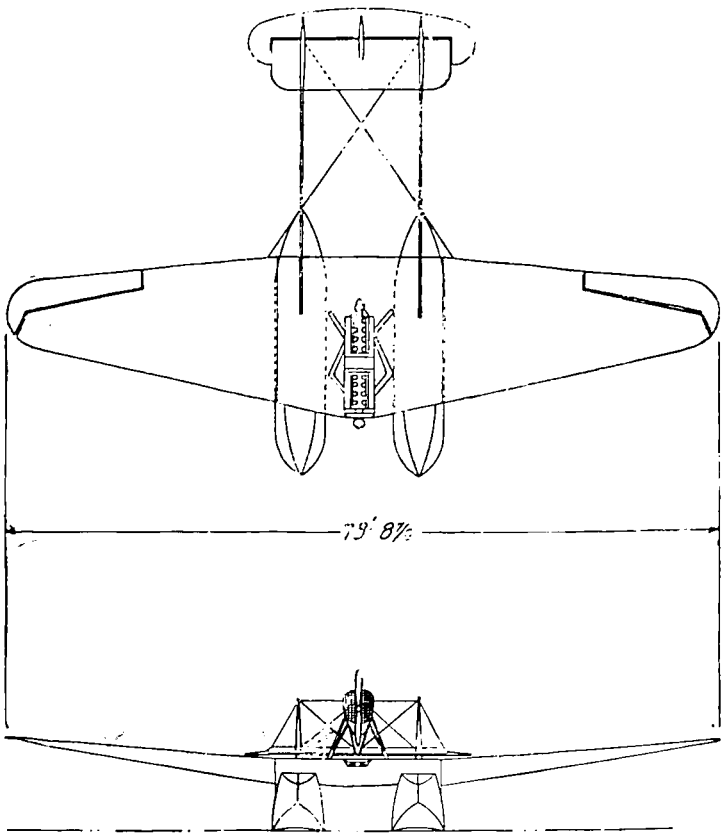
Aeronautic Standards

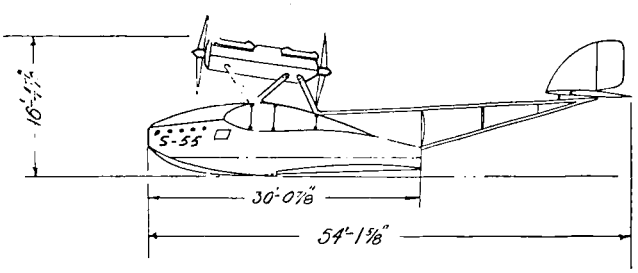
The Society of Automotive Engineers in co-operation with the Aeronautical Chamber of Commerce made valuable contributions to the technical field during 1929 through providing a forum of discussion on engineering problems and the development of aircraft and engine standards. The former was achieved through meetings throughout the country at which the foremost engineers exchanged data on their new projects, and the latter through the S.A.E. standards committee.

New and revised aeronautic standards approved and adopted by the industry during 1929 included: propeller-hubs and shaft ends, aircraft storage batteries, tail-skid shoe mountings, spark plugs, spark-plug terminals, landing wheel hubs and axle ends, airplane tire rims, airplane tires, magneto flange mountings, instrument mountings, propeller blade clamp rings, propeller clamp ring bolts and nuts, propeller blade ends, tachometer drives, and thermometer bulbs.

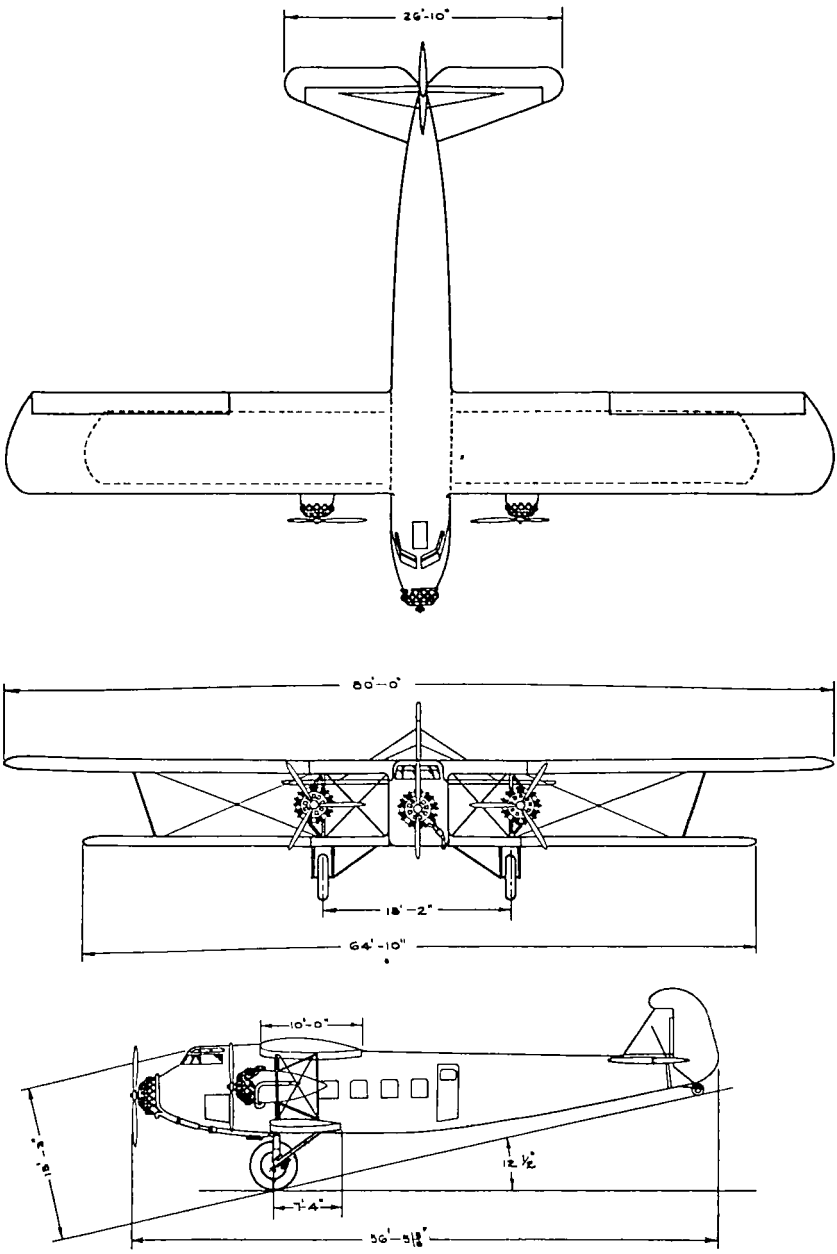
AIRCRAFT DESIGN

Multi-Motored Transports

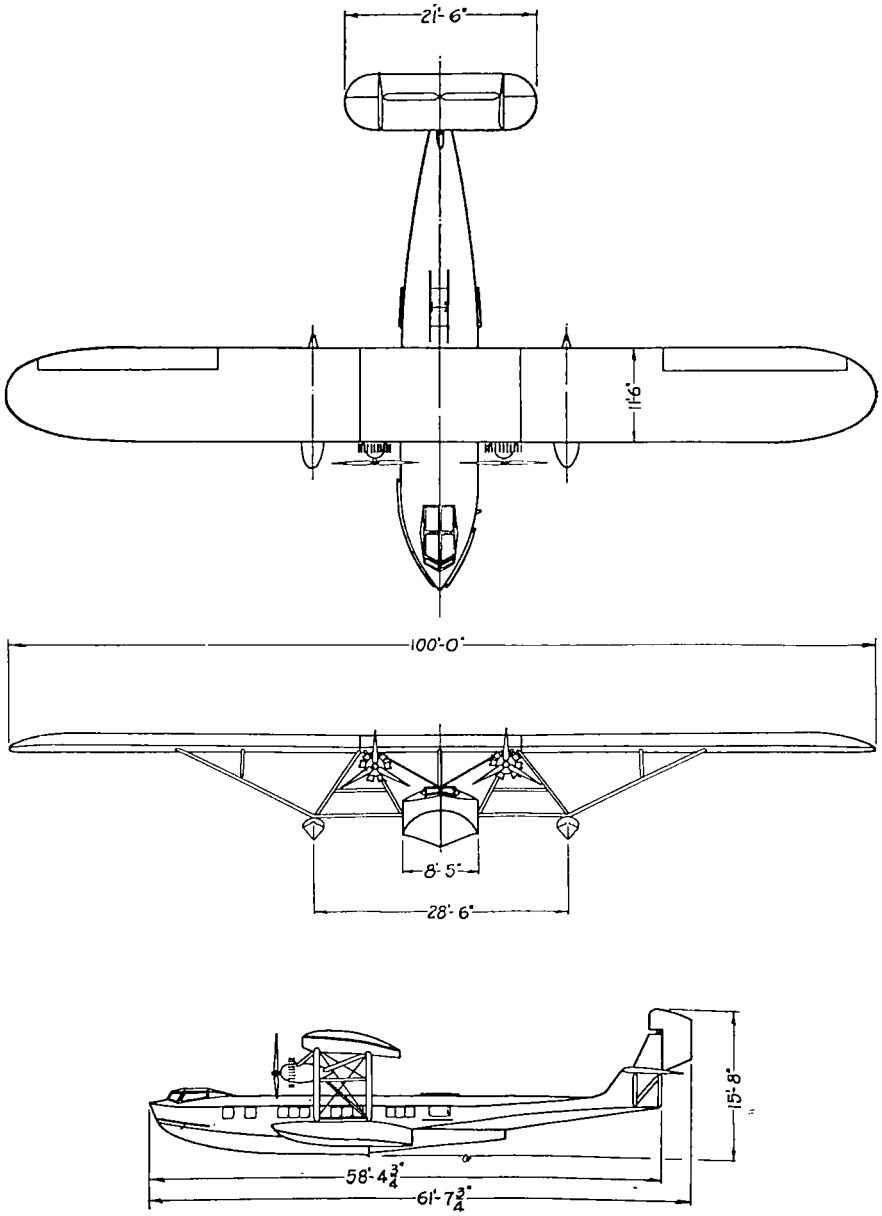




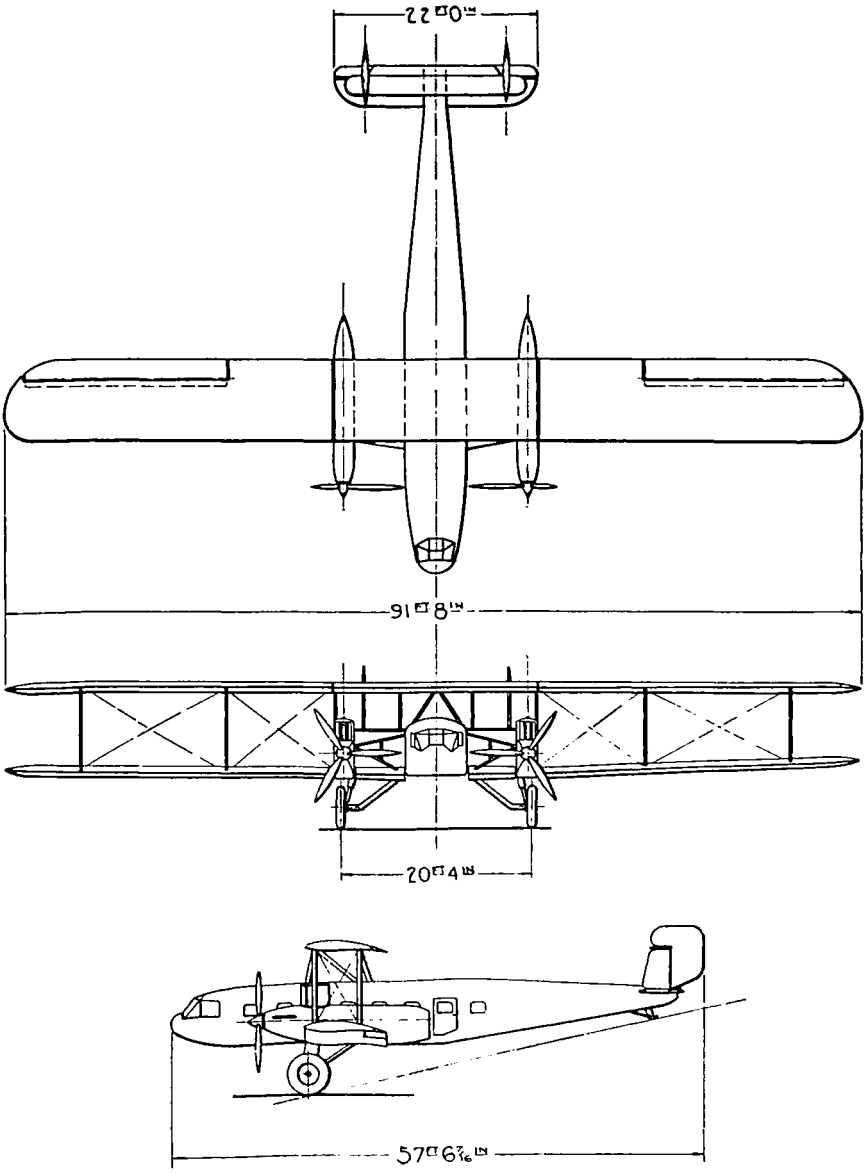
AMERICAN AERONAUTICAL CORPORATION
New York City
AMERICAN MARCHETTI S-55
16 PLACE
ENGINE: TWO ISOTTA FRASCHINI



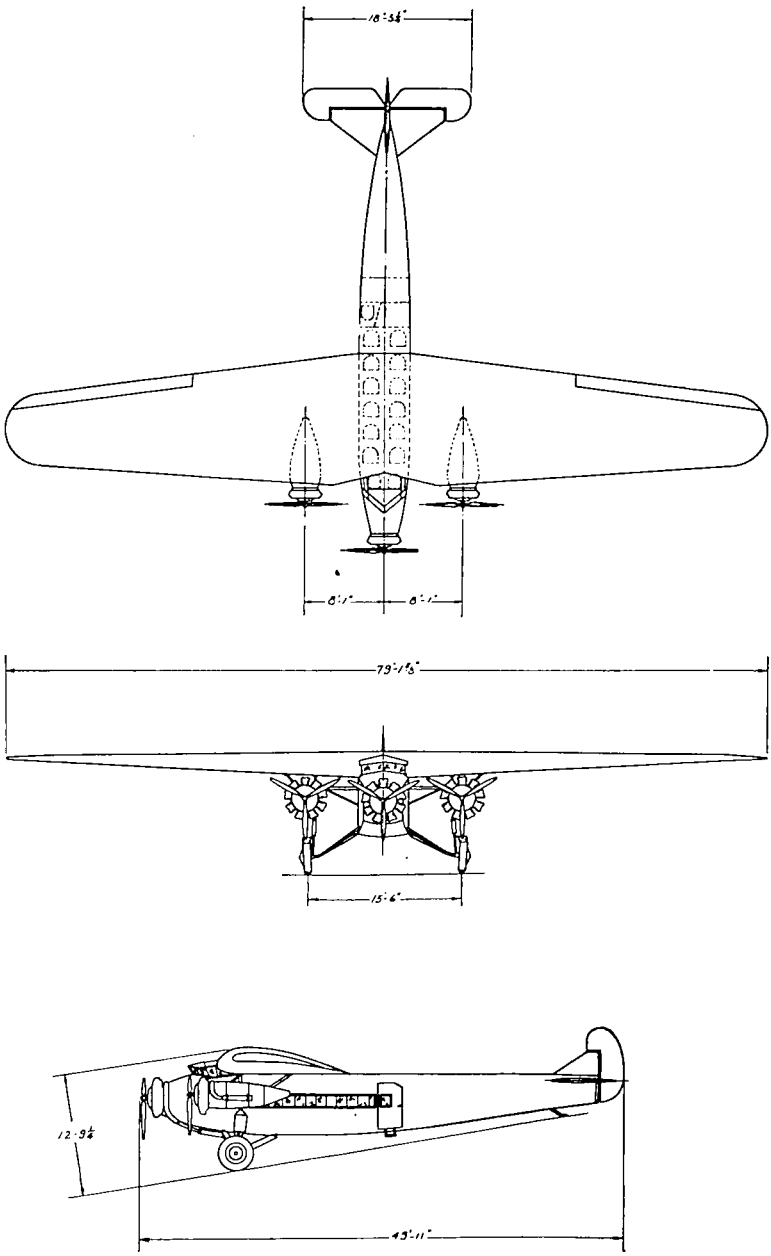
BOEING AIRPLANE COMPANY
Seattle, Wash.
MODEL 80-A
20 PLACE
ENGINE: THREE PRATT & WHITNEY HORNETS



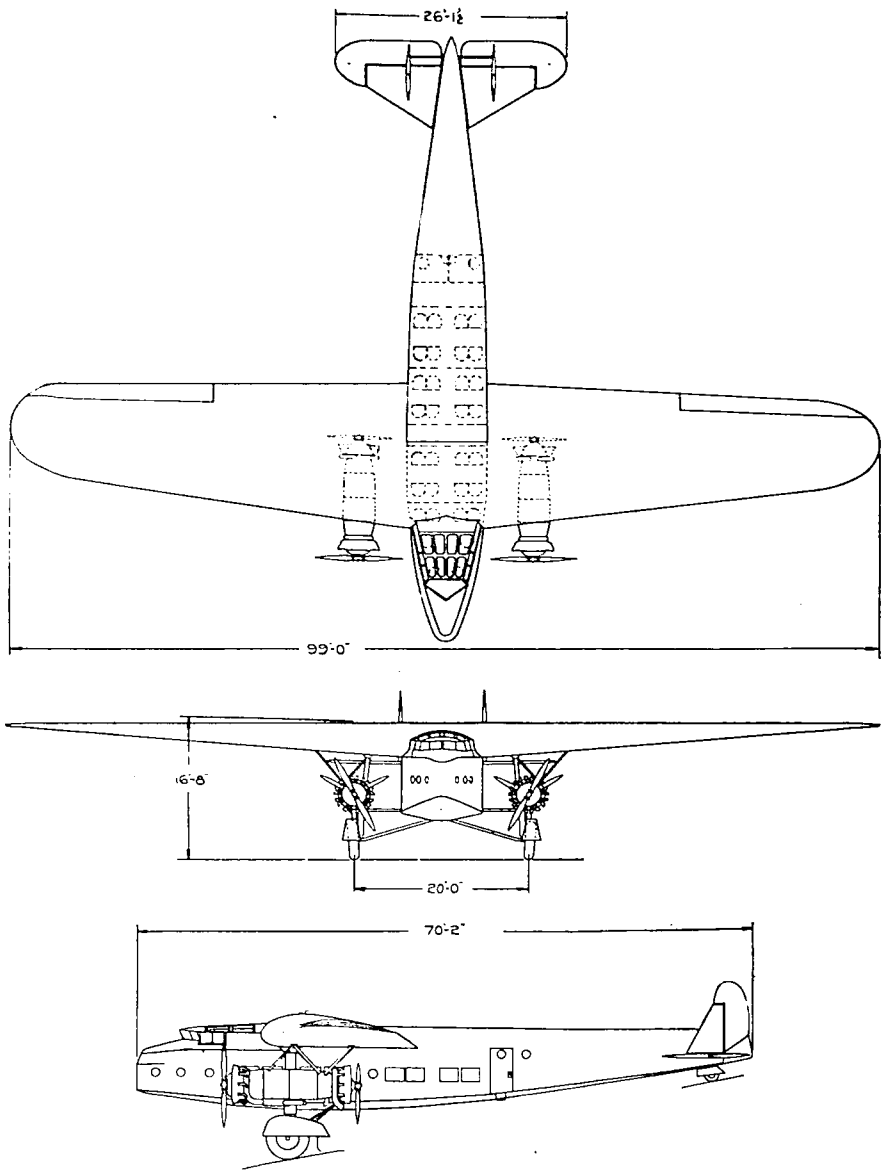
CONSOLIDATED AIRCRAFT CORPORATION
Buffalo, N. Y.
COMMODORE
22 PLACE
ENGINE: TWO PRATT & WHITNEY HORNETS



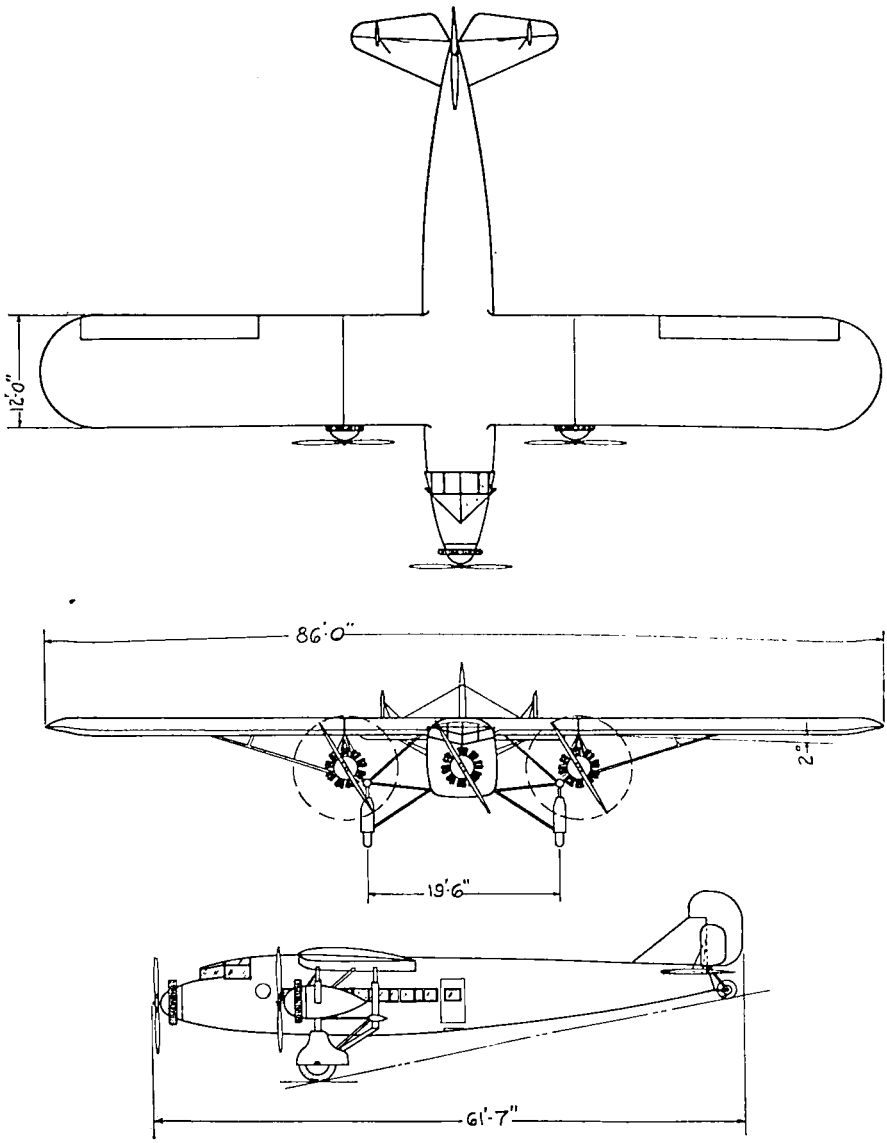
CURTISS AEROPLANE & MOTOR COMPANY
Garden City, L. I., N. Y.
CONDOR
20 PLACE
ENGINE: TWO CURTISS GEARED CONQUERERS



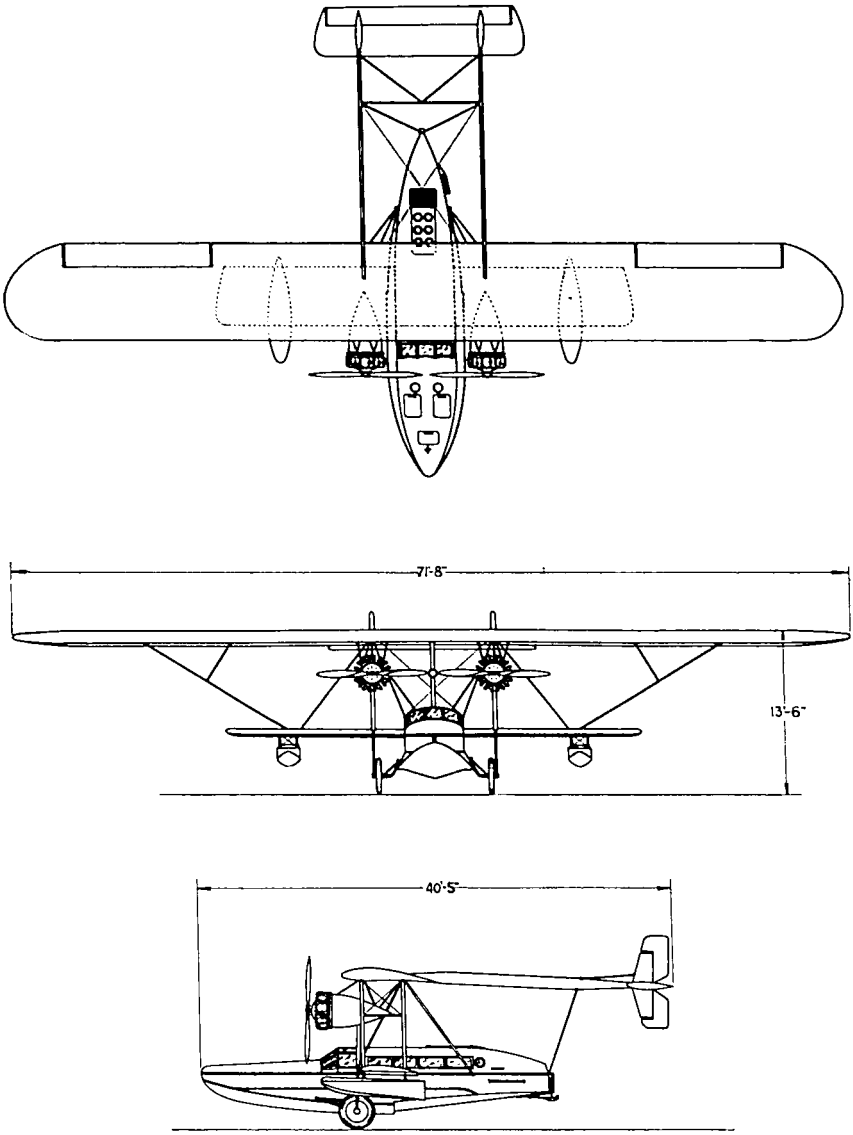
FOKKER AIRCRAFT CORPORATION OF AMERICA
New York City
MODEL F 10
14 PLACE
ENGINE: THREE PRATT & WHITNEY WASPS



FOKKER AIRCRAFT CORPORATION OF AMERICA
New York City
MODEL F 32
32 PLACE
ENGINE: FOUR PRATT & WHITNEY HORNETS

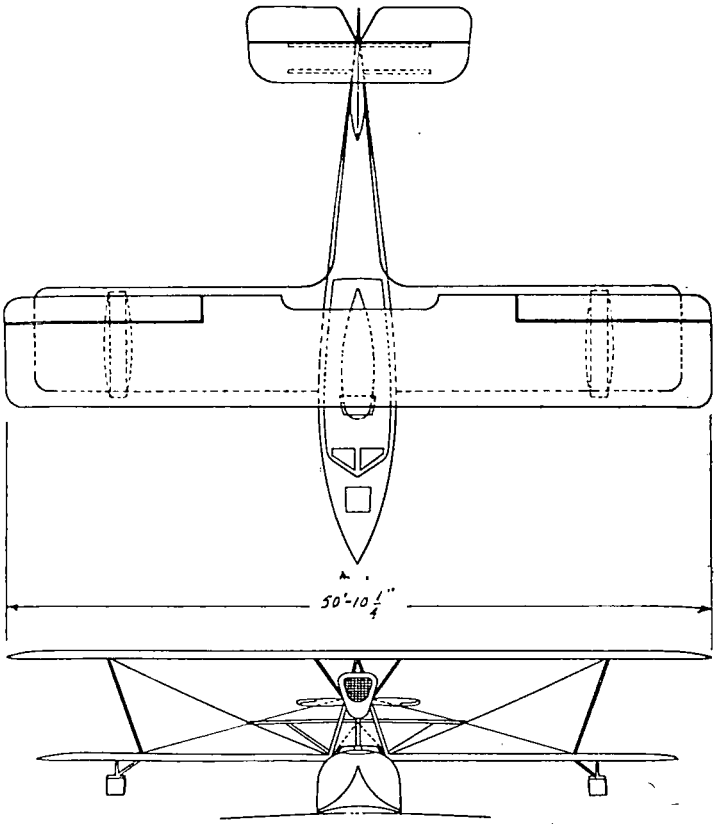


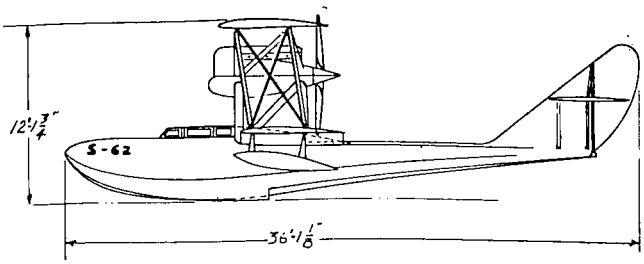
KEYSTONE AIRCRAFT CORPORATION
Bristol, Pa.
PATRICIAN K-78
21 PLACE
ENGINE: THREE WRIGHT CYCLONES



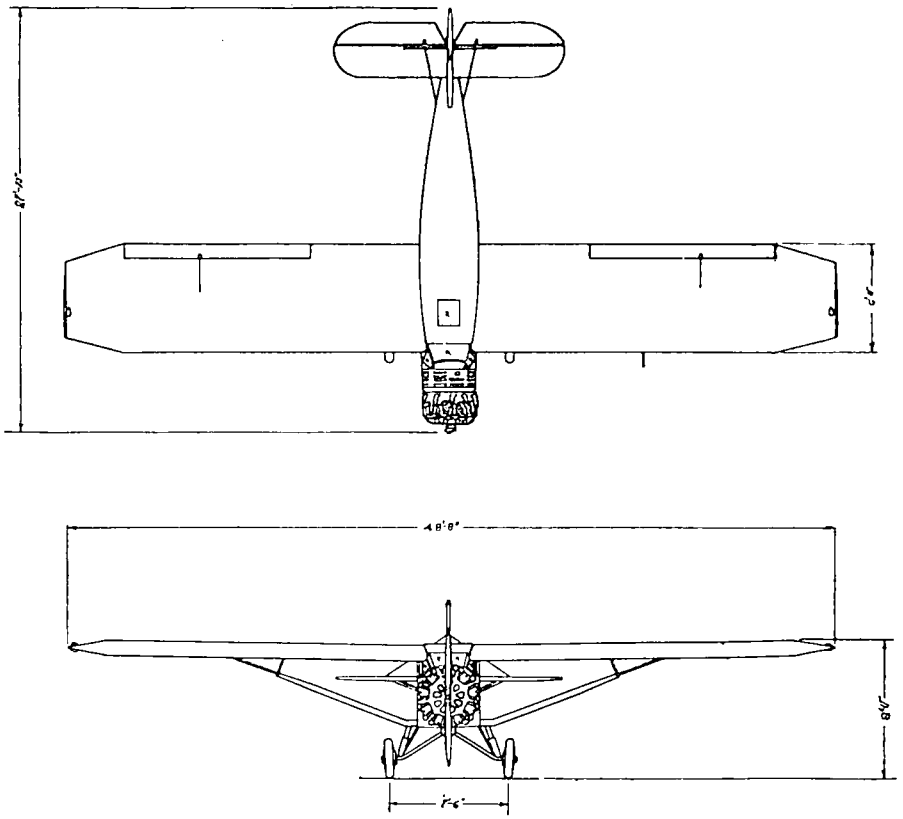
SIKORSKY AVIATION CORPORATION
Bridgeport, Conn.
AMPHIBION
10-12 PLACE
ENGINE: TWO PRATT & WHITNEY WASPS

Light Transports

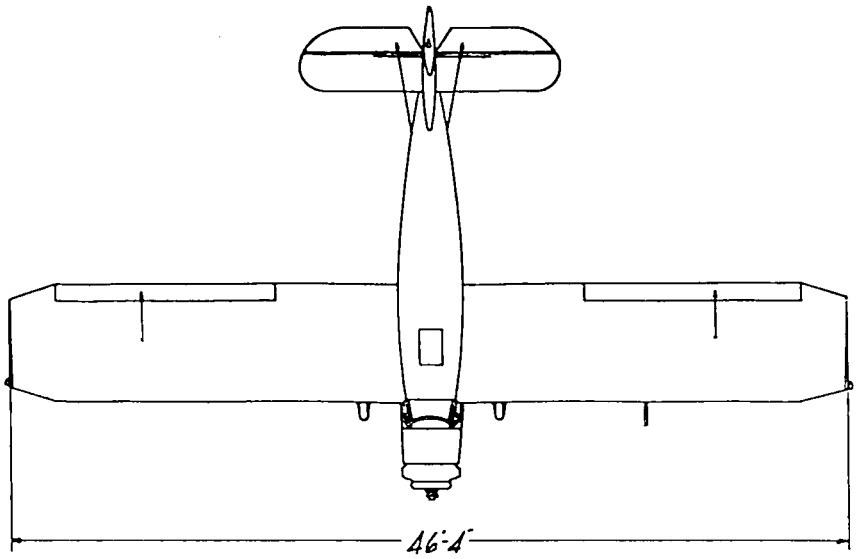


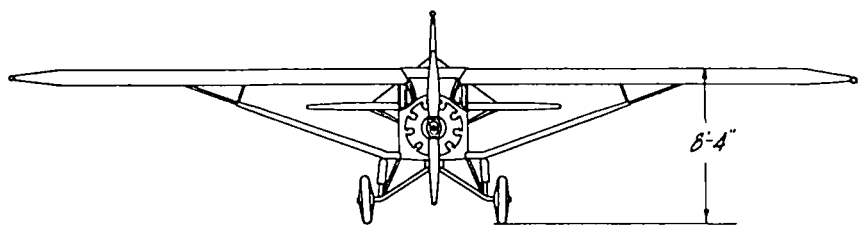


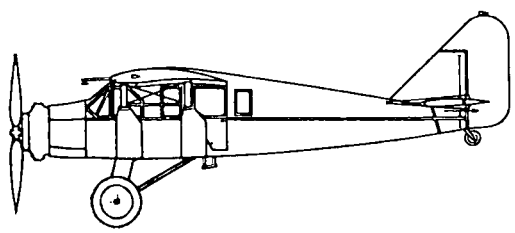
AMERICAN AERONAUTICAL CORPORATION
New York City
AMERICAN MARCHETTI S 62
7 PLACE
ENGINE: ISOTTA FRASCHINI



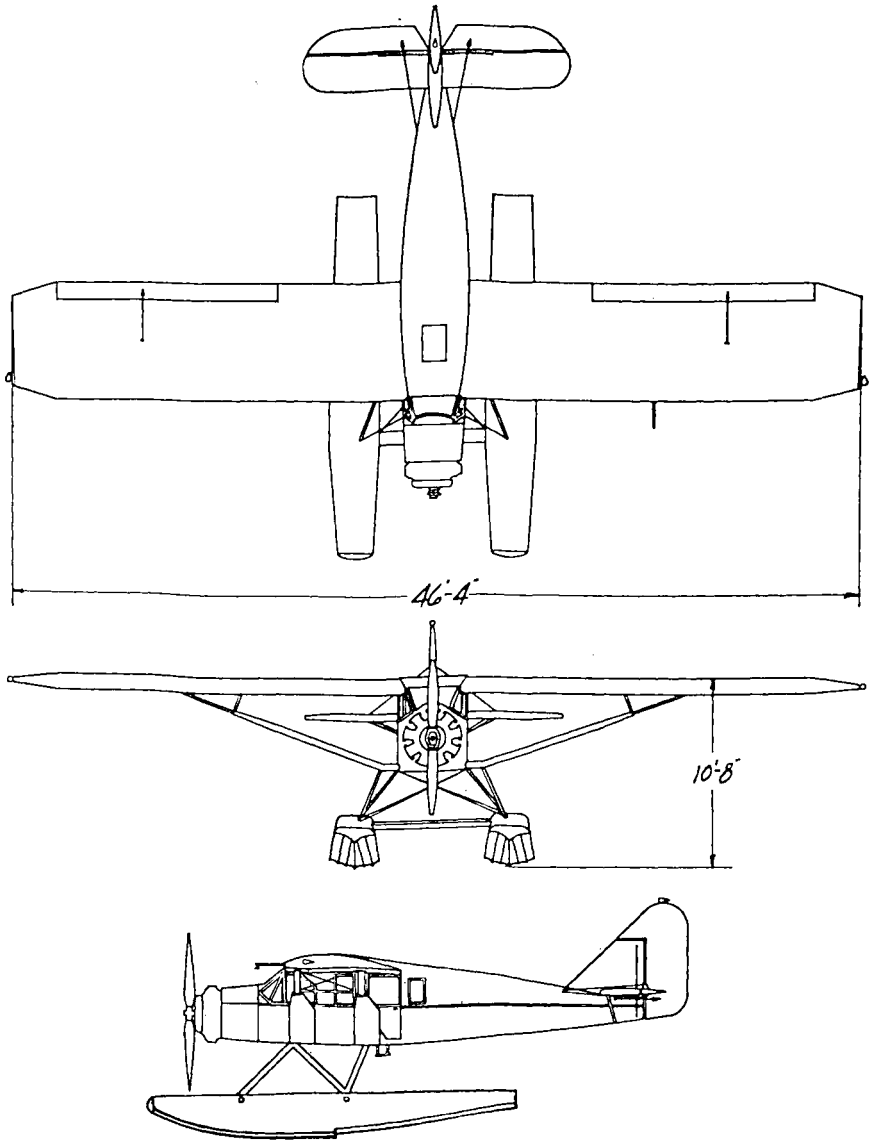
BELLANCA AIRCRAFT CORPORATION
New Castle, Del.
BELLANCA MONOPLANE
6 PLACE
ENGINE: PRATT & WHITNEY WASP



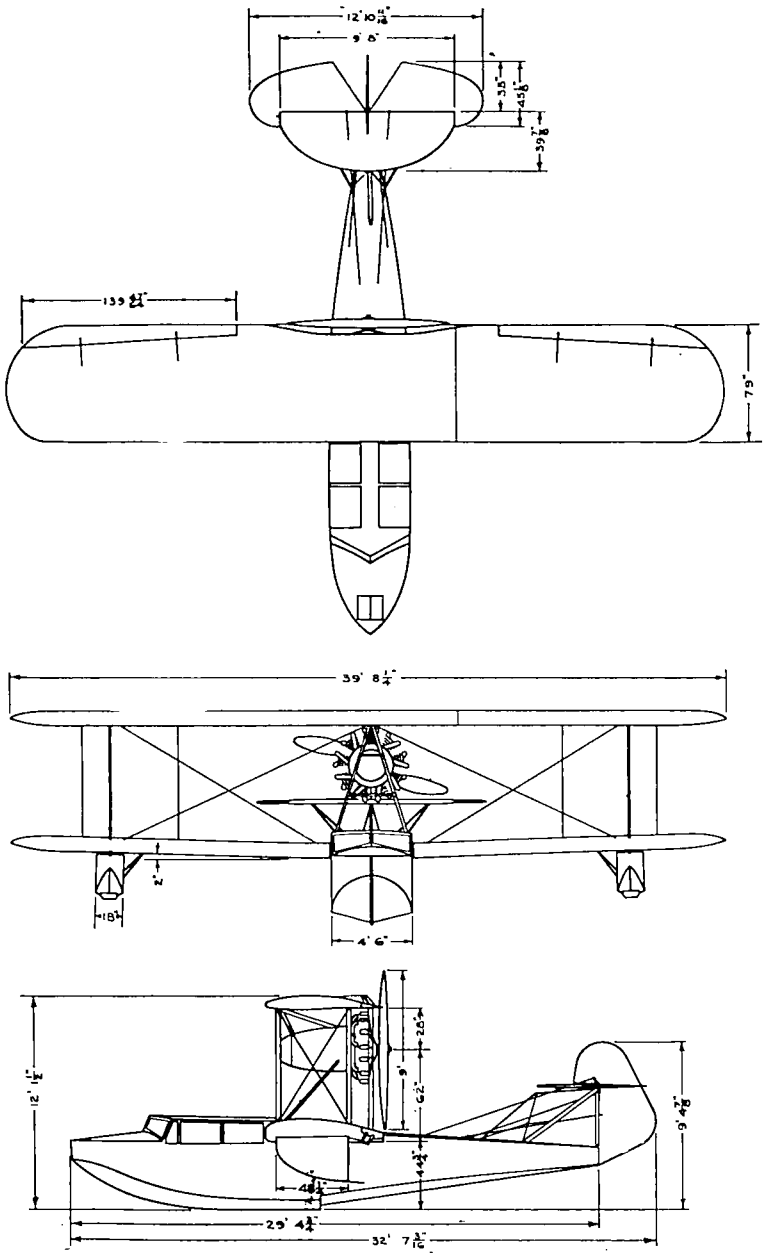




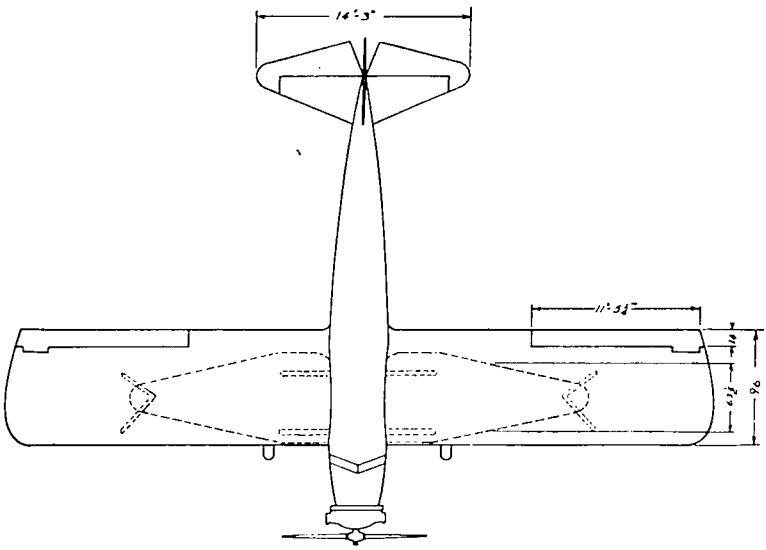
BELLANCA AIRCRAFT CORPORATION
New Castle, Del.
PACEMAKER
6 PLACE
ENGINE: WRIGHT WHIRLWIND 300

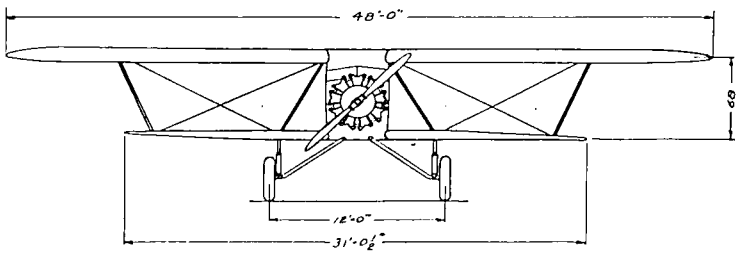


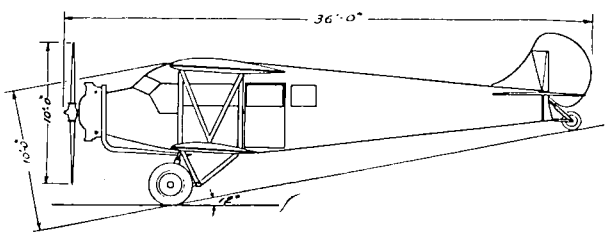
BELLANCA AIRCRAFT CORPORATION
New Castle, Del.
CH 300 SEAPLANE
6 PLACE
ENGINE: WRIGHT WHIRLWIND 300



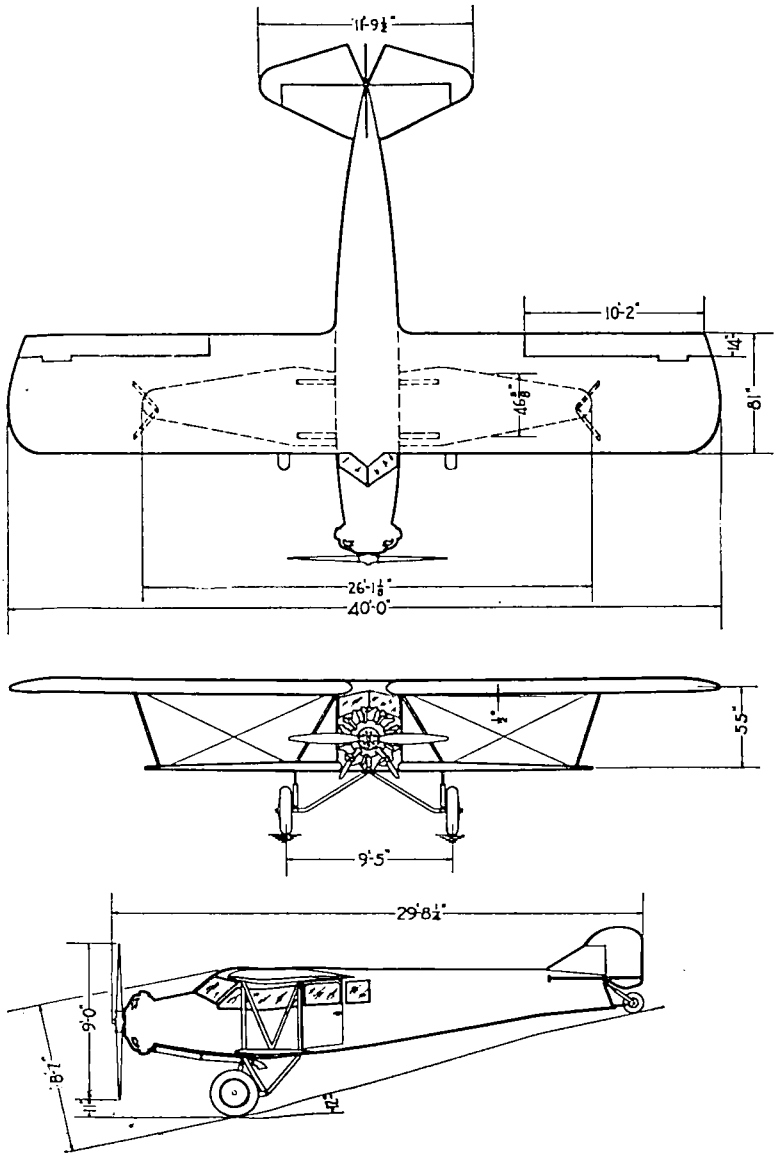
BOEING AIRPLANE COMPANY
Seattle, Wash.
MODEL 204
6 PLACE
ENGINE: PRATT & WHITNEY WASP



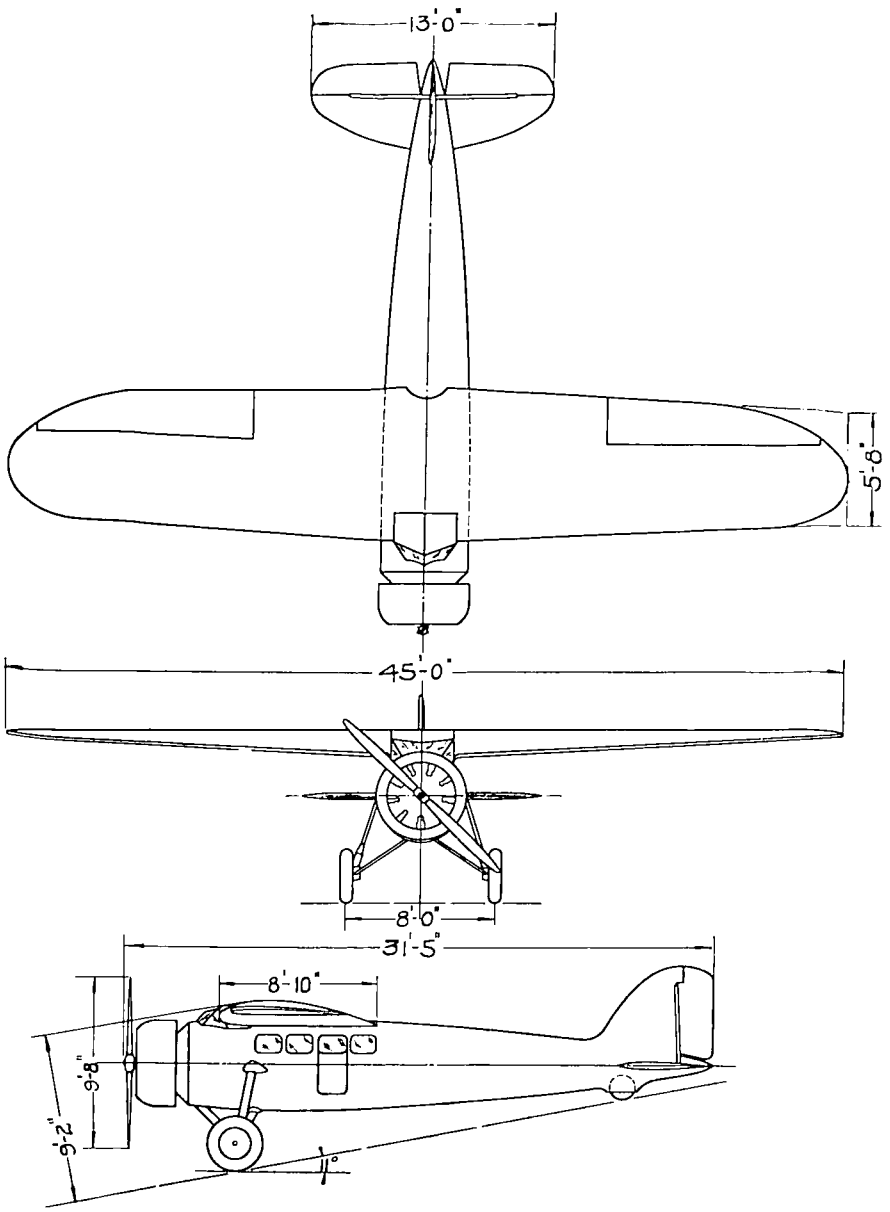




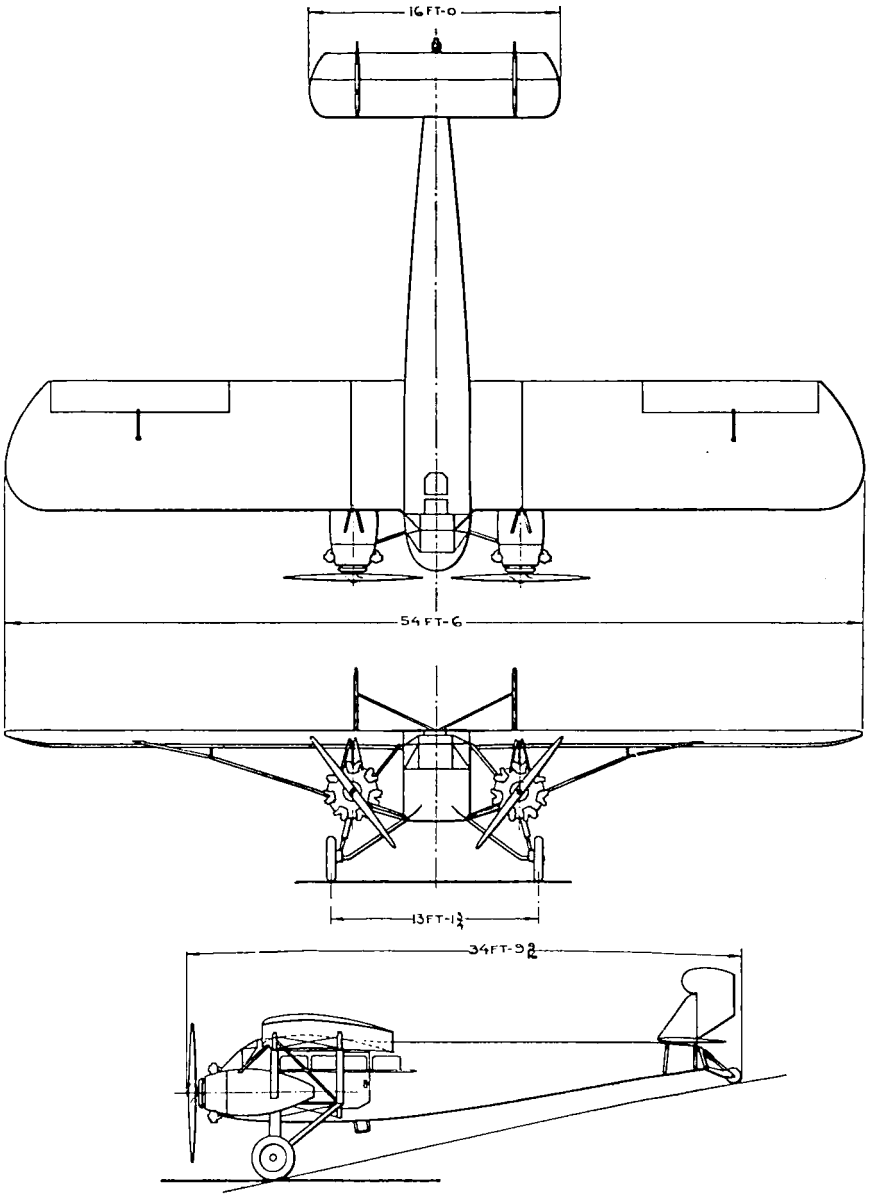
BUHL AIRCRAFT COMPANY
Marysville, Mich.
SENIOR AIRSEDAN CA-8
8 PLACE
ENGINE: PRATT & WHITNEY WASP
PRATT & WHITNEY HORNET
WRIGHT CYCLONE



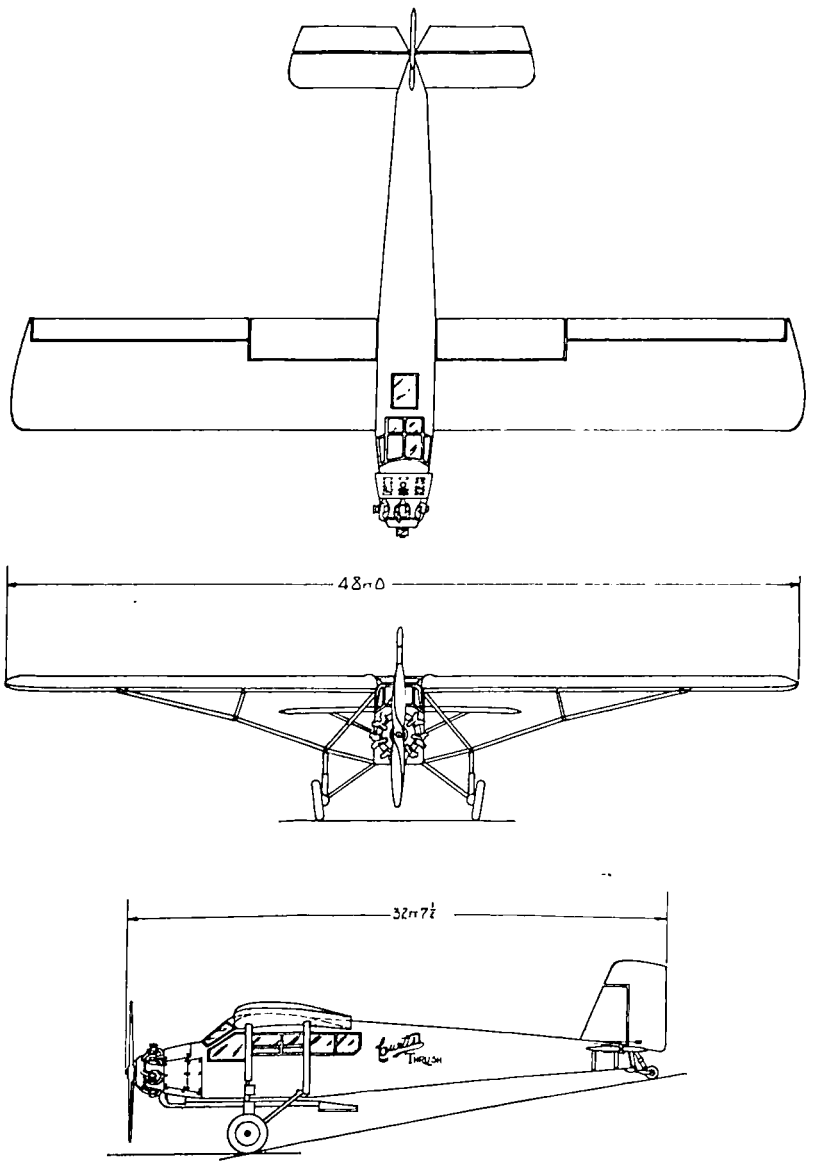
BUHL AIRCRAFT COMPANY
Marysville, Mich.
STANDARD AIRSEDAN CA-6
6 PLACE
ENGINE: WRIGHT WHIRLWIND 300



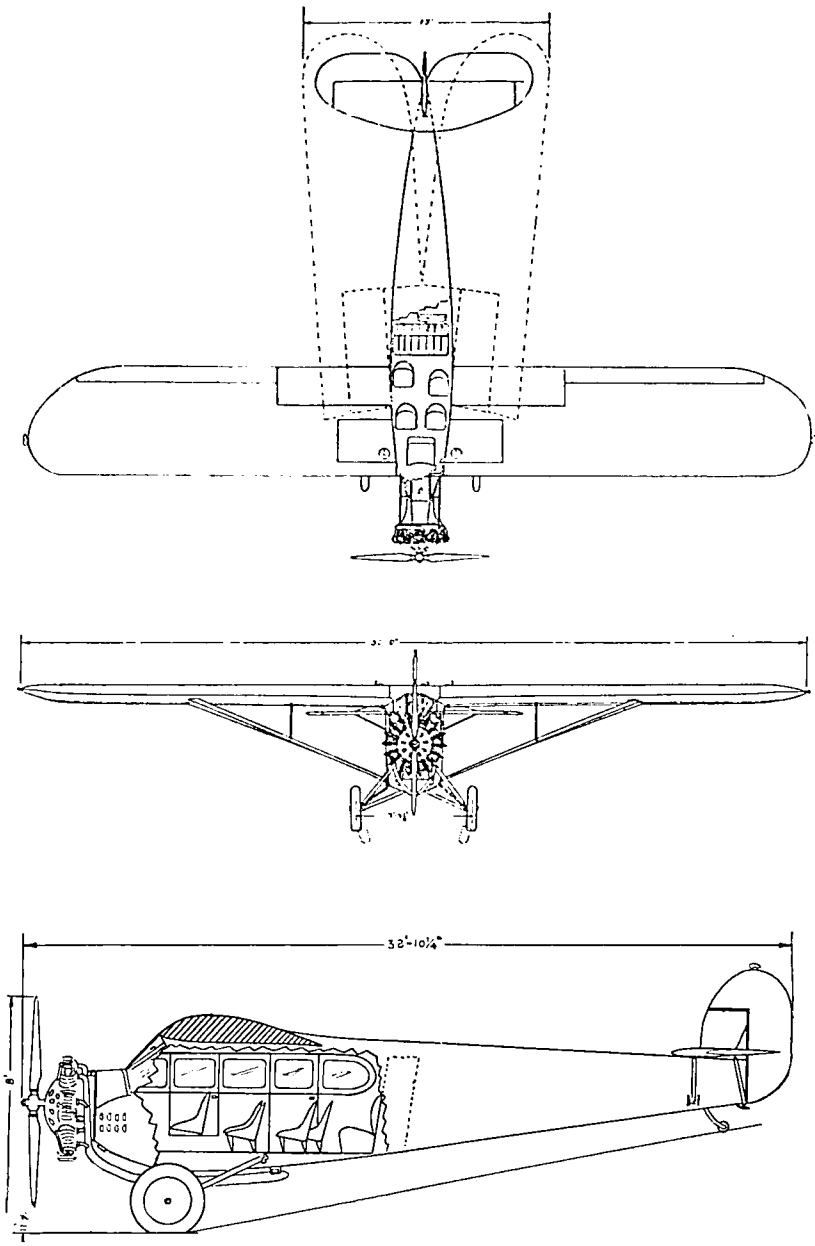
CONSOLIDATED AIRCRAFT CORPORATION
Buffalo, N. Y.
FLEETSTER
8 PLACE
ENGINE: PRATT & WHITNEY HORNET



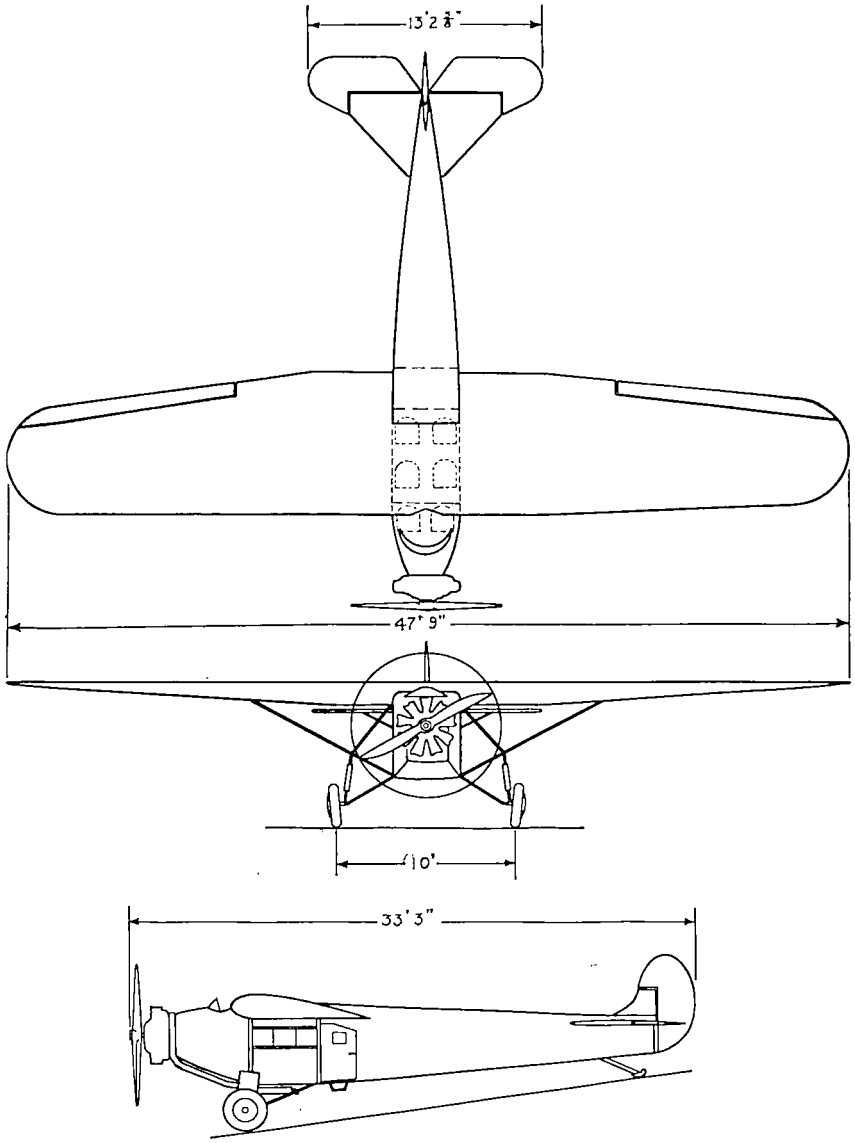
CURTISS AEROPLANE & MOTOR COMPANY, INC.
Garden City, L. I., N. Y.
KING BIRD
8 PLACE
ENGINE: TWO WRIGHT WHIRLWINDS 220



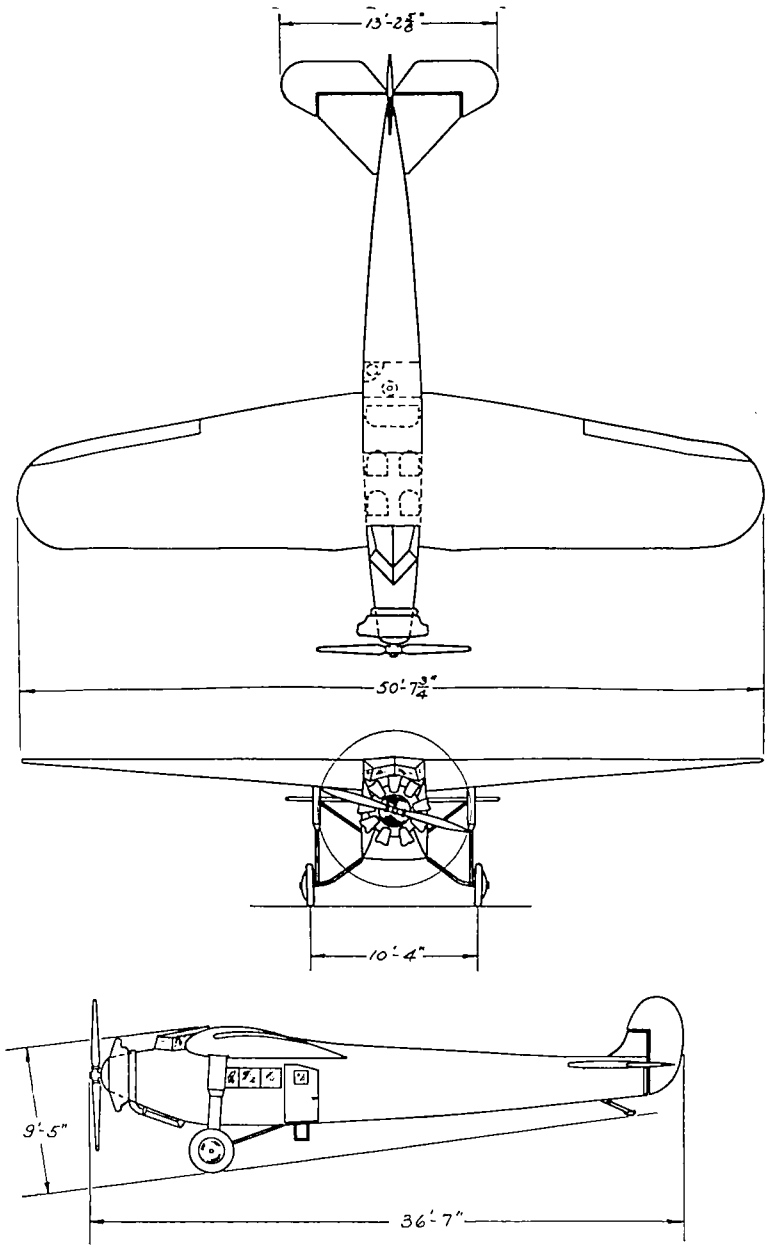
CURTISS-ROBERTSON AIRPLANE MANUFACTURING COMPANY
St. Louis, Mo.
THRUSH
6 PLACE
ENGINE: WRIGHT WHIRLWIND 220



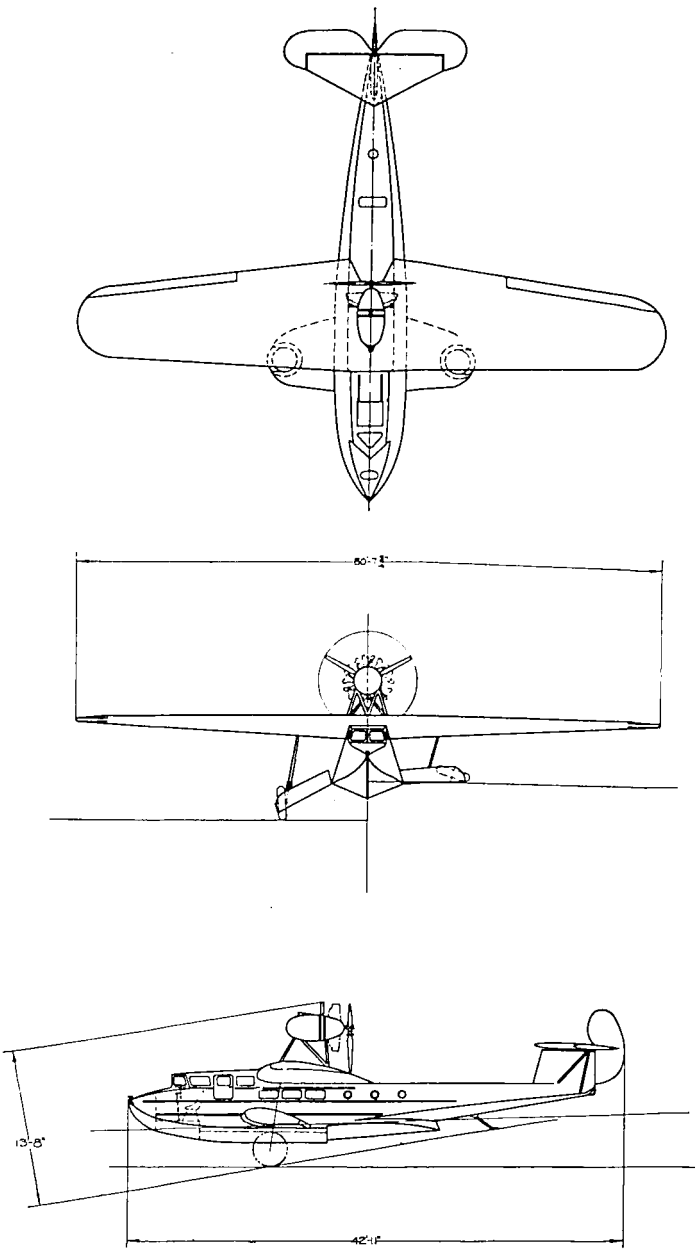
FAIRCHILD AIRPLANE MANUFACTURING CORPORATION
Farmingdale, L. I., N. Y.
FAIRCHILD 71
7 PLACE
ENGINE: PRATT & WHITNEY WASP



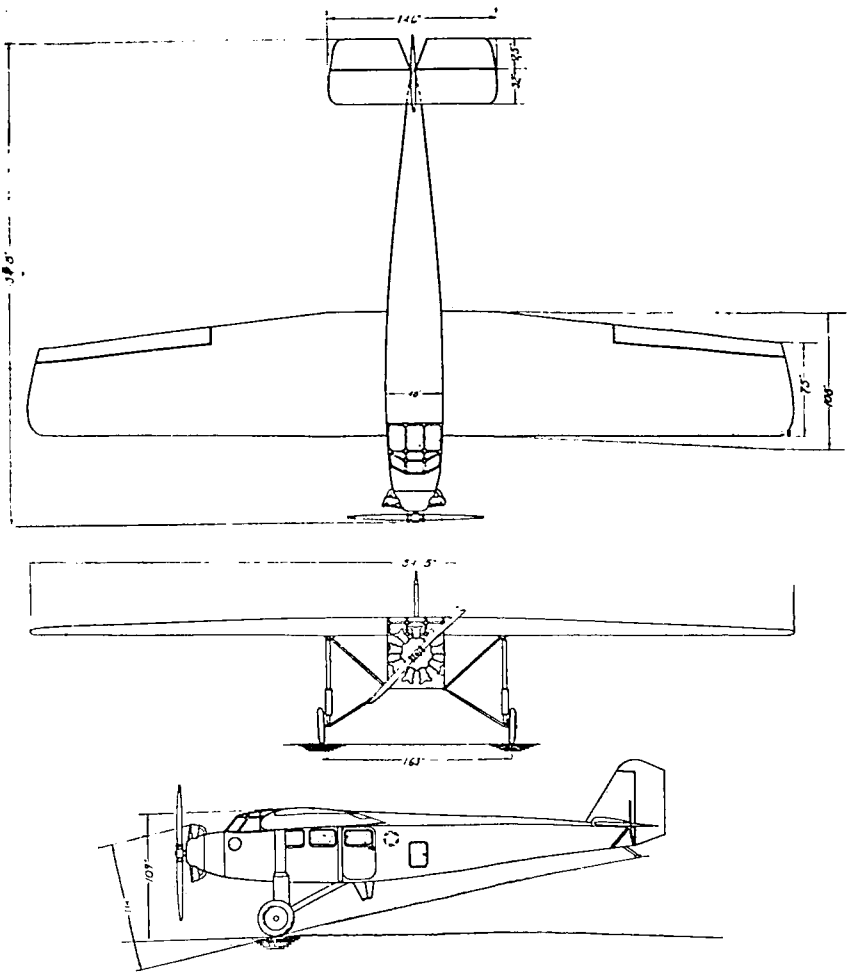
FOKKER AIRCRAFT CORPORATION OF AMERICA
New York City
UNIVERSAL
5 PLACE
ENGINE: WRIGHT WHIRLWIND 300



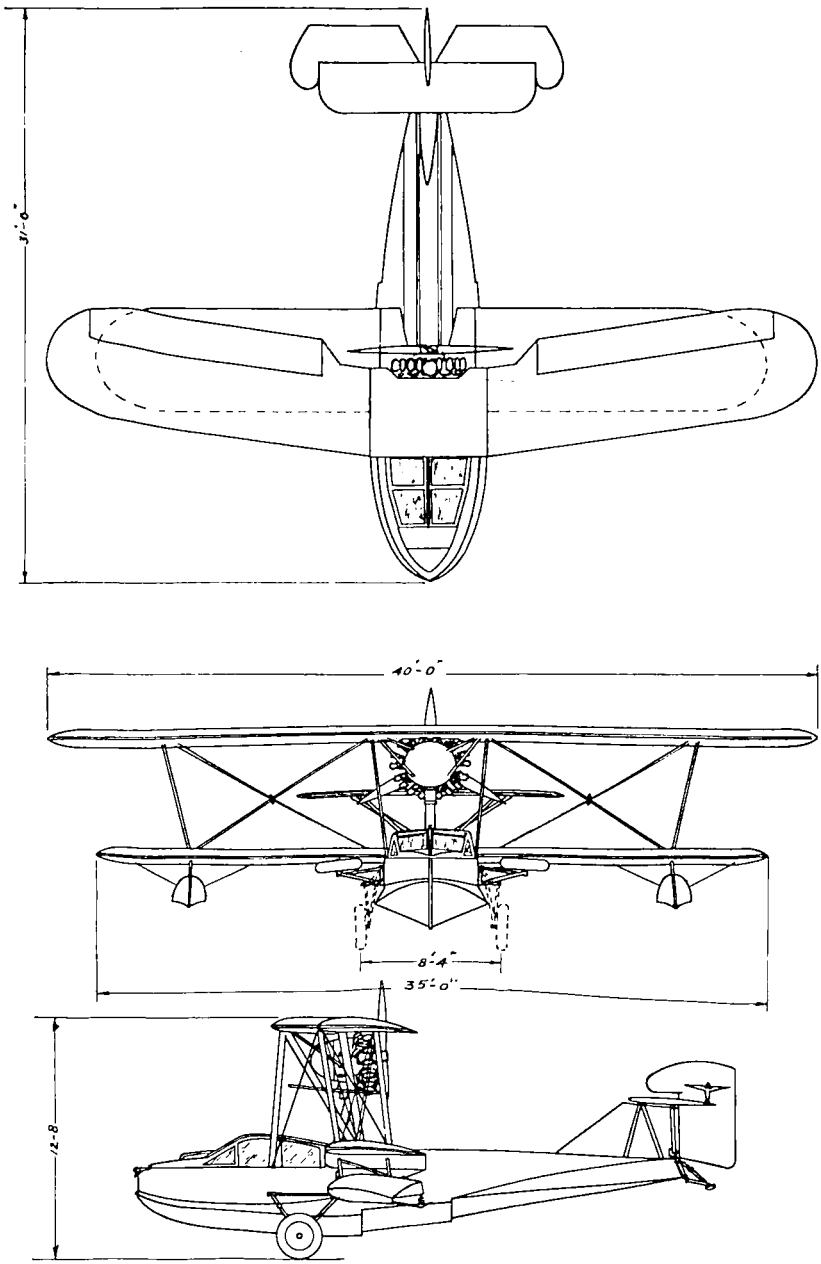
FOKKER AIRCRAFT CORPORATION OF AMERICA
New York City
SUPER UNIVERSAL
7 PLACE
ENGINE: PRATT & WHITNEY WASP



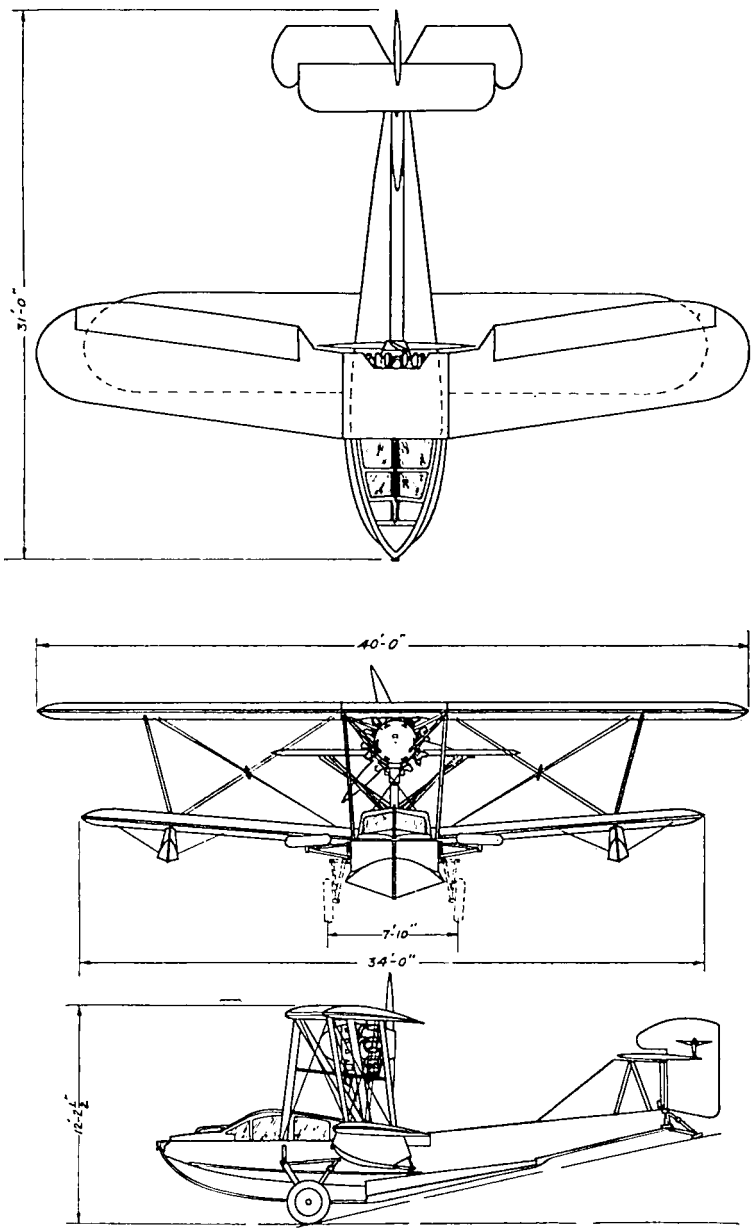
FOKKER AIRCRAFT CORPORATION OF AMERICA
New York City
F-11-A
8 PLACE
ENGINE: WRIGHT CYCLONE OR PRATT & WHITNEY HORNET



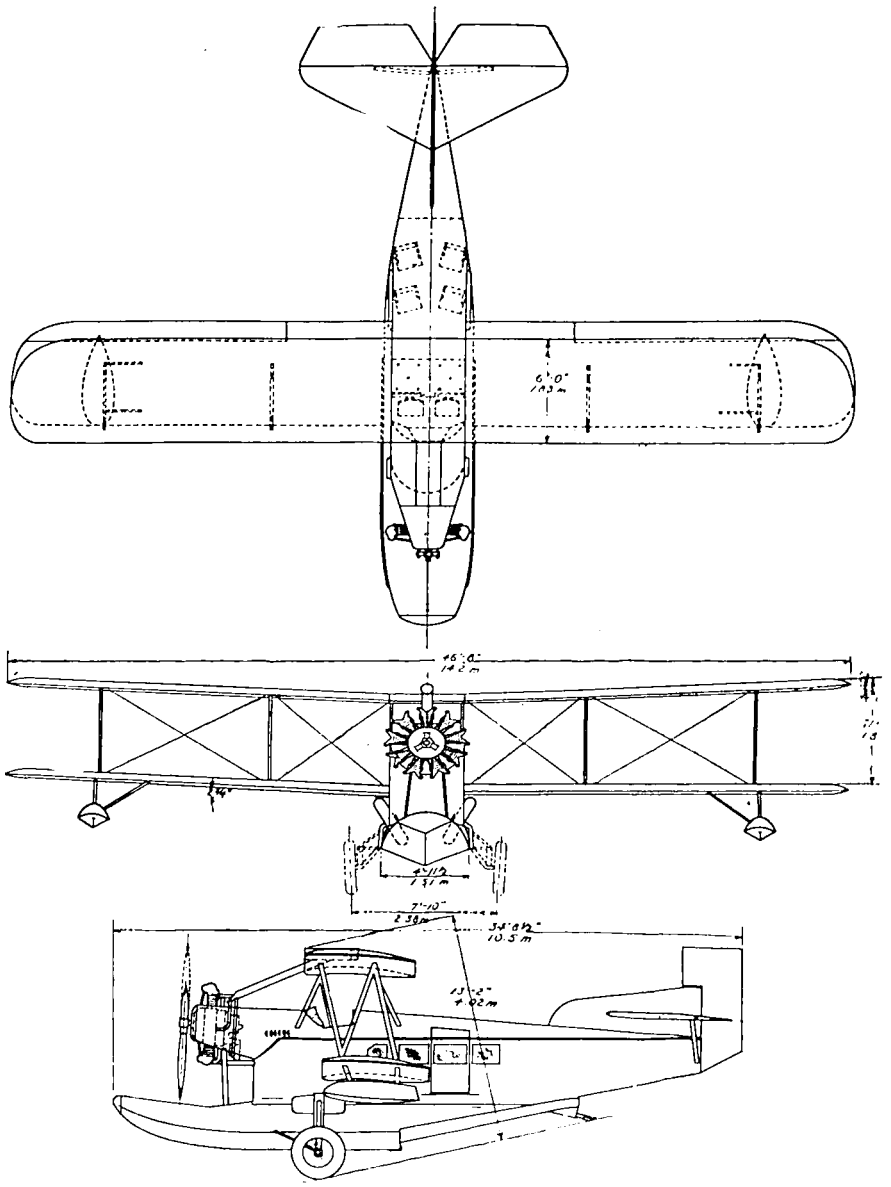
HAMILTON METALPLANE DIVISION
BOEING AIRPLANE COMPANY
Milwaukee, Wis.
HAMILTON
8 PLACE
ENGINE: PRATT & WHITNEY WASP
PRATT & WHITNEY HORNET



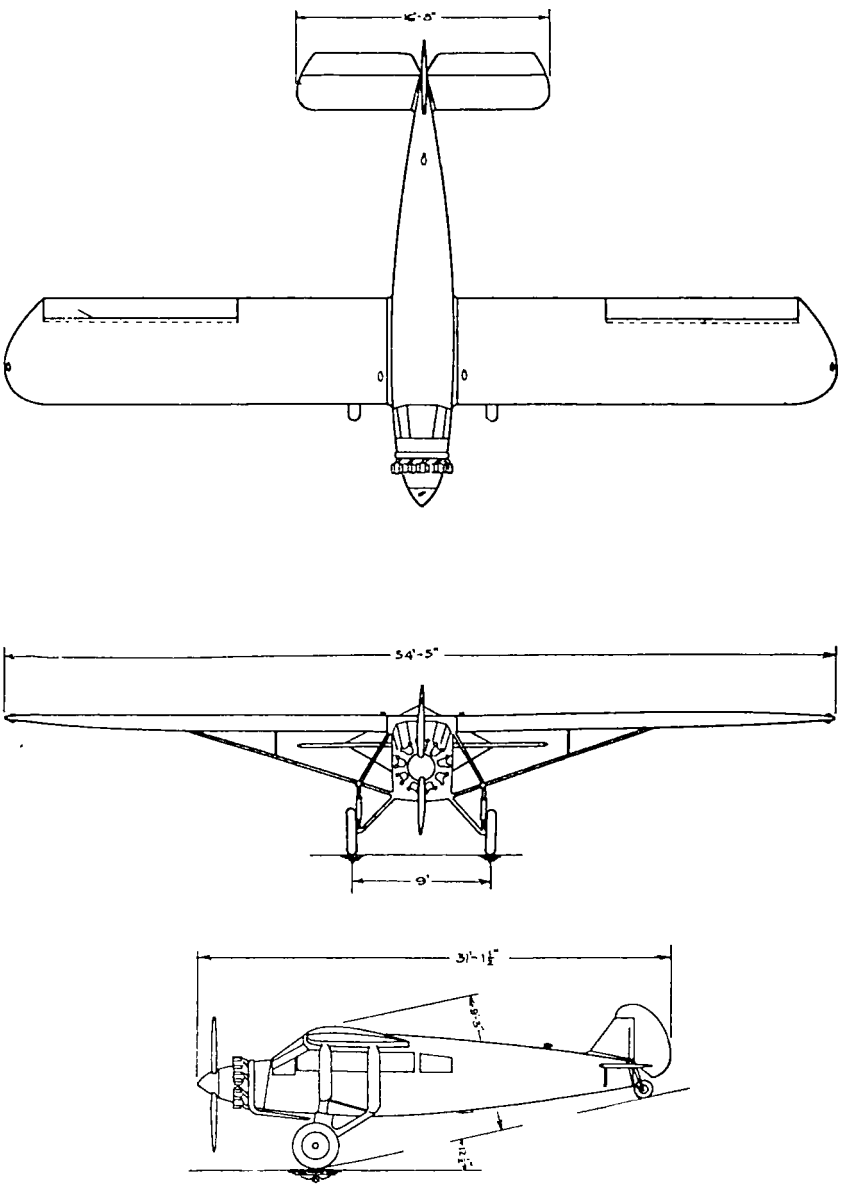
IRELAND AIRCRAFT, INC.
Garden City, L. I., N. Y.
MODEL: ND5—ND6
5 OR 6 PLACE
ENGINE: PRATT & WHITNEY WASP
WRIGHT WHIRLWIND 300



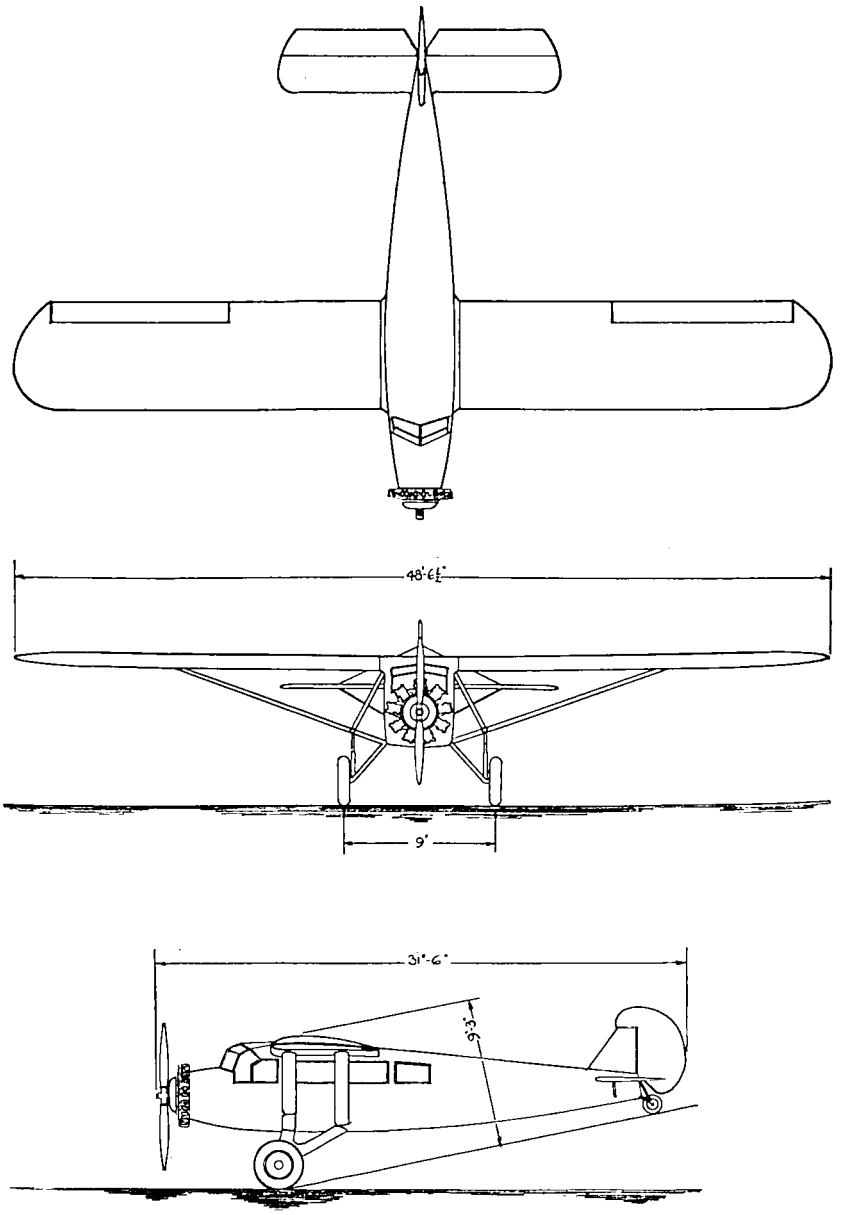
IRELAND AIRCRAFT, INC.
Garden City, L. I., N. Y.
MODEL: N2-B—N2-D
5 PLACE
ENGINE: PRATT & WHITNEY WASP
WRIGHT WHIRLWIND 300



LOENING AERONAUTICAL ENGINEERING CORPORATION
(Division of Keystone Aircraft Corporation)
New York City
AIR YACHT
8 PLACE
ENGINE: WRIGHT CYCLONE

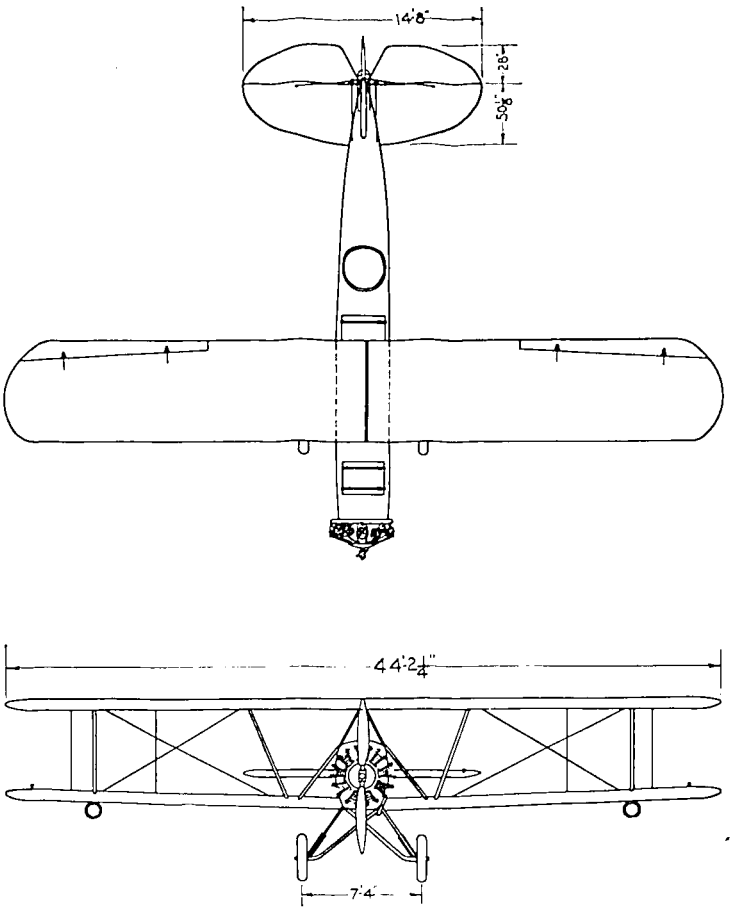


TRAVEL AIR COMPANY
Wichita, Kan.
MODEL A-6000-A
6 PLACE
ENGINE: PRATT & WHITNEY WASP

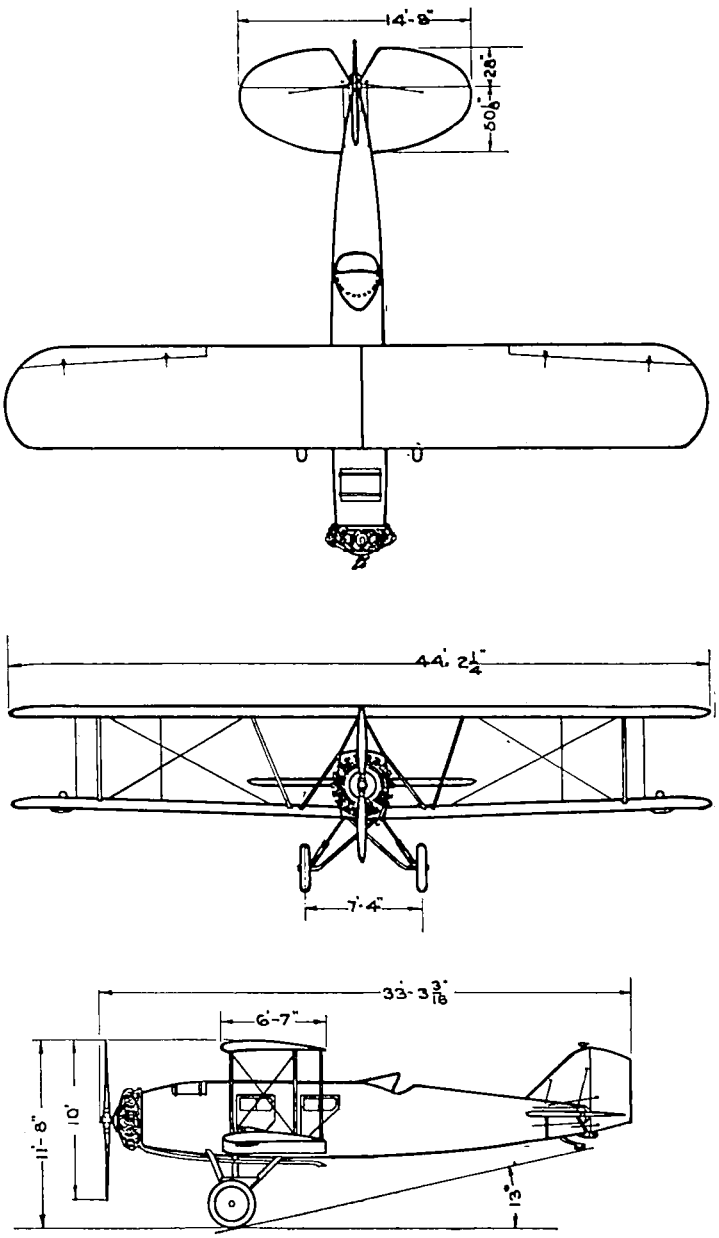


TRAVEL AIR COMPANY
Wichita, Kan.
MODEL 6000 B
6 PLACE
ENGINE: WRIGHT WHIRLWIND 300

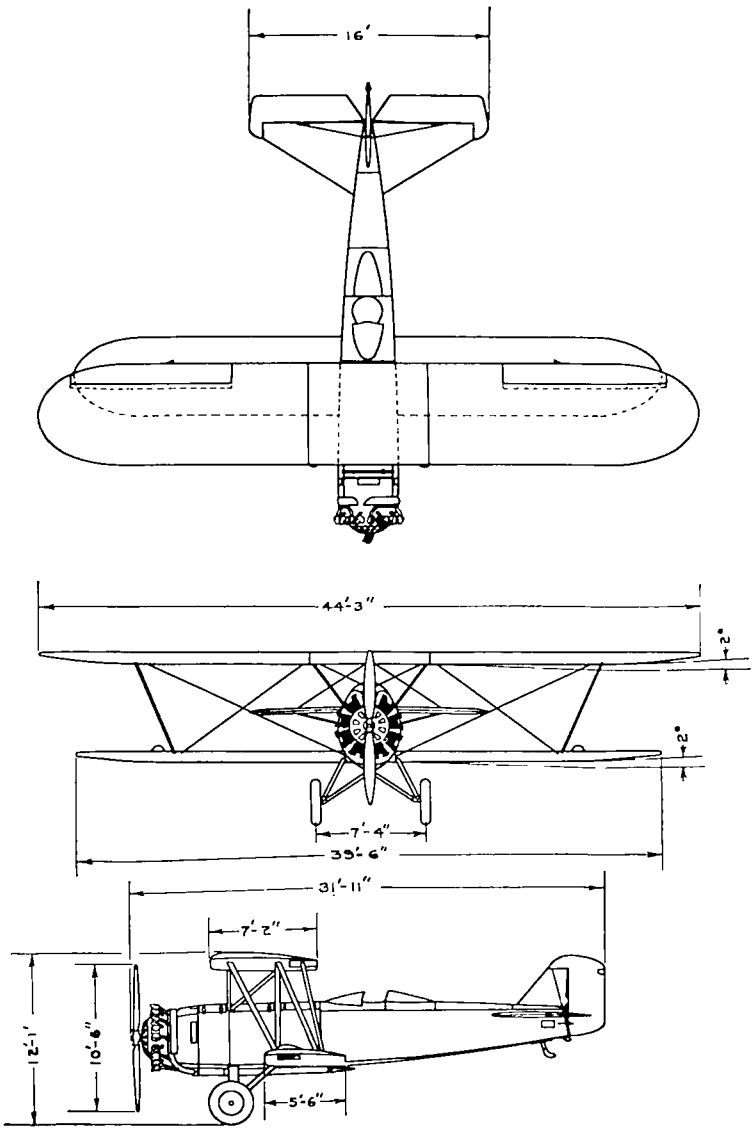
Mail Transports



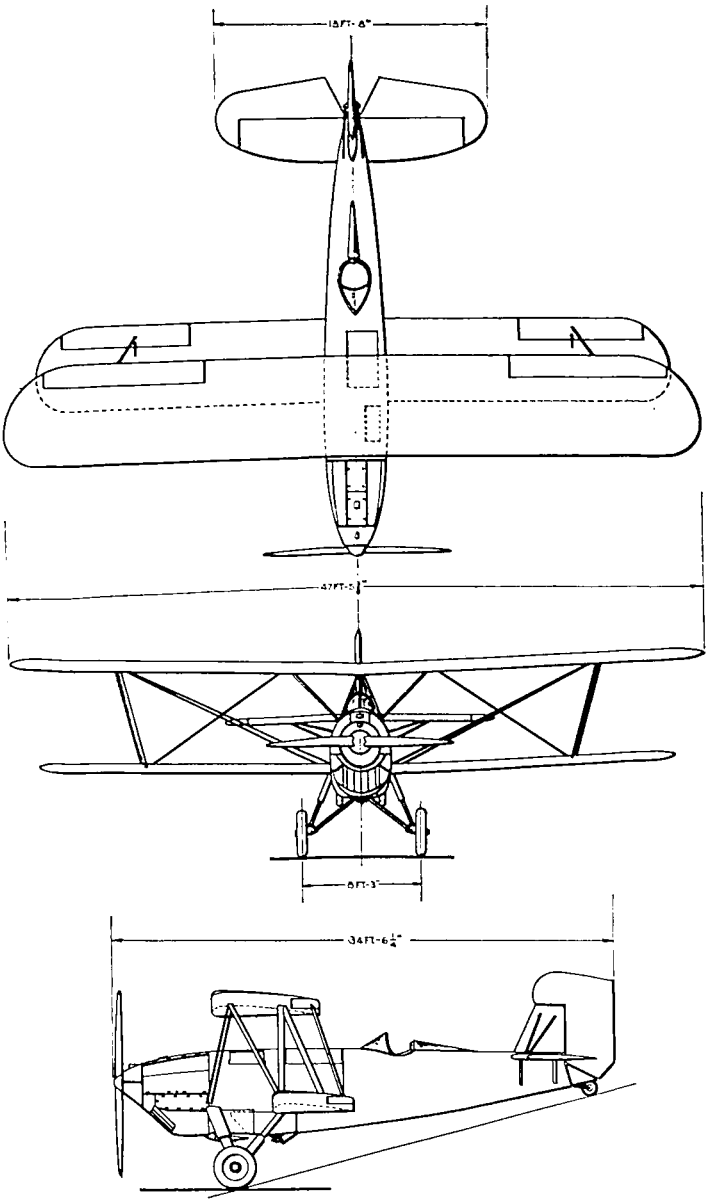
BOEING AIRPLANE COMPANY
Seattle, Wash.
MODEL 40 B
3 PLACE
ENGINE: PRATT & WHITNEY HORNET



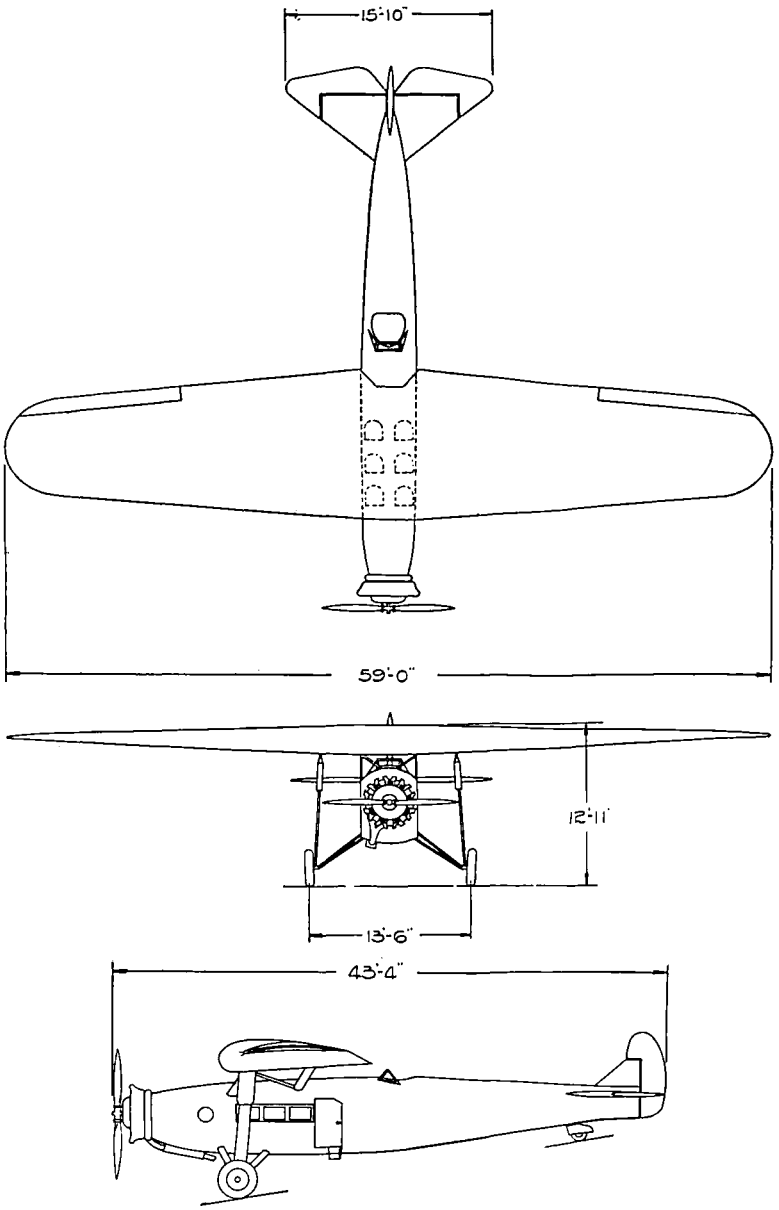
BOEING AIRPLANE COMPANY
Seattle, Wash.
MODEL 40 B 4
5 PLACE
ENGINE: PRATT & WHITNEY HORNET



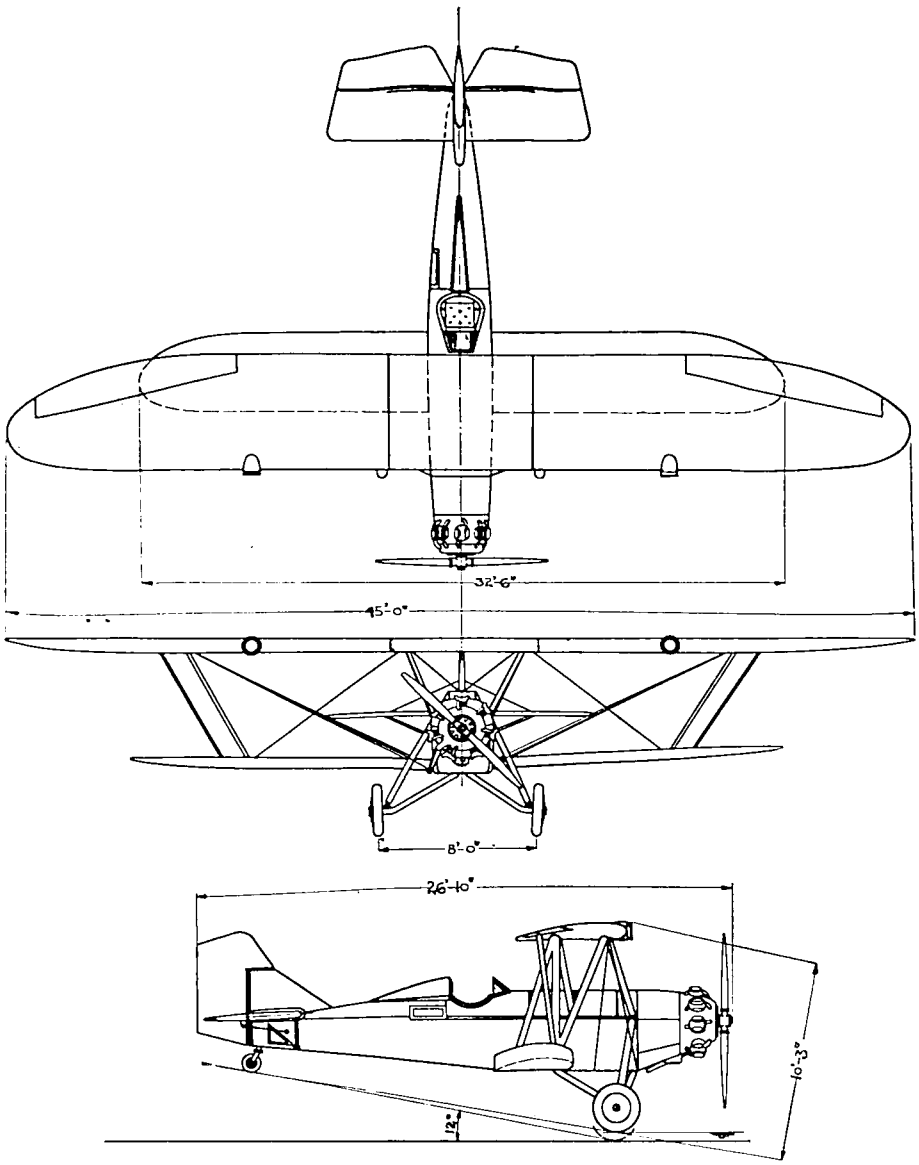
BOEING AIRPLANE COMPANY
Seattle, Wash.
MODEL 95
1 PLACE
ENGINE: PRATT & WHITNEY HORNET



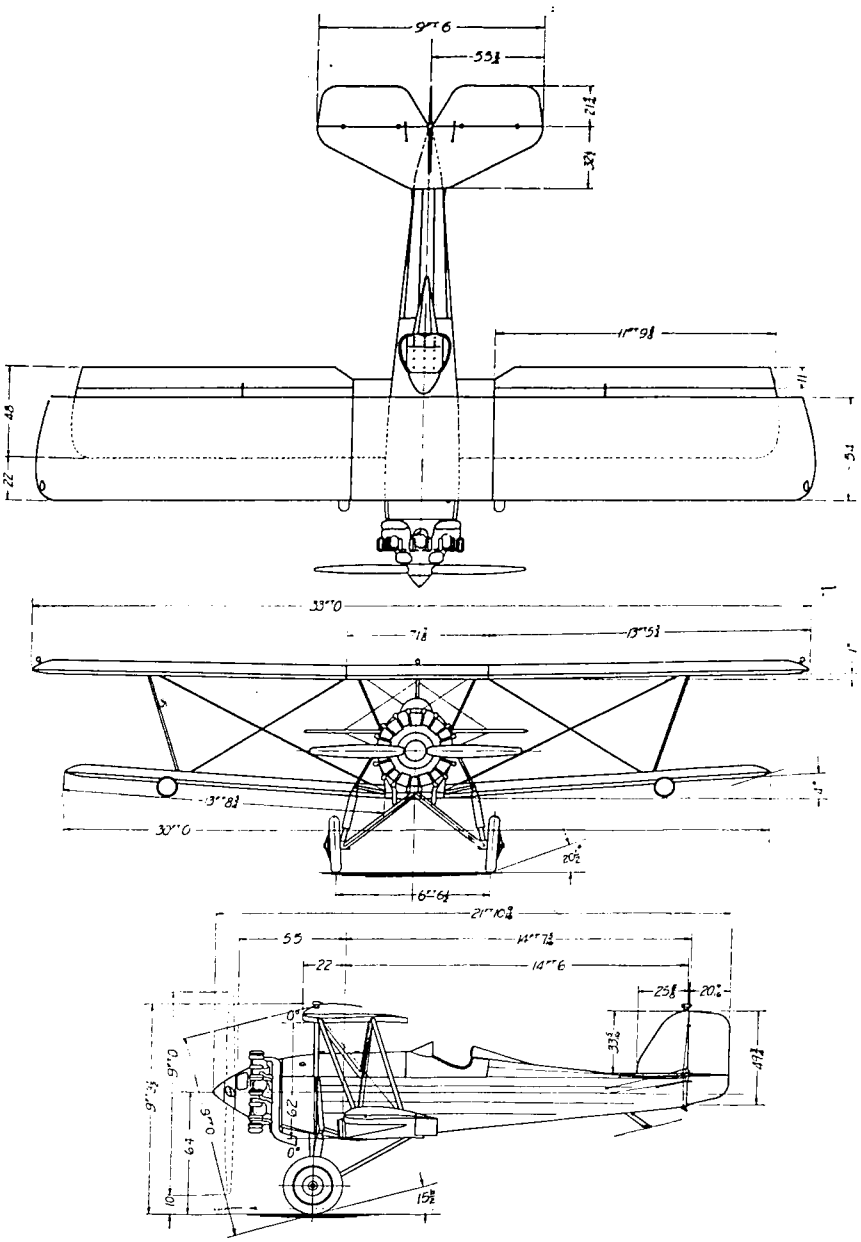
CURTISS AEROPLANE & MOTOR COMPANY, INC.
Garden City, L. I., N. Y.
CARRIER PIGEON II
1 PLACE
ENGINE: CURTISS GEARED CONQUEROR



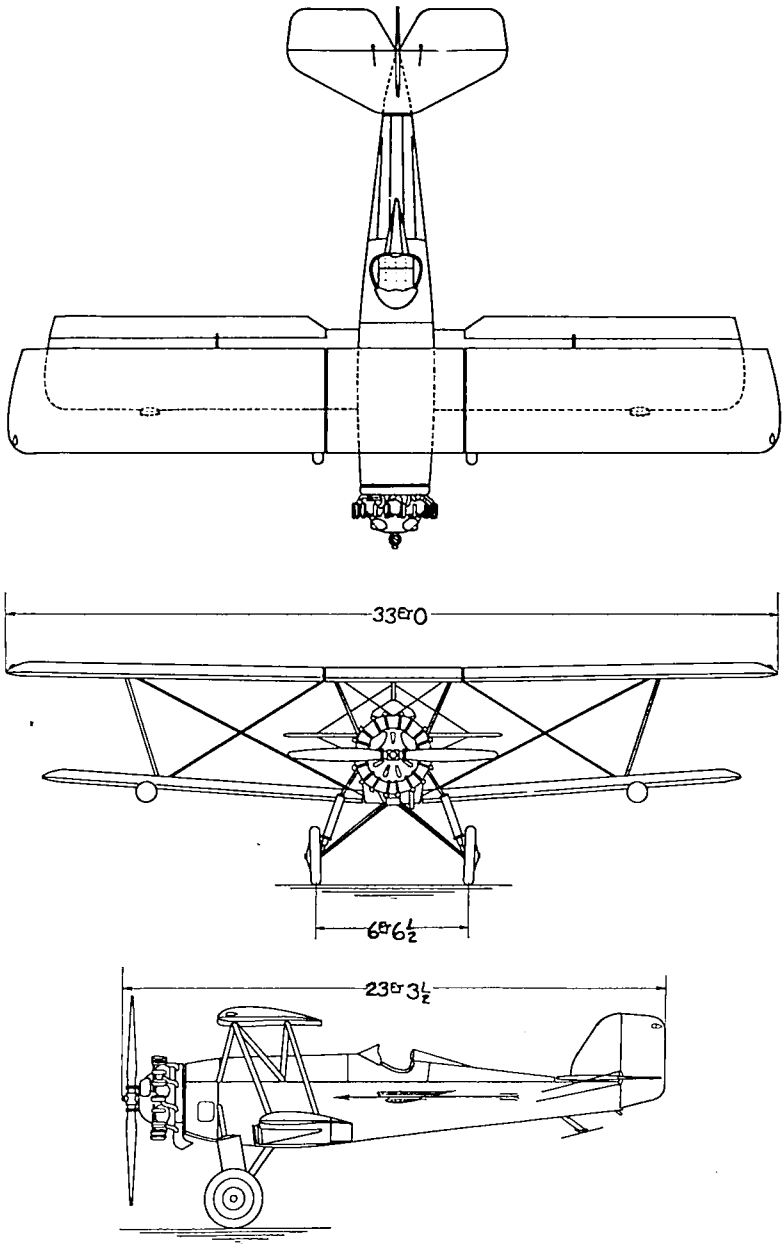
FOKKER AIRCRAFT CORPORATION OF AMERICA
New York City
MODEL F 14
7 PLACE
ENGINE: PRATT & WHITNEY HORNET
WRIGHT CYCLONE



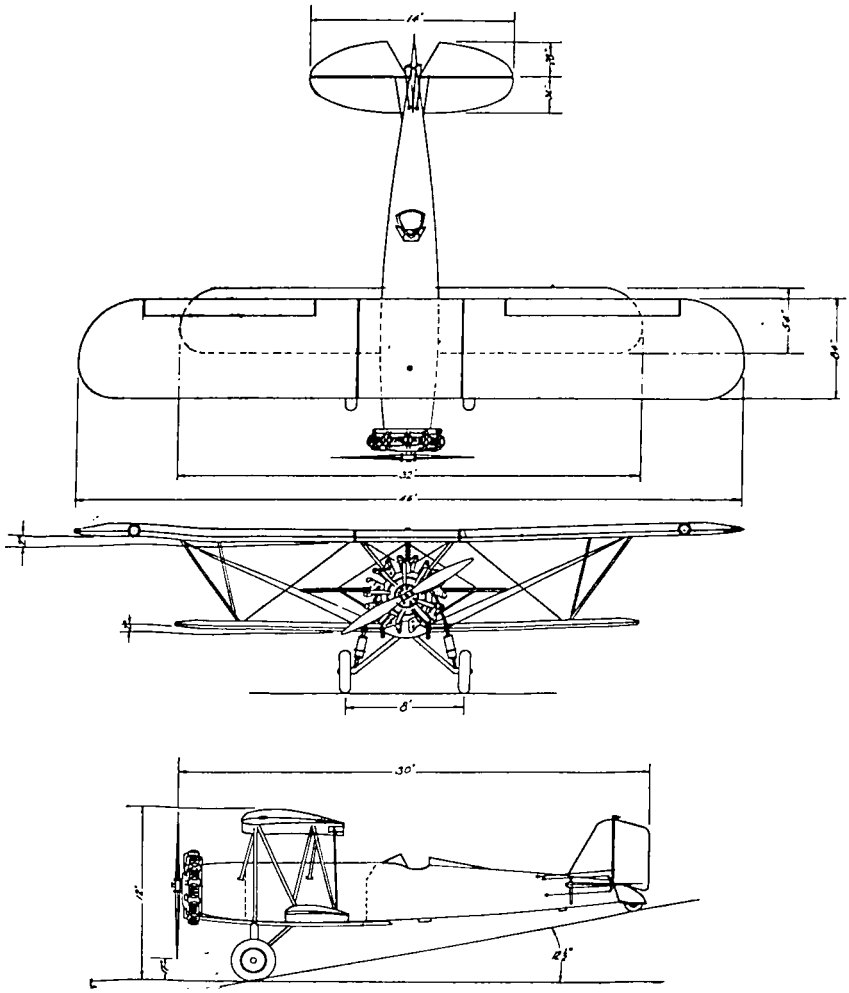
NEW STANDARD AIRCRAFT CORPORATION
Paterson, N. J.
MODEL D 27 A
1 PLACE
ENGINE: WRIGHT WHIRLWIND 220



PITCAIRN AIRCRAFT, INC.
Philadelphia, Pa.
MAILWING
1 PLACE
ENGINE: WRIGHT J-5

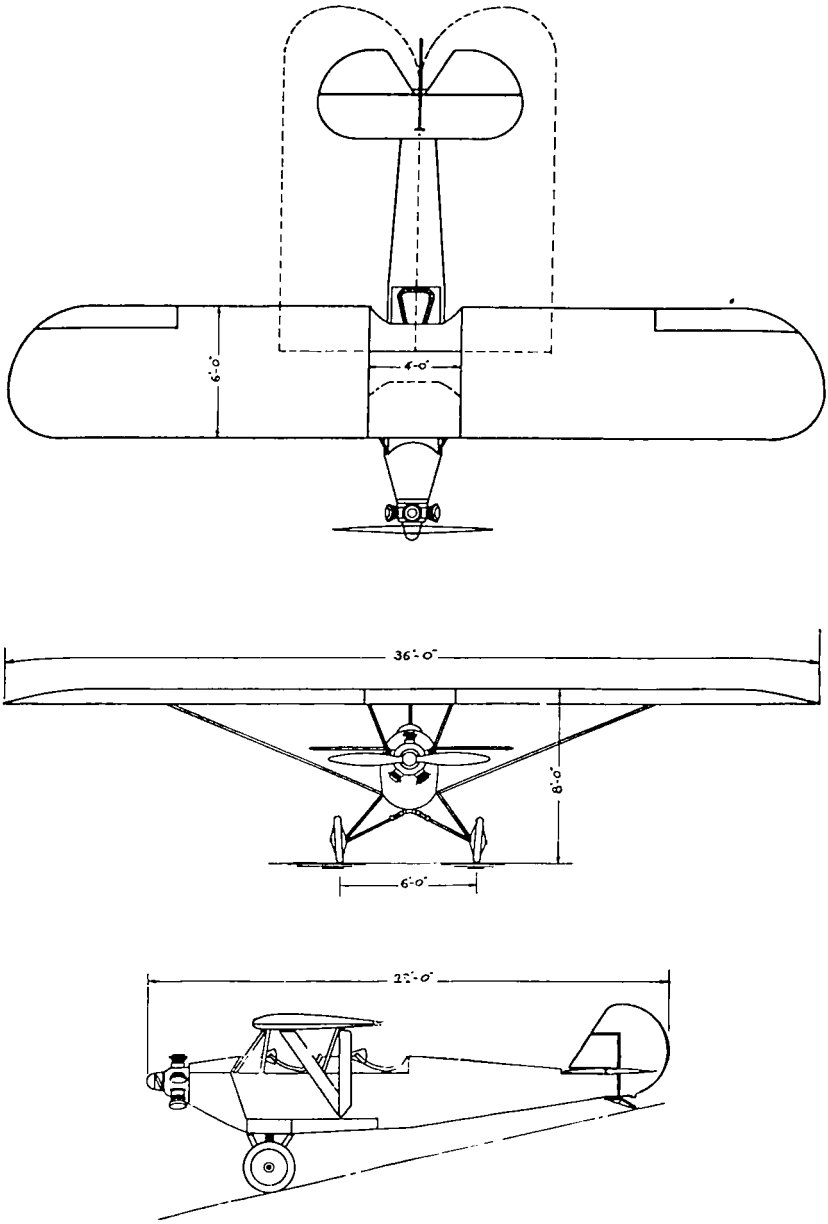


PITCAIRN AIRCRAFT, INC.
Philadelphia, Pa.
SUPER MAILWING
1 PLACE
ENGINE: WRIGHT J-5

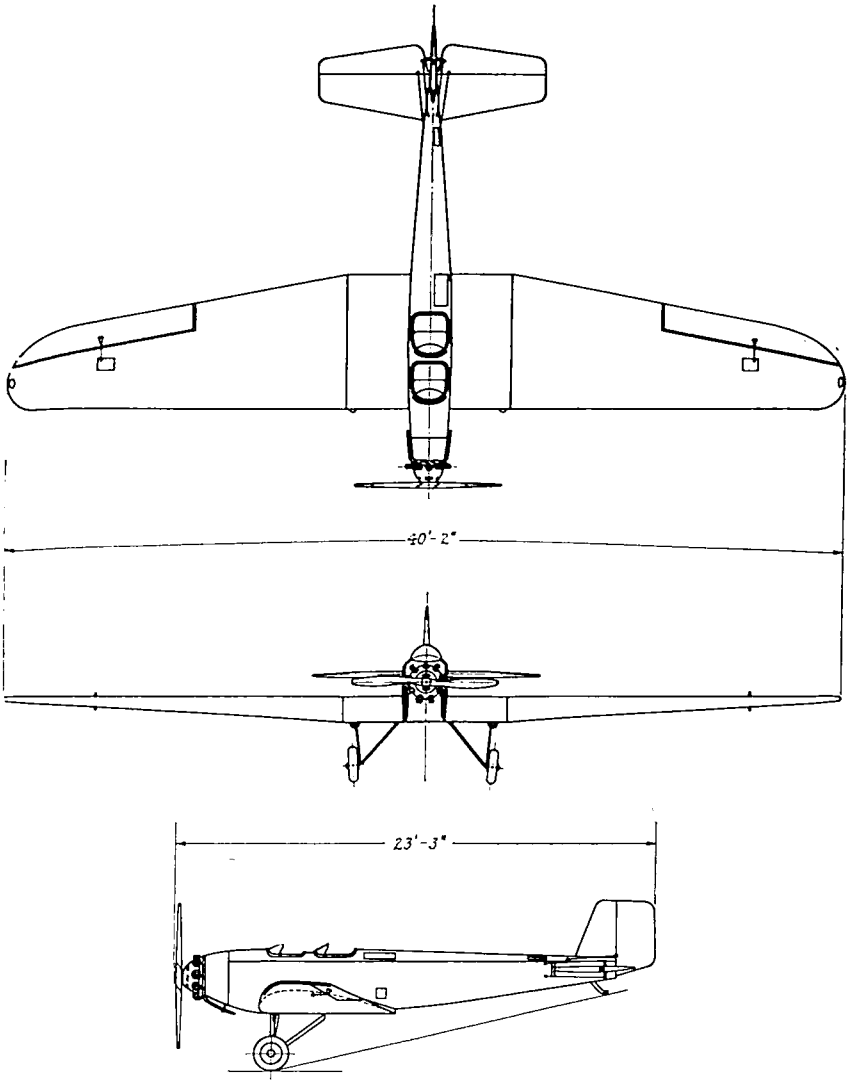


STEARMAN AIRCRAFT COMPANY
Wichita, Kan.
SPEED MAIL
1 PLACE
ENGINE: PRATT & WHITNEY HORNET
WRIGHT CYCLONE

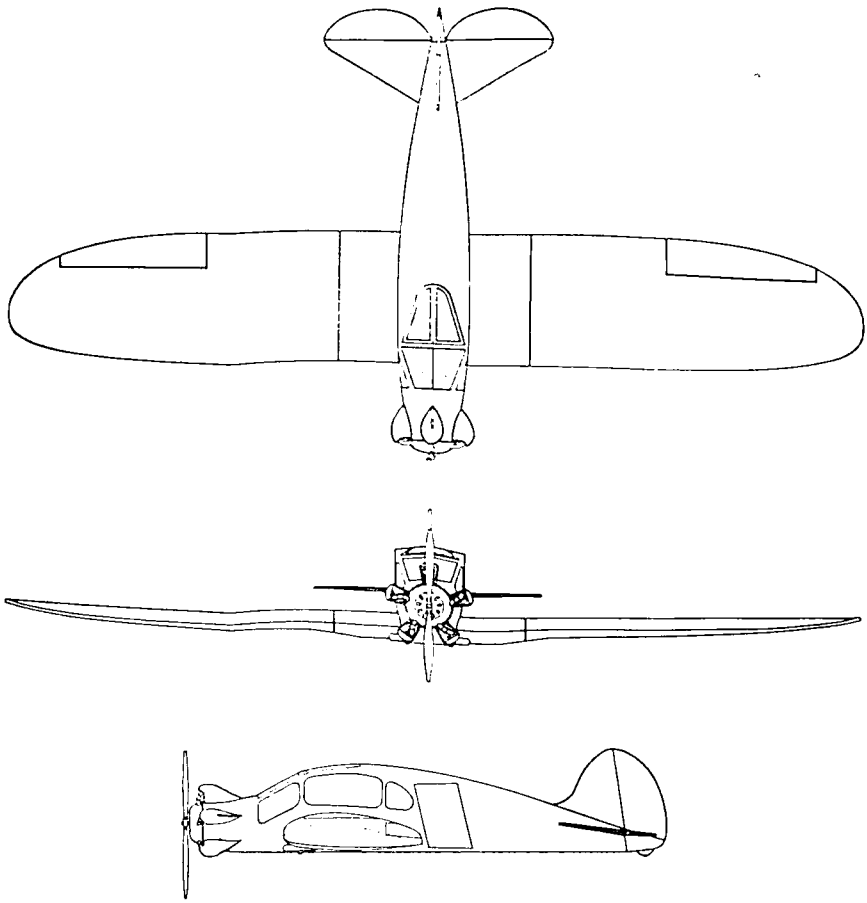
Private Operation and Aerial Service



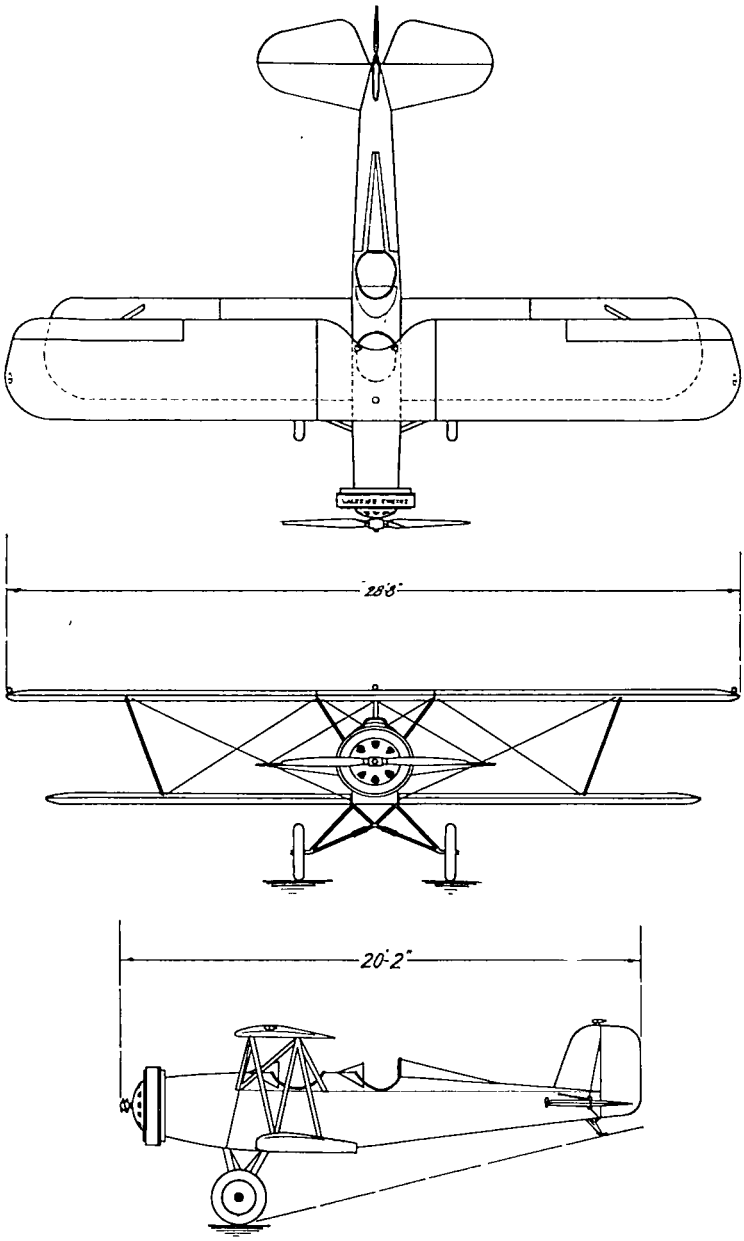
ACME AIRCRAFT CORPORATION
Rockford, Ill.
ACME SPORTSMAN
2 PLACE
ENGINE: WRIGHT GIPSY



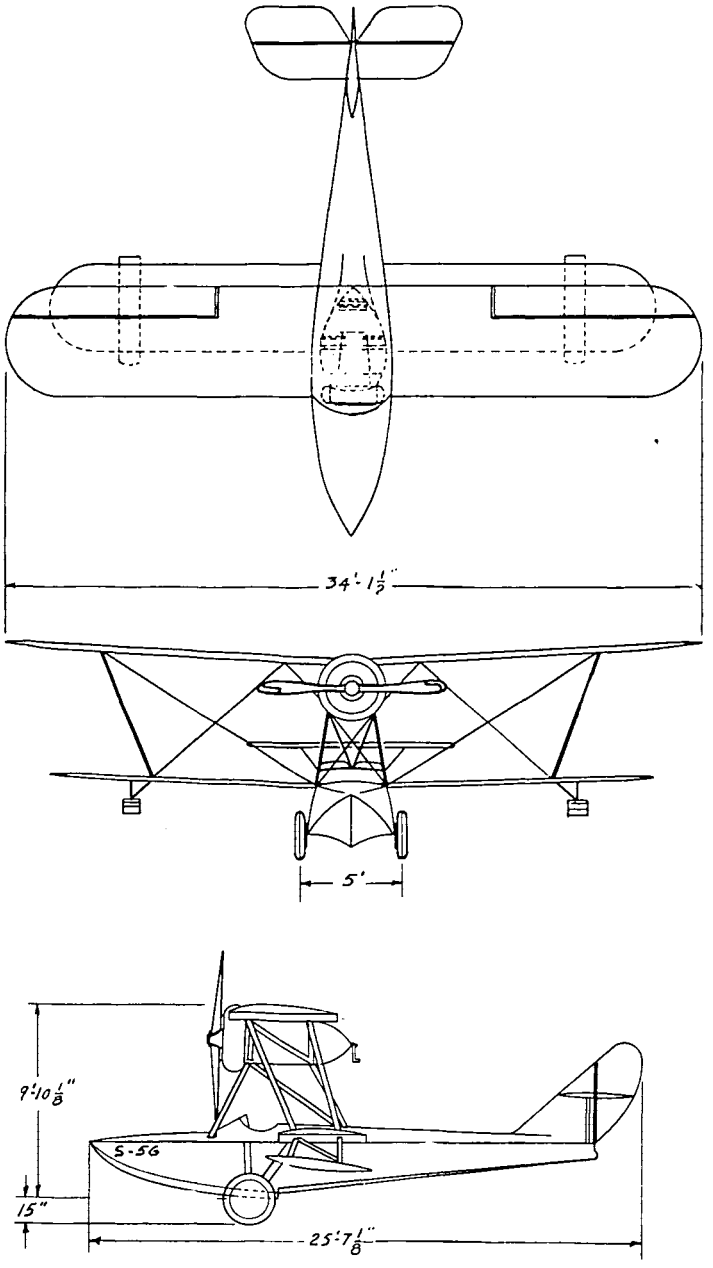
AEROMARINE KLEMM CORPORATION
Keyport, N. J.
AKL-25
2 PLACE
ENGINE: SALMSON
LE BLOND



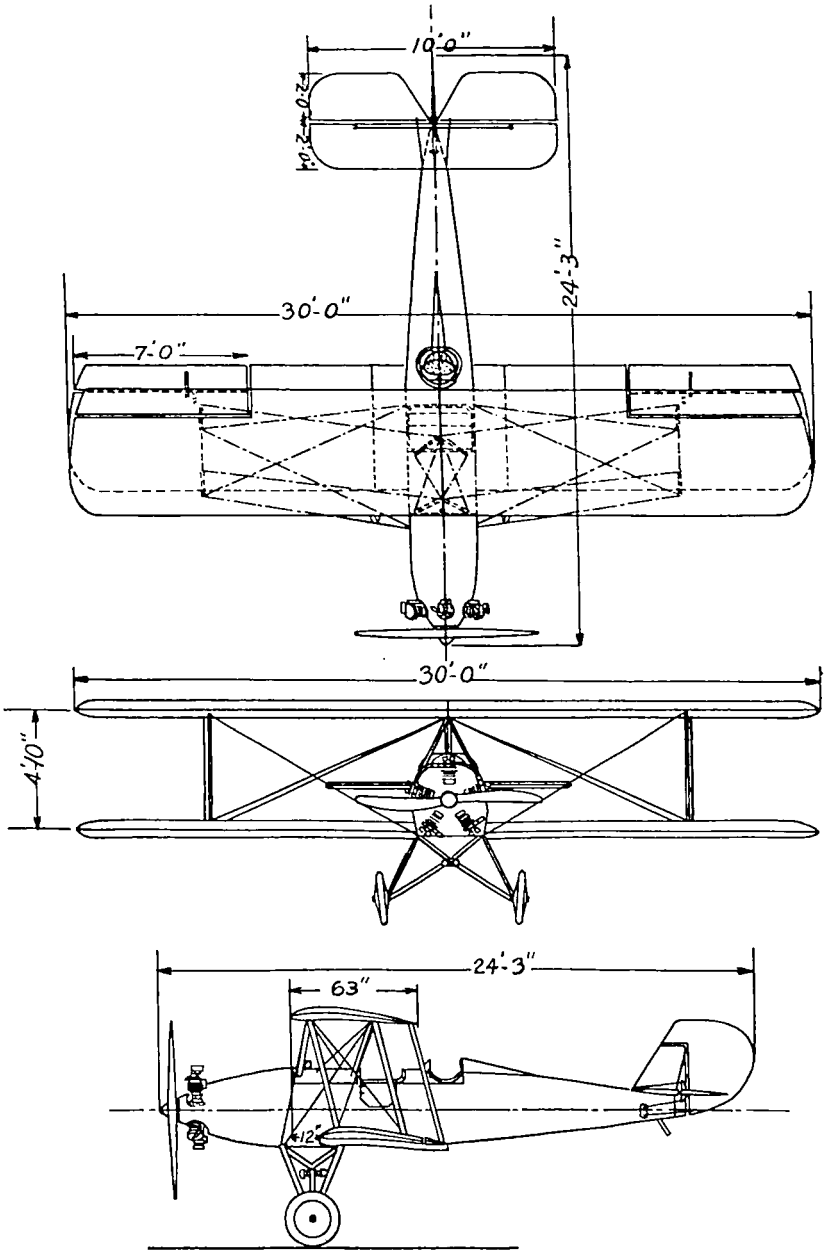
ALEXANDER AIRCRAFT CORPORATION
Colorado Springs, Colo.
BULLET
4 PLACE
ENGINE: KINNER
WHIRLWIND 165



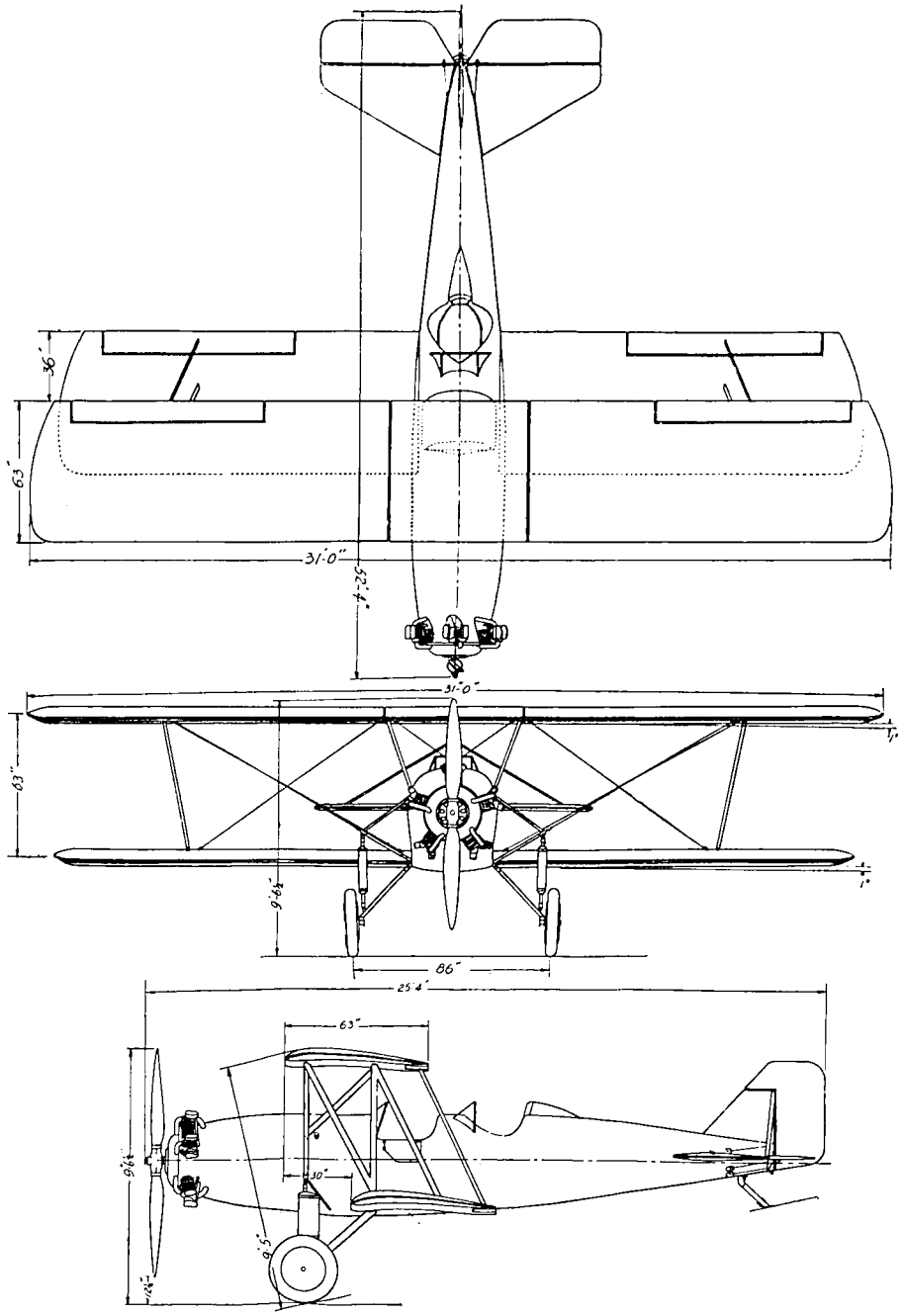
ALLIANCE AIRCRAFT CORPORATION
Alliance, Ohio
ARGO
2 PLACE
ENGINE: HESS "WARRIOR"



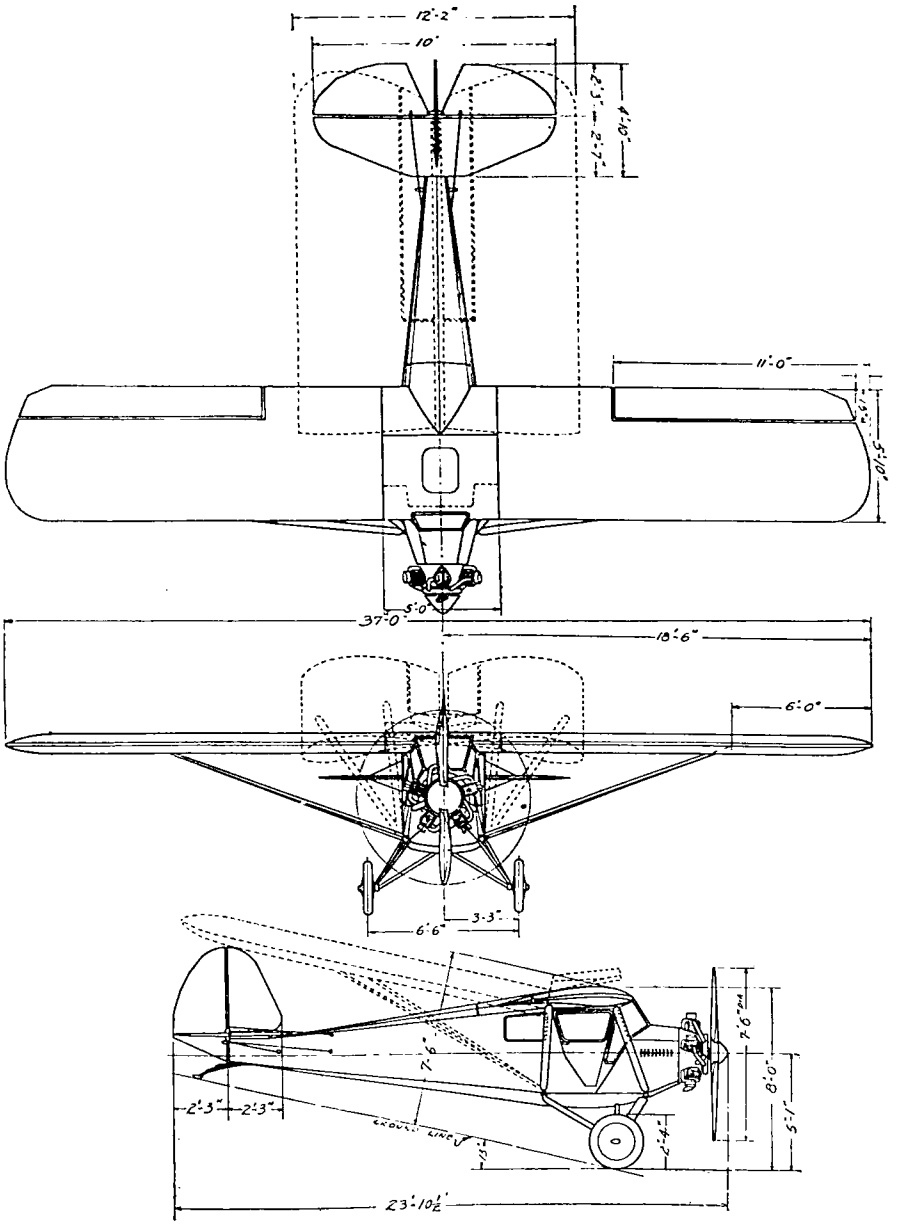
AMERICAN AERONAUTICAL CORPORATION
New York City
AMERICAN MARCHETTI S 56
3 PLACE
ENGINE: KINNER



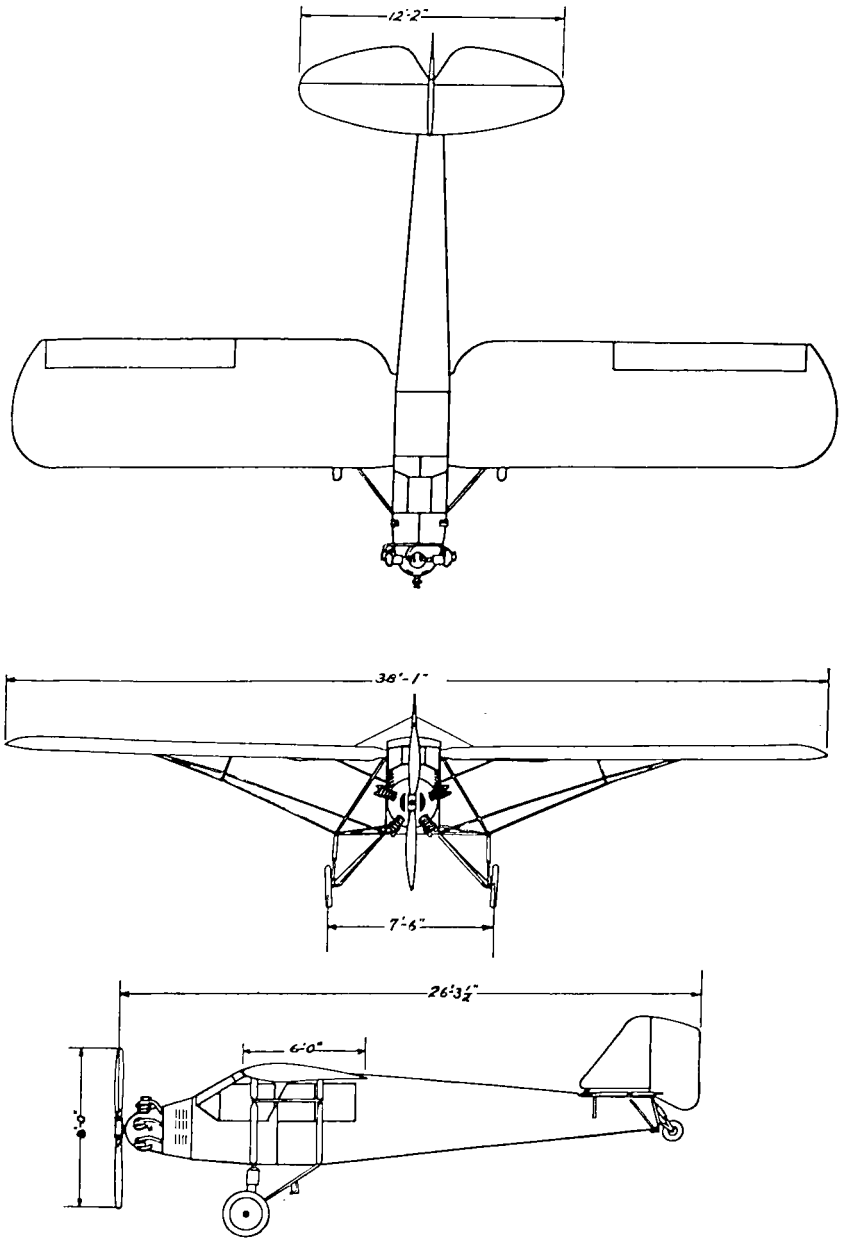
AMERICAN EAGLE AIRCRAFT CORPORATION
Kansas City, Kan.
MODEL A-129
3 PLACE
ENGINE: CURTISS OX5
KINNER



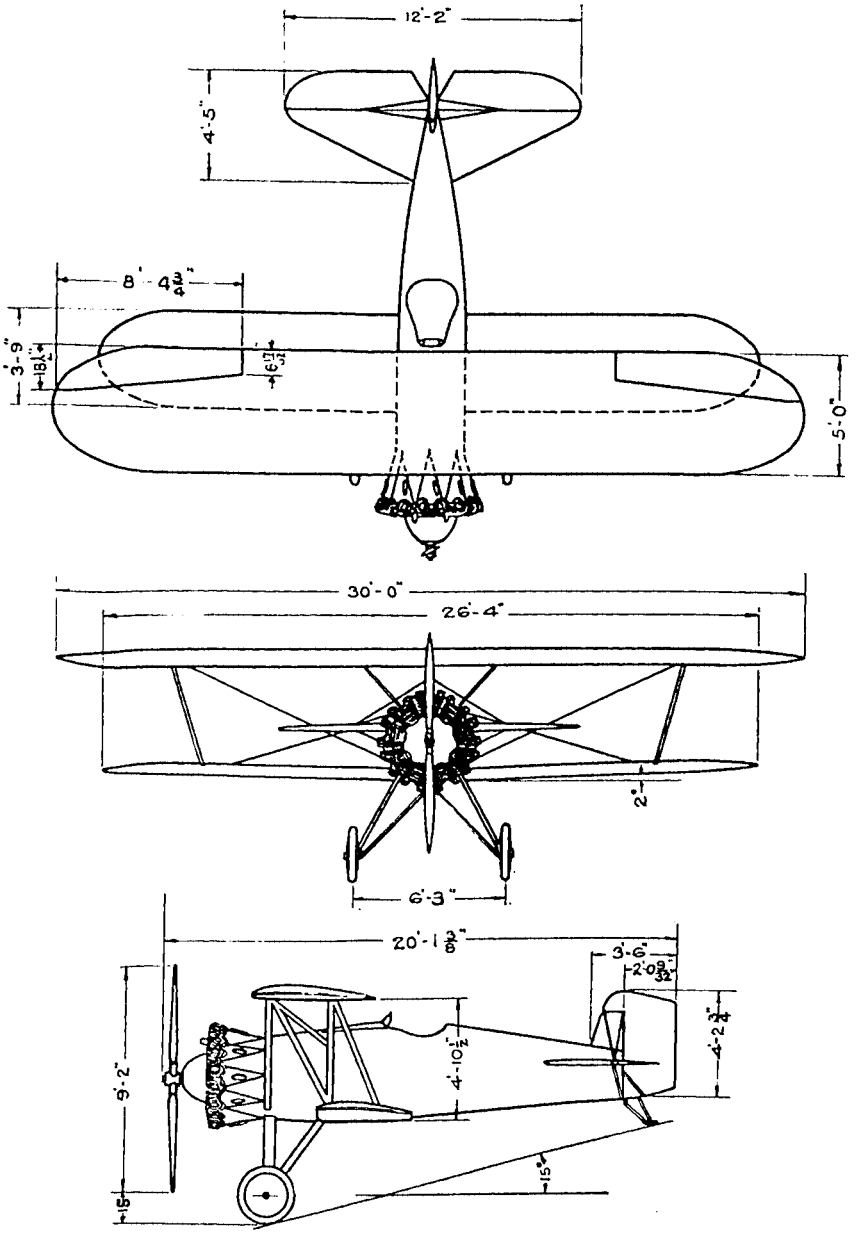
AMERICAN EAGLE AIRCRAFT CORPORATION
Kansas City, Kan.
PHAETON
3 PLACE
ENGINE: HISPANO SUIZA A; HISPANO SUIZA E
WRIGHT WHIRLWIND 165; WRIGHT WHIRLWIND 220



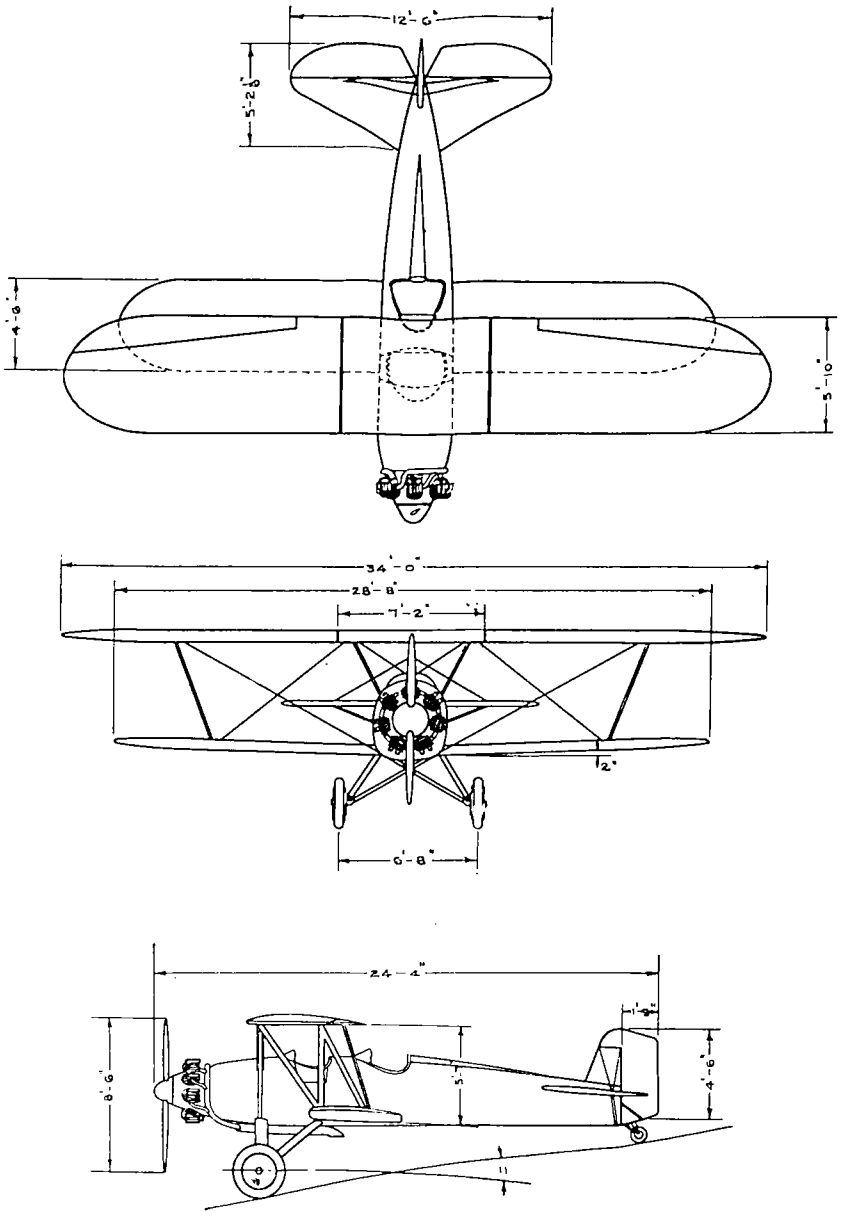
AMERICAN EAGLE AIRCRAFT CORPORATION
Kansas City, Kan.
WALLACE TOUROPLANE
3 AND 4 PLACE
ENGINE: KINNER
WRIGHT WHIRLWIND 165



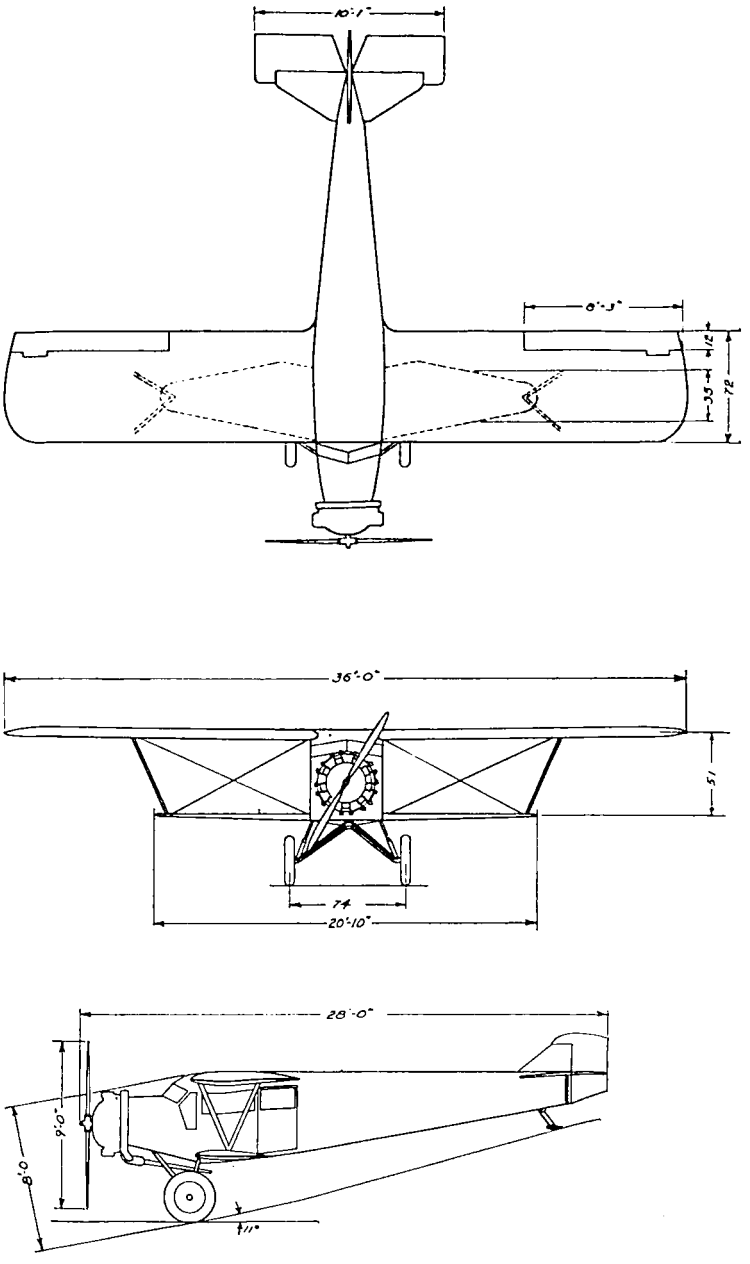
BERLINER JOYCE AIRCRAFT CORPORATION
Baltimore, Md.
B/J 29-1
2 PLACE
ENGINE: KINNER



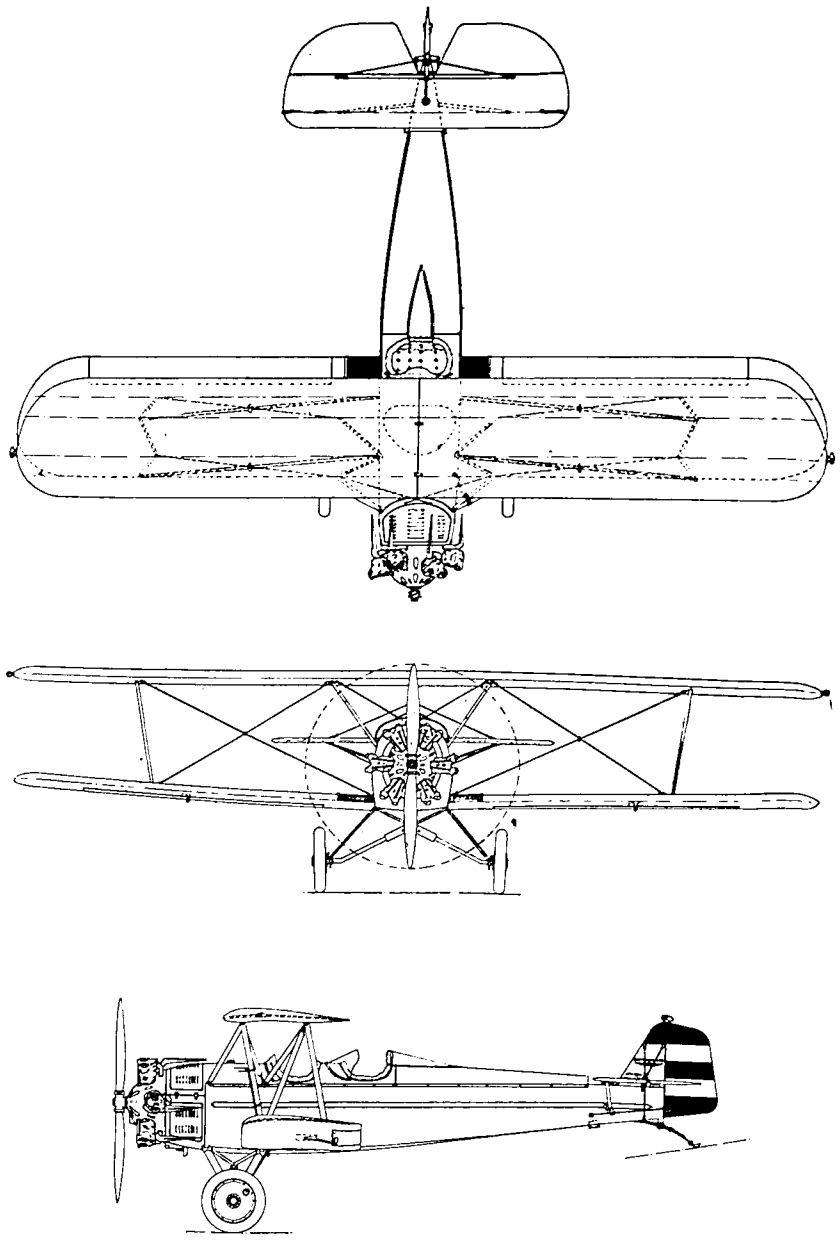
BOEING AIRPLANE COMPANY
Seattle, Wash.
MODEL 100
1 PLACE
ENGINE: PRATT & WHITNEY WASP



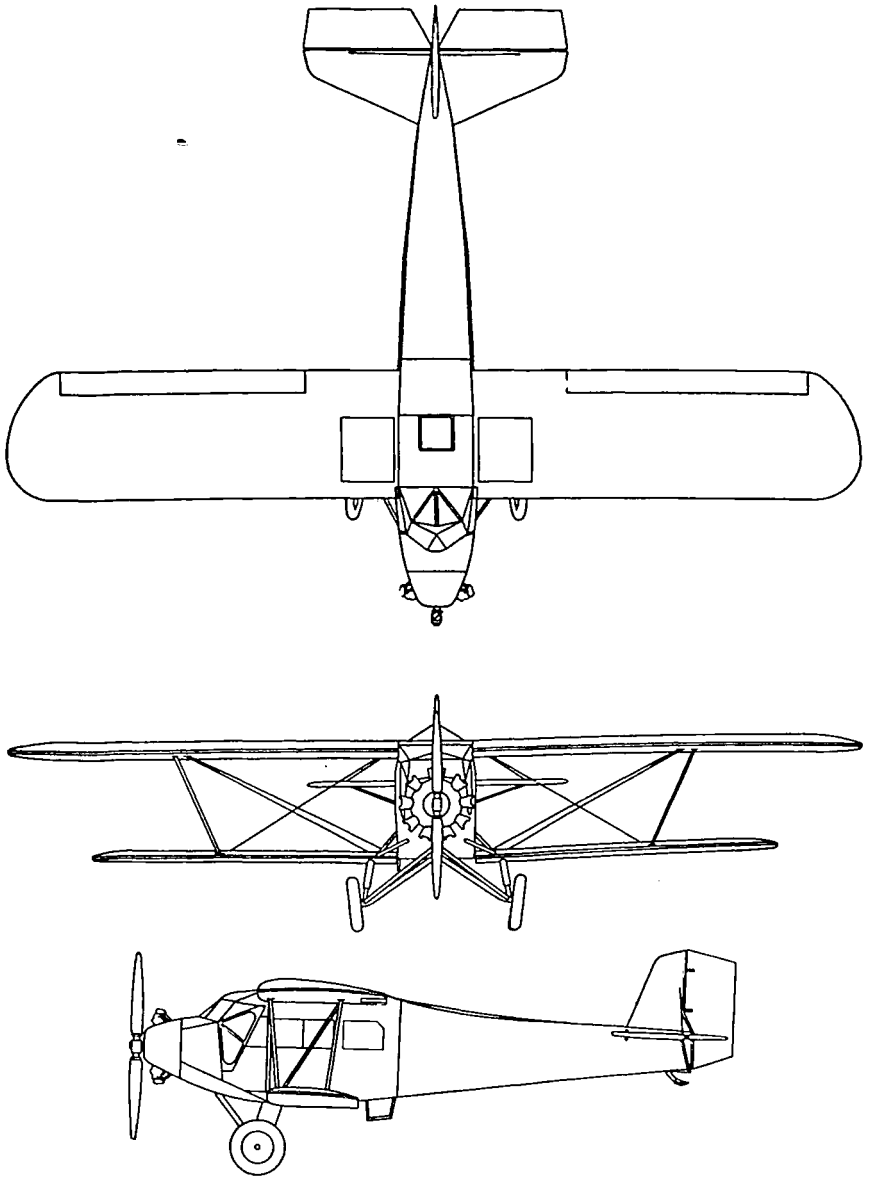
BOEING AIRPLANE COMPANY
Seattle, Wash.
MODEL 203
3 PLACE
ENGINE: AXELSON



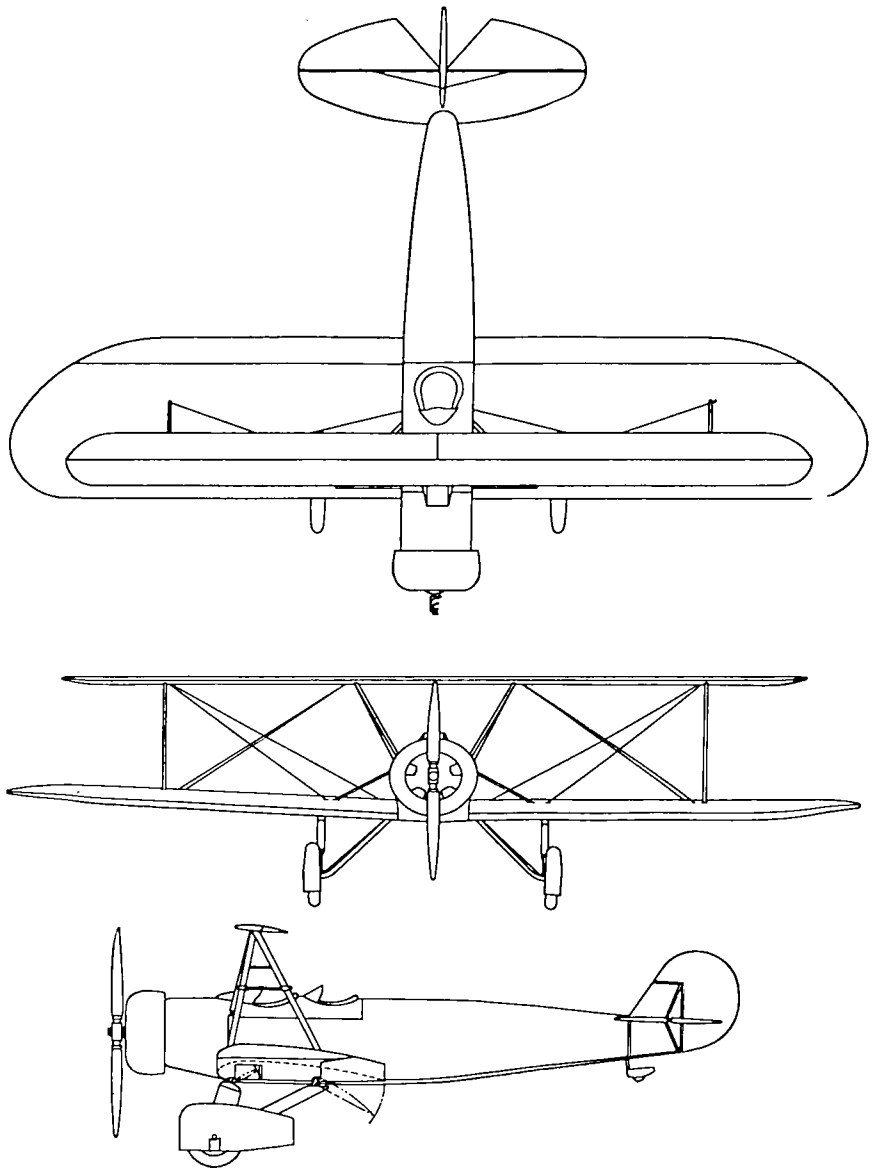
BUHL AIRCRAFT COMPANY
Marysville, Mich.
SPORT AIRSEDAN C A 3C
3 PLACE
ENGINE: WRIGHT WHIRLWIND J-5
WRIGHT WHIRLWIND 300



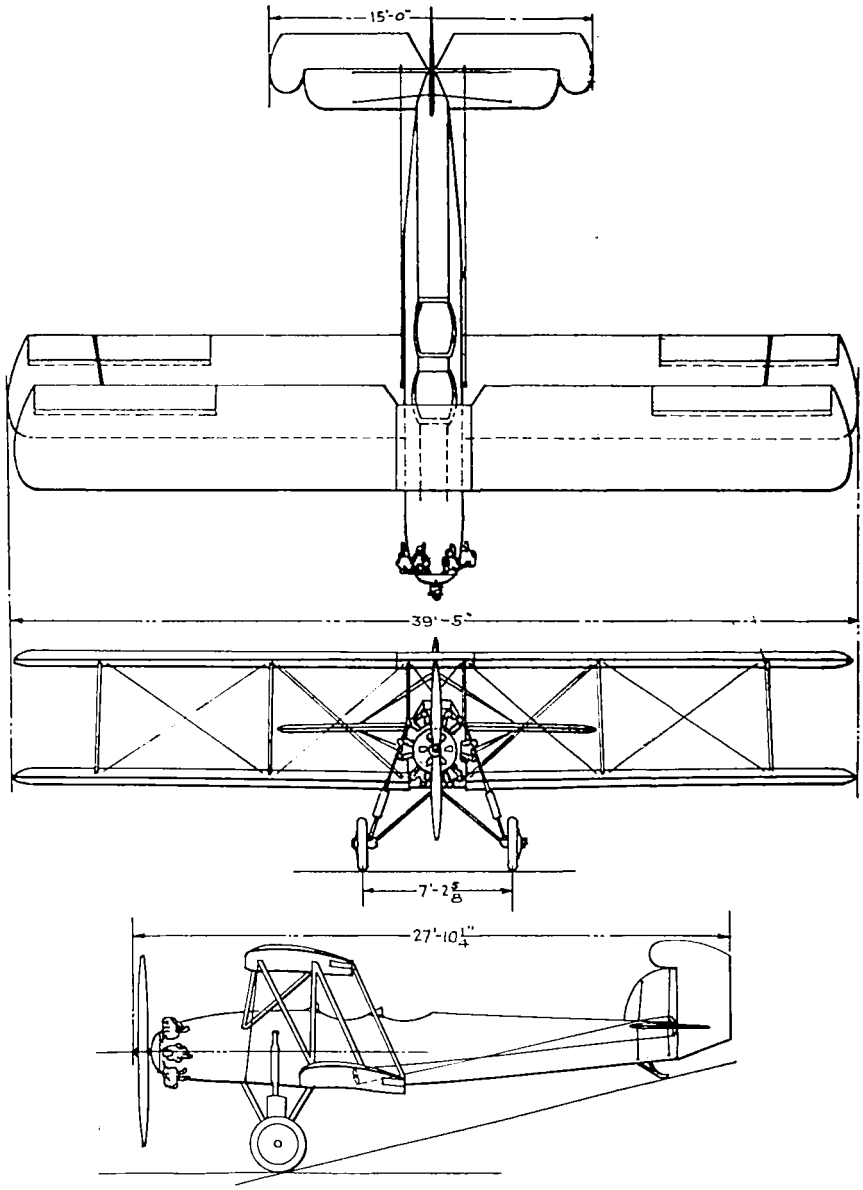
COMMAND-AIRE, INC.
Little Rock, Ark.
MODEL 5C3
3 PLACE
ENGINE: CURTISS CHALLENGER



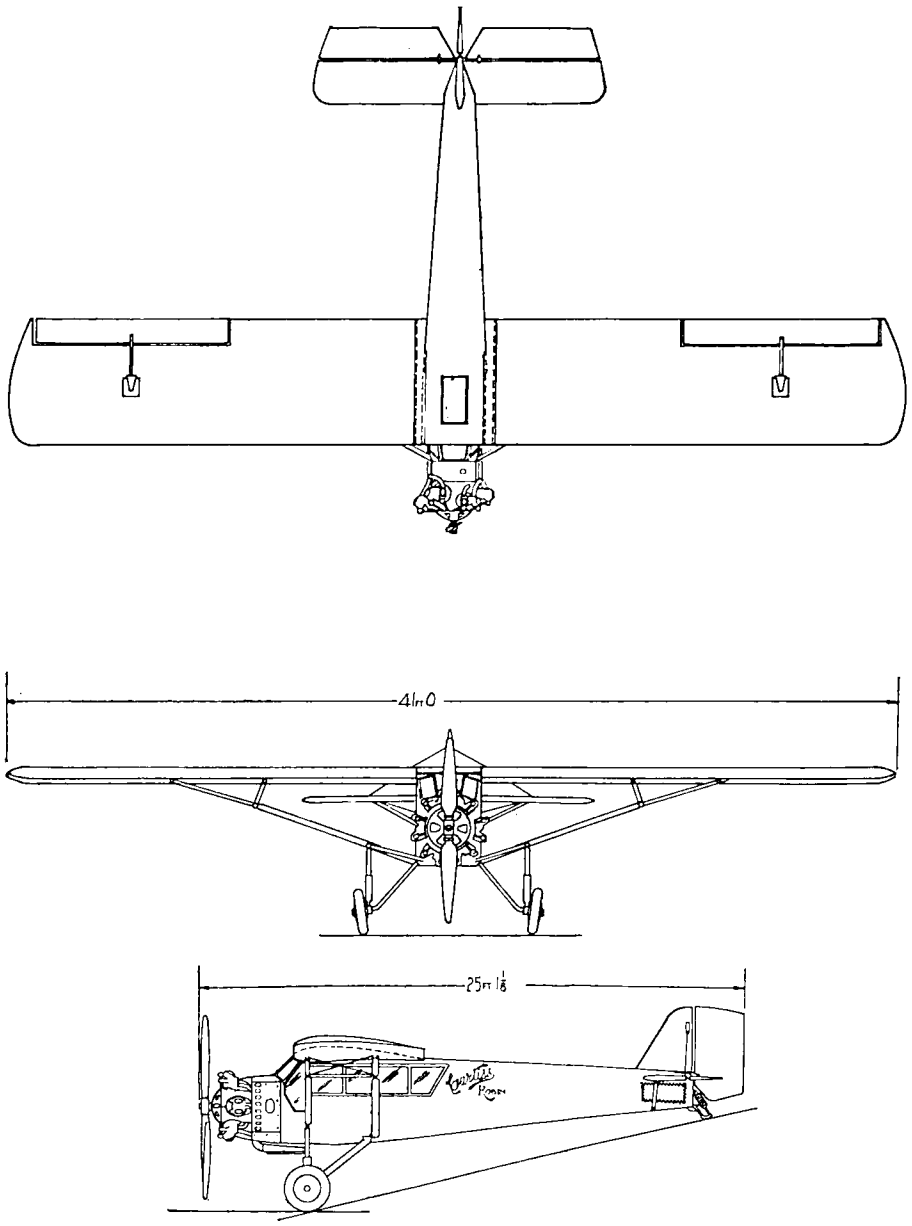
CUNNINGHAM HALL AIRCRAFT CORPORATION
Rochester, N. Y.
P. T. 6
6 PLACE
ENGINE: WRIGHT WHIRLWIND 300



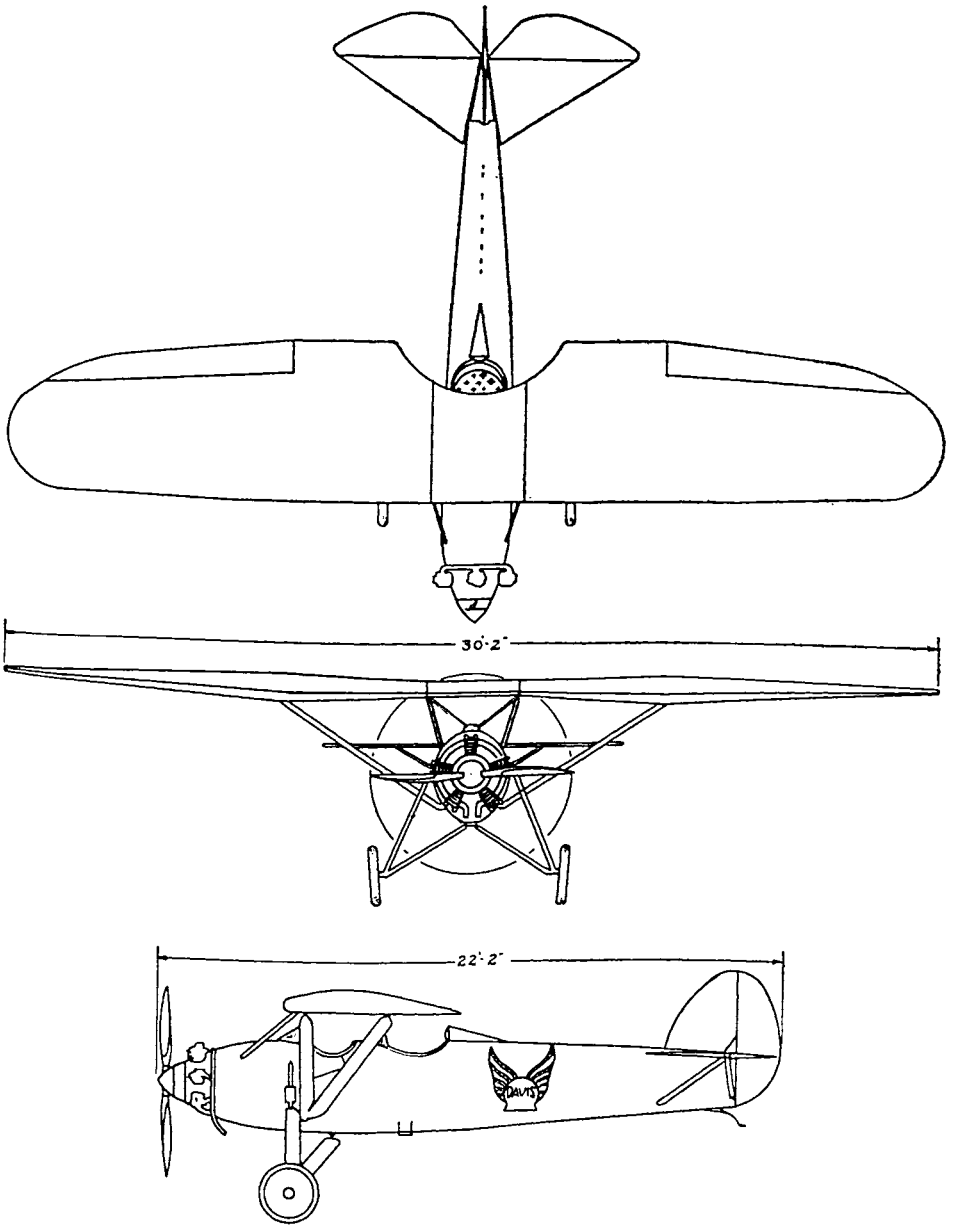
CUNNINGHAM HALL AIRCRAFT CORPORATION
Rochester, N. Y.
MODEL X
2 PLACE
ENGINE: WALTER VEGA



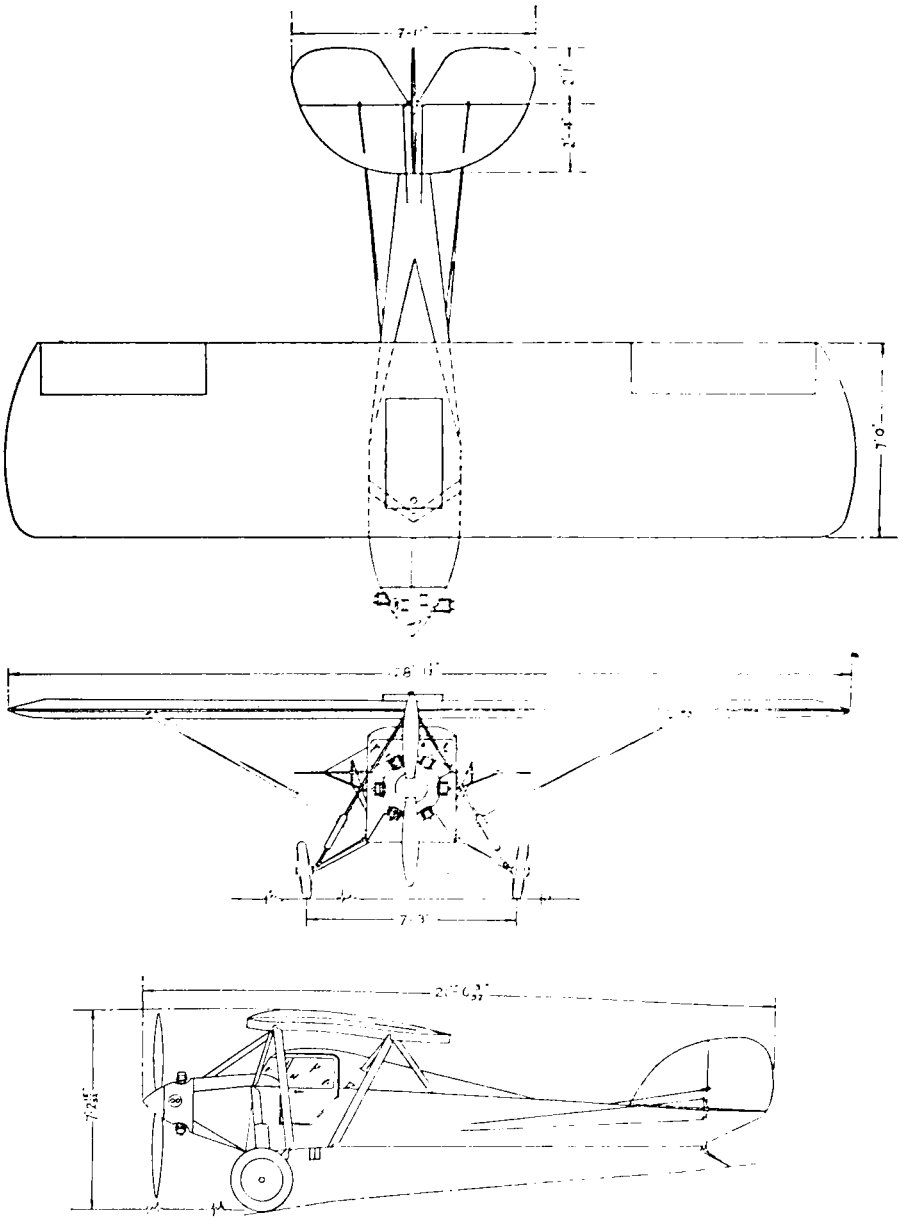
CURTISS AEROPLANE & MOTOR COMPANY
Garden City, L. I., N. Y.
FLEDGLING
2 PLACE
ENGINE: CURTISS CHALLENGER



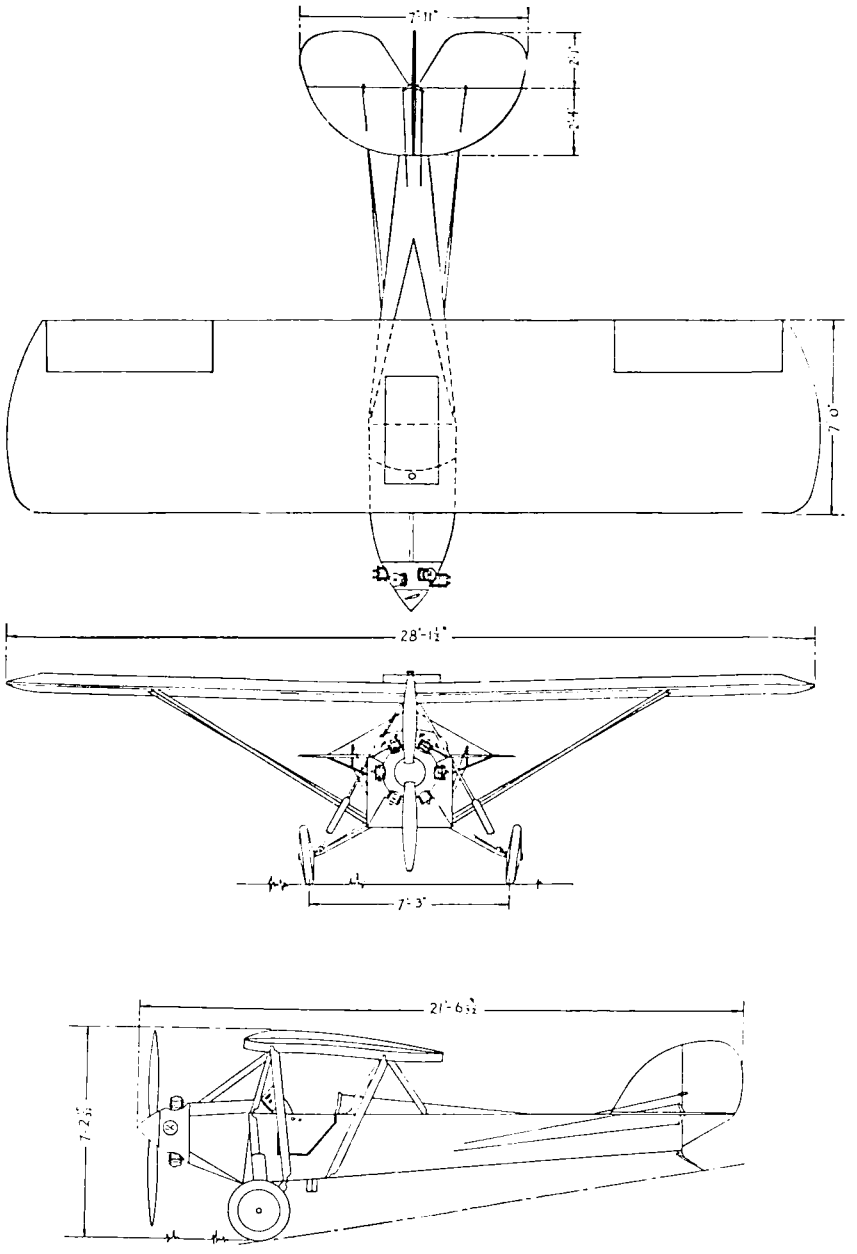
CURTISS-ROBERTSON AIRPLANE MANUFACTURING COMPANY
St. Louis, Mo.
ROBIN C1
3 PLACE
ENGINE: CURTISS CHALLENGER
CURTISS OX5
WRIGHT WHIRLWIND 165



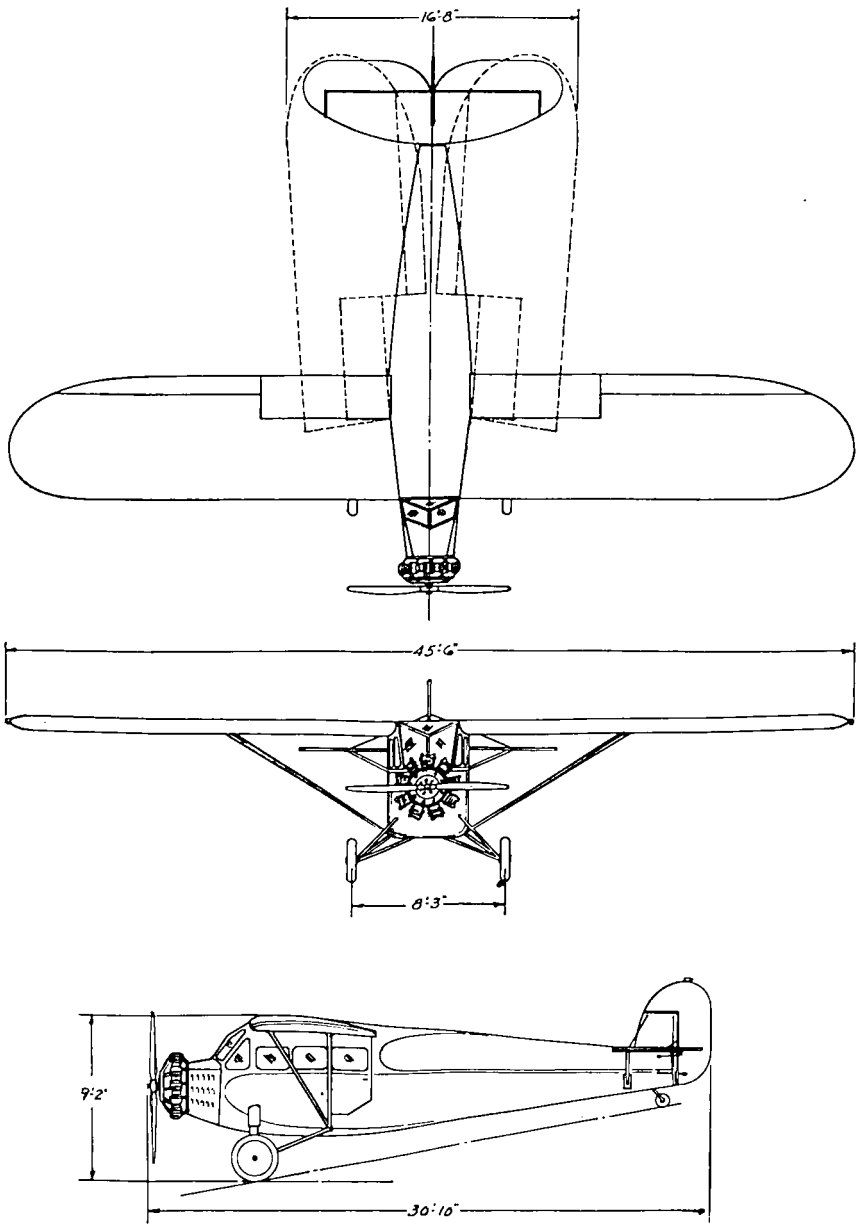
DAVIS AIRCRAFT CORPORATION
Richmond, Ind.
MODEL D
2 PLACE
ENGINE: KINNER
LE BLOND



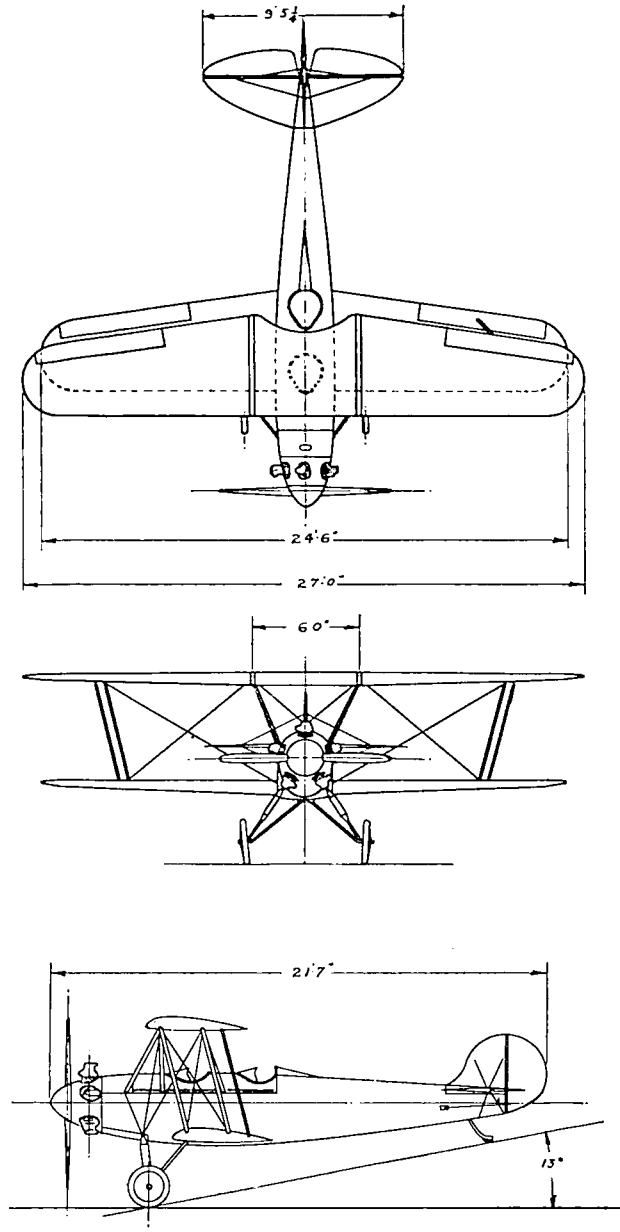
G. ELIAS & BRO., INC.
Buffalo, N. Y.
AIRCOUPE
2 PLACE
ENGINE: KINNER



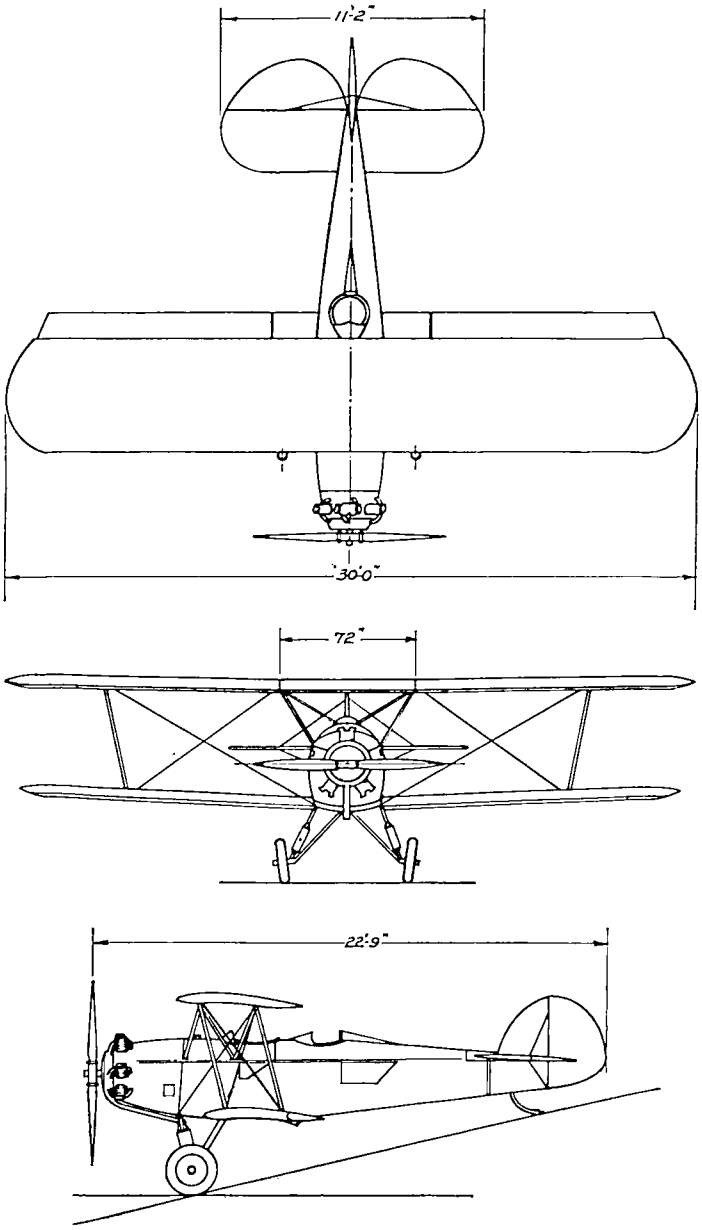
G. ELIAS & BRO., INC.
Buffalo, N. Y.
AIRSPORT
2 PLACE
ENGINE: KINNER



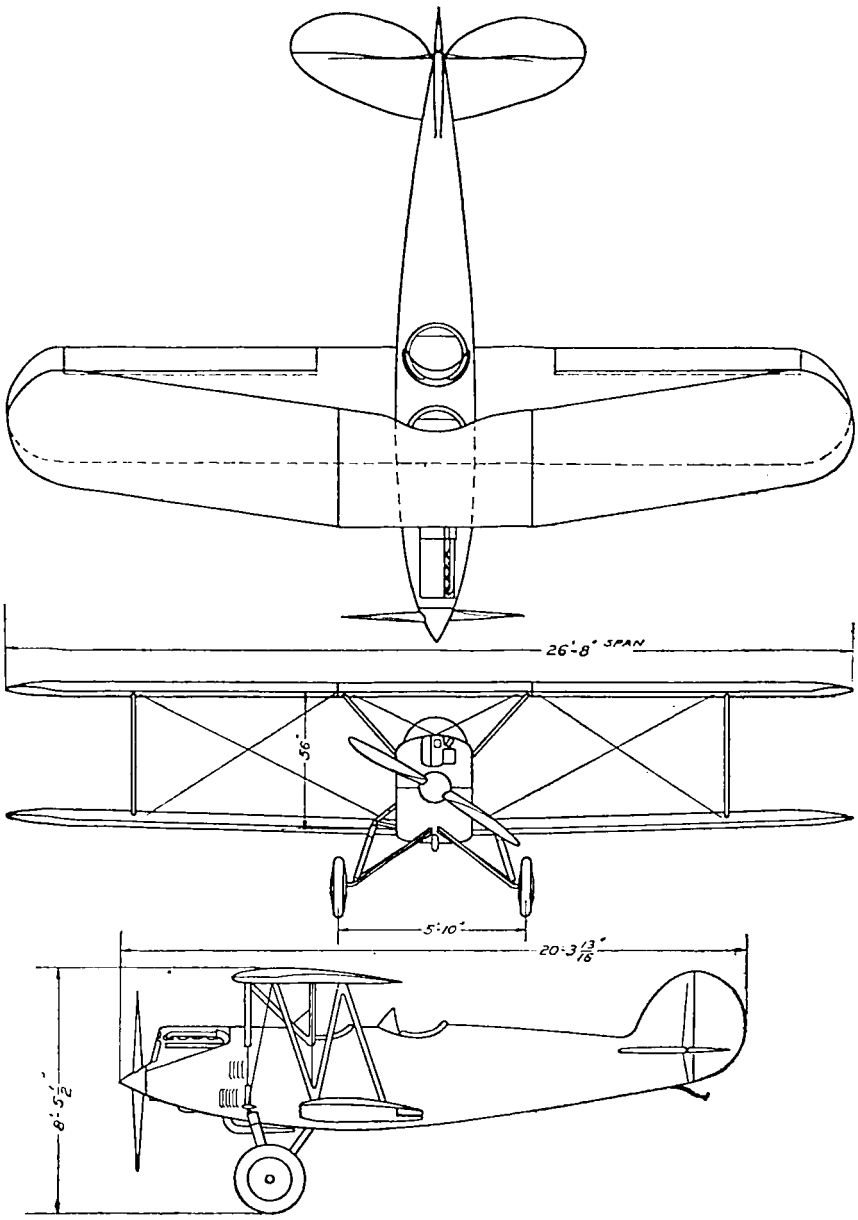
FAIRCHILD AIRPLANE MANUFACTURING CORPORATION
Farmingdale, L. I., N. Y.
MODEL 42
4 PLACE
ENGINE: WRIGHT WHIRLWIND 300



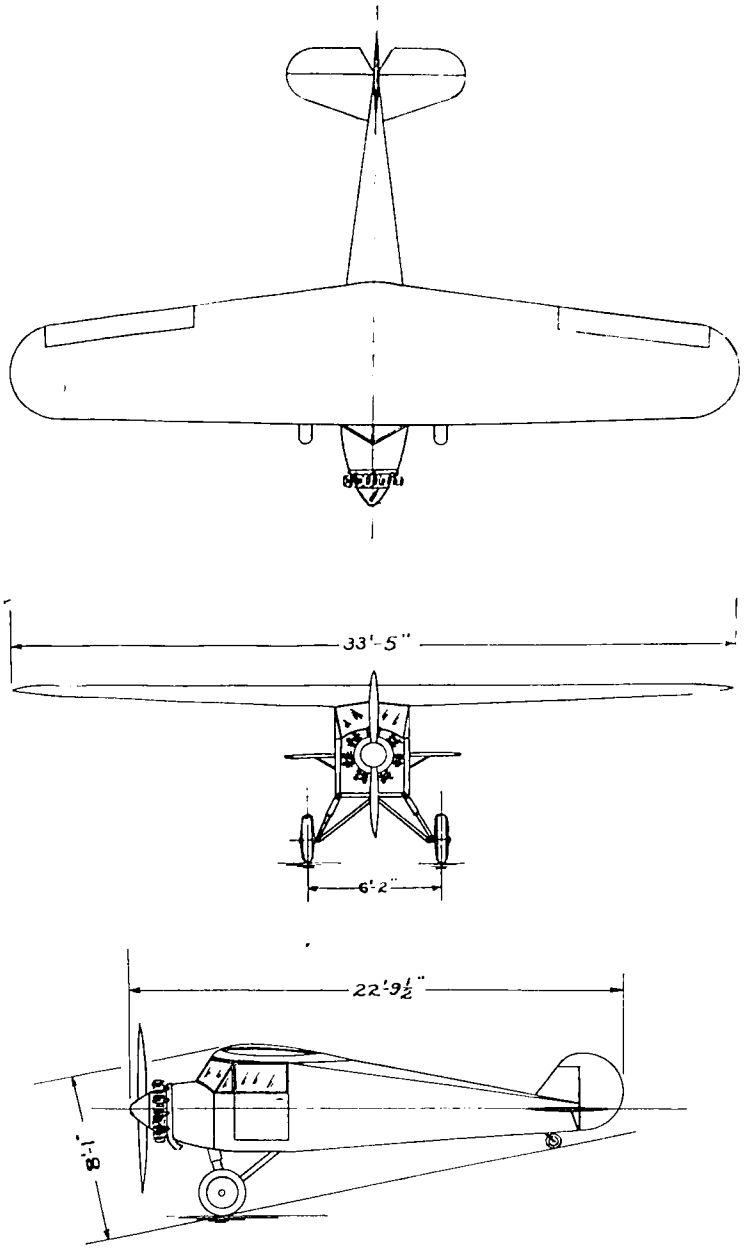
FAIRCHILD AVIATION CORPORATION
(Kreider-Reisner Division)
Hagerstown, Md.
MODEL KR 21
2 PLACE
ENGINE: KINNER



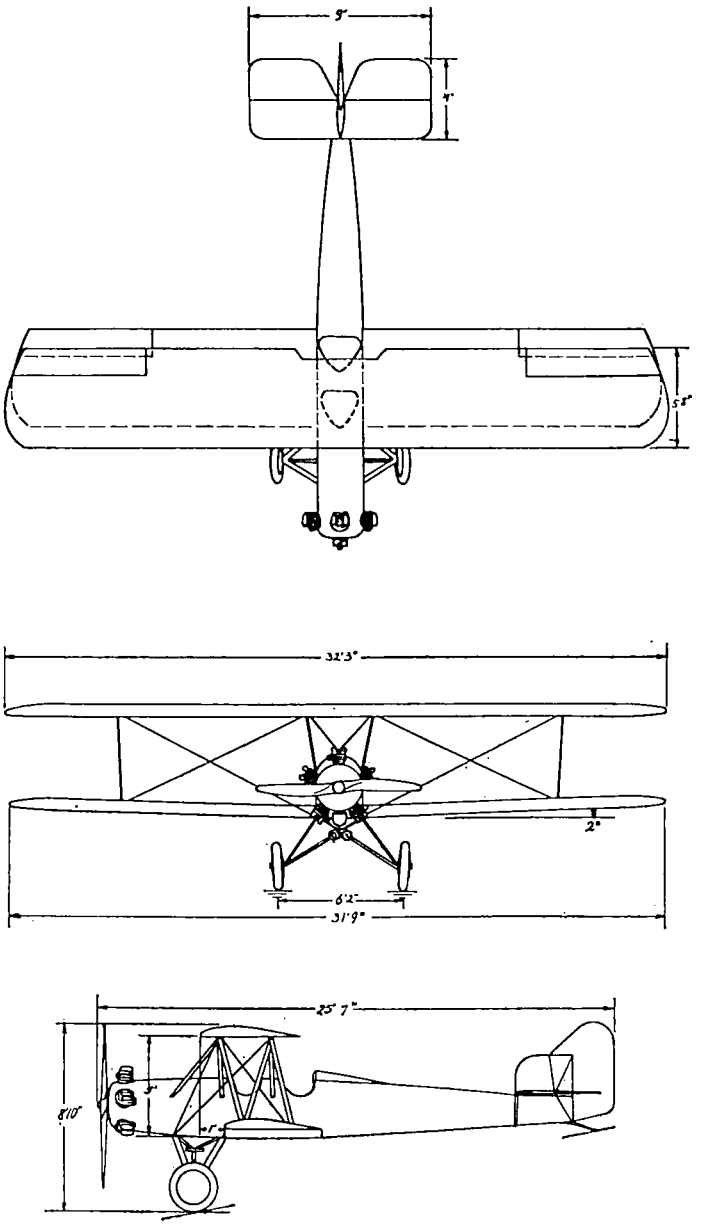
FAIRCHILD AVIATION CORPORATION
(KREIDER-REISNER DIVISION)
Hagerstown, Md.
MODEL KR 34
3 PLACE
ENGINE: WRIGHT WHIRLWIND 165



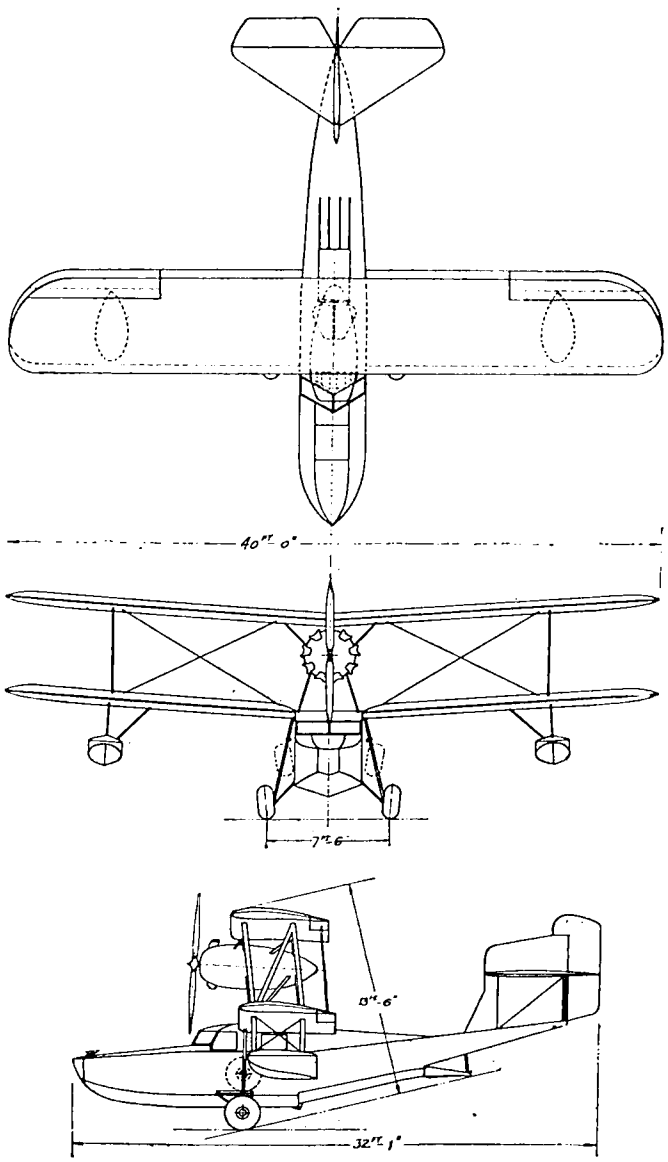
GREAT LAKES AIRCRAFT CORPORATION
Cleveland, Ohio
MODEL 2 T 1
2 PLACE
ENGINE: AMERICAN CIRRUS



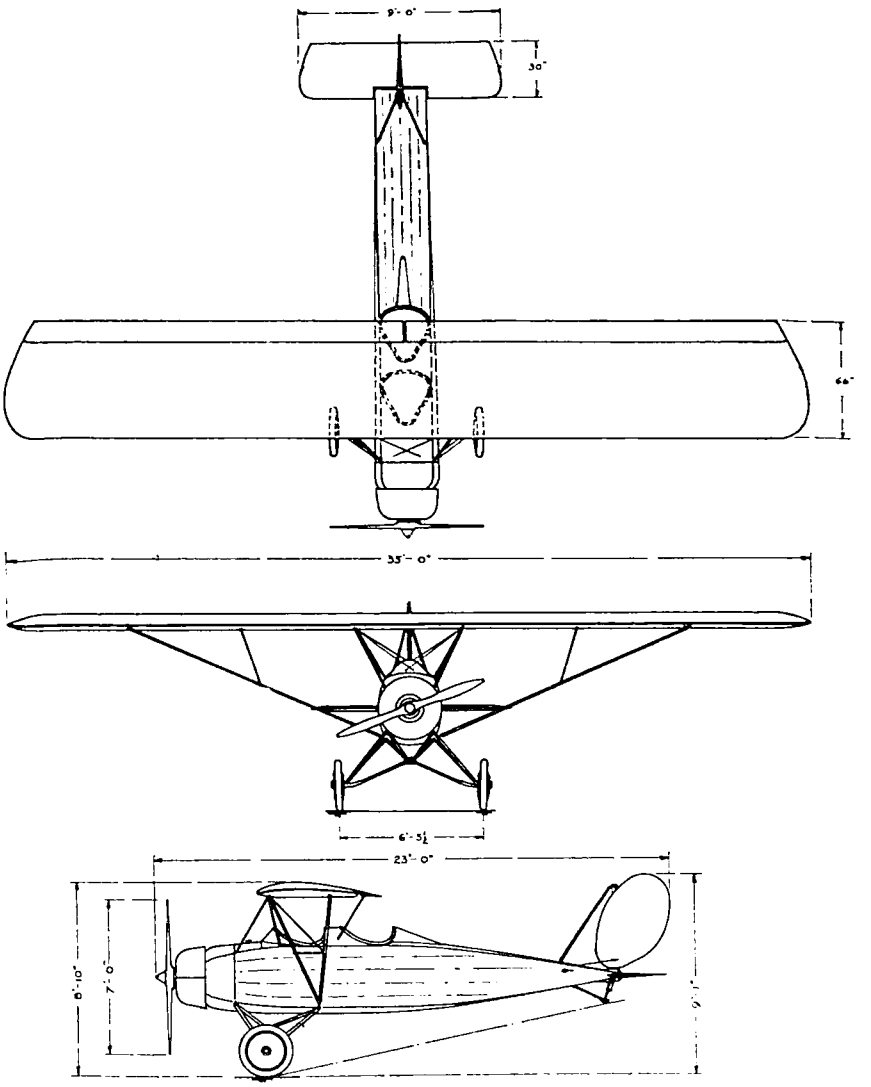
HUNTINGTON AIRCRAFT CORPORATION
Bridgeport, Conn.
MODEL 11
2 PLACE
ENGINE: WARNER SCARAB



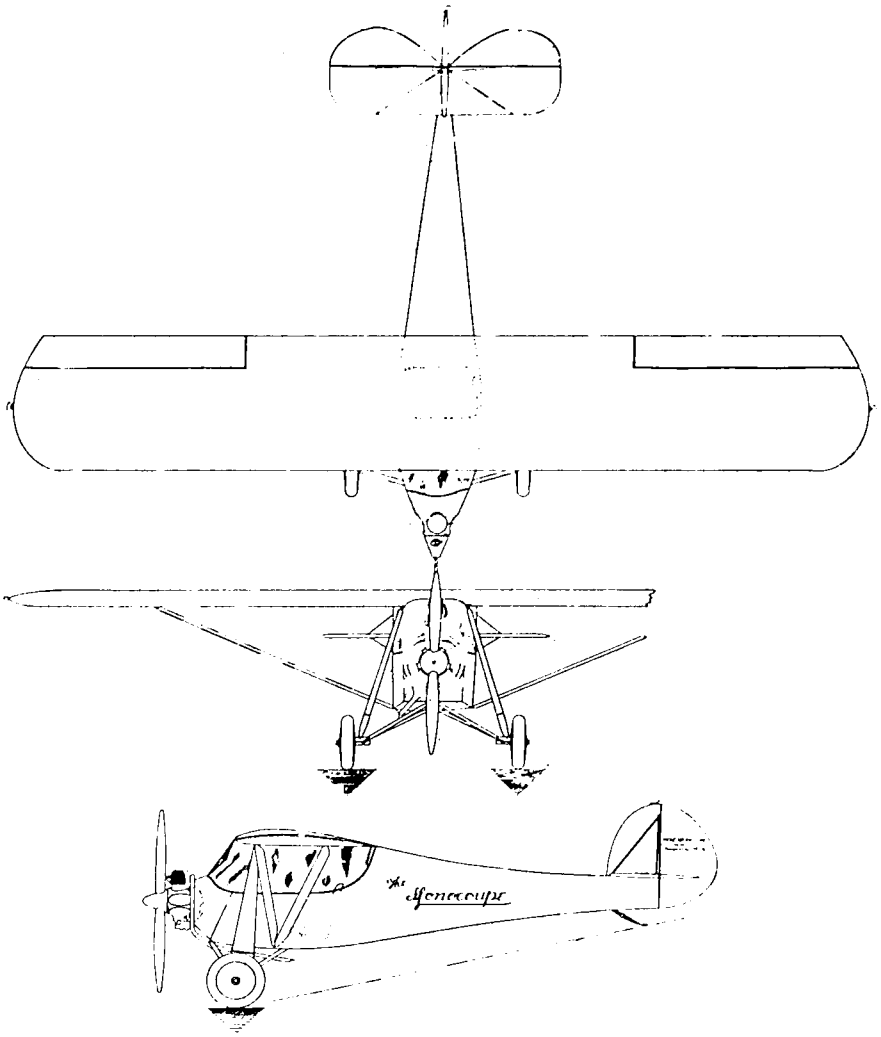
LINCOLN AIRCRAFT COMPANY, INC.
Lincoln, Neb.
MODEL 1 P T
2 PLACE
ENGINE: KINNER
CURTISS OX5



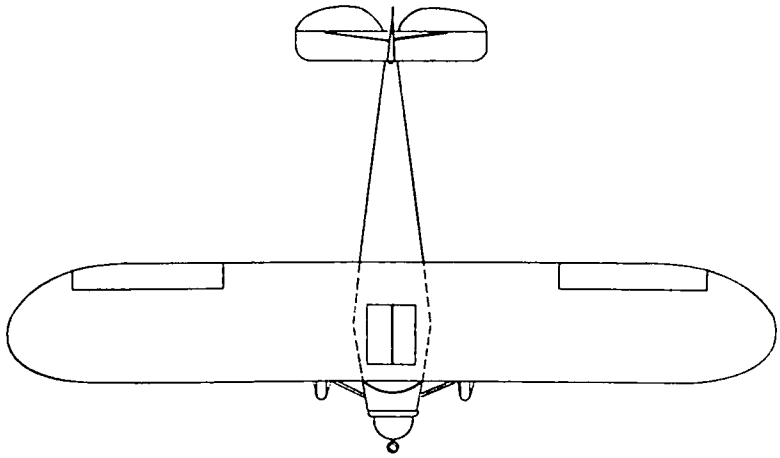
LOENING AERONAUTICAL ENGINEERING CORPORATION
(DIVISION KEYSTONE AIRCRAFT CORPORATION)
COMMUTER
4 PLACE
ENGINE: WRIGHT WHIRLWIND 300

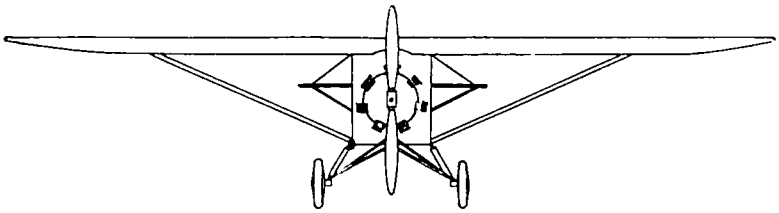


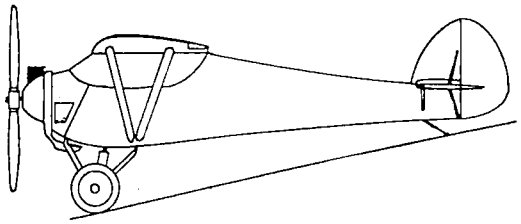
MERCURY AIRCRAFT, INC.
Hammondsport, N. Y.
MODEL T 2
ENGINE: LE BLOND



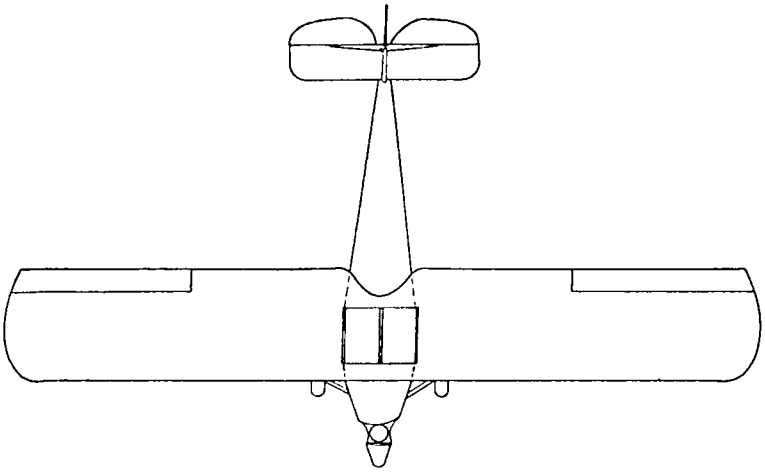
MONO AIRCRAFT, INC.
Moline, Ill.
MONOCOUPE
2 PLACE
ENGINE: VELIE M5

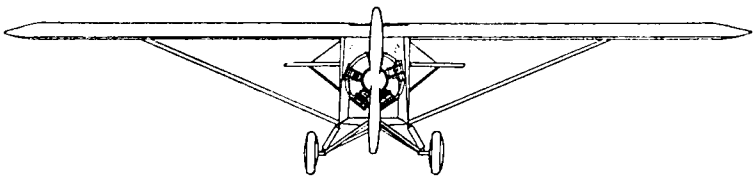


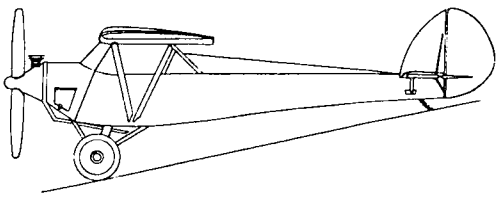




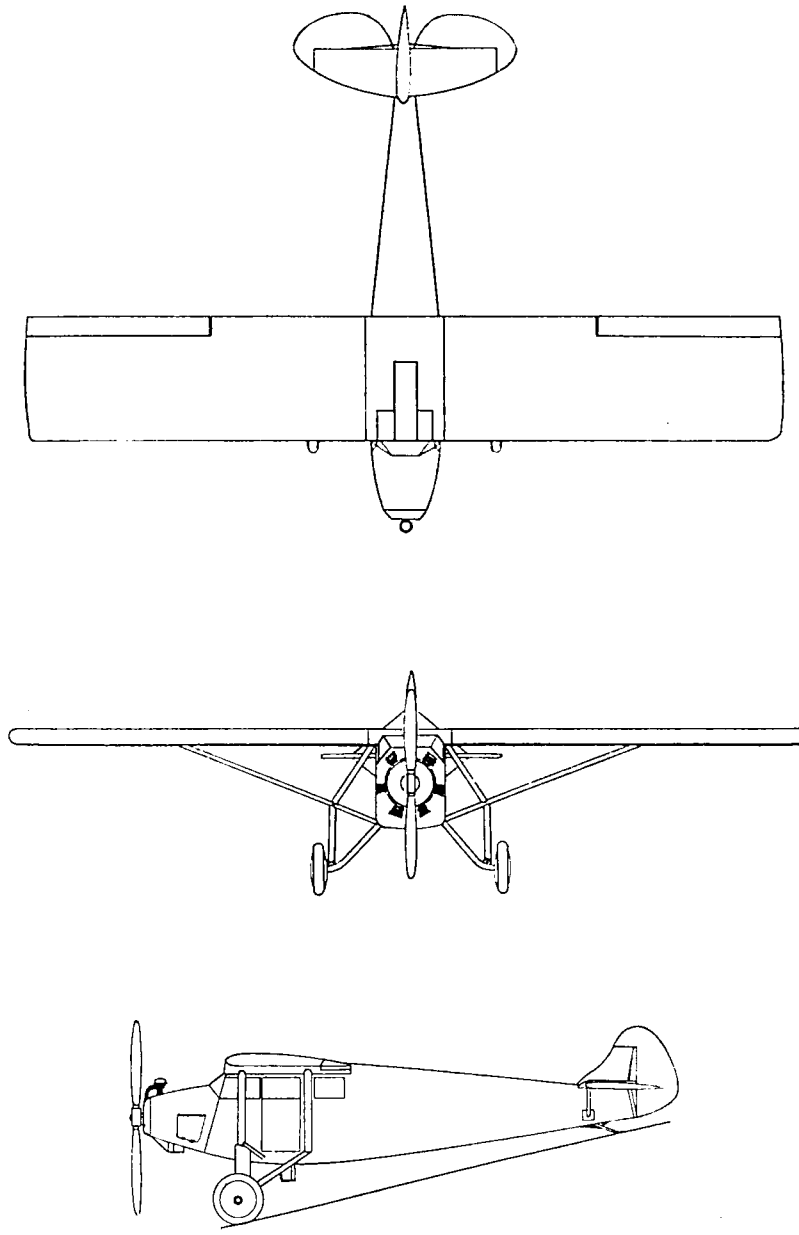
MONO AIRCRAFT, INC.
Moline, Ill.
MONOSPORT
2 PLACE
ENGINE: WARNER
KINNER



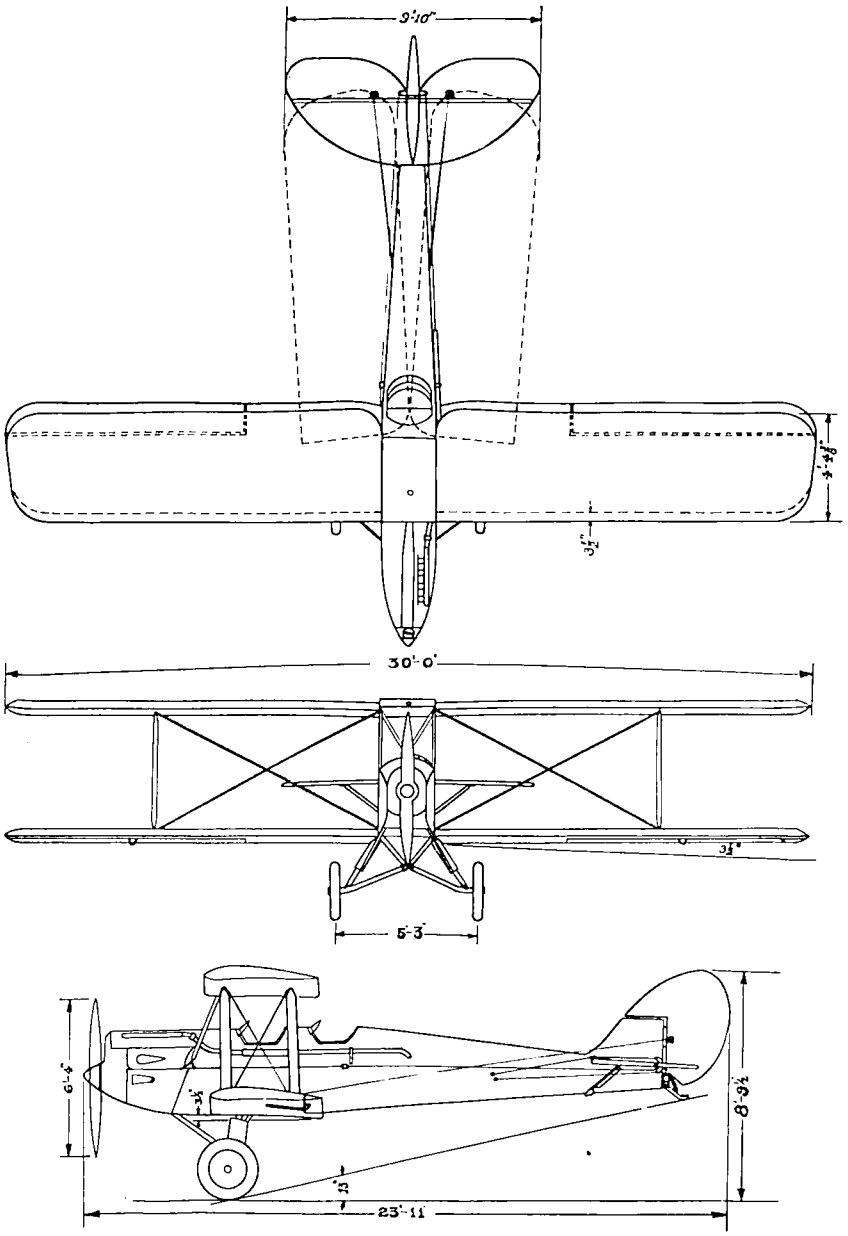




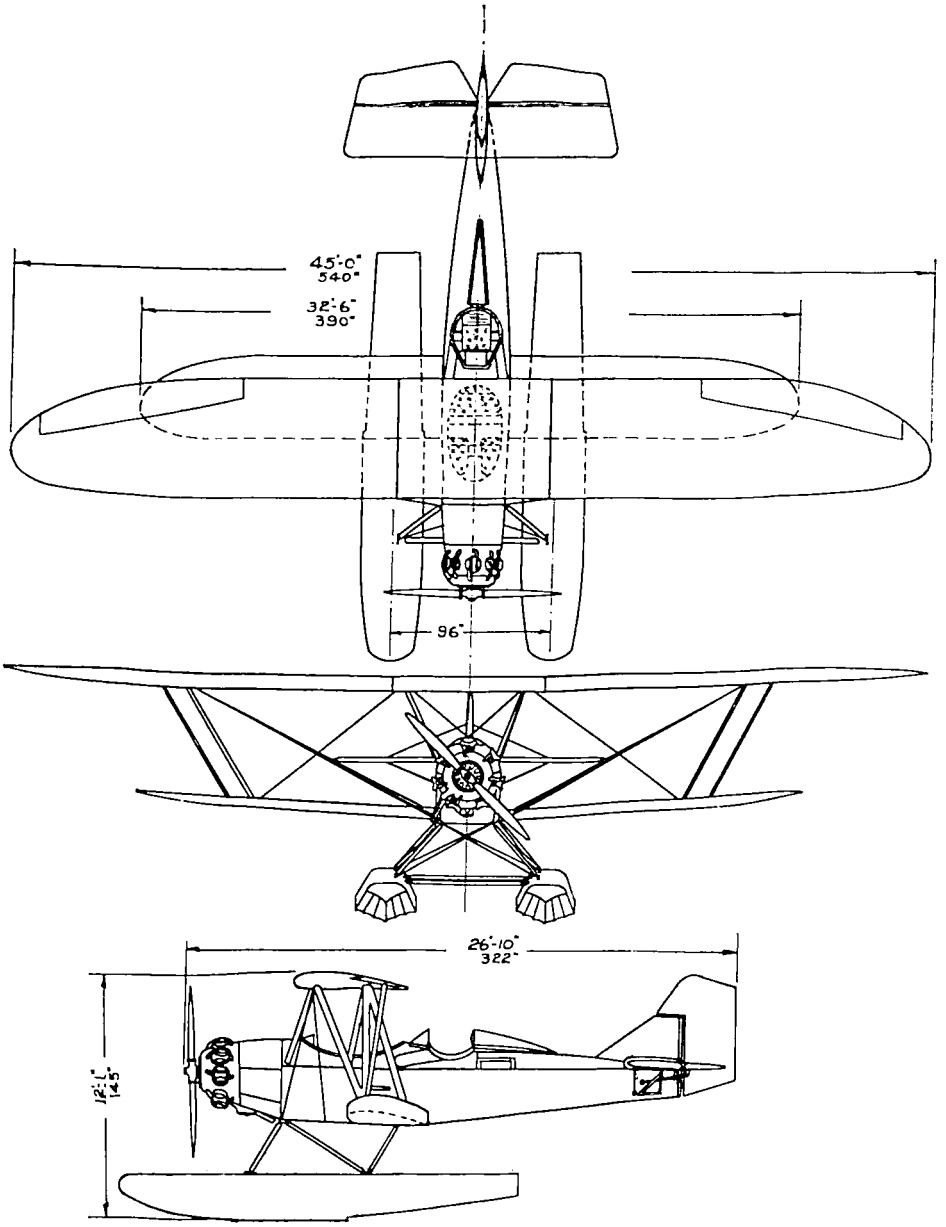
MONO AIRCRAFT, INC.
Moline, Ill.
MONOPREP
2 PLACE
ENGINE: VELIE



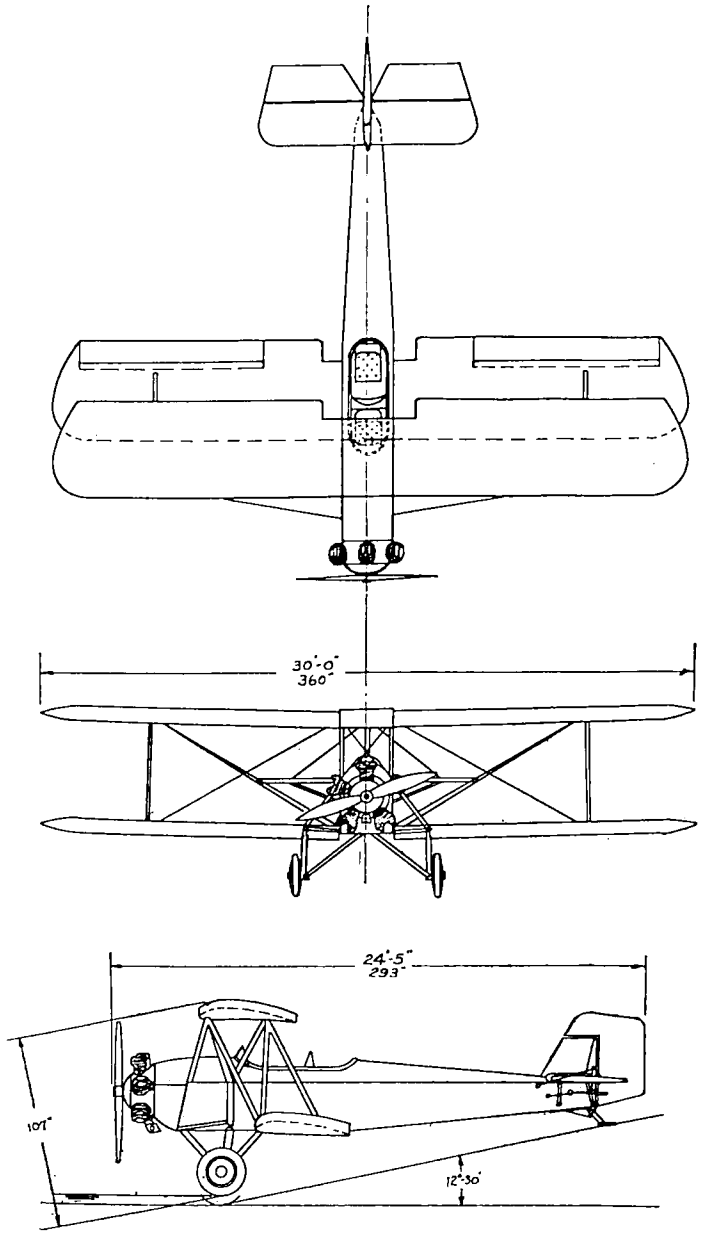
MONO AIRCRAFT, INC.
Moline, Ill.
MONOCOACH
4 PLACE
ENGINE: WRIGHT WHIRLWIND 220



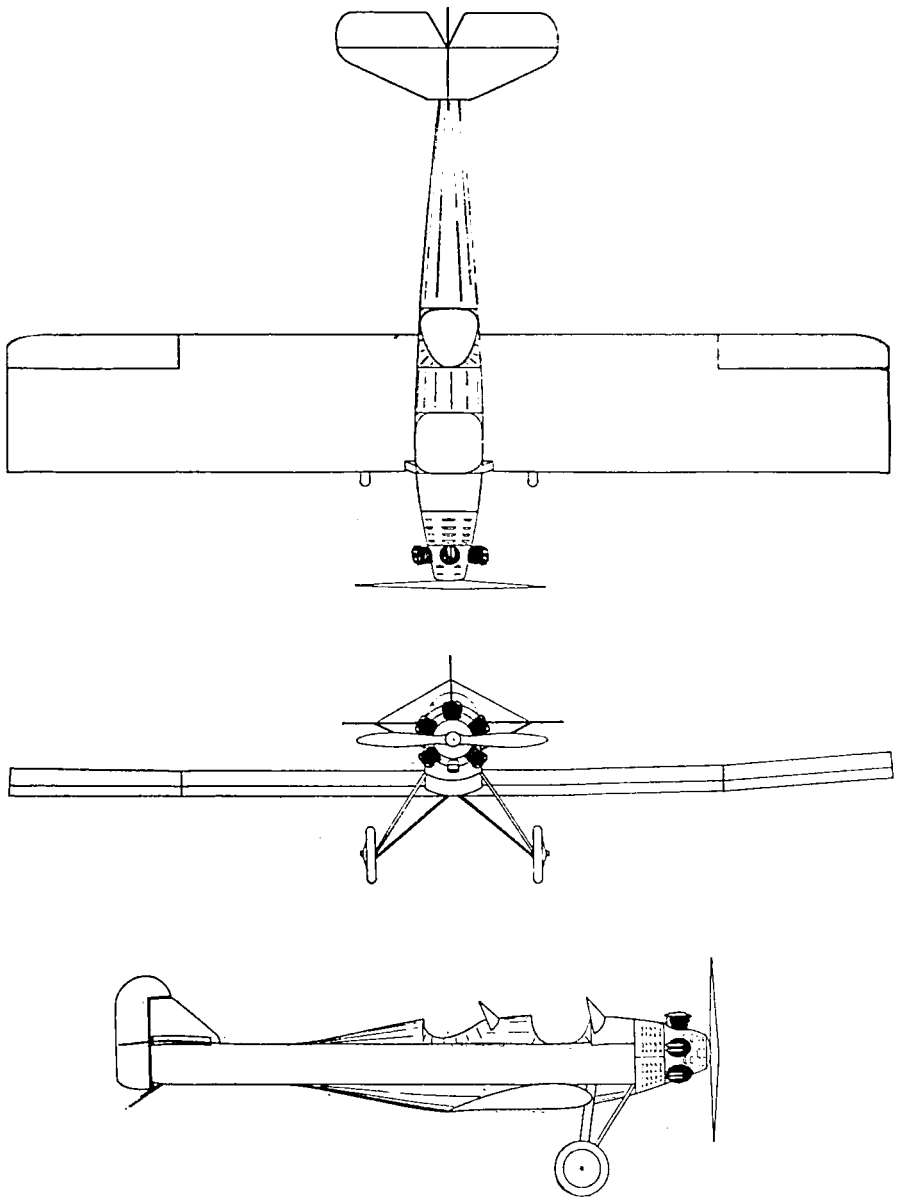
MOTH AIRCRAFT CORPORATION
Lowell, Mass.
DE HAVILAND GIPSY MOTH
2 PLACE
ENGINE: D. H. GYPSY



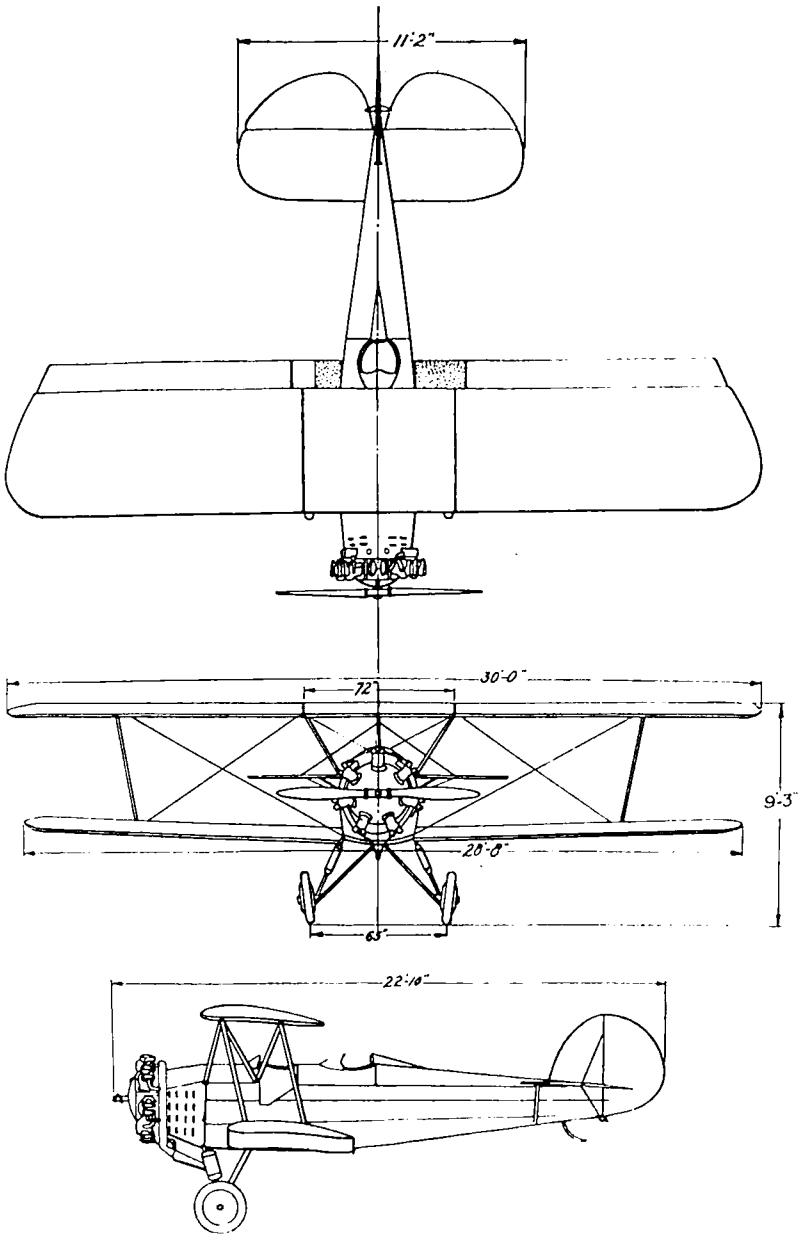
NEW STANDARD AIRCRAFT CORPORATION
Paterson, N. J.
MODEL: D 28 A—D 25 A
5 PLACE
ENGINE: WRIGHT WHIRLWIND 220



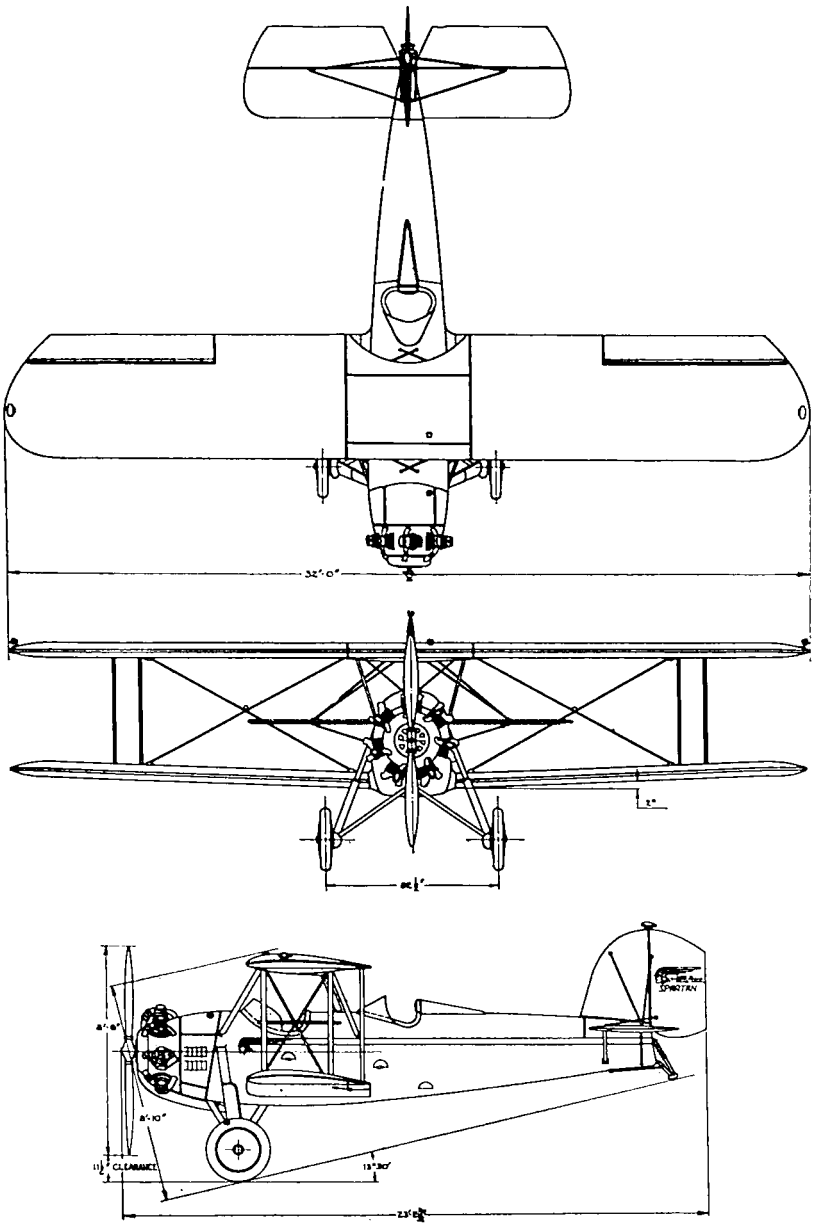
NEW STANDARD AIRCRAFT CORPORATION
Paterson, N. J.
MODEL D 29 A
2 PLACE
ENGINE: KINNER



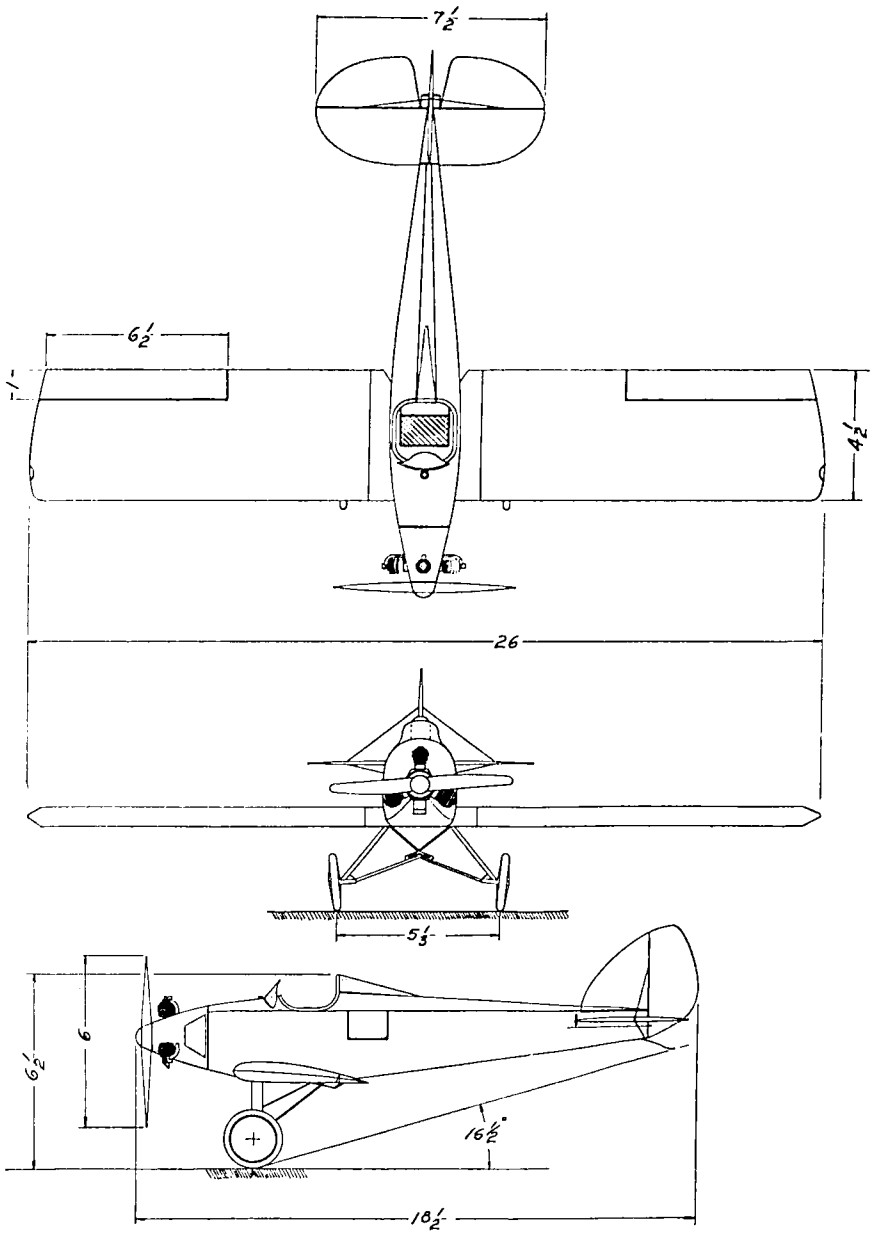
NICHOLAS-BEAZLEY AIRPLANE COMPANY
Marshall, Mo.
BARLING NB 3
3 PLACE
ENGINE: LE BLOND



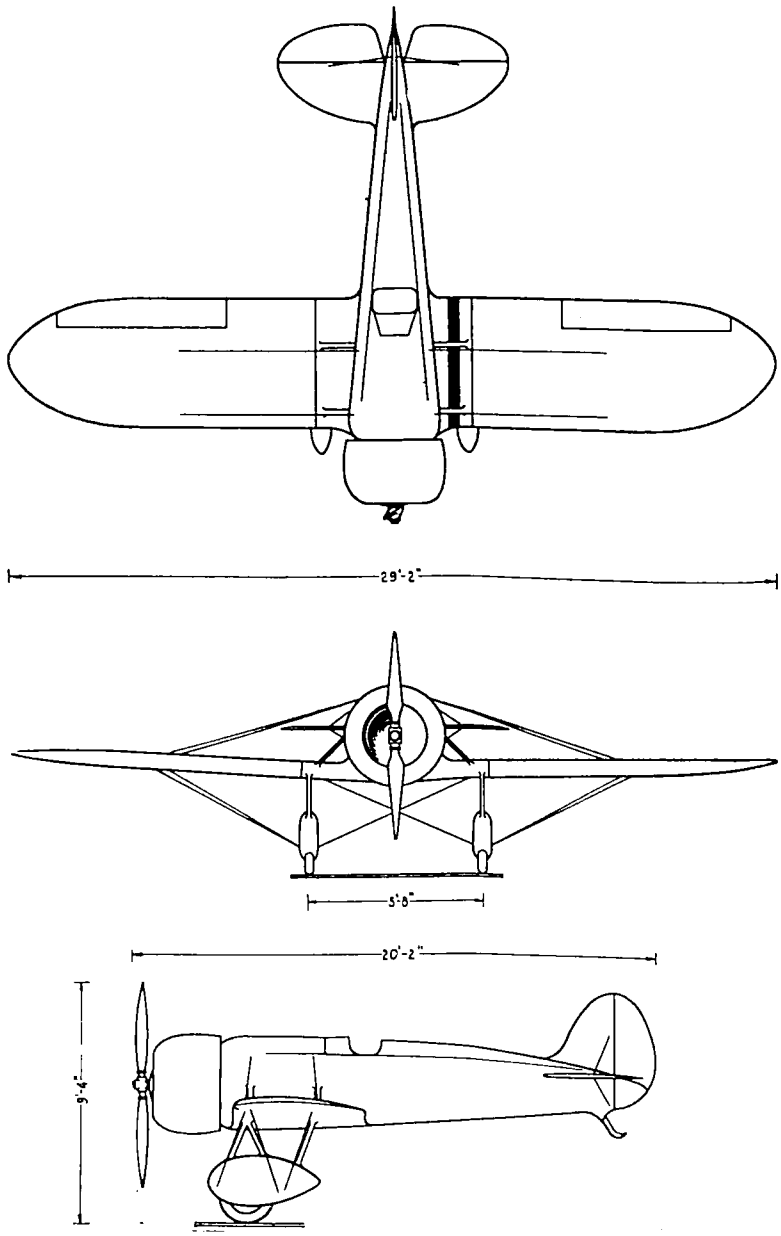
PARKS AIR COLLEGE
(MANUFACTURING DIVISION)
East St. Louis, Ill.
MODEL: P 11—P 11 A—P 1
ENGINE: AXELSON
CURTISS OX5
WRIGHT WHIRLWIND 165



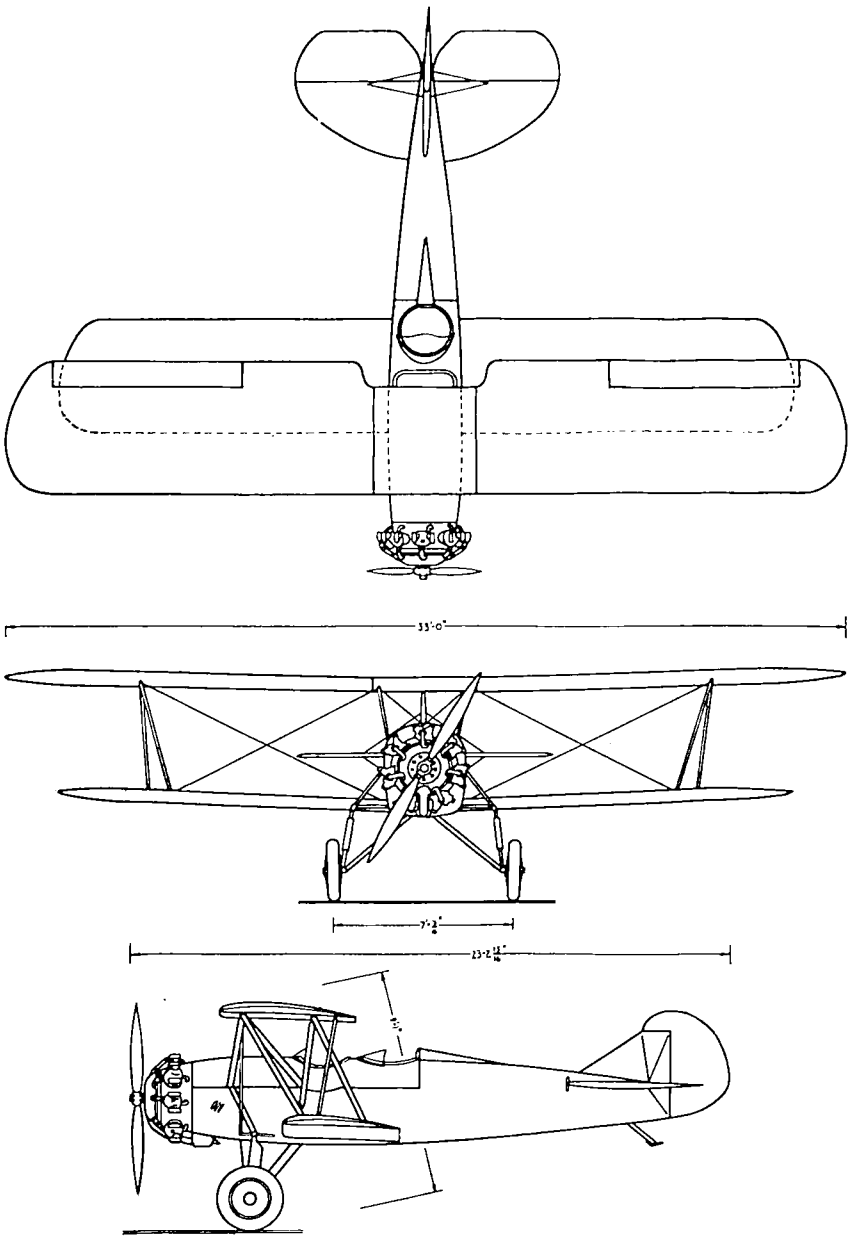
SPARTAN AIRCRAFT COMPANY, INC.
Tulsa, Okla.
MODEL C 3
ENGINE: WRIGHT WHIRLWIND 220
WRIGHT WHIRLWIND 165



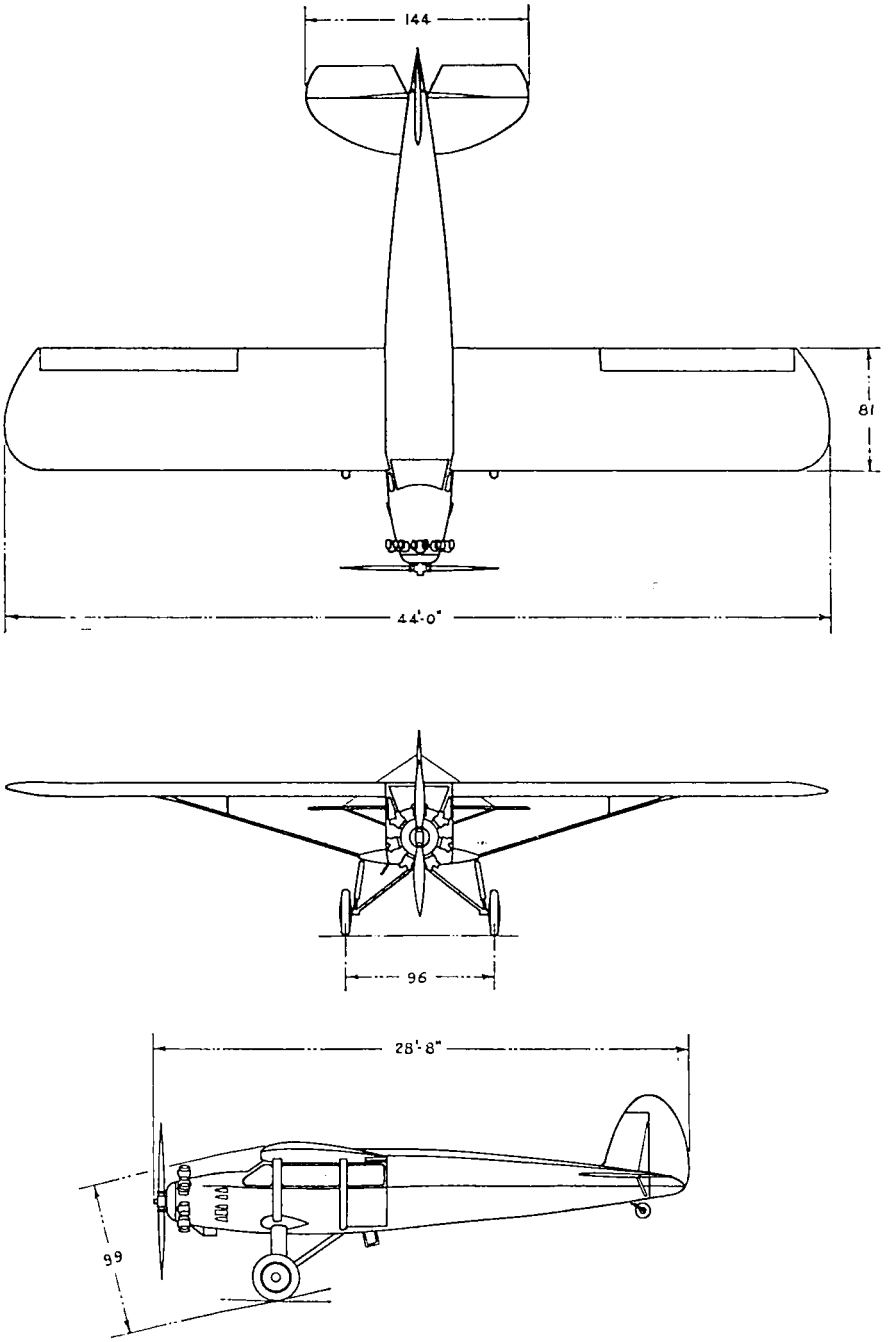
SZEKELY AIRCRAFT AND ENGINE COMPANY
Holland, Mich.
FLYING DUTCHMAN
1 PLACE
ENGINE: SZEKELY SR 3



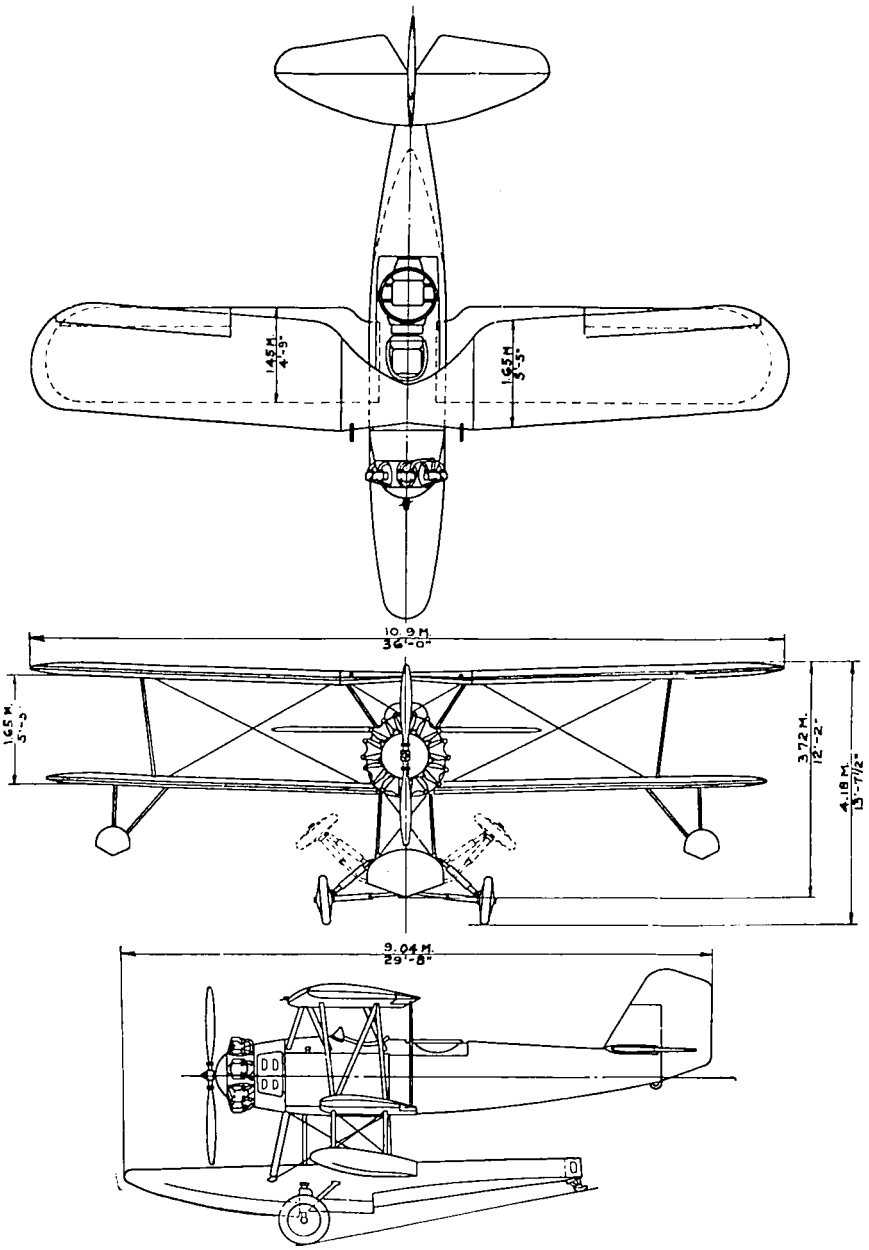
TRAVEL AIR COMPANY
Wichita, Kan.
MODEL R
1 PLACE
ENGINE: SPECIAL WRIGHT WHIRLWIND 300



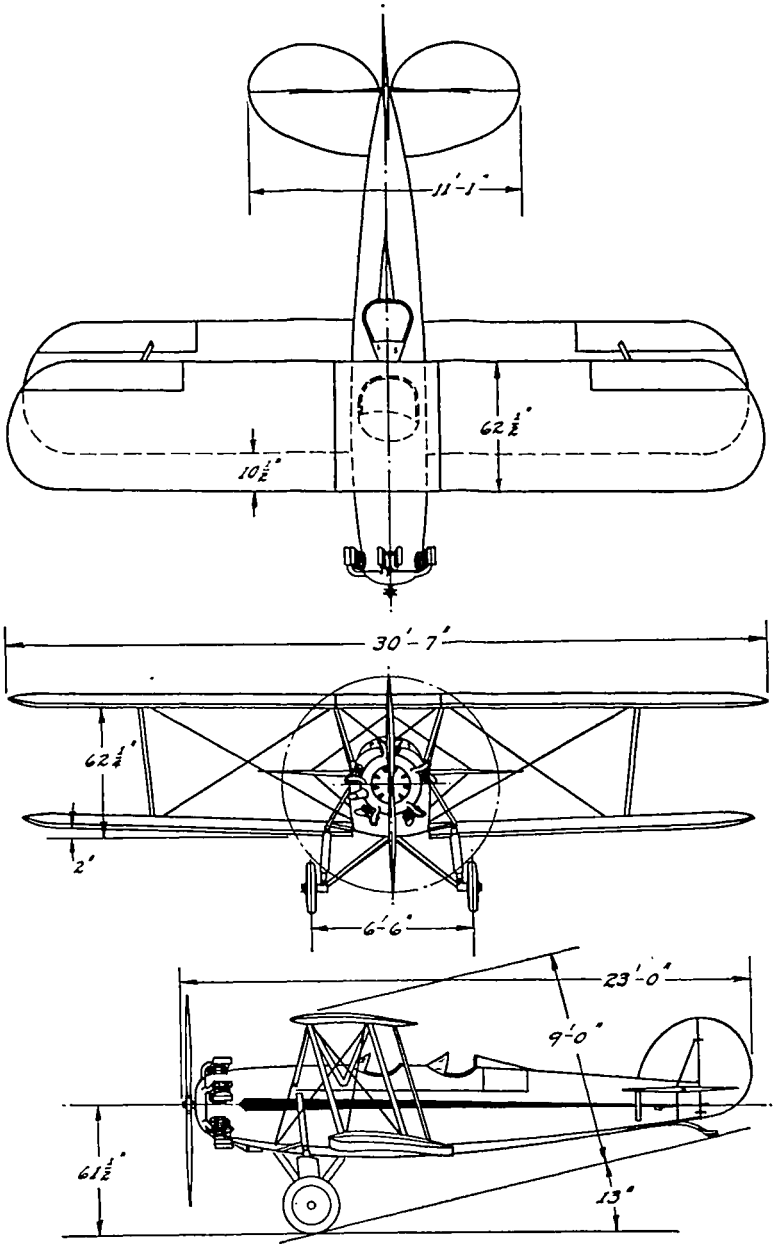
TRAVEL AIR COMPANY
Wichita, Kan.
MODEL 4 D
3 PLACE
ENGINE: WRIGHT WHIRLWIND 220
WRIGHT WHIRLWIND 165



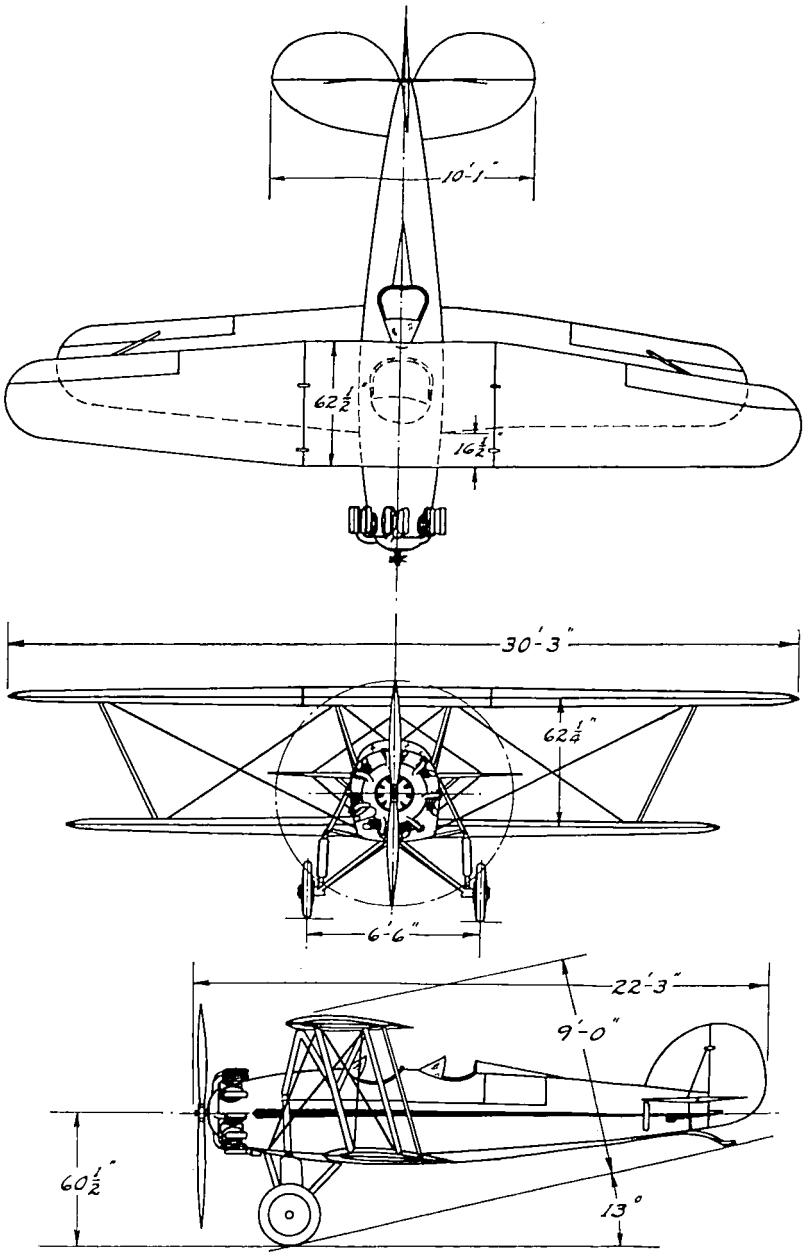
VERVILLE AIRCRAFT COMPANY
Detroit, Mich.
MODEL 104
4 PLACE
ENGINE: WRIGHT WHIRLWIND 220



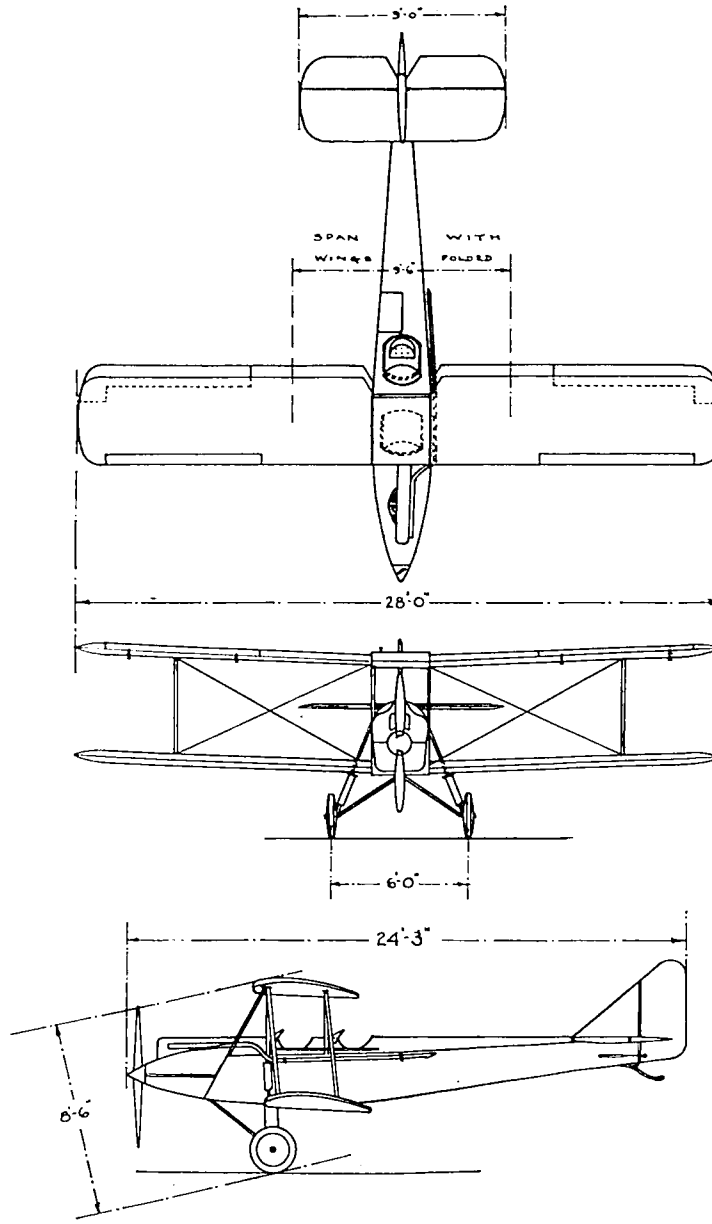
CHANCE VOUGHT CORPORATION
Long Island City, N. Y.
MODEL O24-2
ENGINE: PRATT & WHITNEY WASP



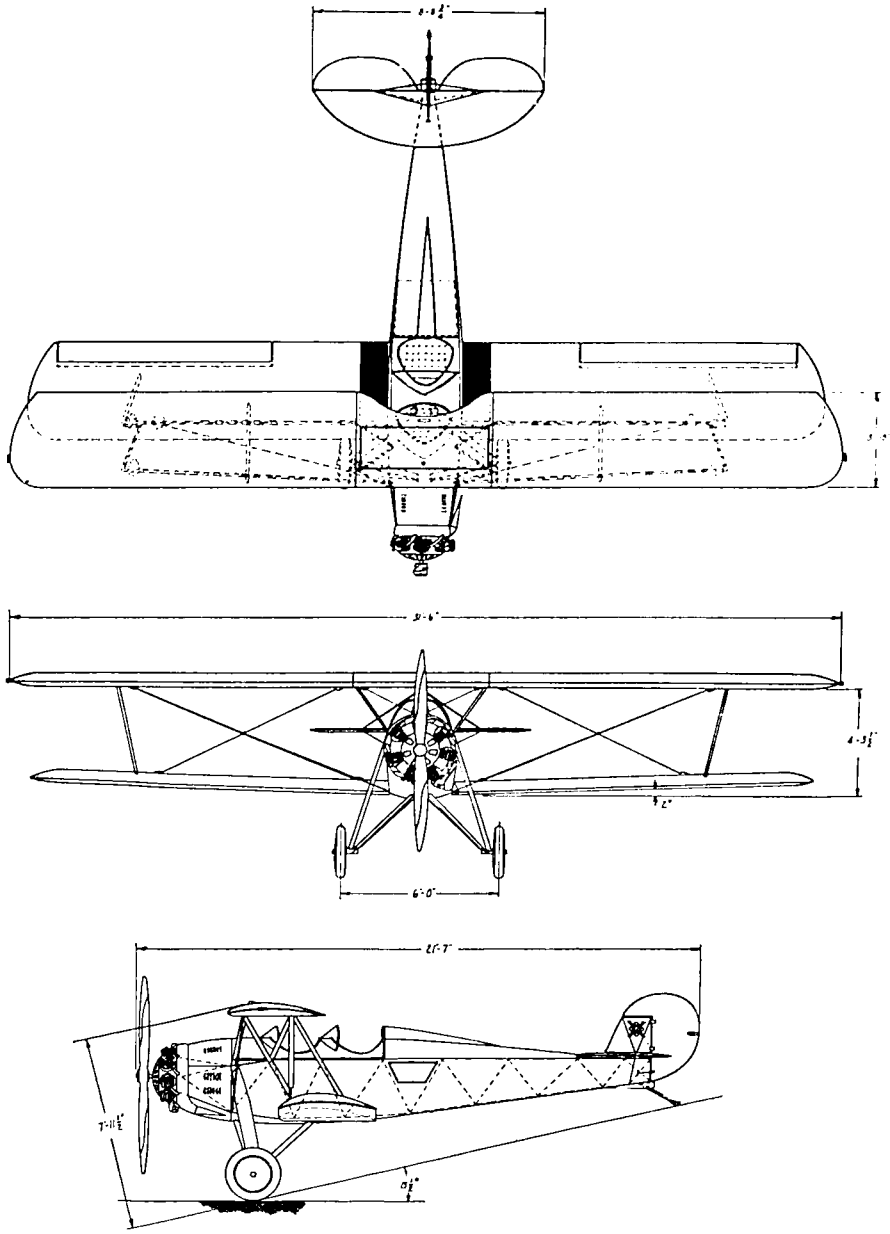
WACO AIRCRAFT COMPANY
Troy, Ohio
MODEL 165 STRAIGHT WING
3 PLACE
ENGINE: WRIGHT WHIRLWIND 165
WRIGHT WHIRLWIND 220



WACO AIRCRAFT COMPANY
Troy, Ohio
MODEL 225 TAPER WING
3 PLACE
ENGINE: WRIGHT WHIRLWIND 225

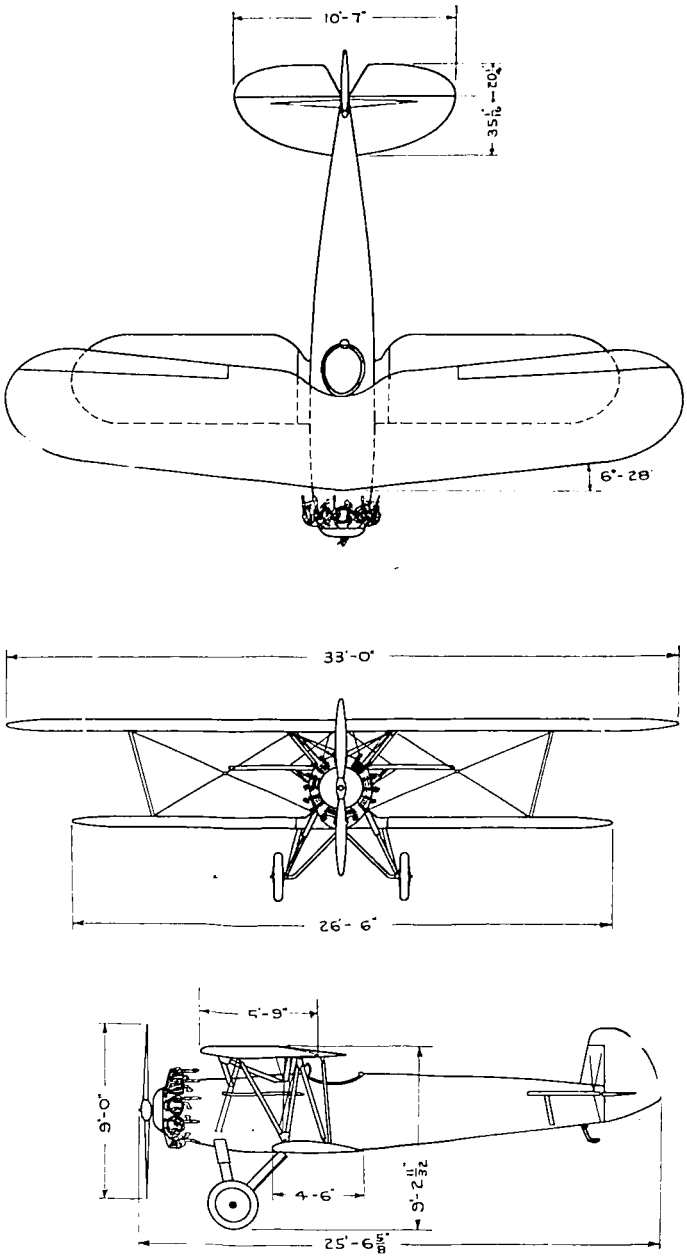


WHITTELSEY MANUFACTURING COMPANY
Bridgeport, Conn.
WHITTELSEY AVIAN
2 PLACE
ENGINE: CIRRUS

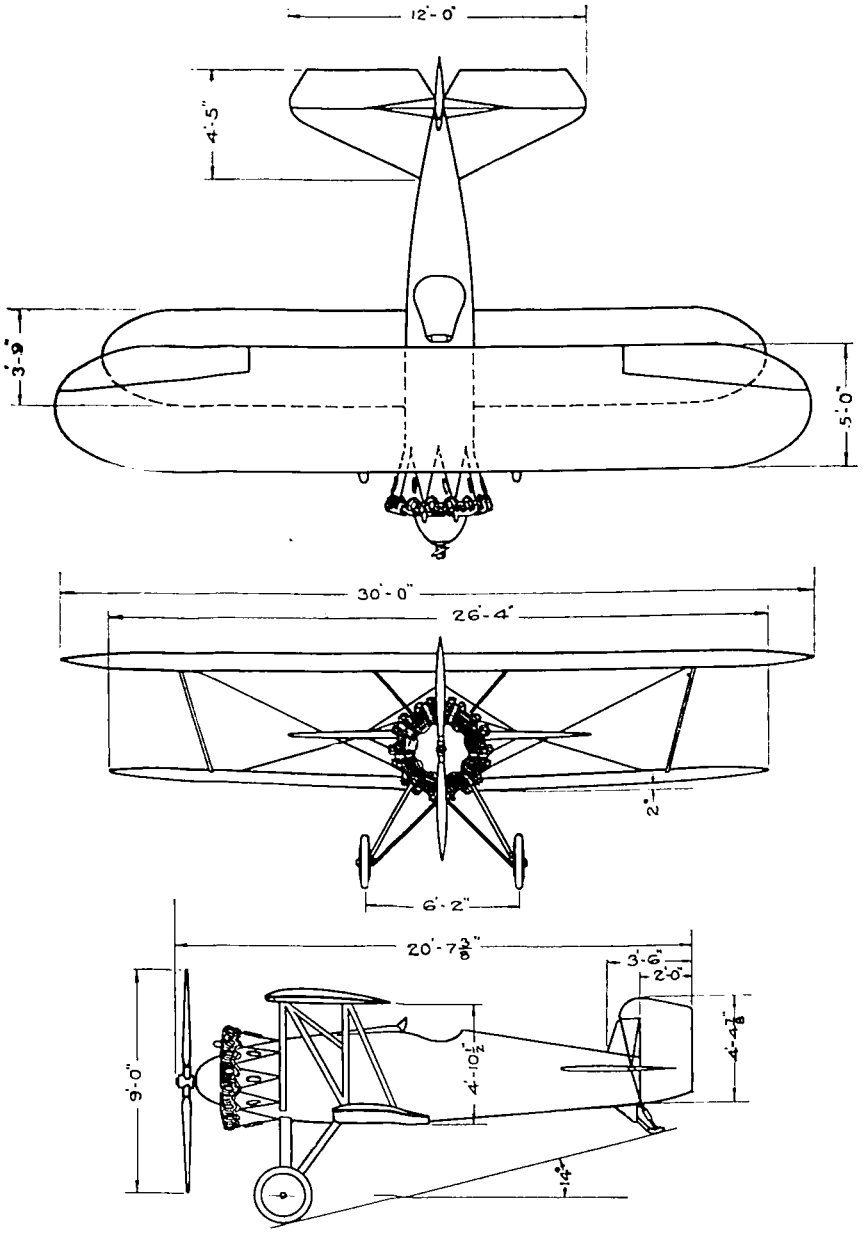


H. F. WILCOX AERONAUTICS, INC.
Tulsa, Okla.
MODEL: T 12—1
3 PLACE
ENGINE: WARNER

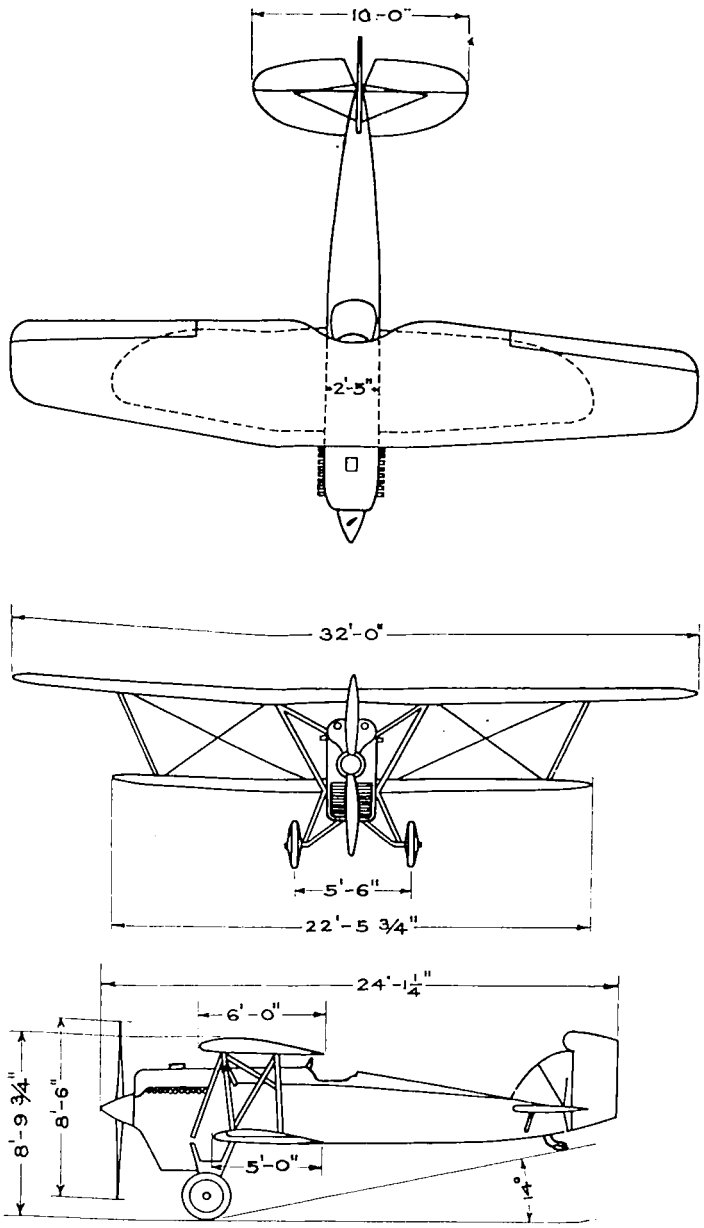
Military Planes



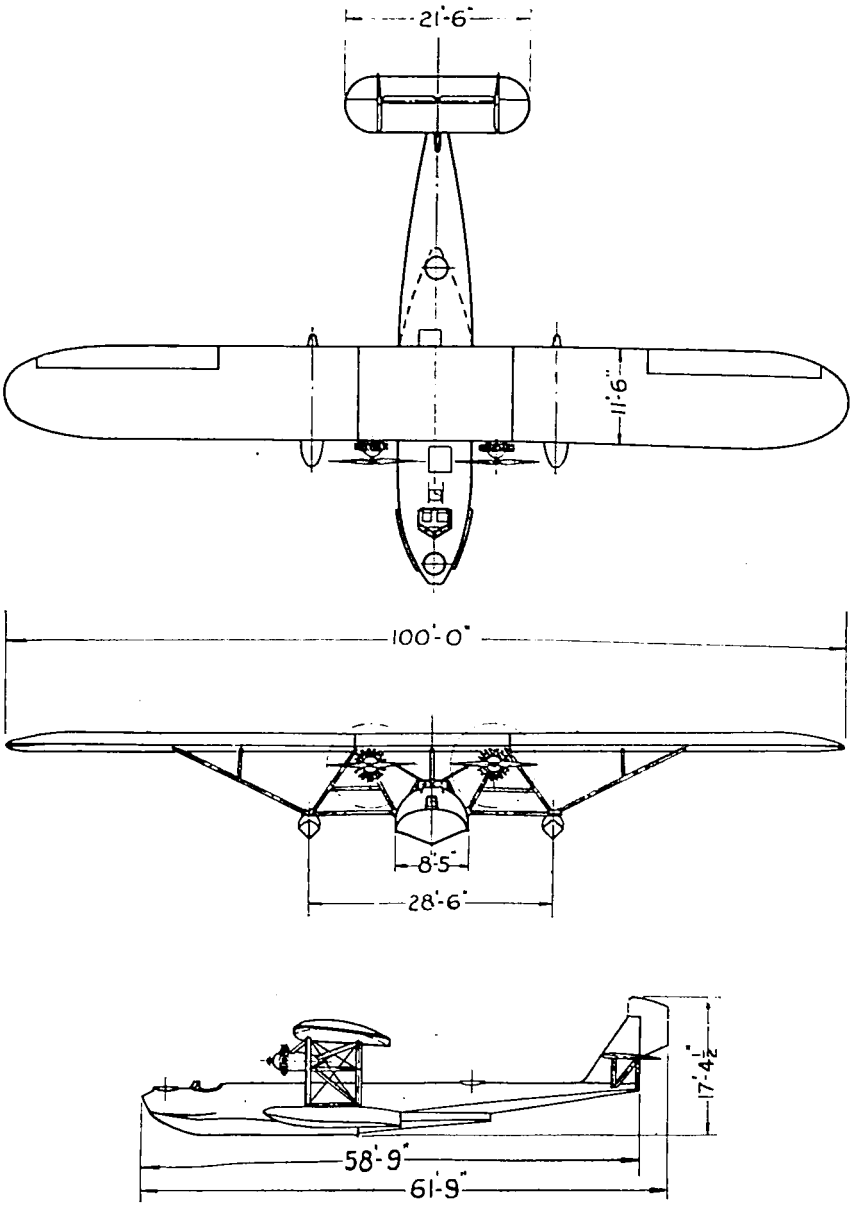
BOEING AIRPLANE COMPANY
Seattle, Wash.
FIGHTER F3B-1
ENGINE: PRATT & WHITNEY WASP



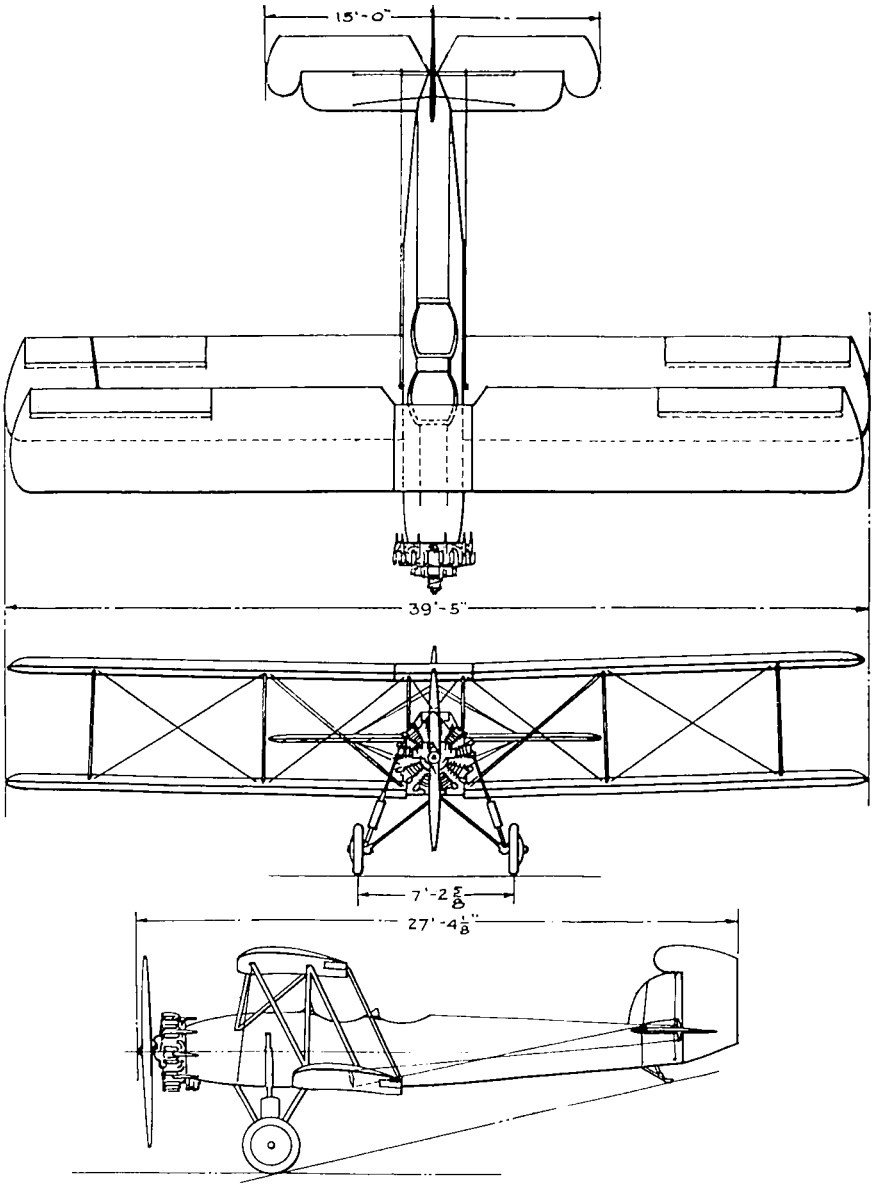
BOEING AIRPLANE COMPANY
Seattle, Wash.
FIGHTER F4B-1
ENGINE: PRATT & WHITNEY WASP



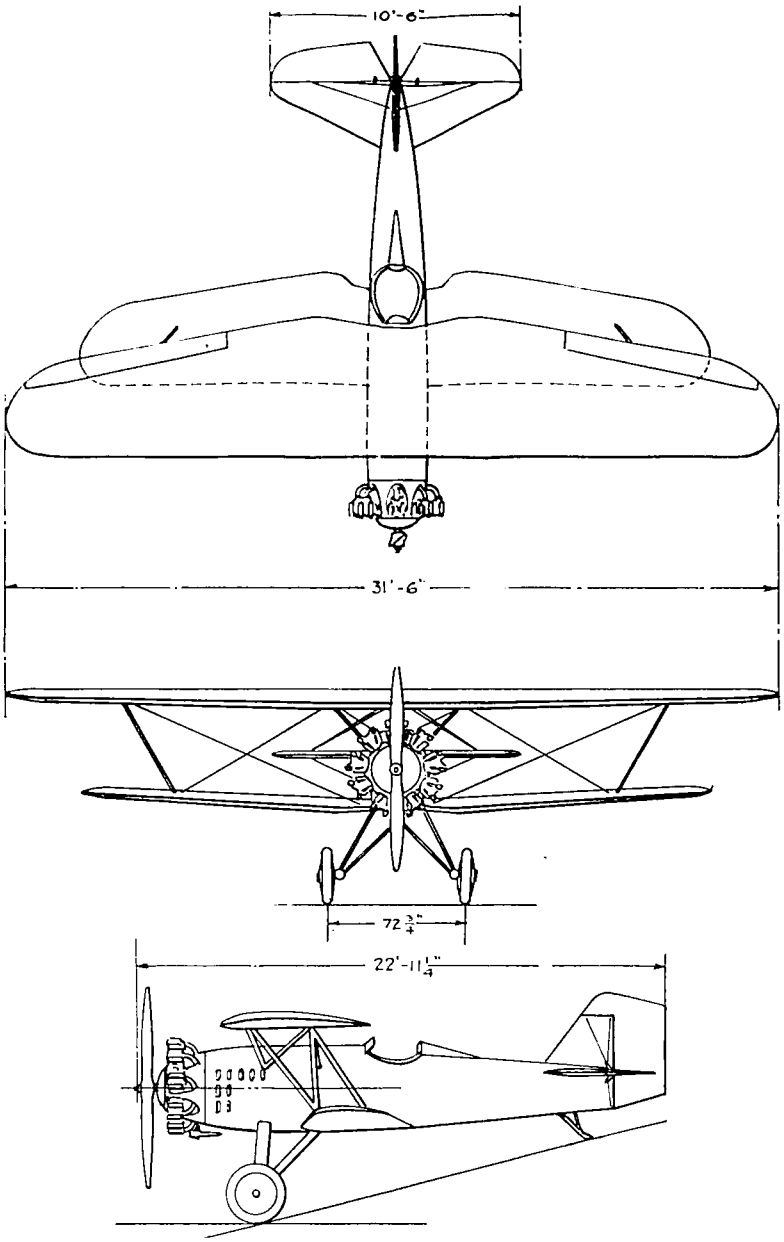
BOEING AIRPLANE COMPANY
Seattle, Wash.
PURSUIT XP 7
ENGINE: CURTISS V-1570



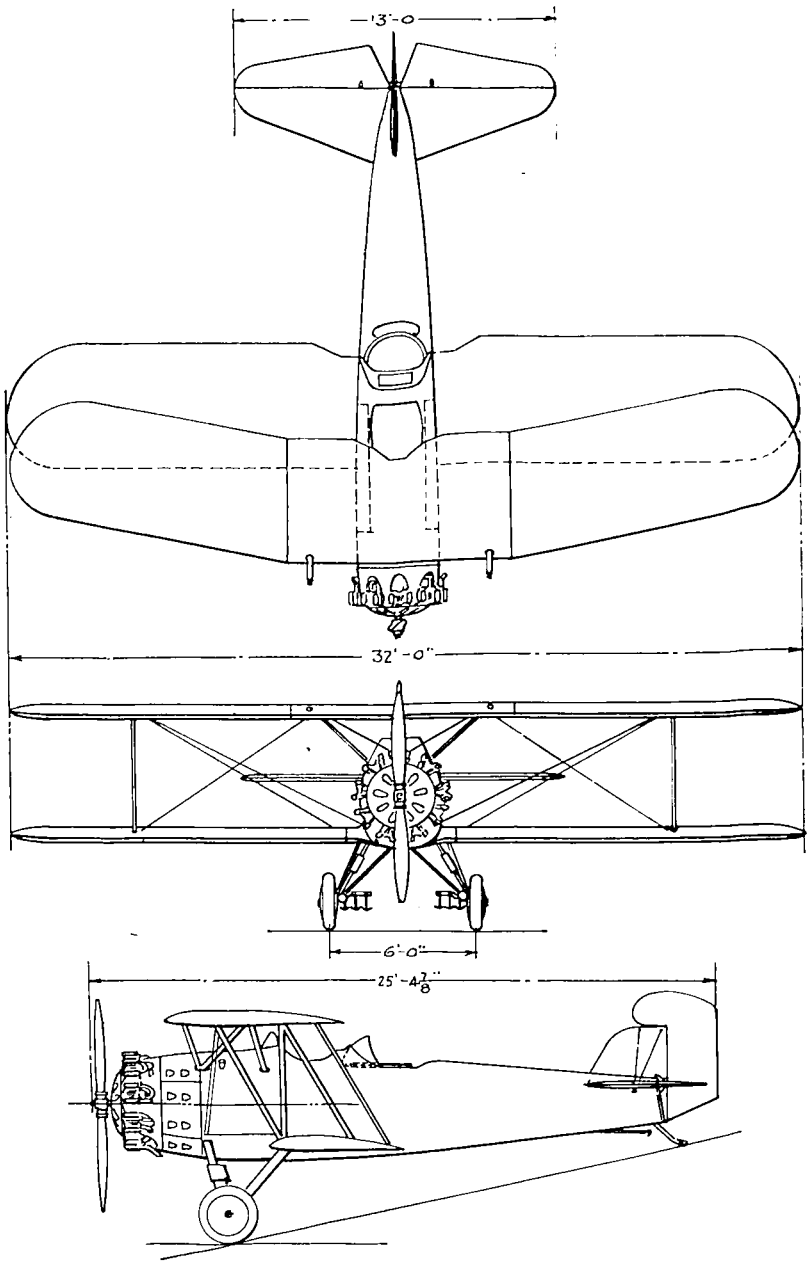
CONSOLIDATED AIRCRAFT CORPORATION
Buffalo, N. Y.
PATROL BOAT XPY-1
ENGINES: TWO PRATT & WHITNEY WASPS



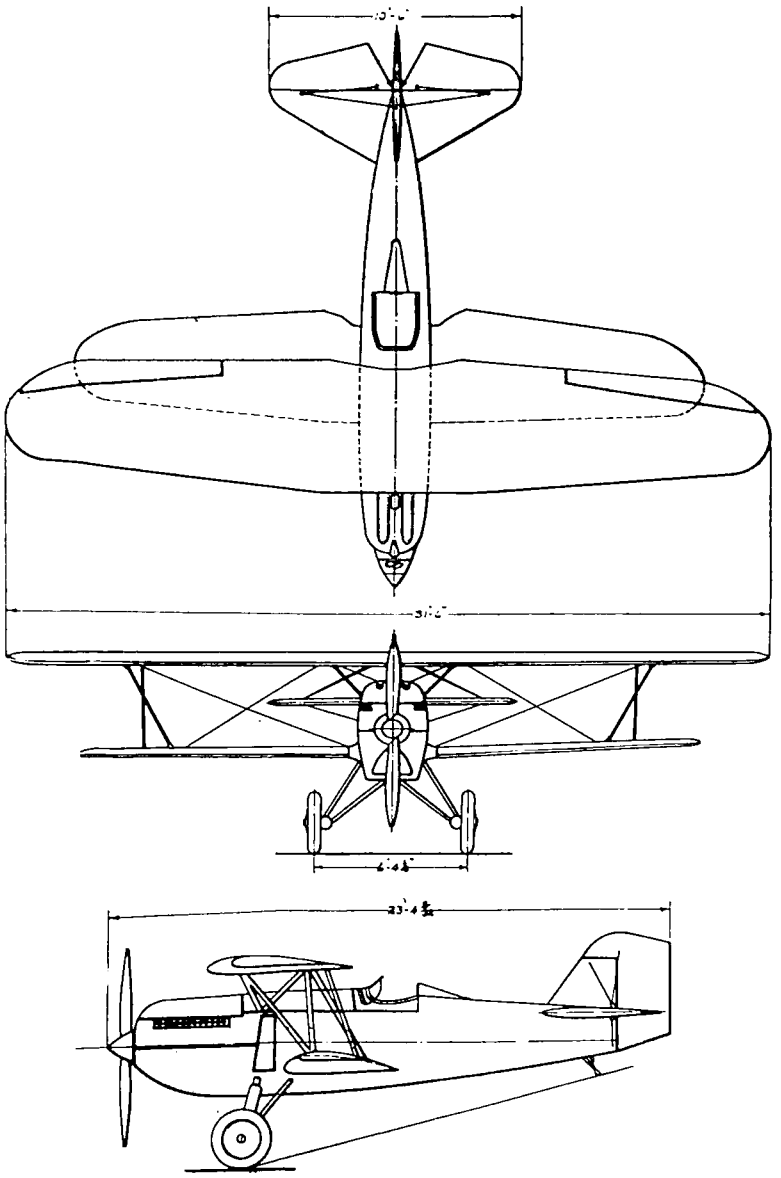
CURTISS AEROPLANE & MOTOR COMPANY, INC.
Garden City, L. I., N. Y.
TRAINING N2C-1
ENGINE: WRIGHT WHIRLWIND J-5



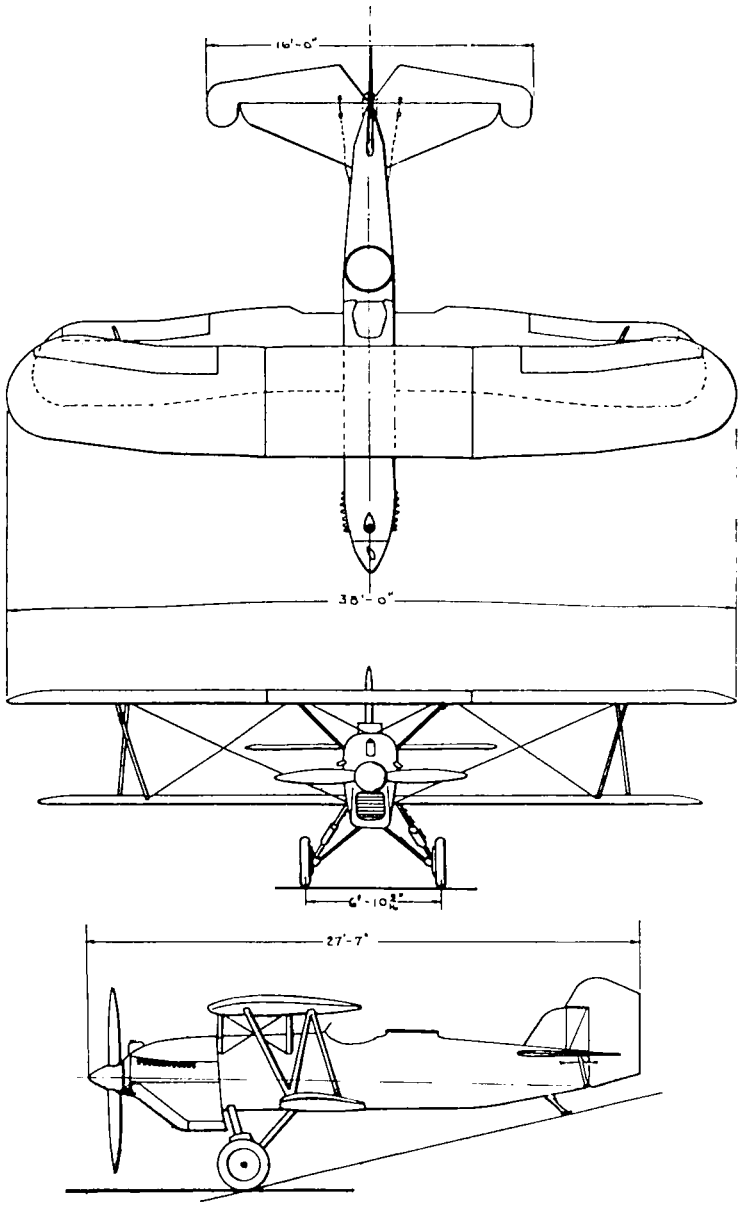
CURTISS AEROPLANE & MOTOR COMPANY, INC.
Garden City, L. I., N. Y.
PURSUIT P3A
ENGINE: PRATT & WHITNEY WASP



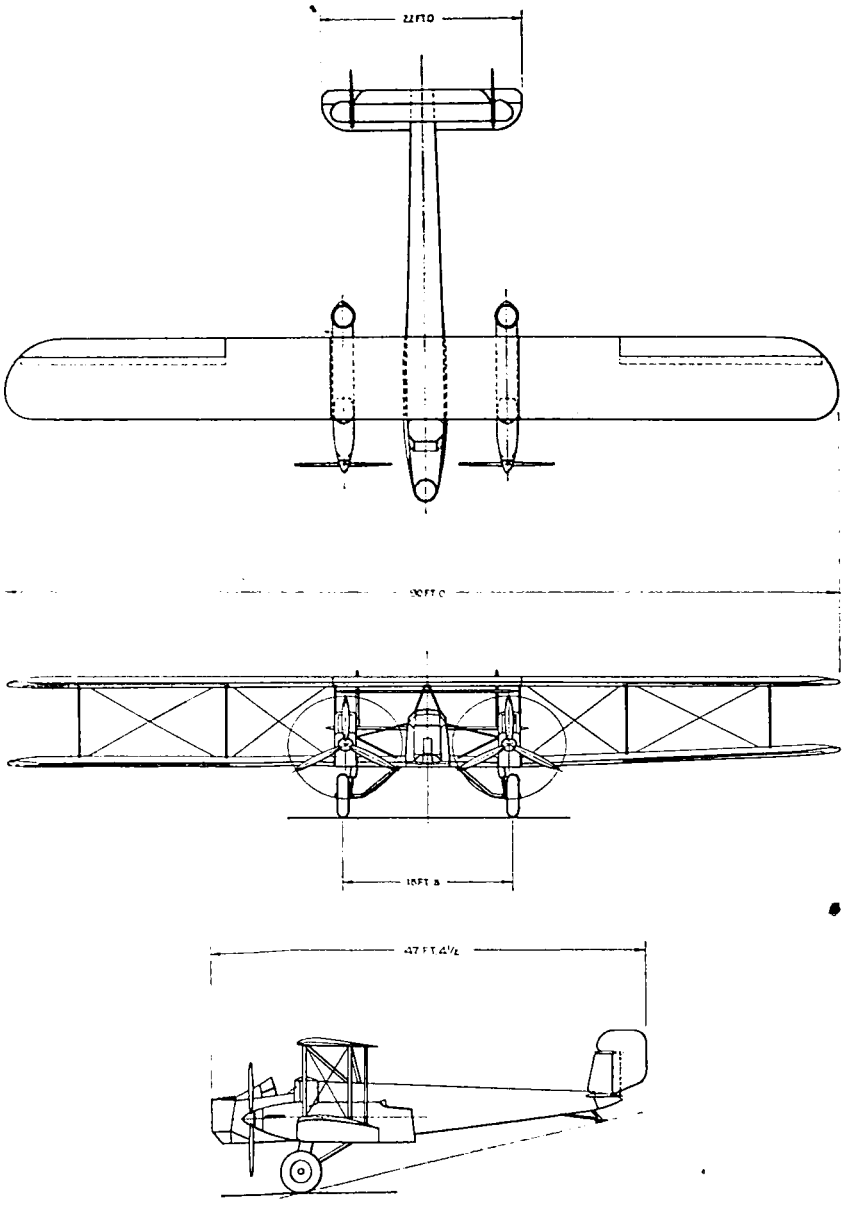
CURTISS AEROPLANE & MOTOR COMPANY, INC.
Garden City, L. I., N. Y.
FIGHTER XF8C-2
2 PLACE
ENGINE: PRATT & WHITNEY WASP



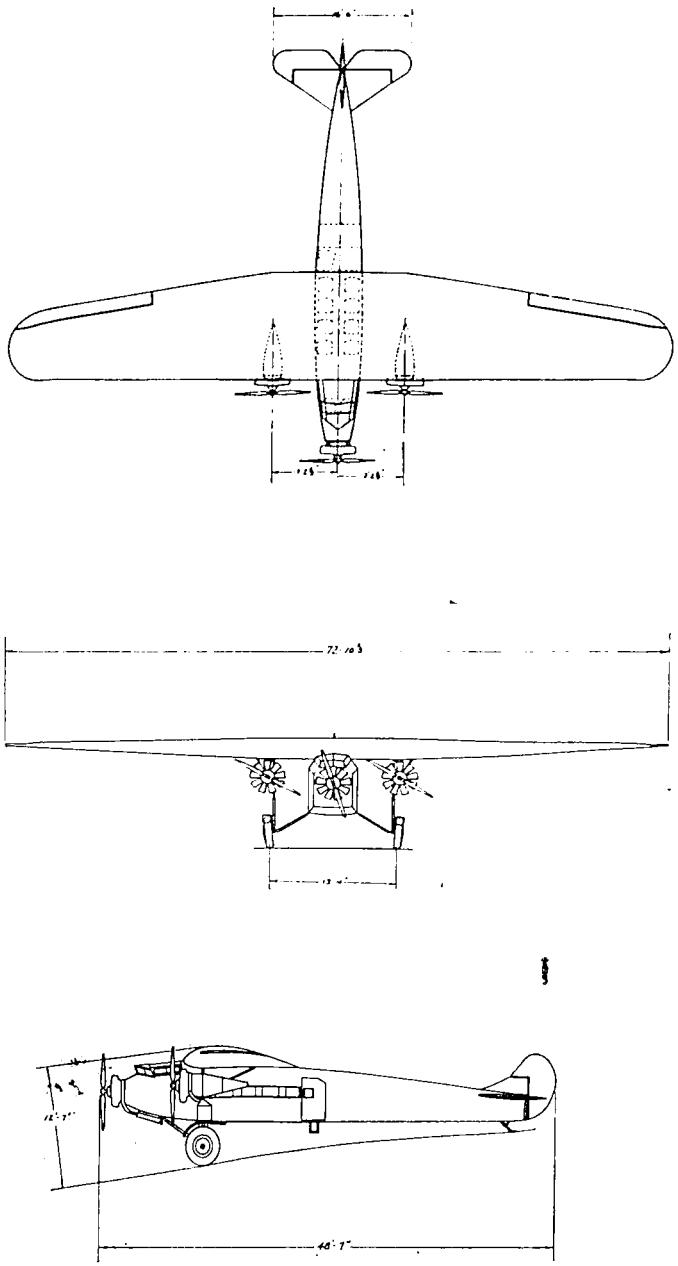
CURTISS AEROPLANE & MOTOR COMPANY, INC.
Garden City, L. I., N. Y.
PURSUIT P6
PRESTONE COOLED
ENGINE: CURTISS CONQUEROR



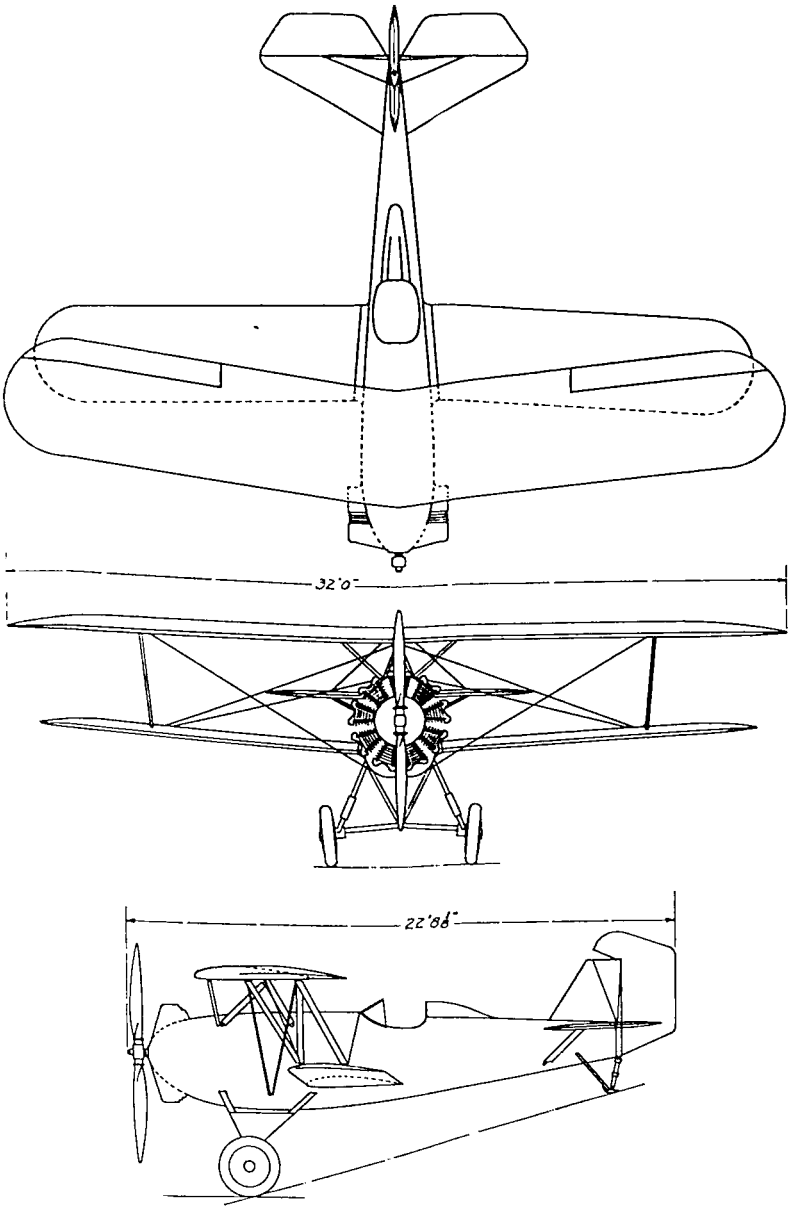
CURTISS AEROPLANE & MOTOR COMPANY, INC.
Garden City, L. I., N. Y.
OBSERVATION O-1E
ENGINE: D-12-E



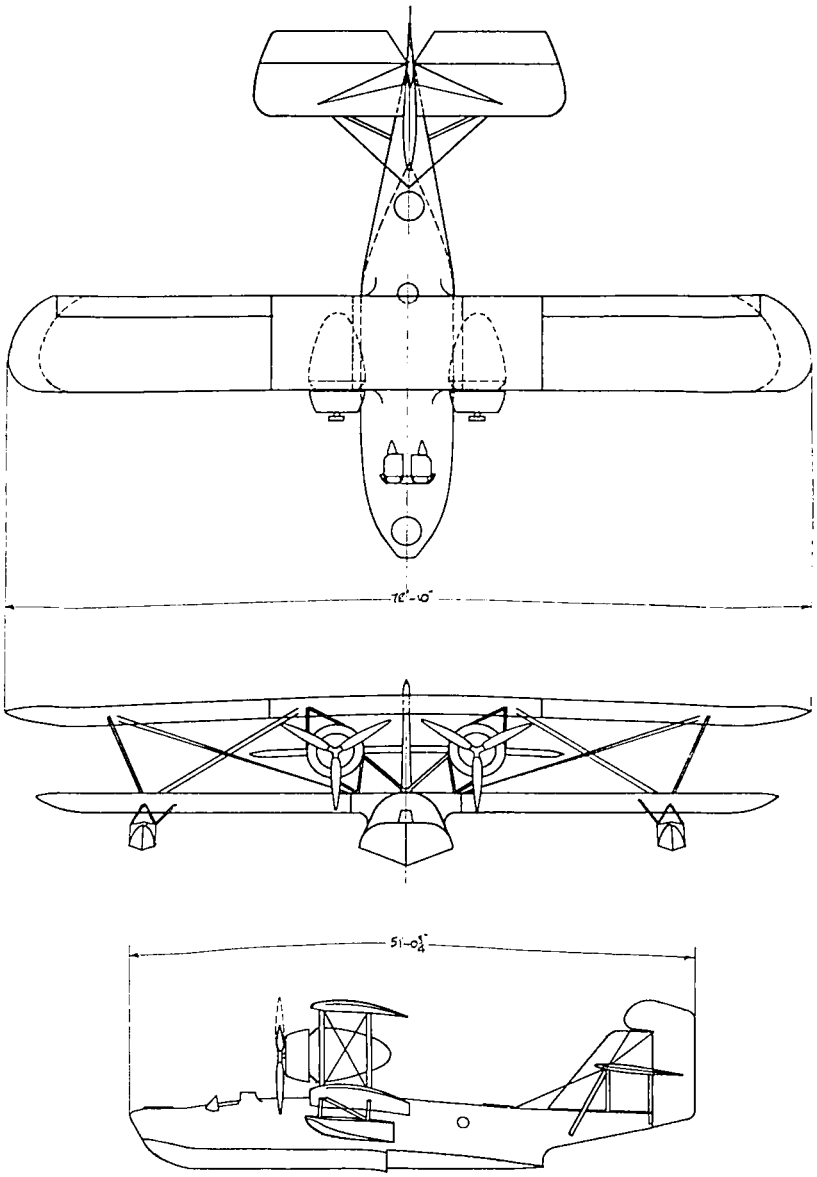
CURTISS AEROPLANE & MOTOR COMPANY, INC.
Garden City, L. I., N. Y.
BOMBER B-2
ENGINE: TWO CURTISS GEARED CONQUERORS



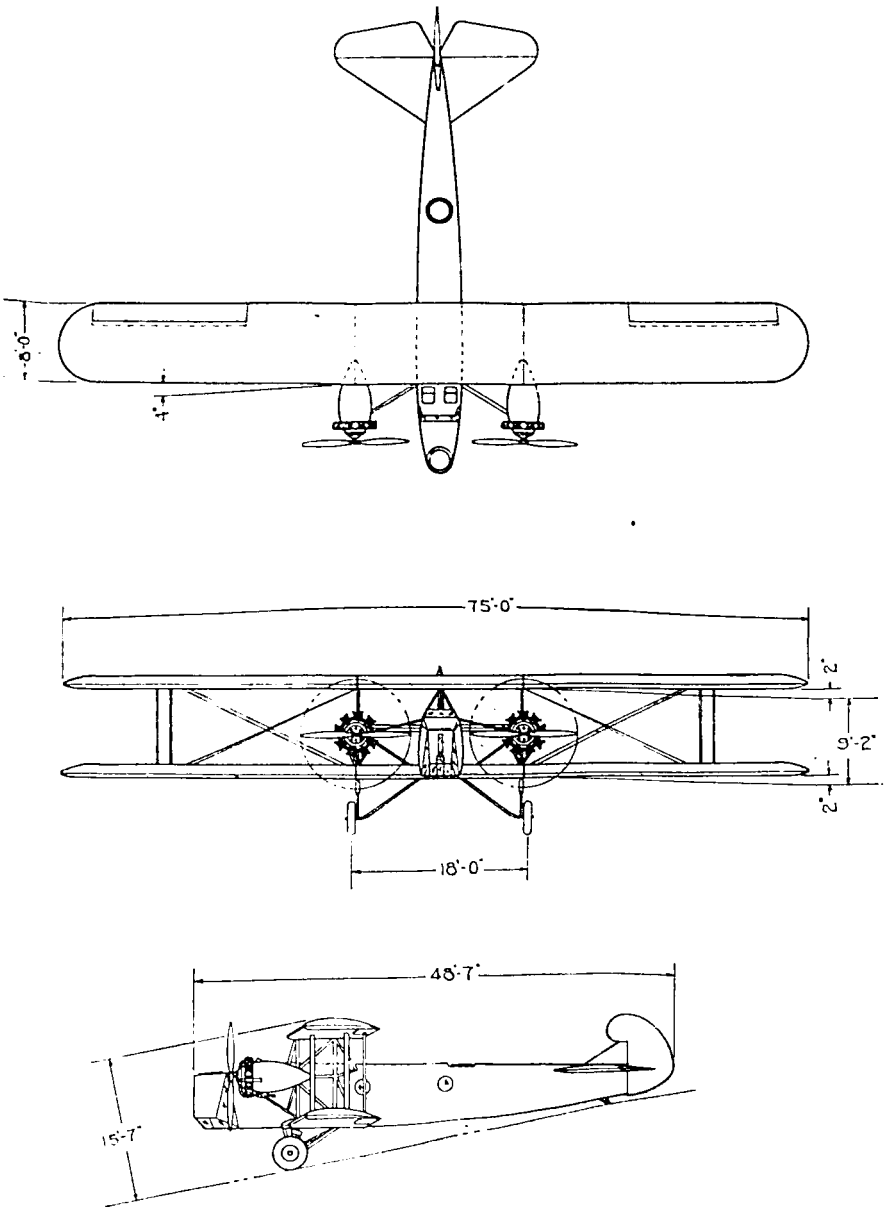
FOKKER AIRCRAFT CORPORATION OF AMERICA
New York City
TRANSPORT C2A
ENGINE: THREE WRIGHT J-5



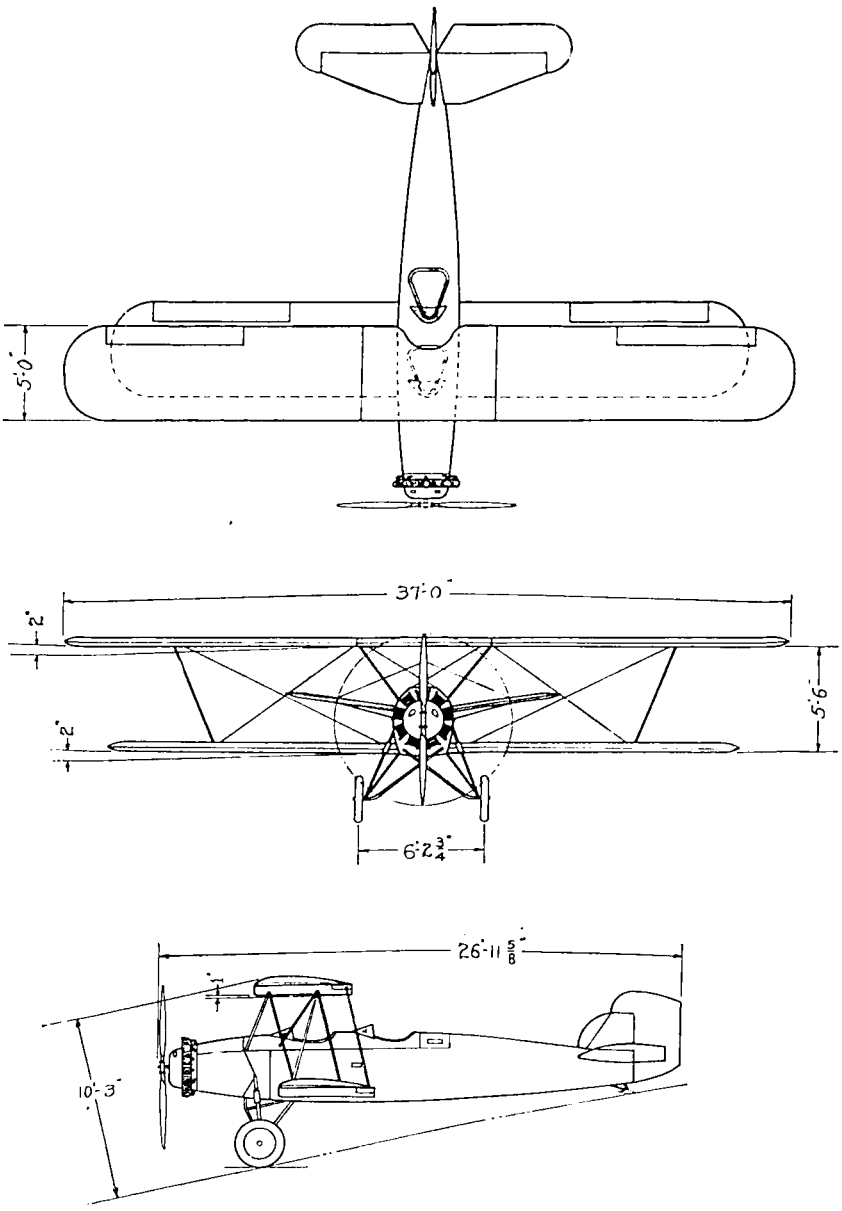
HALL ALUMINUM AIRCRAFT CORPORATION
Buffalo, N. Y.
FIGHTER XFH-1
ENGINE: PRATT & WHITNEY WASP



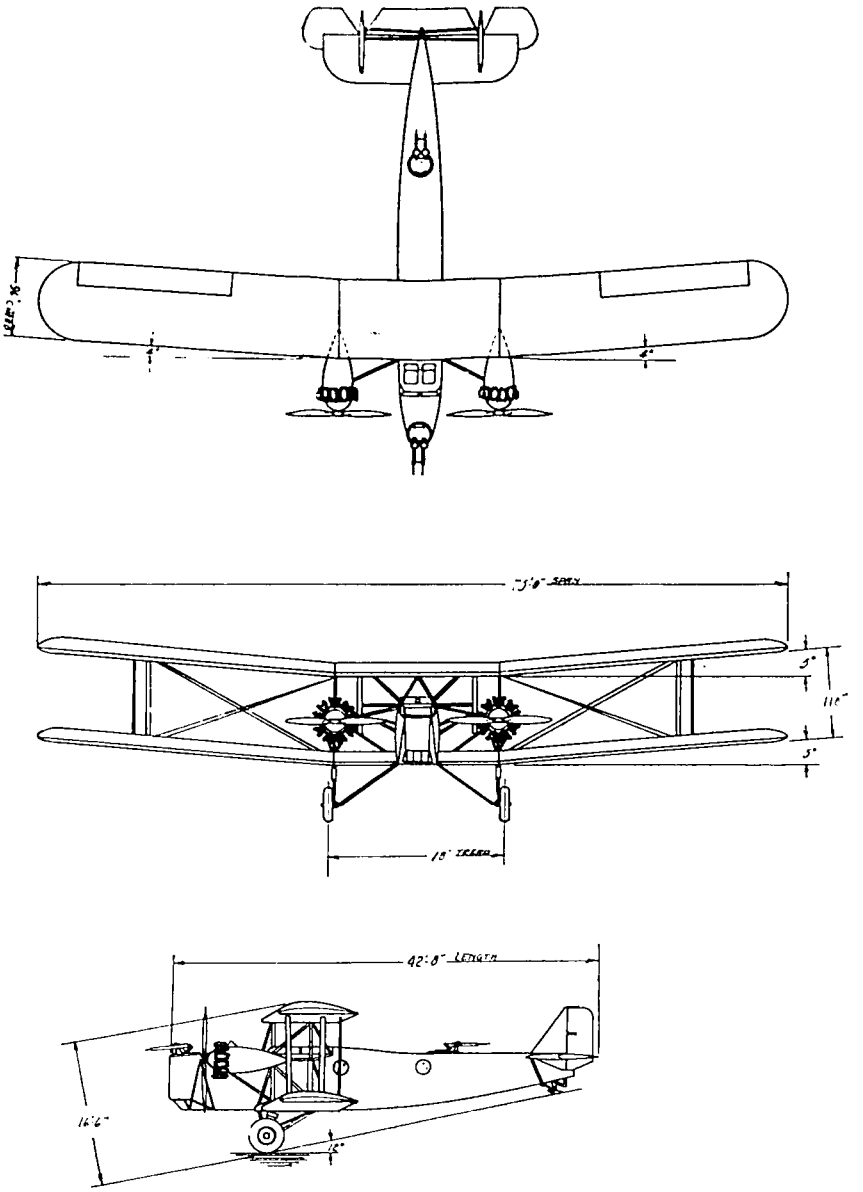
HALL ALUMINUM AIRCRAFT CORPORATION
Buffalo, N. Y.
PATROL BOAT XPH-1
ENGINE: TWO WRIGHT GEARED CYCLONES



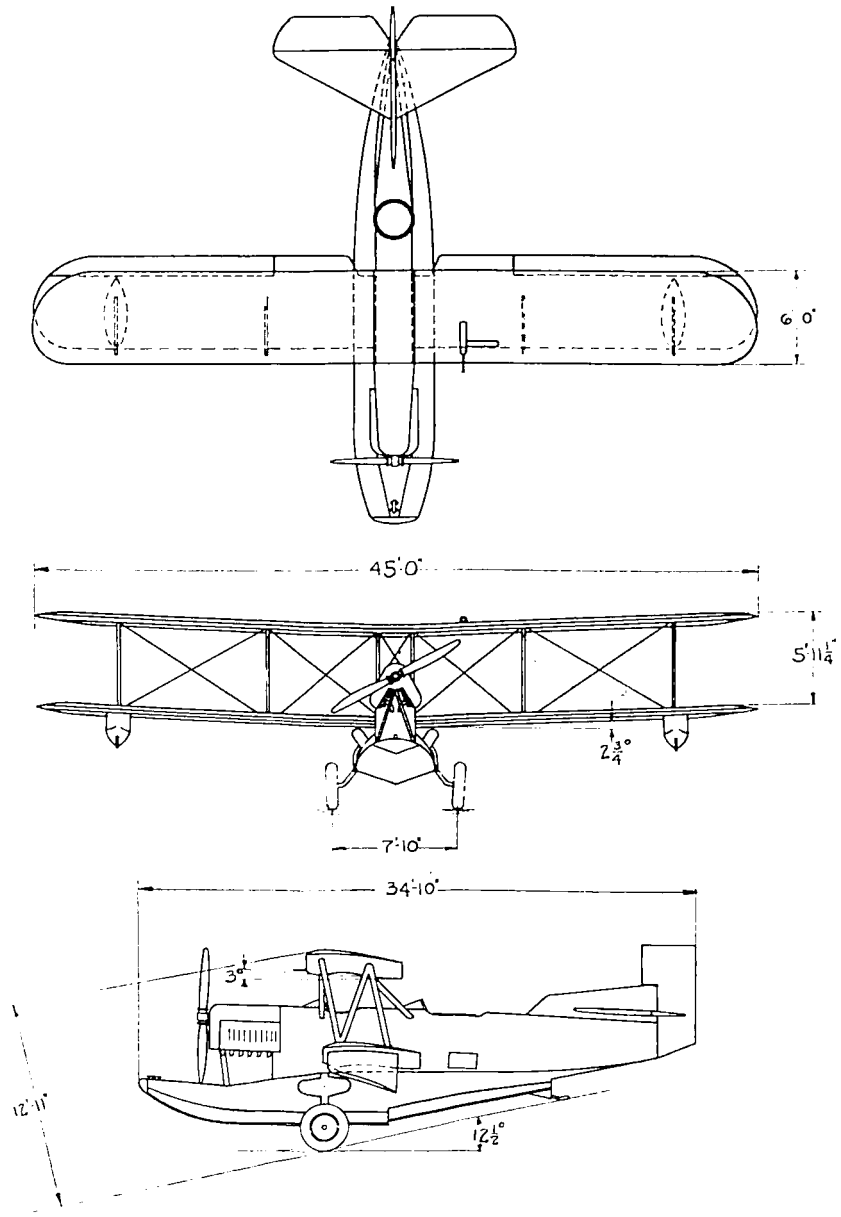
KEYSTONE AIRCRAFT CORPORATION
Bristol, Pa.
NAVY TRAINING NK-1
ENGINE: WRIGHT WHIRLWIND



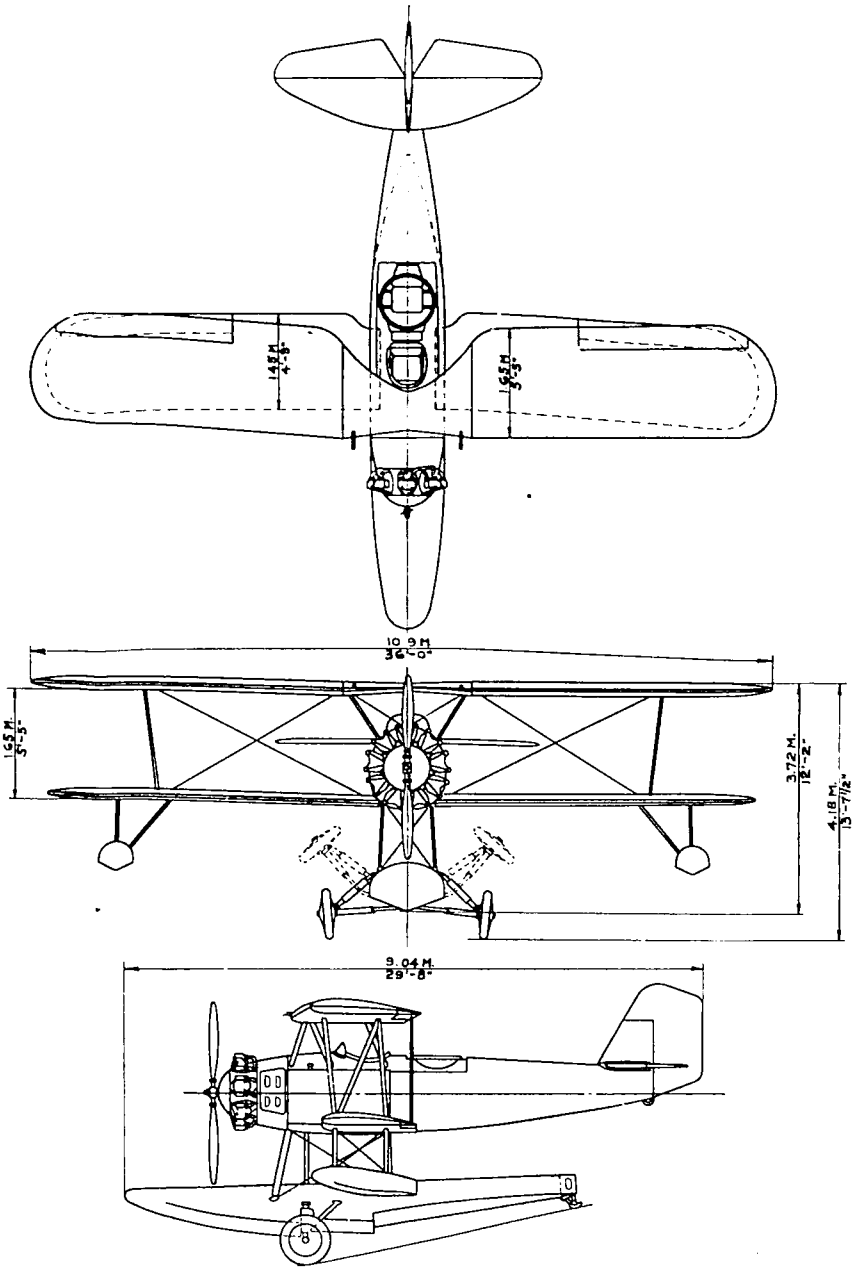
KEYSTONE AIRCRAFT CORPORATION
Bristol, Pa.
BOMBERS LB-6 AND LB-7
ENGINES: LB-6, TWO WRIGHT CYCLONES
LB-7, TWO PRATT & WHITNEY HORNETS



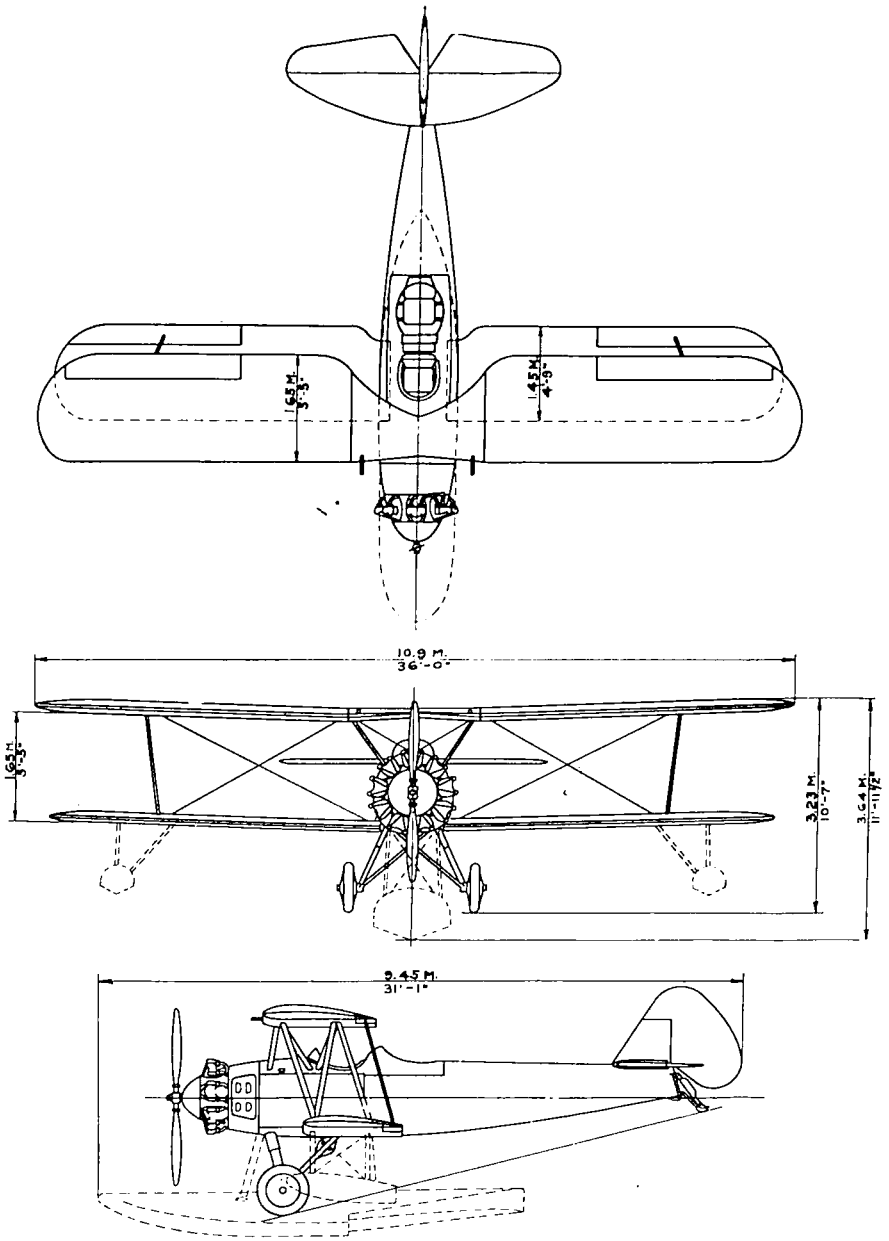
KEYSTONE AIRCRAFT CORPORATION
Bristol, Pa.
BOMBER LB-10
ENGINES: TWO WRIGHT CYCLONES



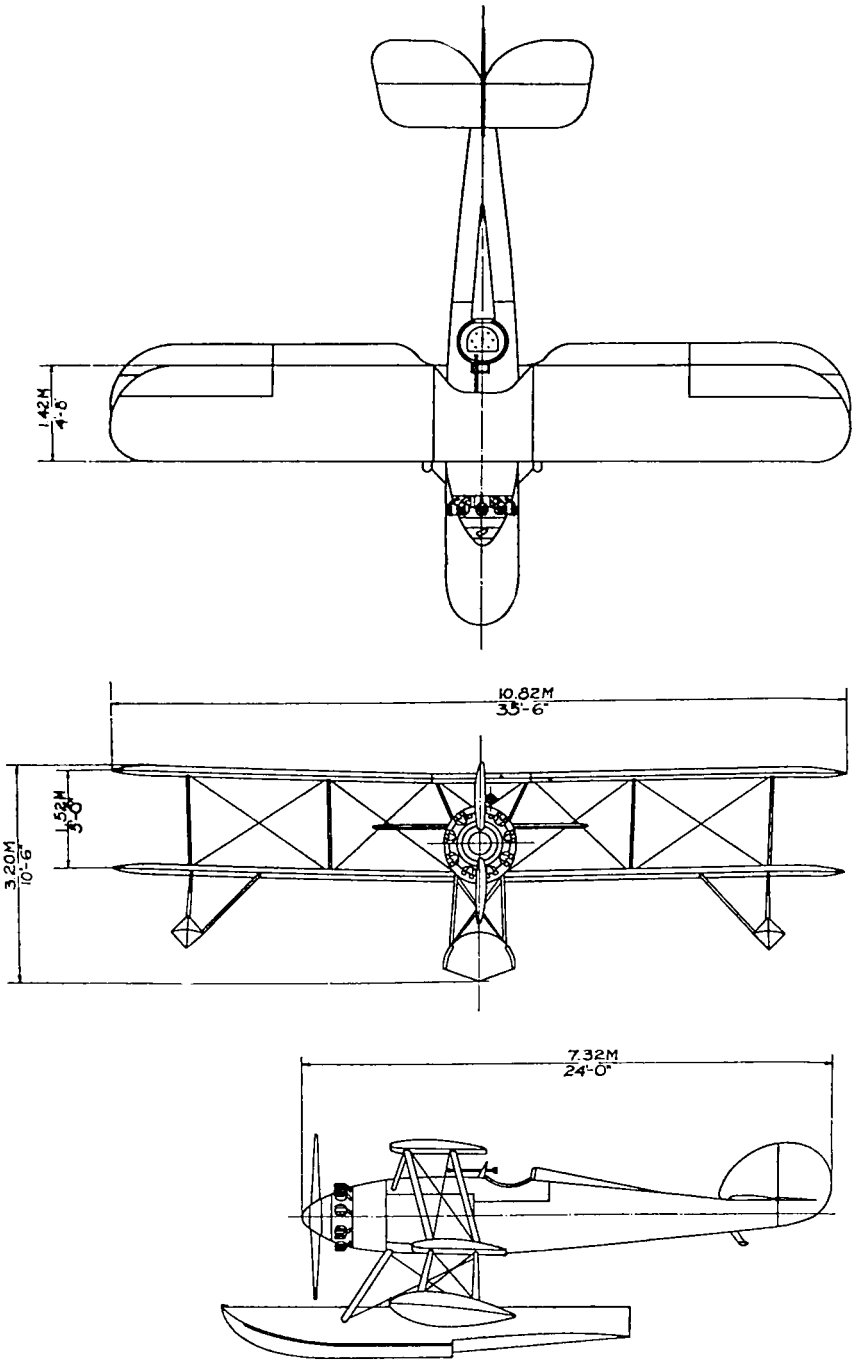
LOENING AERONAUTICAL ENGINEERING CORPORATION
(DIVISION KEYSTONE AIRCRAFT CORPORATION)
New York City
MODEL OA-2
ENGINE: WRIGHT TORNADO



CHANCE VOUGHT CORPORATION
Long Island City, N. Y.
OBSERVATION O24-2
ENGINE: PRATT & WHITNEY WASP

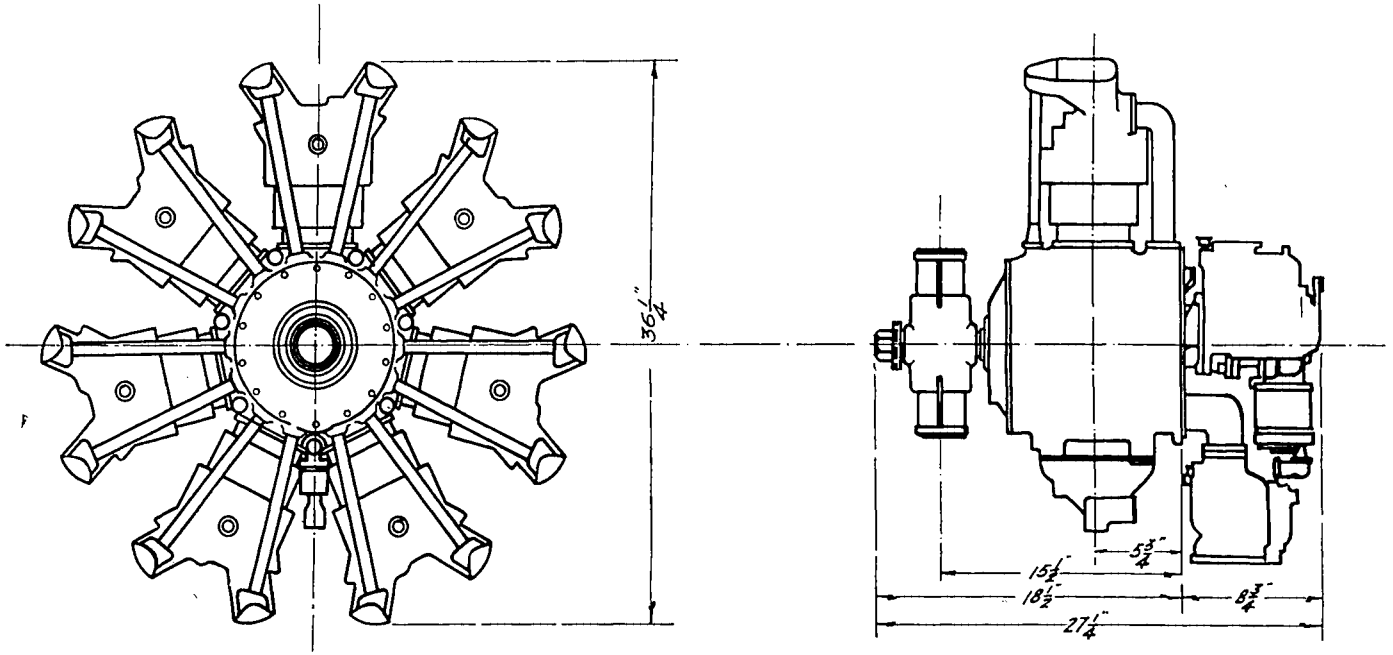


CHANCE VOUGHT CORPORATION
Long Island City, N. Y.
FIGHTER XF20-1
2 PLACE
ENGINE: PRATT & WHITNEY WASP

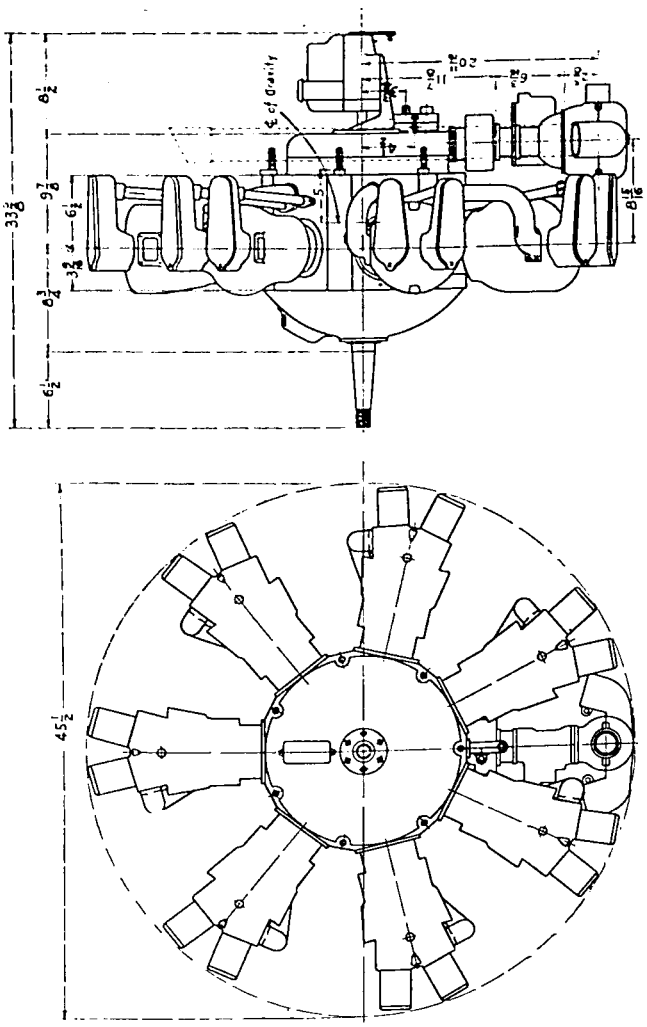


CHANCE VOUGHT CORPORATION
Long Island City, N. Y.
FIGHTER FU-1
ENGINE: WRIGHT WHIRLWIND J-5

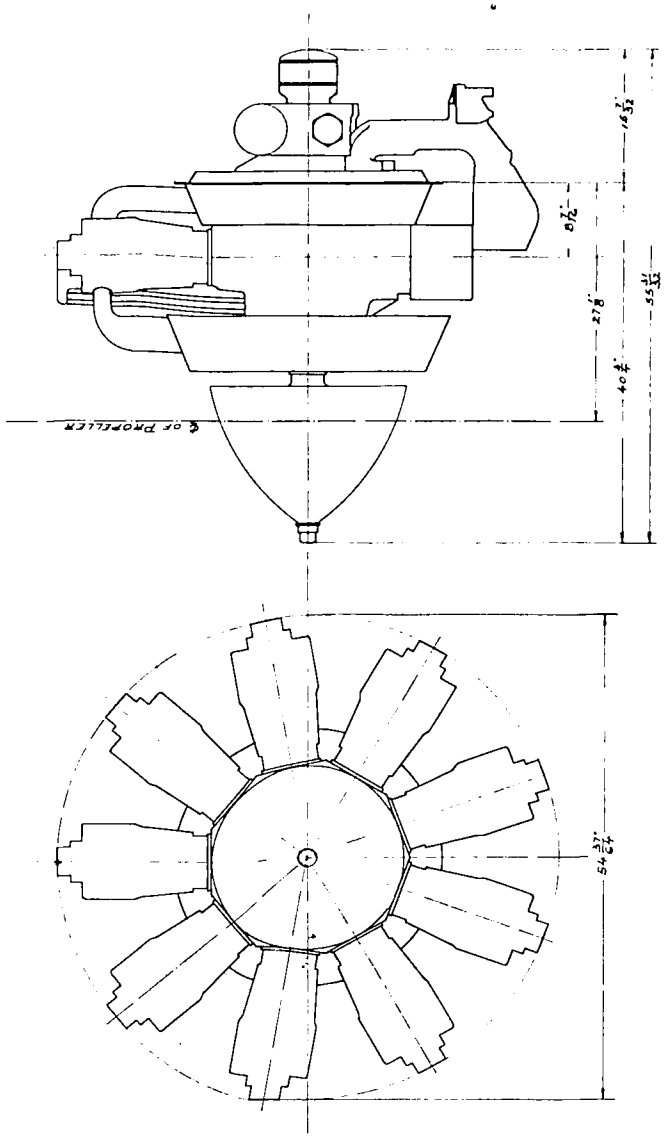
ENGINE DESIGN



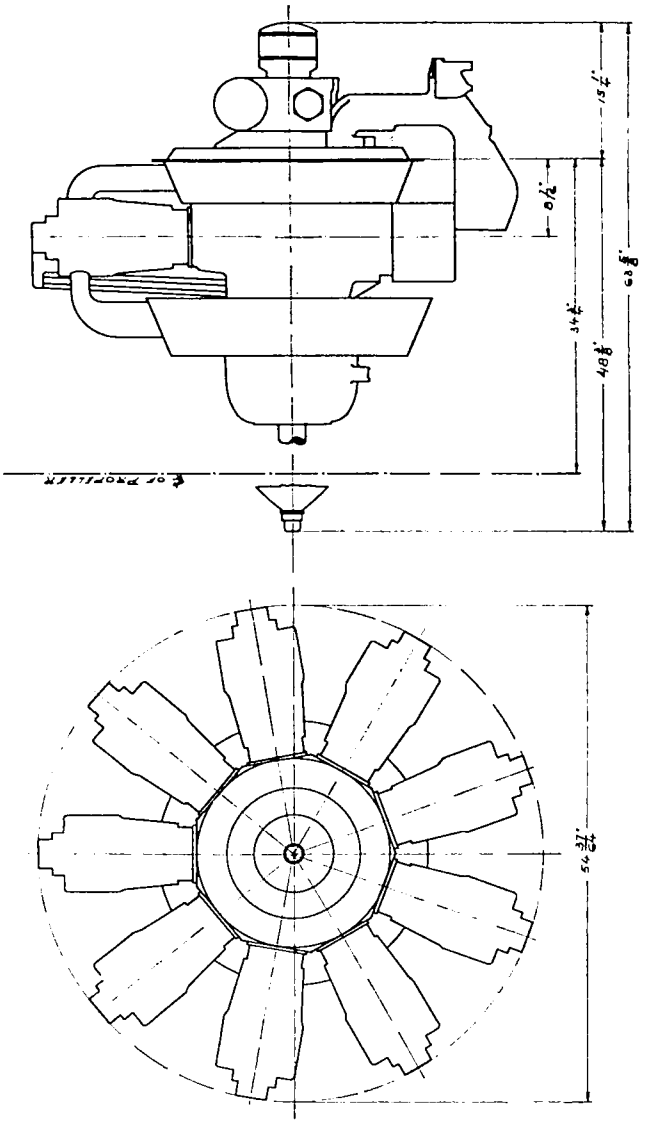
ALLIANCE AIRCRAFT CORPORATION
Alliance, Ohio
HESS WARRIOR
125 H.P.
7 CYLINDER RADIAL AIRCOOLED



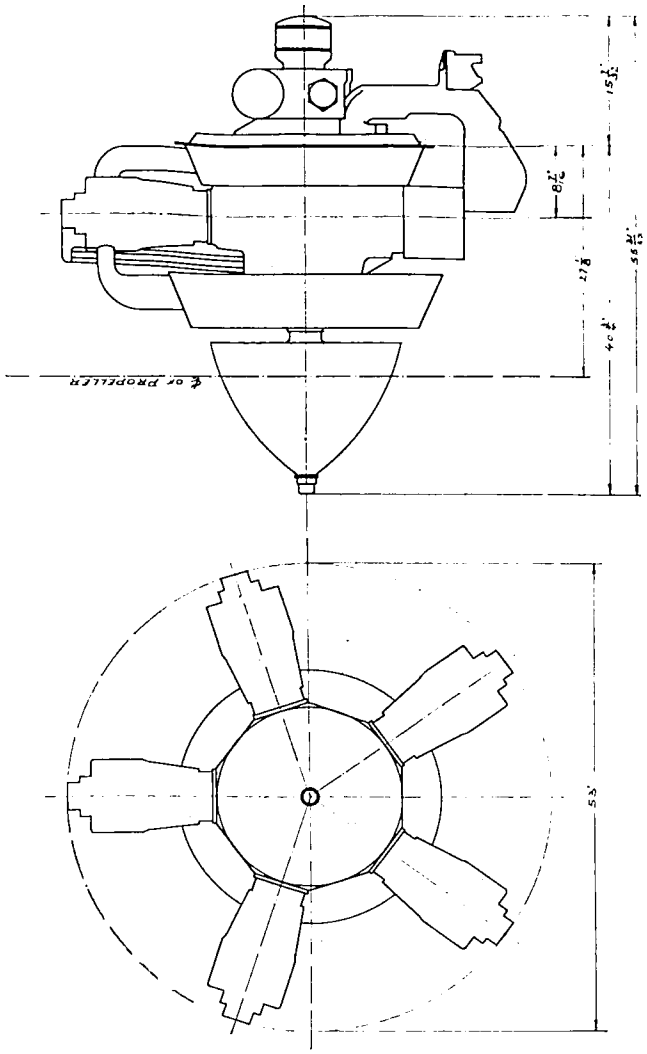
AXELSON MACHINE CO.
Los Angeles, Calif.
AXELSON
150 H.P.
7 CYLINDER RADIAL AIRCOOLED



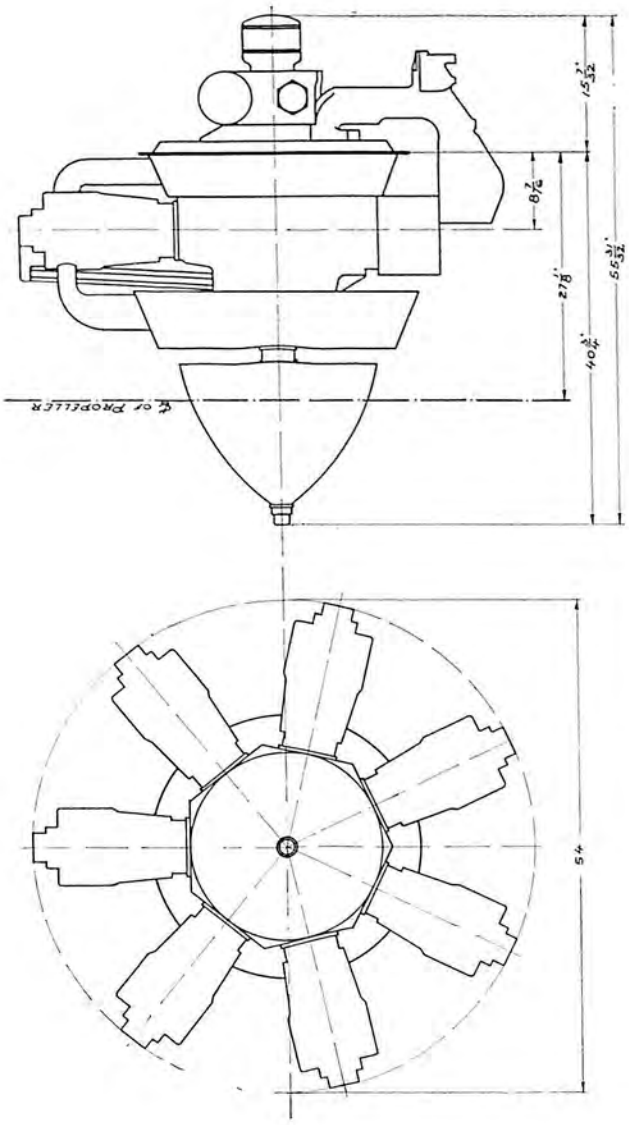
E. W. BLISS COMPANY
Brooklyn, N. Y.
BLISS-JUPITER
550 H.P.
9 CYLINDER RADIAL AIRCOOLED



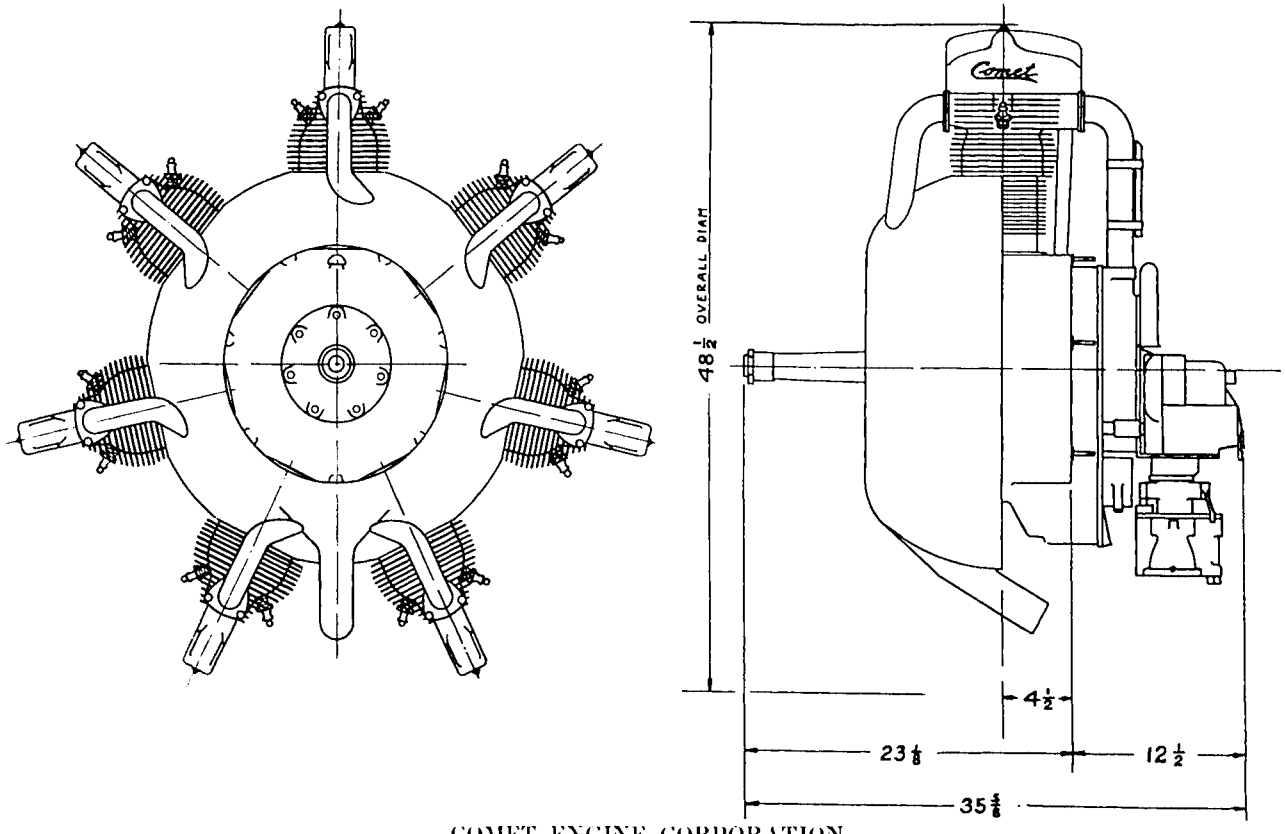
E. W. BLISS COMPANY
Brooklyn, N. Y.
BLISS-JUPITER (GEARED)
550 H.P.
9 CYLINDER RADIAL AIRCOOLED



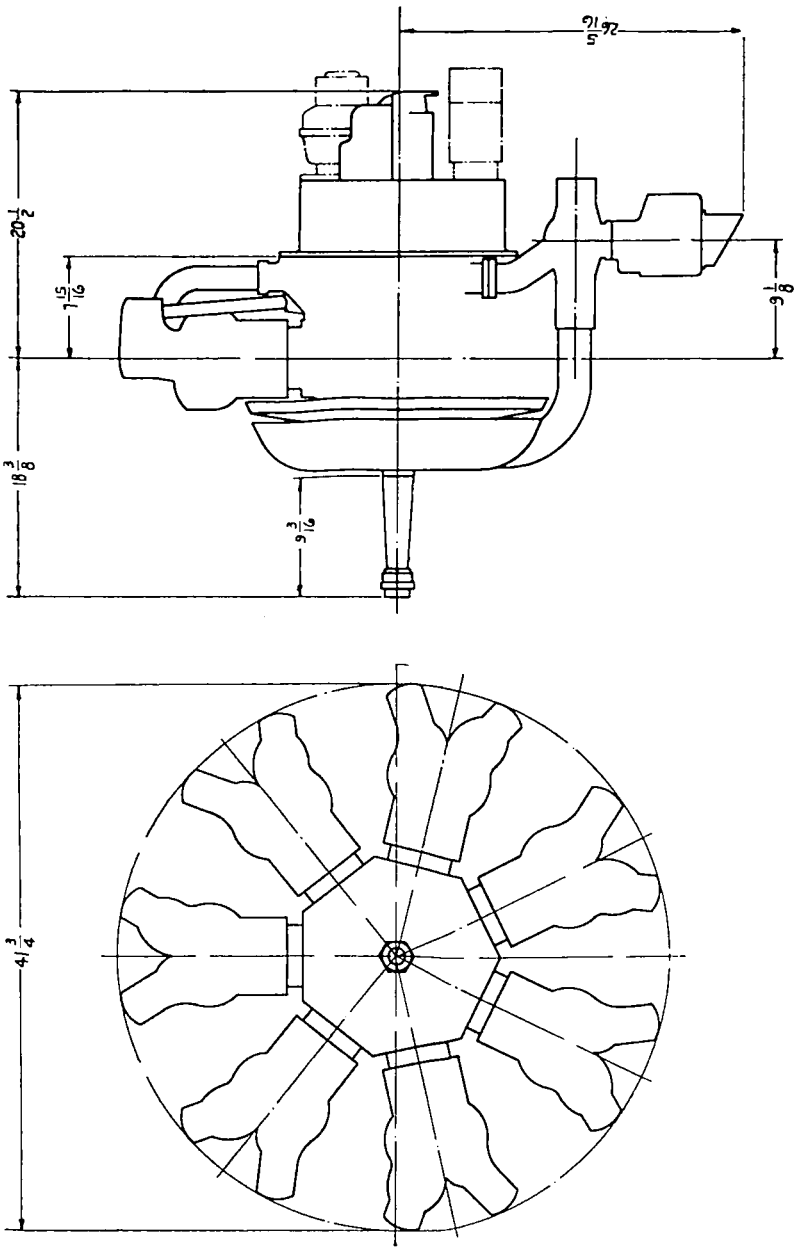
E. W. BLISS COMPANY
Brooklyn, N. Y.
BLISS-TITAN
250 H.P.
5 CYLINDER RADIAL AIRCOOLED



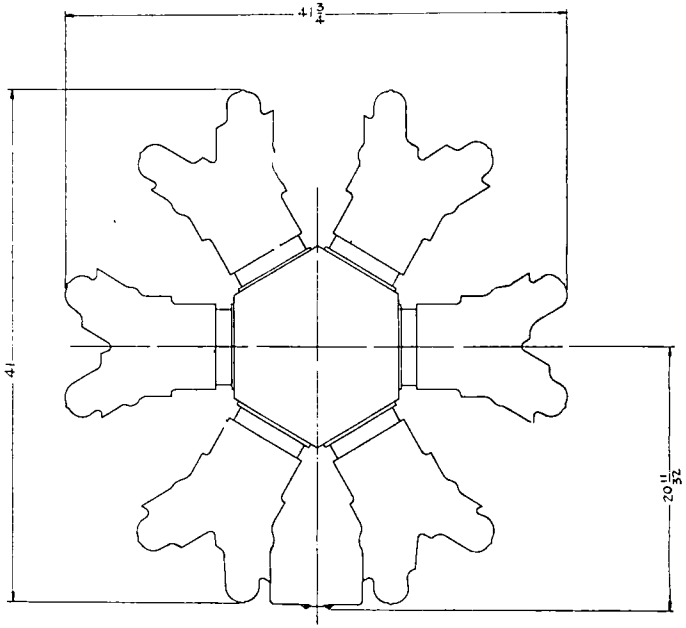
E. W. BLISS COMPANY
Brooklyn, N. Y.
BLISS-NEPTUNE
400 H.P.
7 CYLINDER RADIAL AIRCOOLED

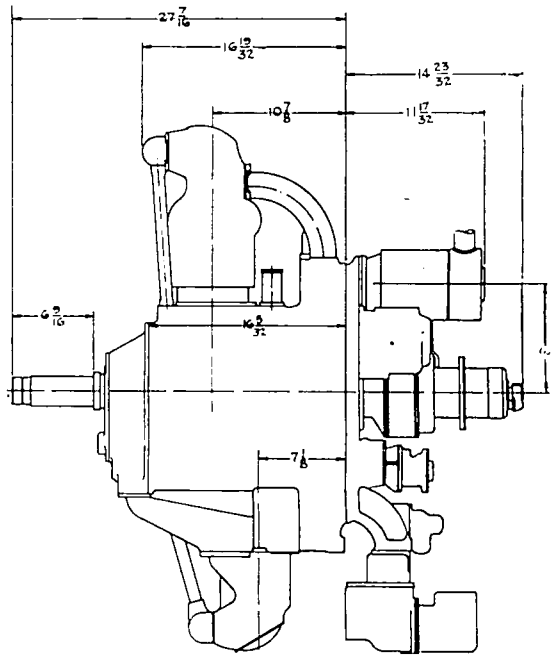


COMET ENGINE CORPORATION
Madison, Wis.
COMET
150 H.P.
7 CYLINDER RADIAL AIRCOOLED

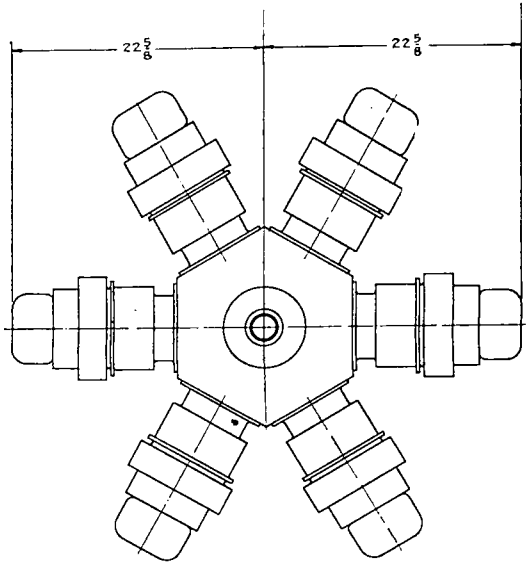


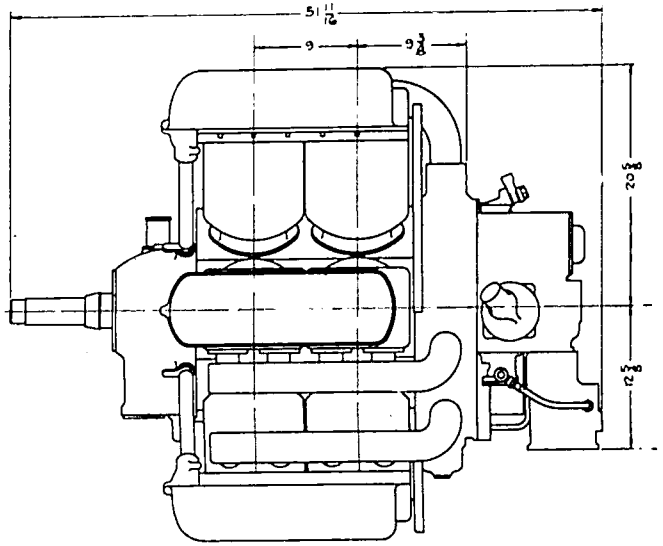
CONTINENTAL AIRCRAFT ENGINE COMPANY
Detroit, Mich.
MODEL A70
165 H.P.
7 CYLINDER RADIAL AIRCOOLED



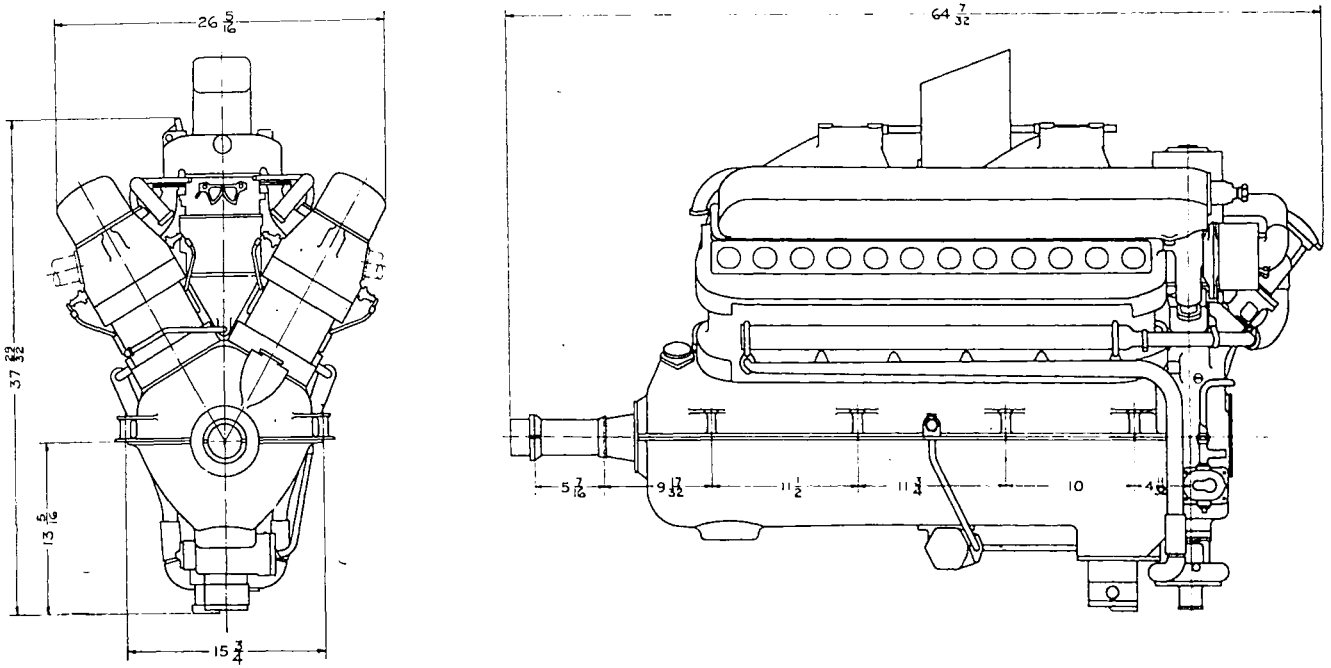


CURTISS AEROPLANE & MOTOR COMPANY, INC.
Buffalo, N. Y.
CHALLENGER
170 H.P.
6 CYLINDER RADIAL AIRCOOLED





CURTISS AEROPLANE & MOTOR COMPANY, INC.
Buffalo, N. Y.
CHIEFTAIN
600 H.P.
12 CYLINDER RADIAL AIRCOOLED

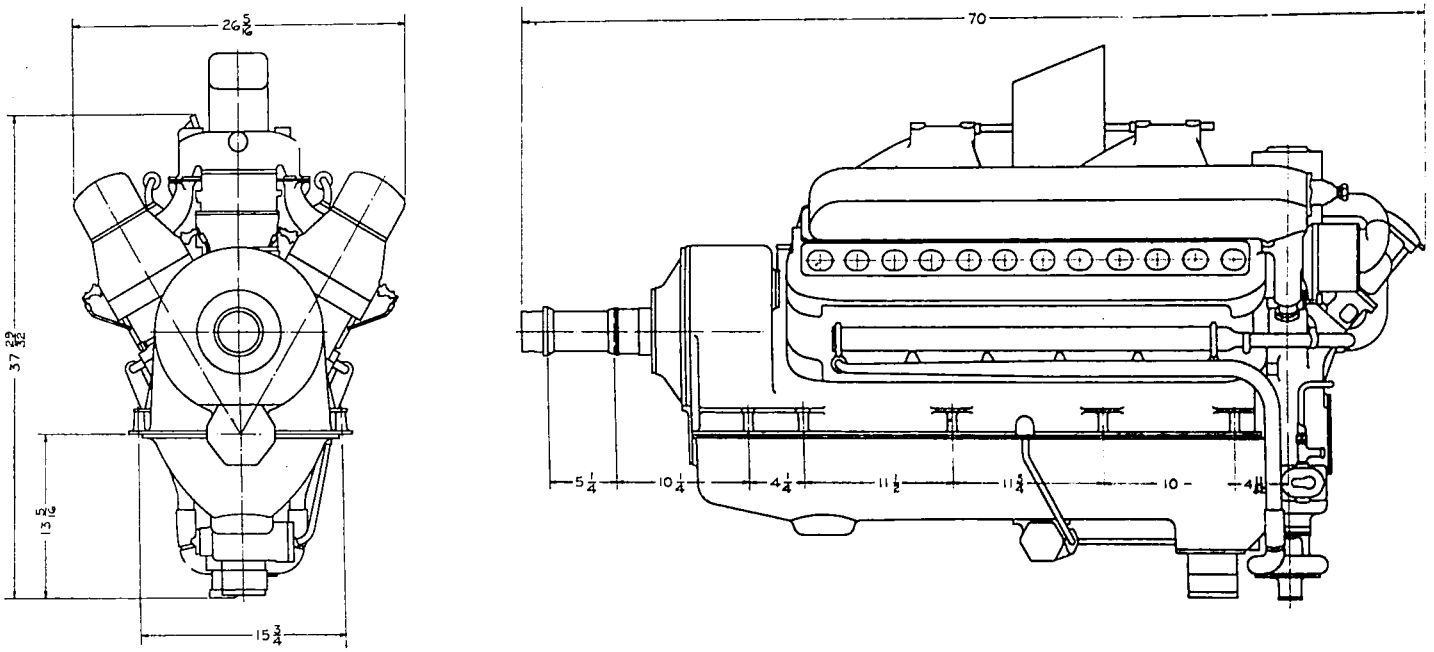


CURTISS AEROPLANE & MOTOR COMPANY, INC.
Buffalo, N. Y.

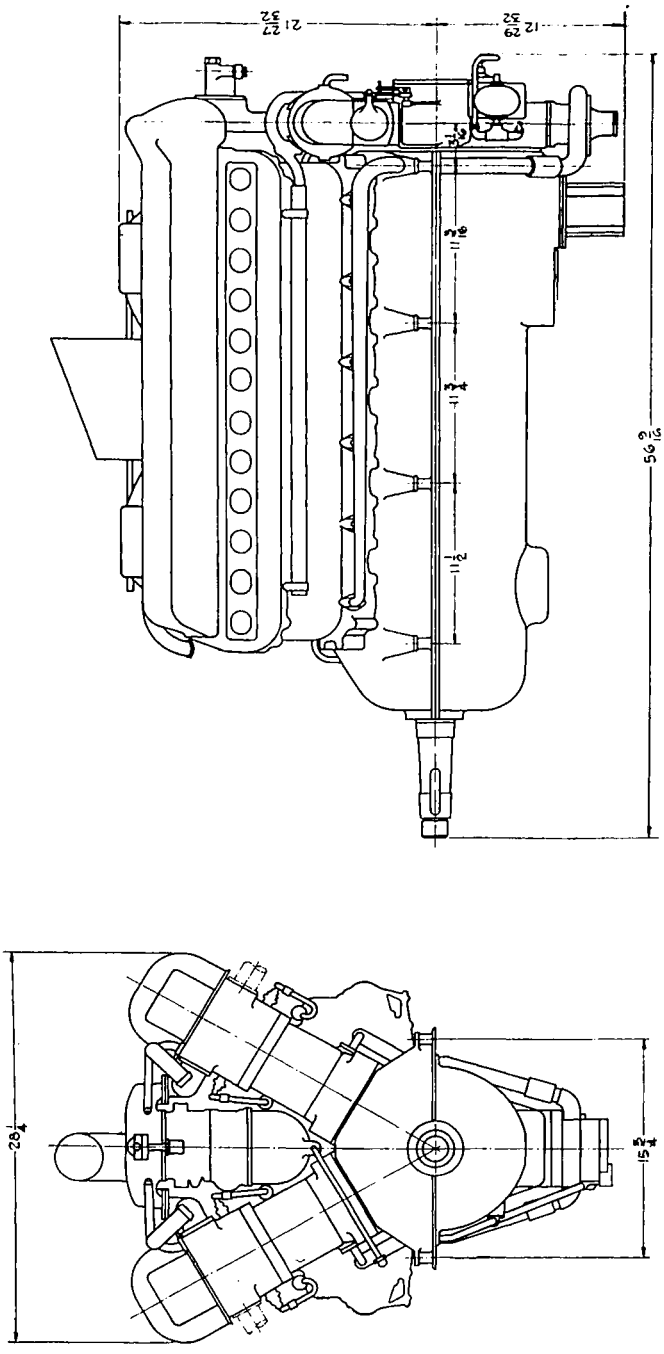
CONQUEROR

625 H.P.

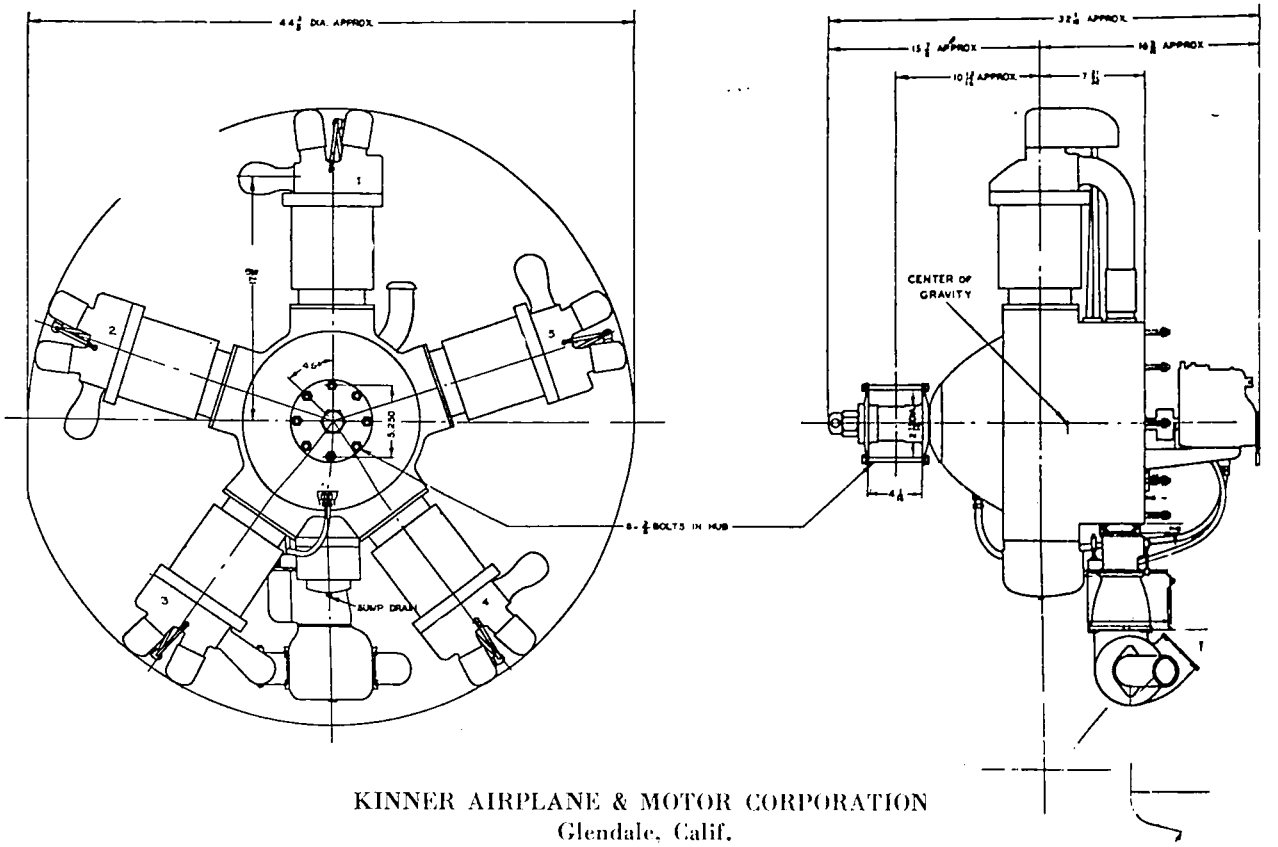
12 CYLINDER V TYPE WATERCOOLED



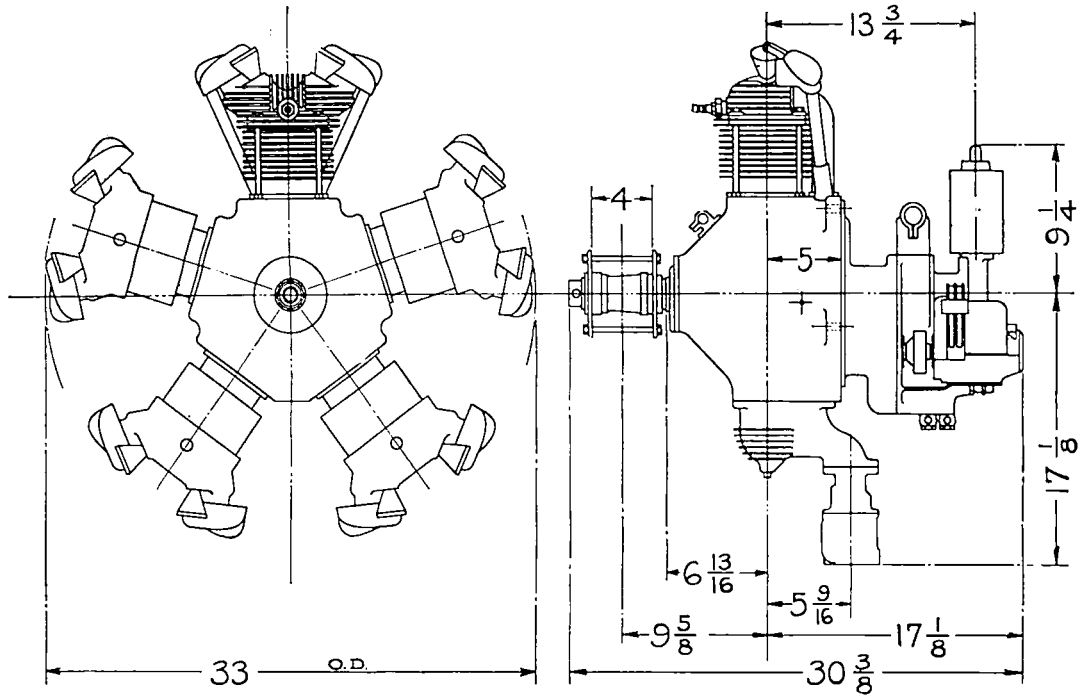
CURTISS AEROPLANE & MOTOR COMPANY, INC.
Buffalo, N. Y.
CONQUEROR (GEARED)
600 H.P.
12 CYLINDER V TYPE WATERCOOLED



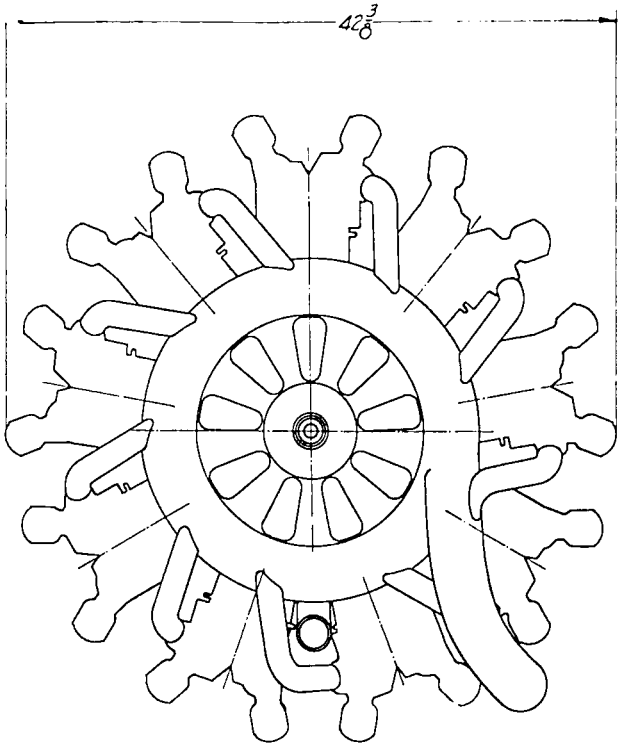
CURTISS AEROPLANE & MOTOR COMPANY, INC.
Buffalo, N. Y.
MODEL D12
435 H.P.
12 CYLINDER V TYPE WATERCOOLED

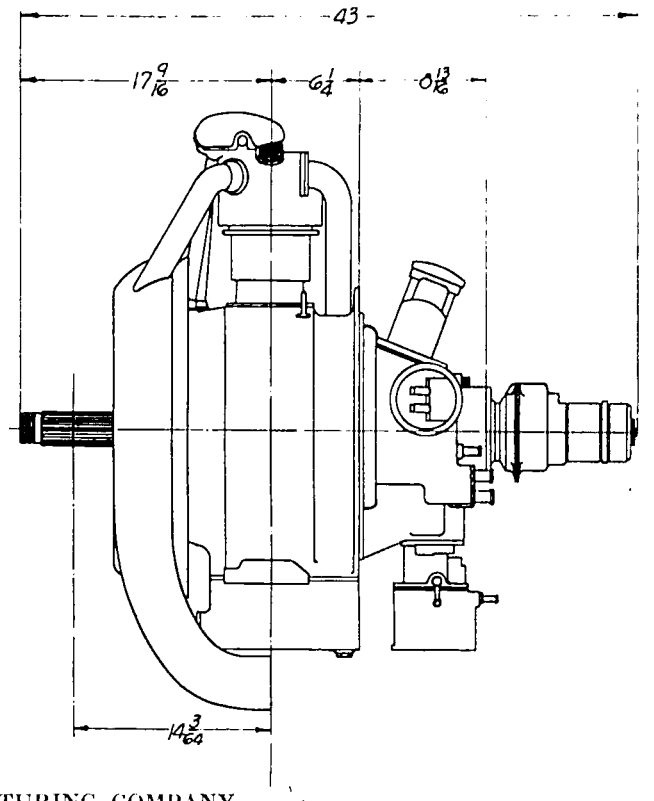


KINNER AIRPLANE & MOTOR CORPORATION
Glendale, Calif.
MODEL K5
100 H.P.
5 CYLINDER RADIAL AIRCOOLED

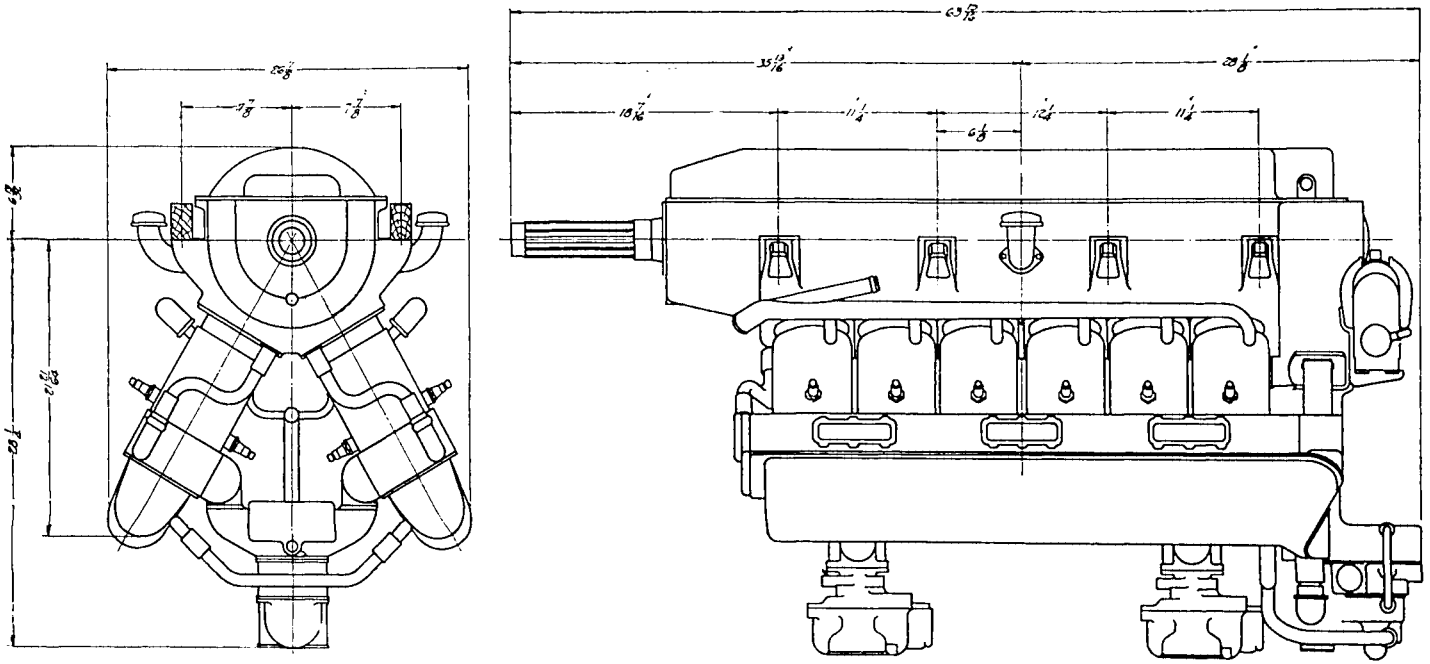


LAMBERT AIRCRAFT ENGINE CORPORATION
Moline, Ill.
MODEL R266
90 H.P.
5 CYLINDER RADIAL AIRCOOLED

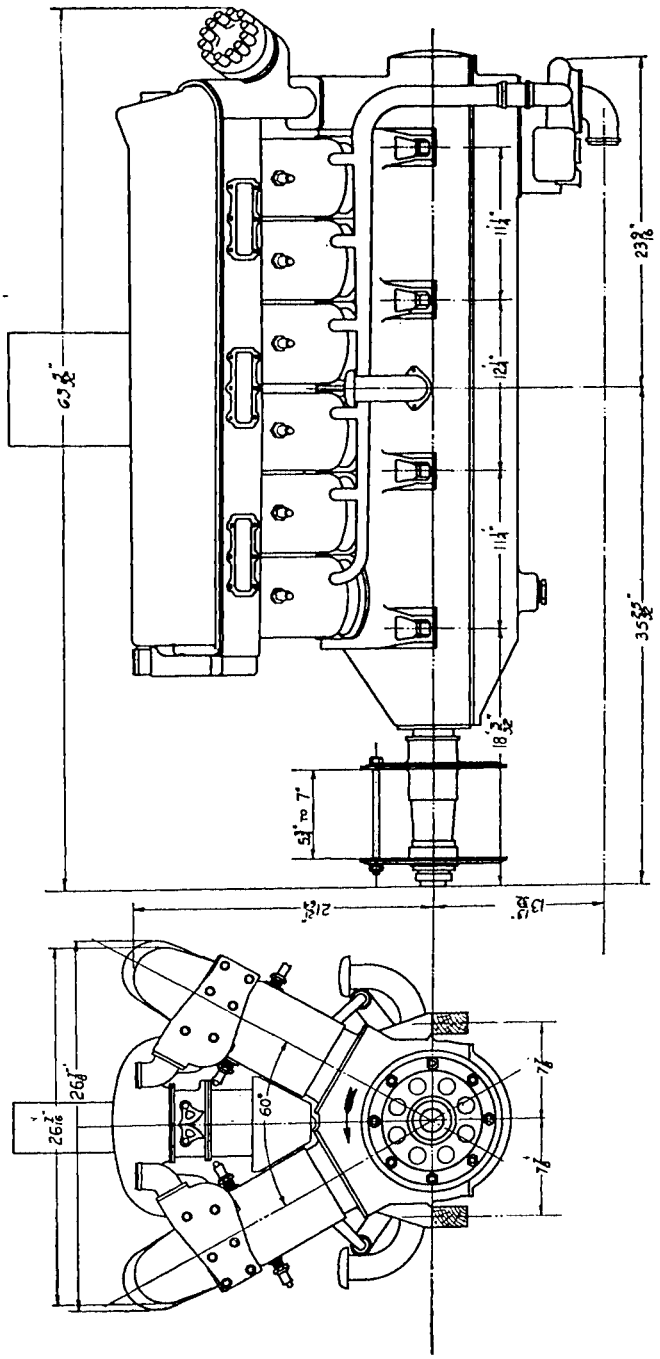




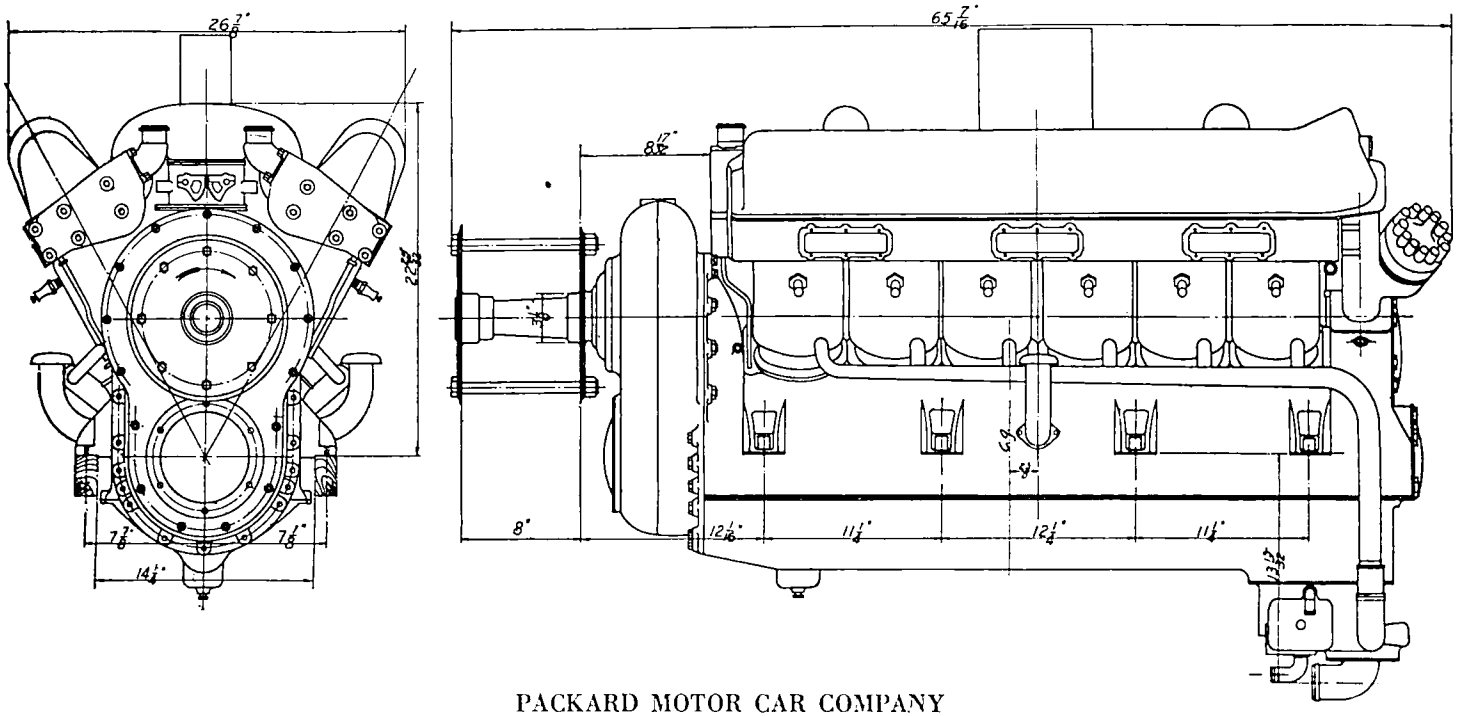
LYCOMING MANUFACTURING COMPANY
Williamsport, Pa.
MODEL R645
185 H.P.
9 CYLINDER RADIAL AIRCOOLED



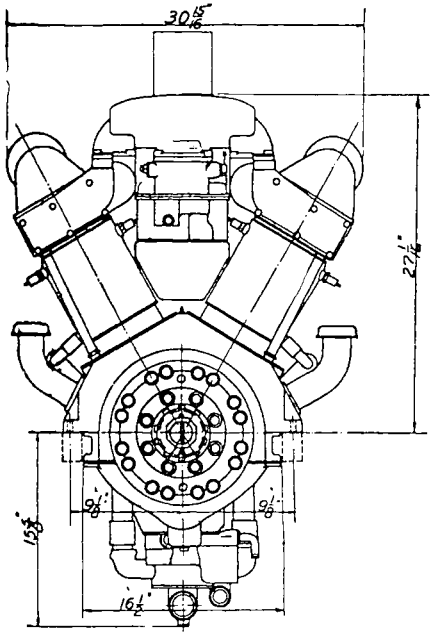
PACKARD MOTOR CAR COMPANY
Detroit, Mich.
MODEL 2A-1500
600 H.P.
12 CYLINDER INVERTED V TYPE WATERCOOLED

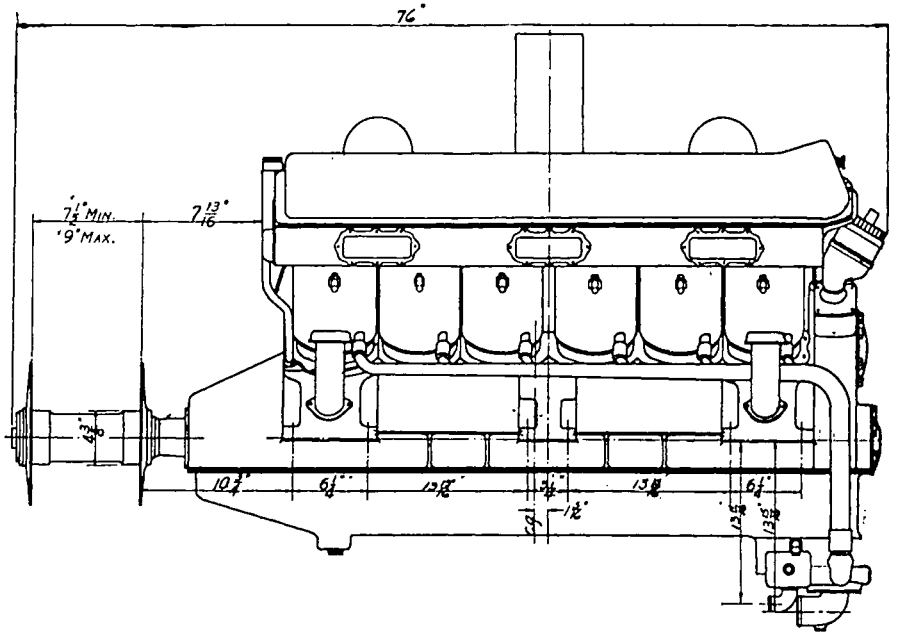


PACKARD MOTOR CAR COMPANY
Detroit, Mich.
MODEL 2A-1500
600 H.P.
12 CYLINDER V TYPE WATERCOOLED

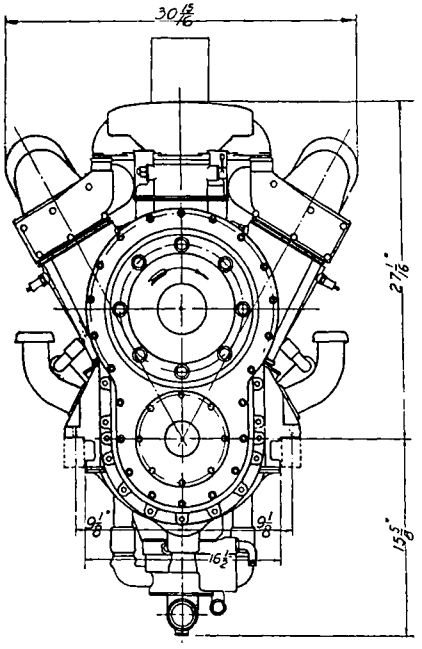


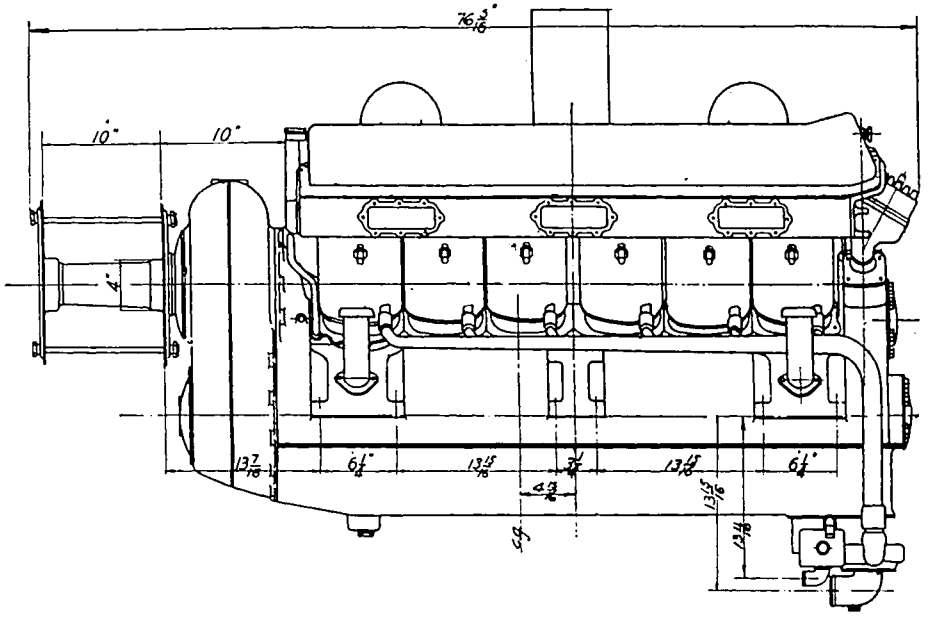
PACKARD MOTOR CAR COMPANY
Detroit, Mich.
MODEL 2A-1500 (GEARED)
600 H.P.
12 CYLINDER V TYPE WATERCOOLED



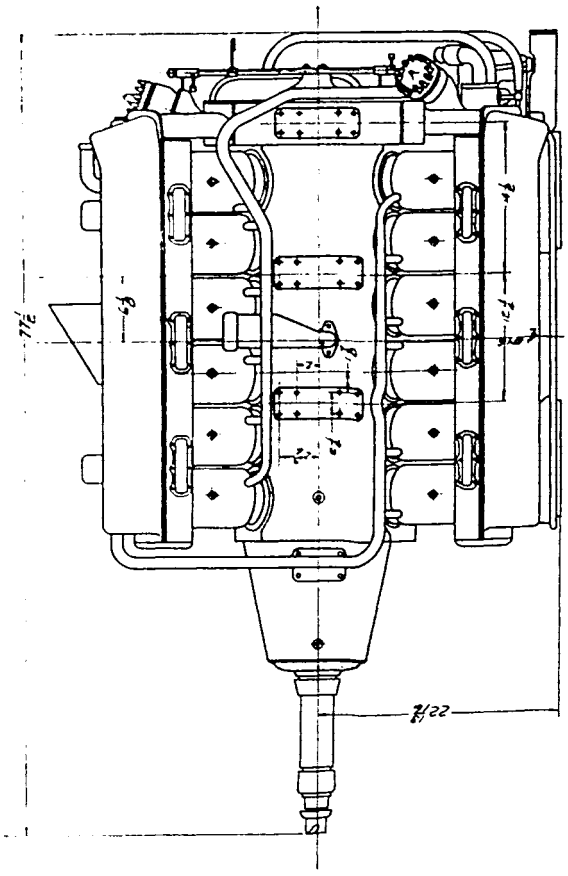


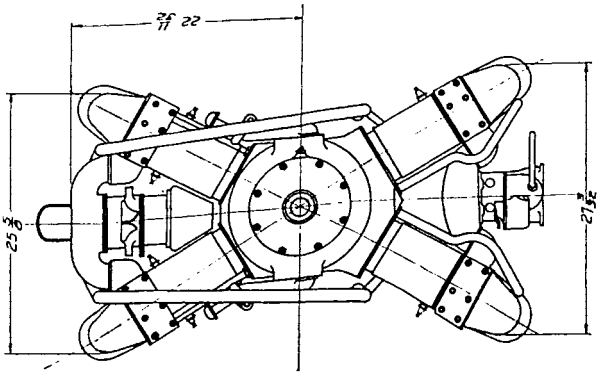
PACKARD MOTOR CAR COMPANY
Detroit, Mich.
MODEL 2A-2500
800 H.P.
12 CYLINDER V TYPE WATERCOOLED



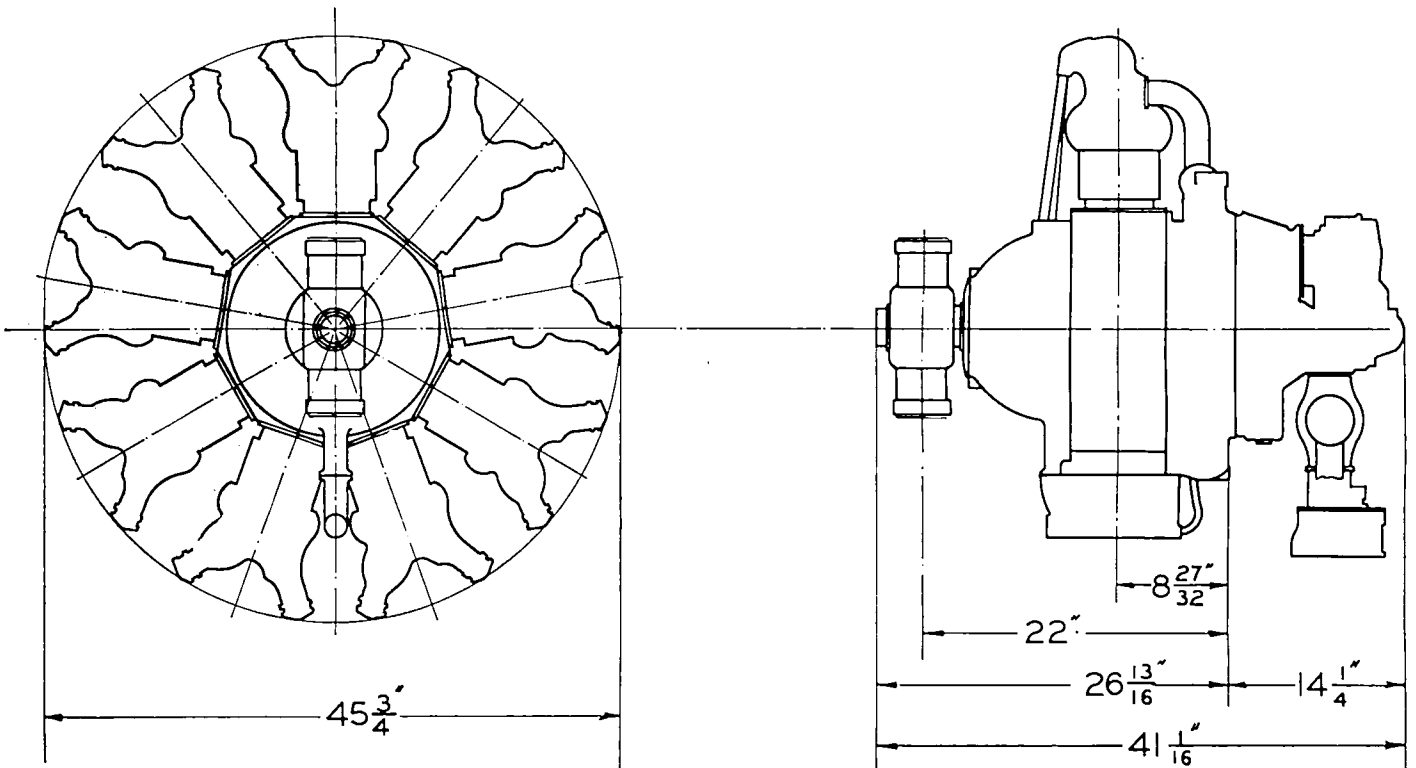


PACKARD MOTOR CAR COMPANY
Detroit, Mich.
MODEL 2A-2500 (GEARED)
800 H.P.
12 CYLINDER V TYPE WATERCOOLED

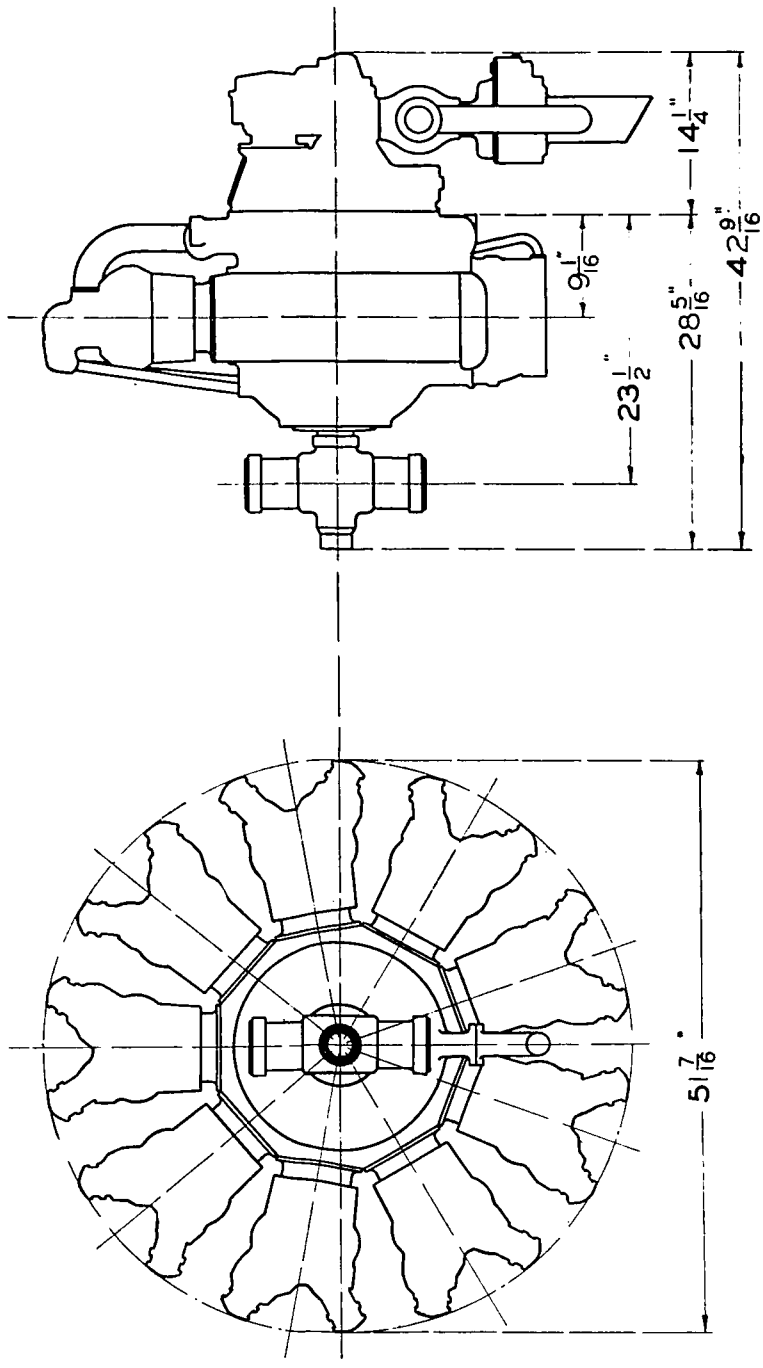




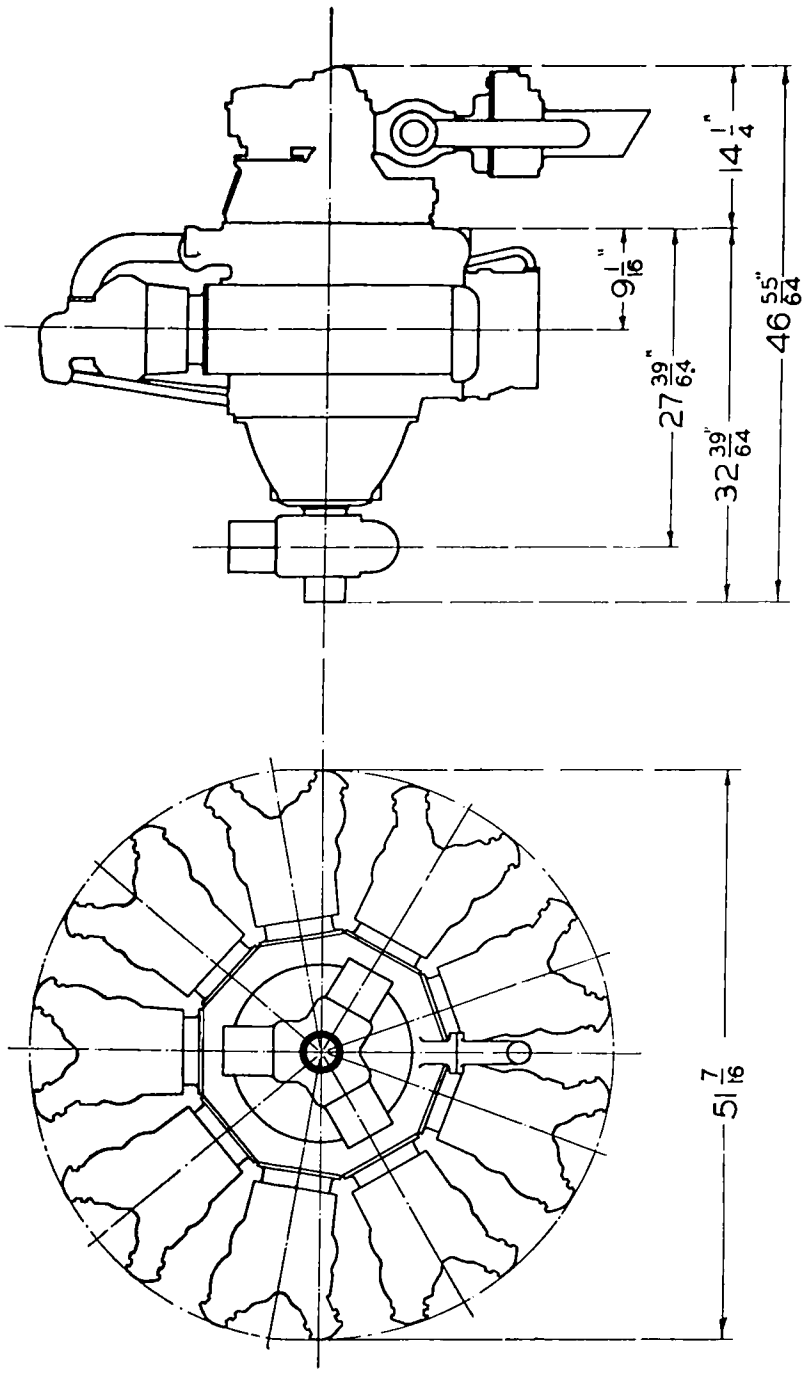
PACKARD MOTOR CAR COMPANY
Detroit, Mich.
MODEL 1A-2775
1250 H.P.
24 CYLINDER X TYPE WATERCOOLED



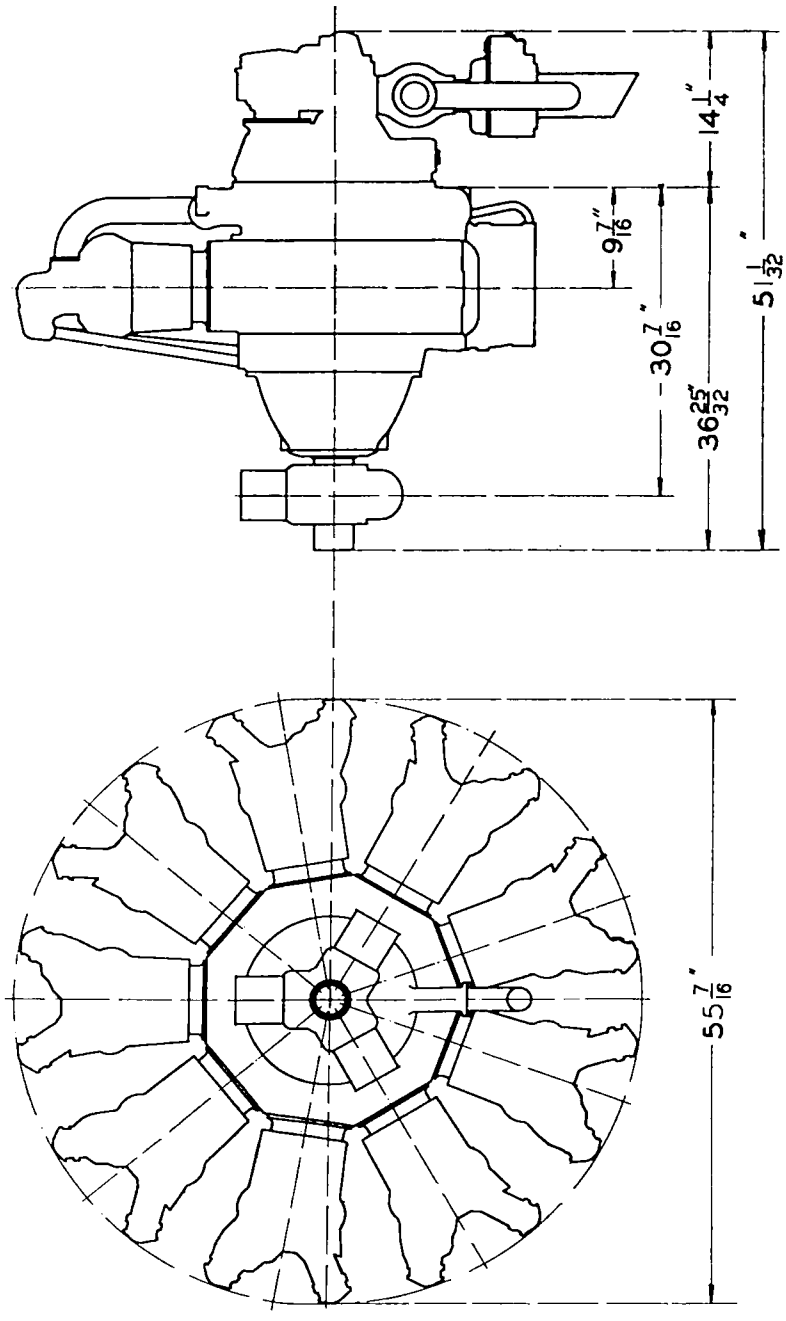
PRATT & WHITNEY AIRCRAFT COMPANY
Hartford, Conn.
WASP JR.
300 H.P.
9 CYLINDER RADIAL AIRCOOLED



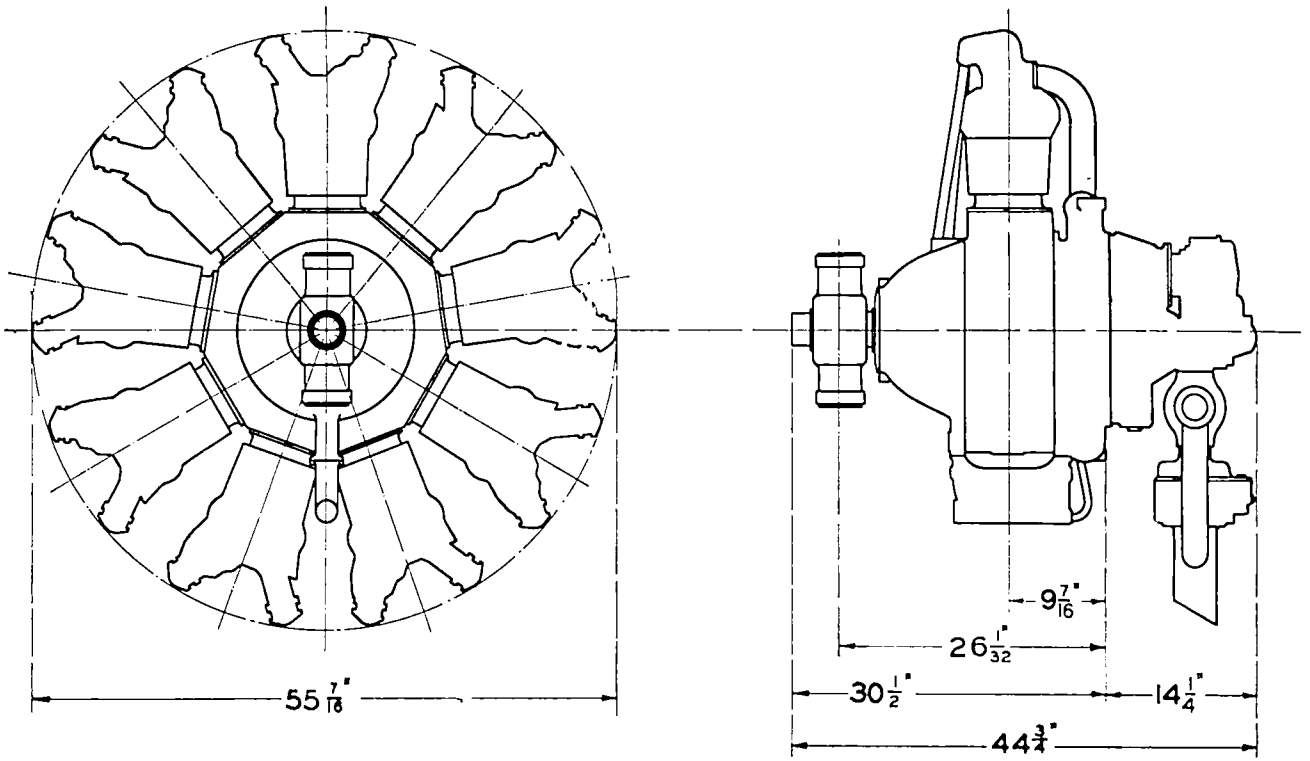
PRATT & WHITNEY AIRCRAFT COMPANY
Hartford, Conn.
WASP C
420 H.P.
9 CYLINDER RADIAL AIRCOOLED



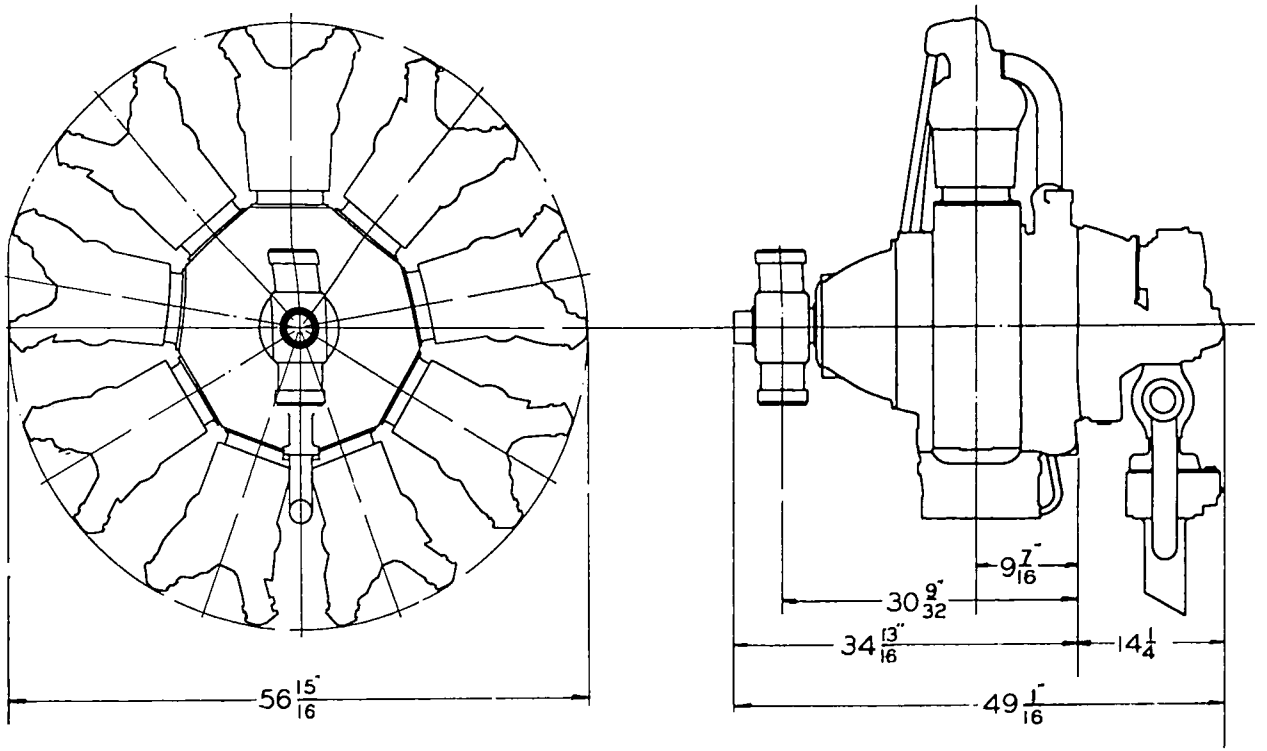
PRATT & WHITNEY AIRCRAFT COMPANY
Hartford, Conn.
WASP C (GEARED)
420 H.P.
9 CYLINDER RADIAL AIRCOOLED



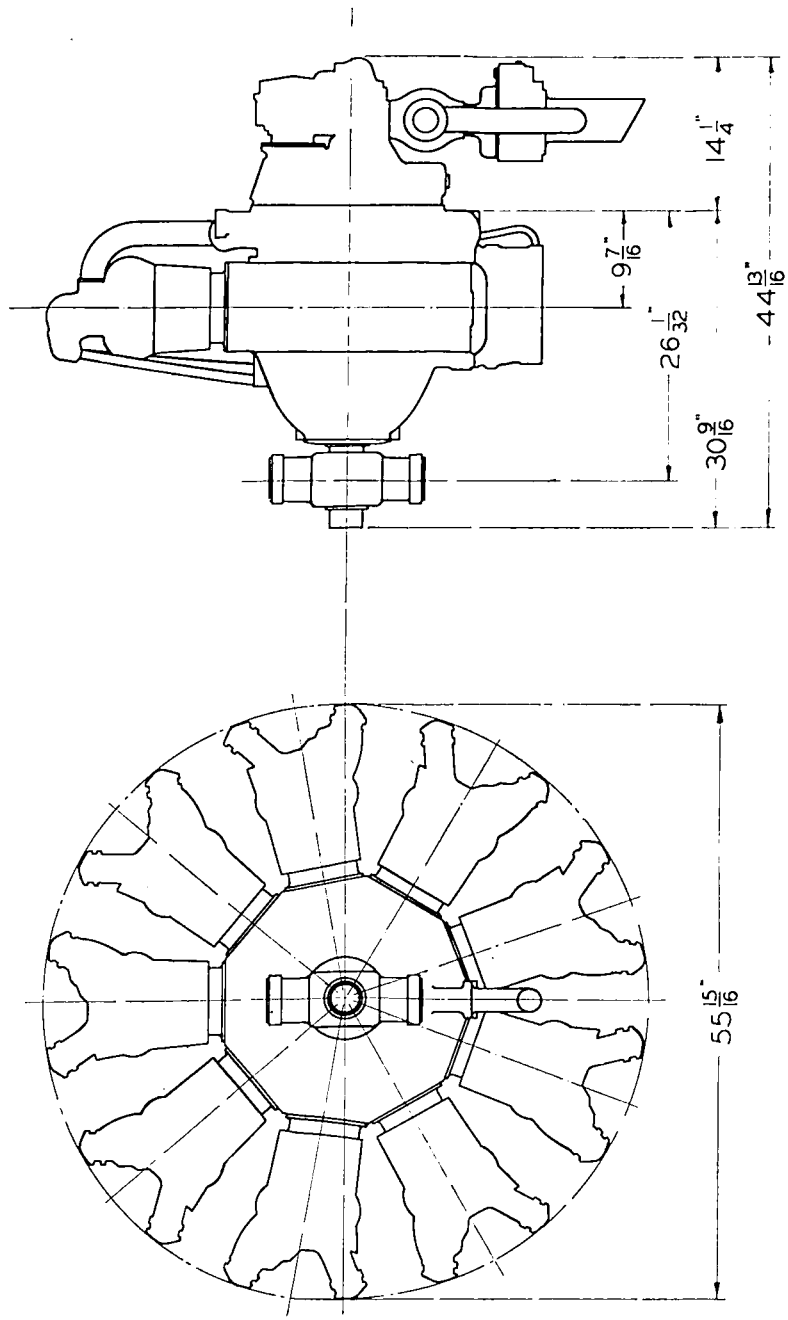
PRATT & WHITNEY AIRCRAFT COMPANY
Hartford, Conn.
HORNET (GEARED)
525 H.P.
9 CYLINDER RADIAL AIRCOOLED



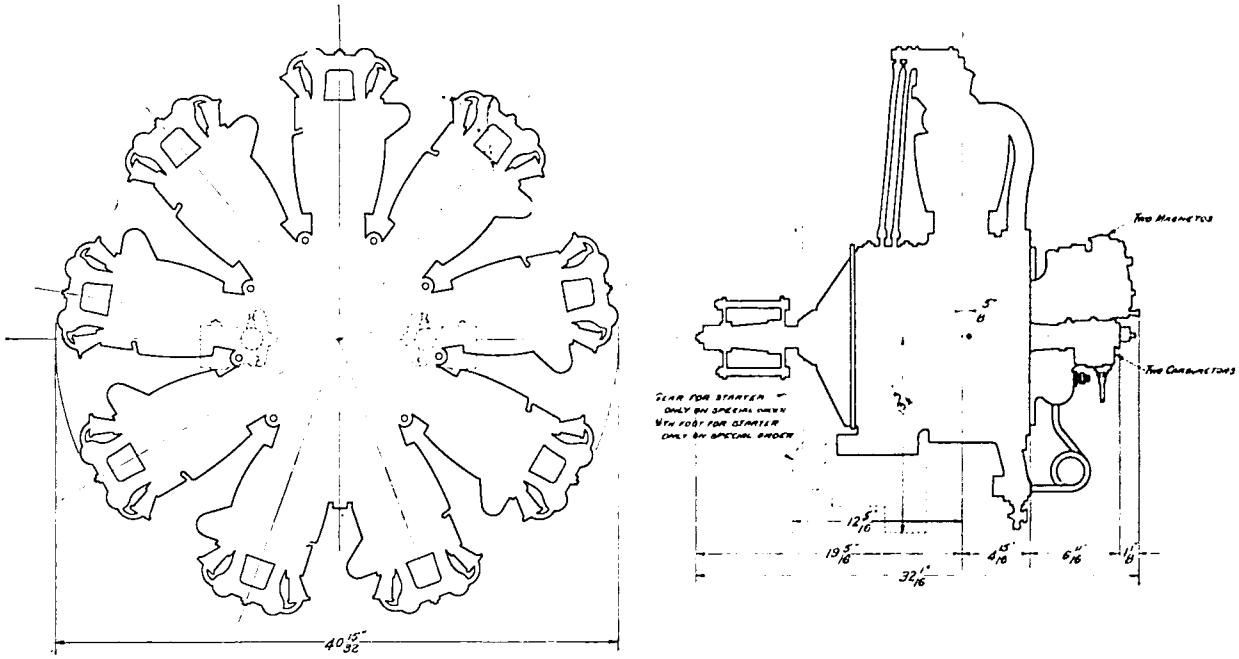
PRATT & WHITNEY AIRCRAFT COMPANY
Hartford, Conn.
HORNET A-1
525 H.P.
9 CYLINDER RADIAL AIRCOOLED



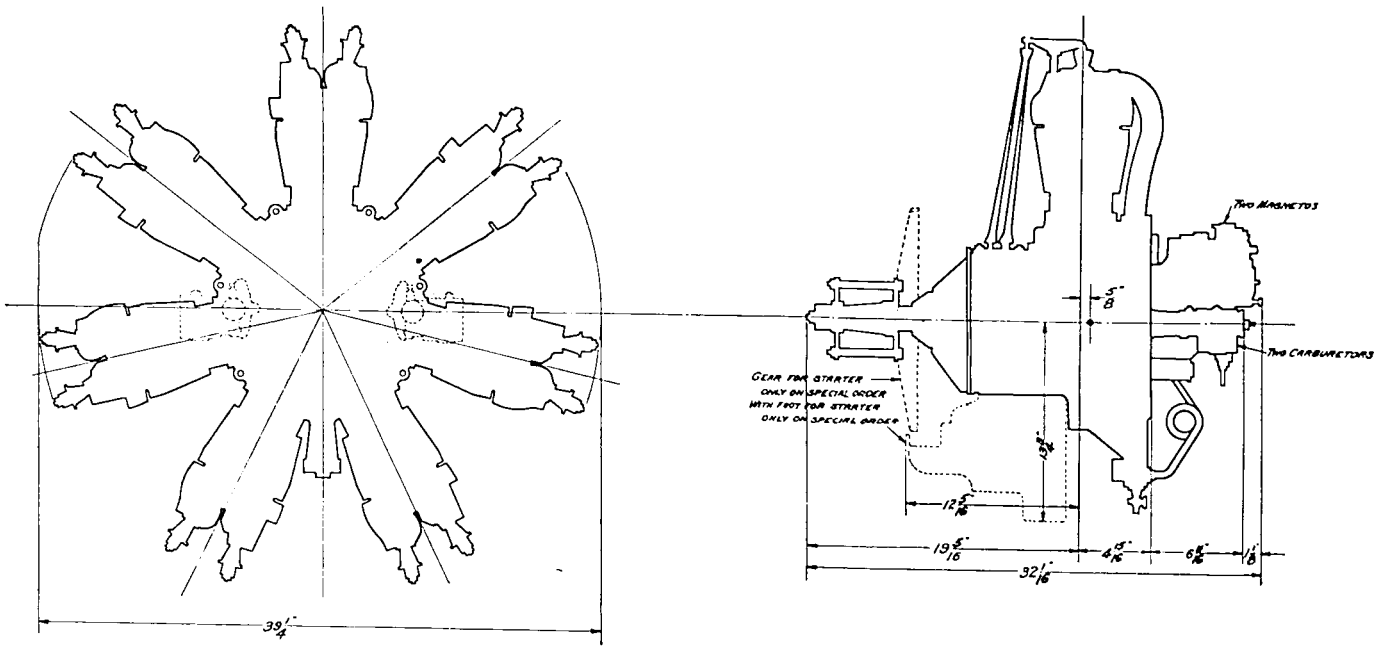
PRATT & WHITNEY AIRCRAFT COMPANY
Hartford, Conn.
HORNET B (GEARED)
550 H.P.
9 CYLINDER RADIAL AIRCOOLED



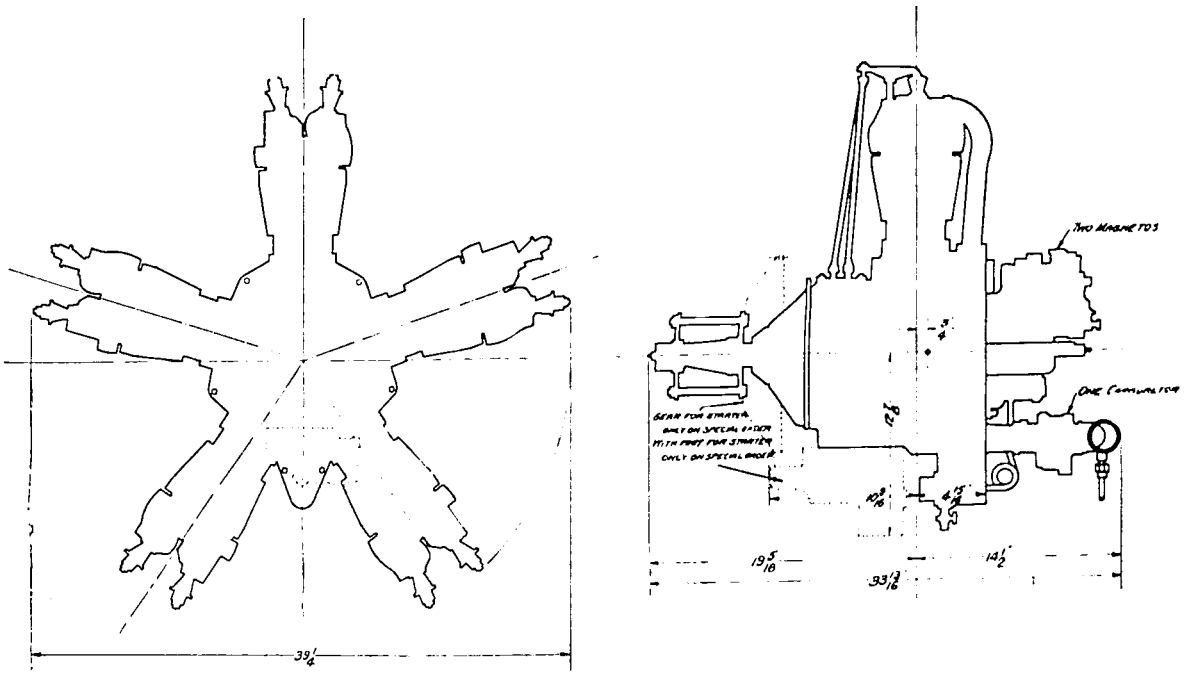
PRATT & WHITNEY AIRCRAFT COMPANY
Hartford, Conn.
HORNET 1860
575 H.P.
9 CYLINDER RADIAL AIRCOOLED



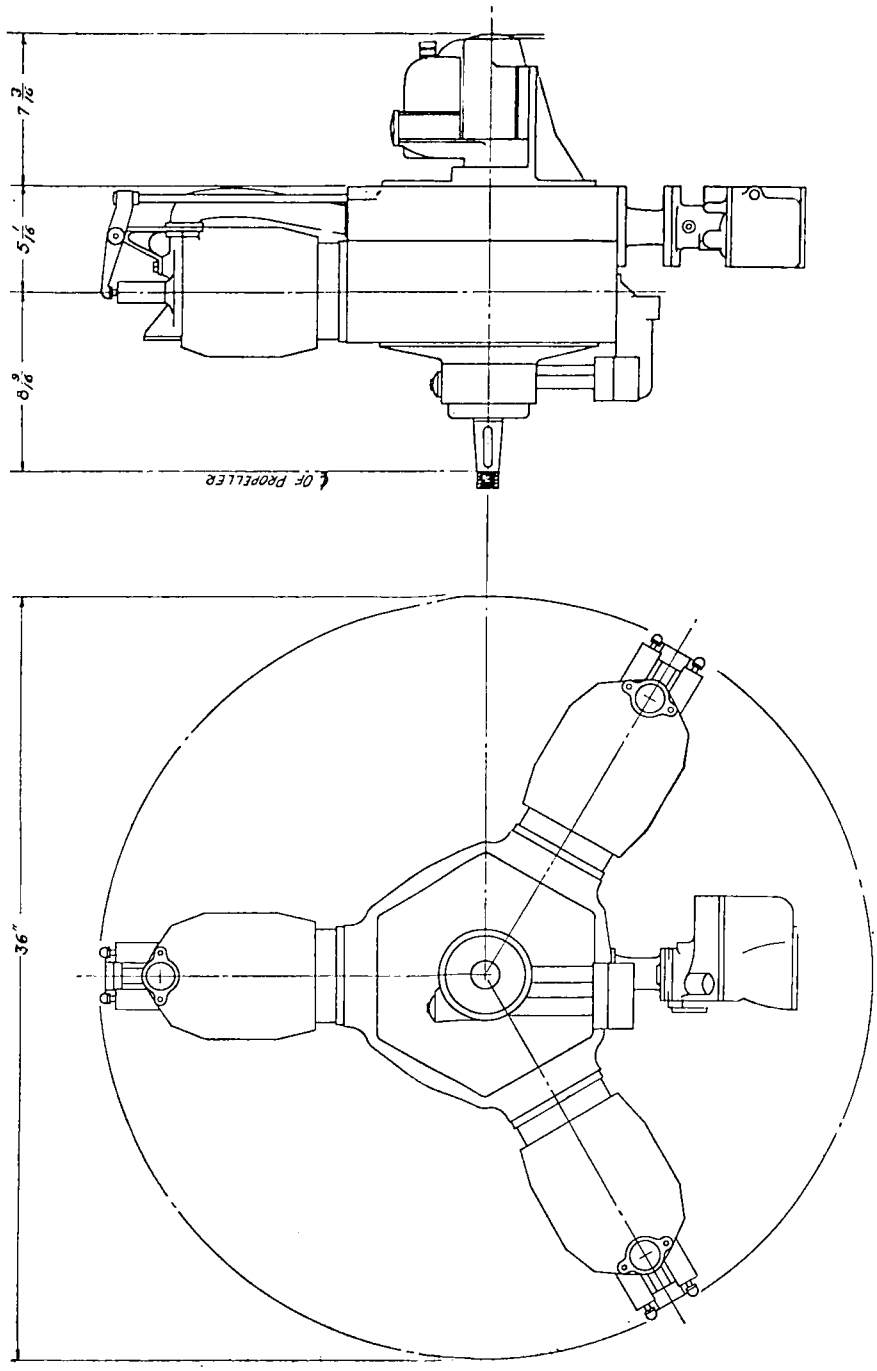
SIEMENS & HALSKE
American Representative: K. G. Frank
75 West Street, New York City
Model SH 12
125 H.P.
9 Cylinder Radial Aircooled



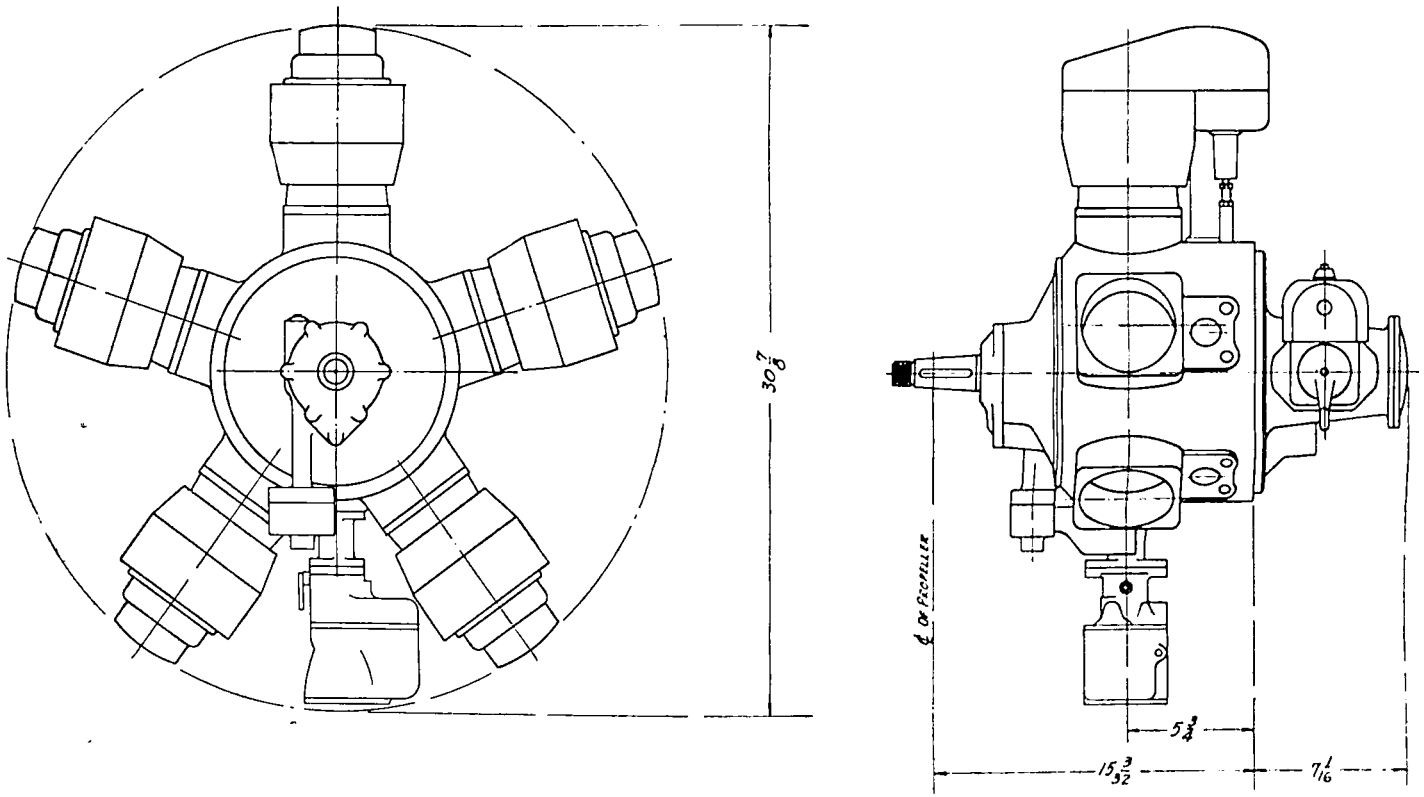
SIEMENS & HALSKE
American Representative: K. G. Frank
75 West Street, New York City
Model SH 14
110 H.P.
7 Cylinder Radial Aircooled



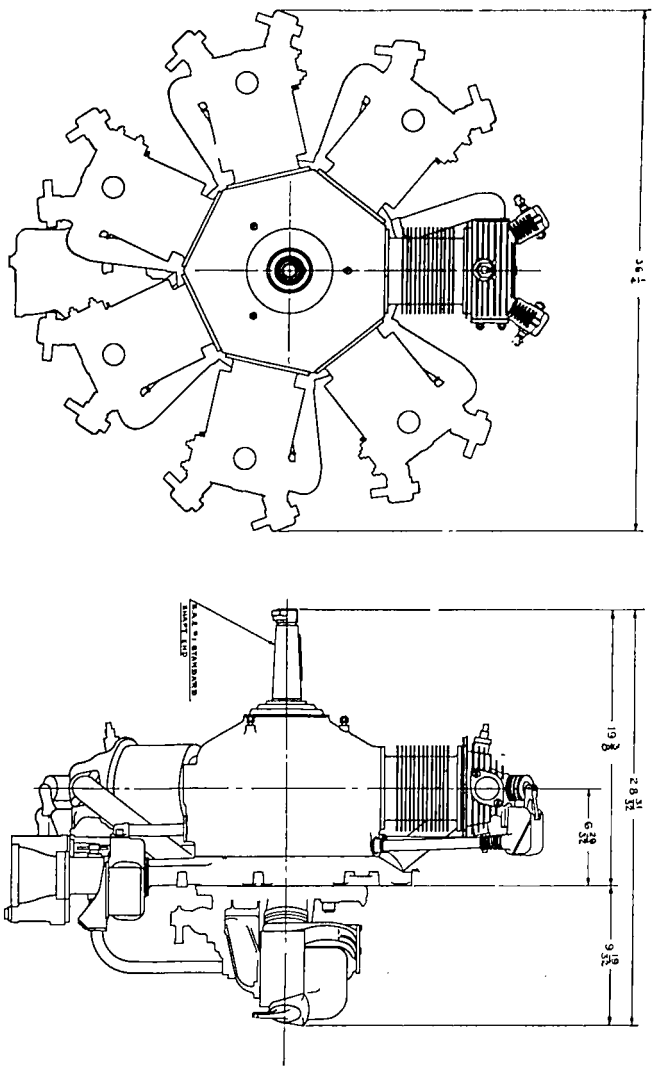
SIEMENS & HALSKE
American Representative: K. G. Frank
75 West Street, New York City
Model SH 13
80 H.P.
5 Cylinder Radial Aircooled



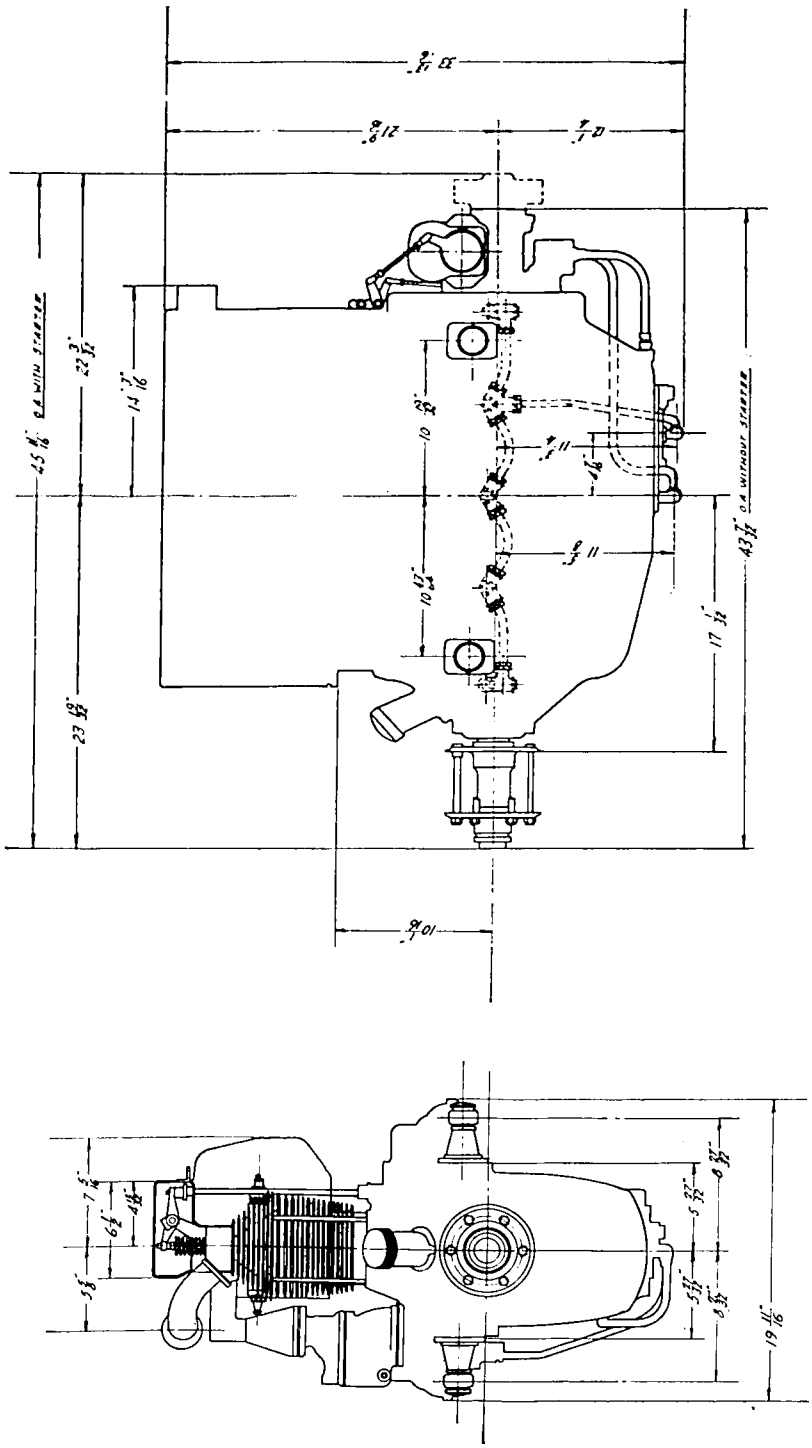
SZEKELY AIRCRAFT & ENGINE COMPANY
Holland, Mich.
MODEL SR3-B
40 H.P.
3 CYLINDER RADIAL AIRCOOLED



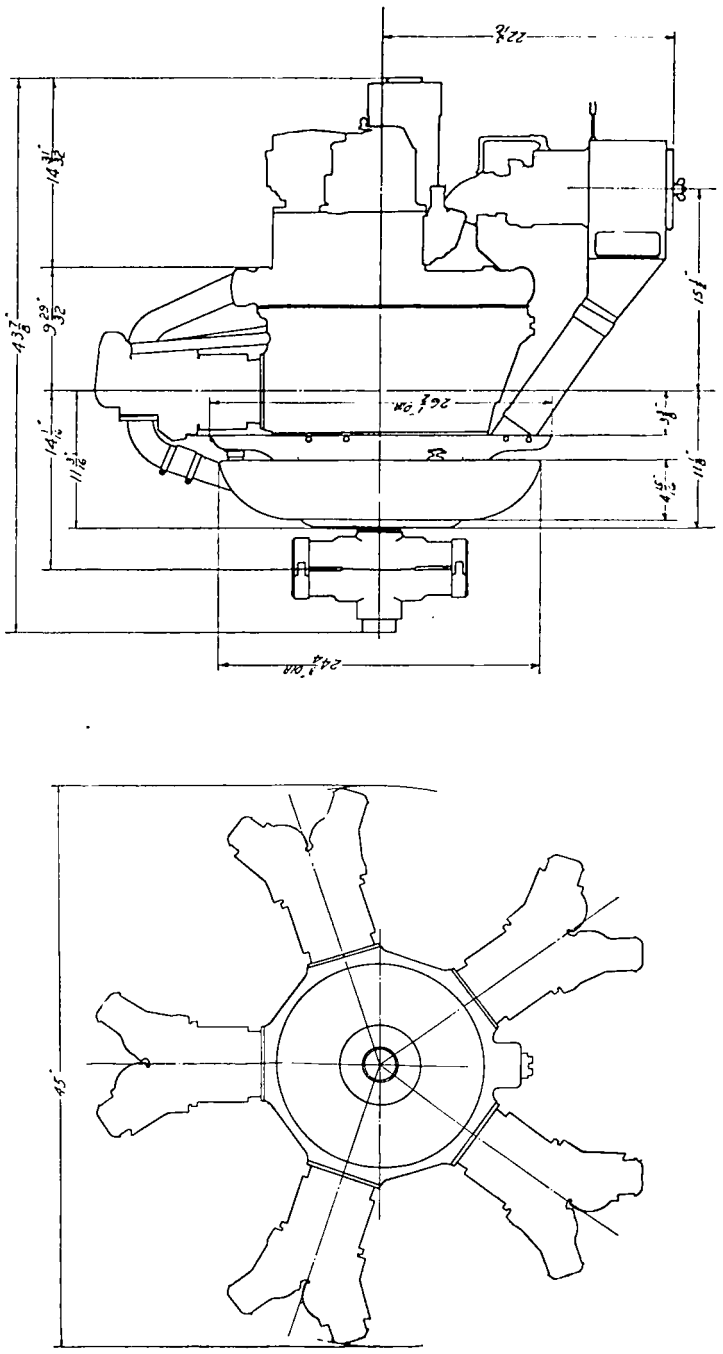
SZEKELY AIRCRAFT & ENGINE COMPANY
Holland, Mich.
MODEL SR5-L
70 H.P.
5 CYLINDER RADIAL AIRCOOLED



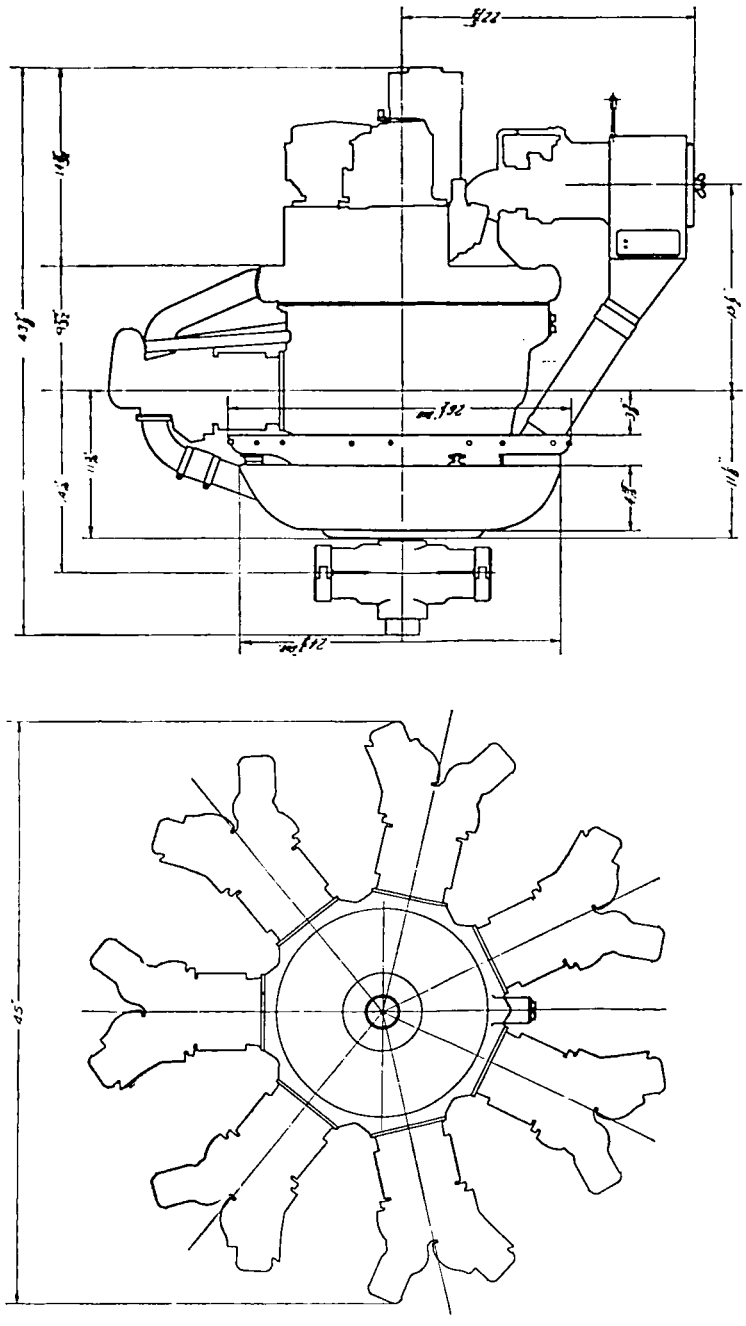
WARNER AIRCRAFT CORPORATION
Detroit, Mich.
SCARAB
110 H.P.
7 CYLINDER RADIAL AIRCOOLED



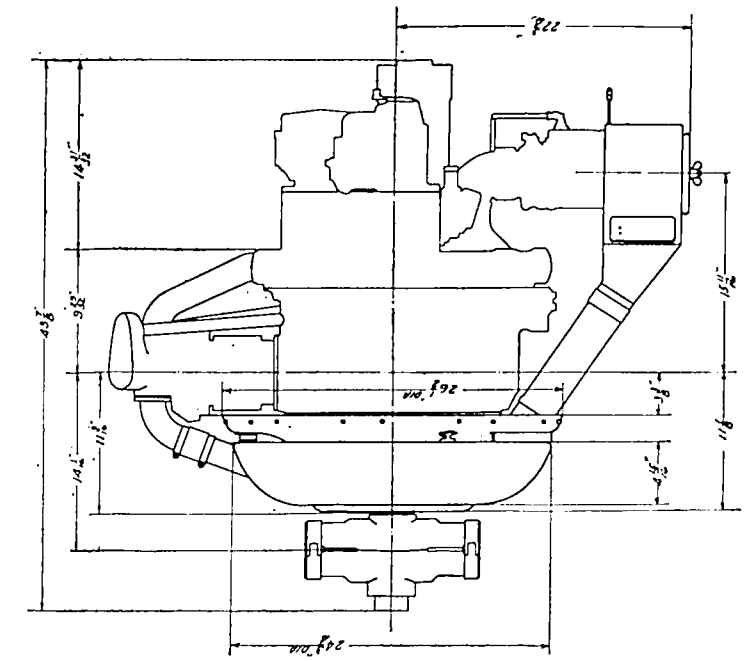
WRIGHT AERONAUTICAL CORPORATION
Paterson, N. J.
WRIGHT GIPSY
85 H.P.
4 CYLINDER IN LINE AIRCOOLED

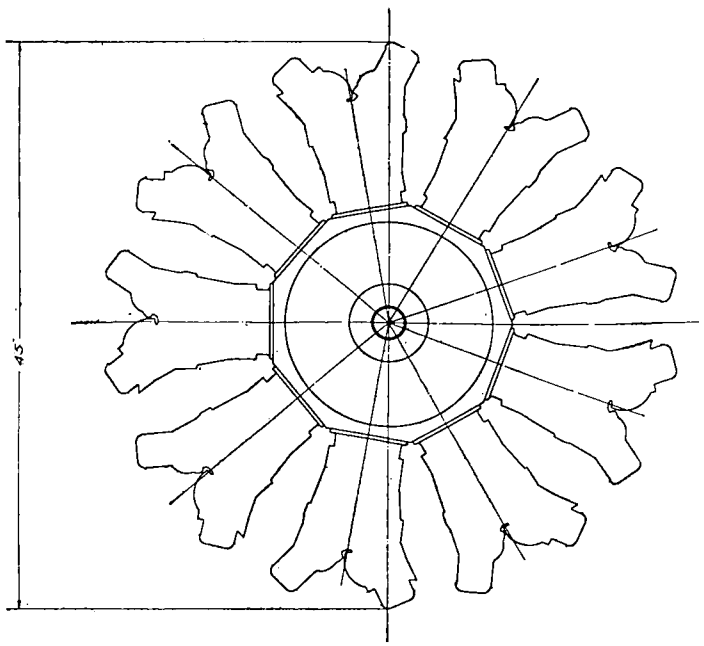


WRIGHT AERONAUTICAL CORPORATION
Paterson, N. J.
WHIRLWIND
165 H.P.
5 CYLINDER RADIAL AIRCOOLED

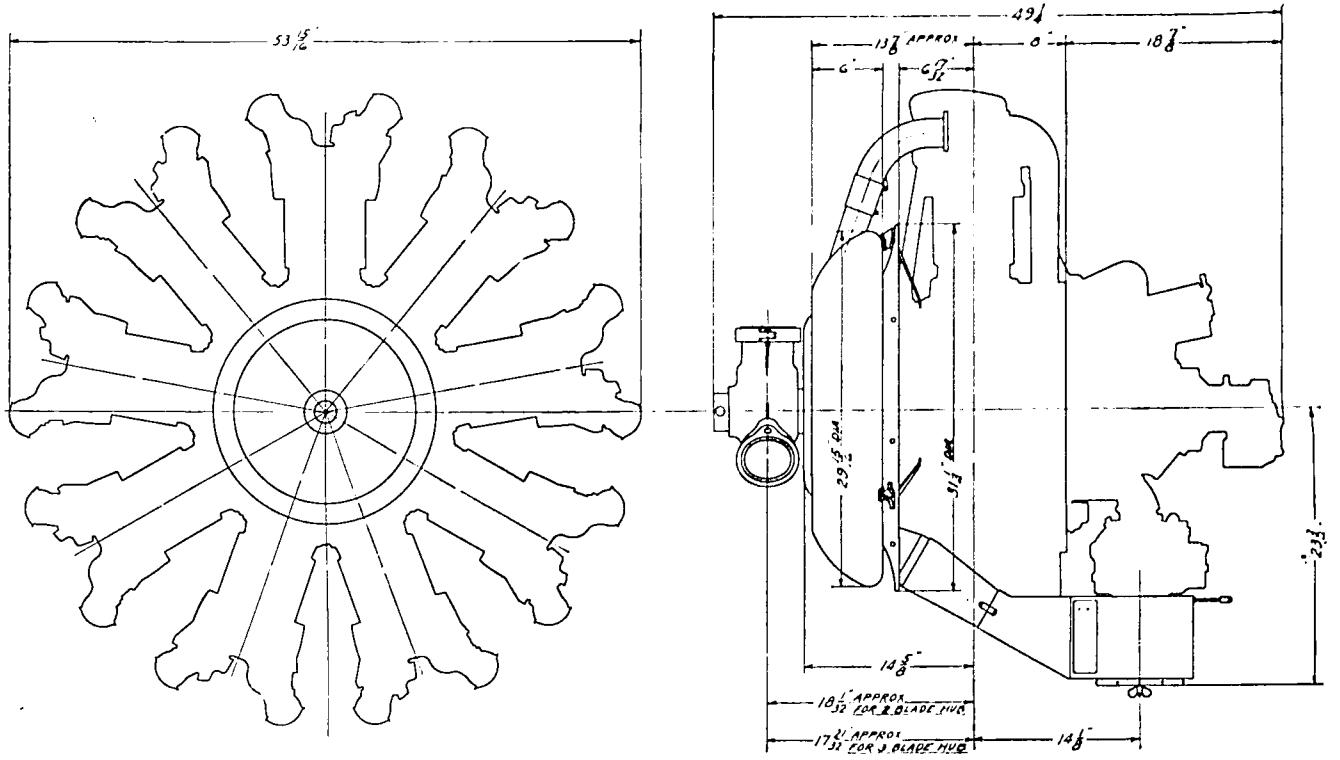


WRIGHT AERONAUTICAL CORPORATION
Paterson, N. J.
WHIRLWIND
220 H.P.
7 CYLINDER RADIAL AIRCOOLED





WRIGHT AERONAUTICAL CORPORATION
Paterson, N. J.
WHIRLWIND
300 H.P.
9 CYLINDER RADIAL AIRCOOLED



WRIGHT AERONAUTICAL CORPORATION
Paterson, N. J.
CYCLONE
525 H.P.
9 CYLINDER RADIAL AIRCOOLED

CHRONOLOGY FOR 1929

CHRONOLOGY FOR 1929

Jan. 1–7	Refueling endurance record of 150 hrs. 40 min. 15 sec. set by Army transport "Question Mark," under command of Maj. Carl Spatz with a crew of four, flying over Los Angeles airport. (Fokker, Wright motored.)
Jan. 2	Bobbie Trout sets new endurance record for women of 12 hrs. 11 min. at Los Angeles. (Golden Eagle, LeBlond motored.)
Jan. 9	Opening of air mail line from Miami to San Juan, Porto Rico, under operation of Pan American Airways, Inc.
Jan. 12	First air mail stamped envelopes go on sale.
Jan. 16	Lady Bailey lands at Croyden airport, having completed an 18,000 mile flight around Africa, flying a DeHavilland Moth, Cirrus motored. Trip began March 9, 1928.
Jan. 23	Inauguration of air mail service between New Orleans, La., and Houston, Tex., by Gulf Air Lines.
Jan. 26	Collier Trophy for 1928 is presented to Assistant Secretary of Commerce William P. MacCracken and Maj. Clarence M. Young for outstanding work by the Aeronautics Branch of the Department of Commerce in the development of aviation.
Jan. 29	Election of officers of the Aeronautical Chamber of Commerce.
Jan. 29	Dinner of the National Exchange Clubs to inaugurate nation-wide program of service to aviation.
Jan. 30	Elinor Smith establishes endurance record for women of 13 hrs. 16 min. at New York. (Brunner-Winkle, Curtiss OX-5 motored.)
Feb. 1	Aircraft customs regulations go into effect, as promulgated by the Customs Bureau of the Treasury Department.
Feb. 4	Army airship TC-5-251 picks up and exchanges mail with the steamship "Virginia Lee" between Norfolk and Cape Charles.
Feb. 4–5	Capt. Frank Hawks and Oscar E. Grubb fly non-stop from Los Angeles to New York, setting a new west-east record of 18 hrs. 21 min. 59 sec. (Lockheed, Pratt & Whitney Wasp motored, N.A.C.A. cowling.)
Feb. 4–13	Opening of Pan American Airways line from Miami to Cristobal, Panama Canal Zone.
Feb. 5	Baron von Huenefeld dies in Berlin. With Captain Koehl and Major Fitzmaurice he flew the "Bremen" east to west across the Atlantic, April 12–13, 1928.
Feb. 6–13	Aeronautical Exposition, New York City, under auspices of Aviators Post No. 743, American Legion.
Feb. 11	Bobbie Trout, Los Angeles, sets new endurance record for women of 17 hrs. 5 min. 37 sec. (Golden Eagle, LeBlond motored.)
Feb. 11	Army and Navy Standards Conference.
Feb. 12	Announcement of the engagement of Col. Charles A. Lindbergh to Miss Anne Morrow.
Feb. 21	Col. Charles A. Lindbergh is appointed technical advisor to the Aeronautics Branch of the Department of Commerce.
Feb. 23	George Haldeman, pilot, and James Hayden, mechanic, make first non-stop flight from Canada to Cuba, flying 1,404 mi. in 12 hrs. 56 min. (Bellanca, Wright motored.)
Mar. 8	Harmon Trophy for 1928 presented to Lieut. Carl B. Eielson for his flight with Wilkins in 1928 over the North Pole.
Mar. 9	Opening of air mail line from Brownsville to Mexico City, under operation of Mexican Aviation Co., controlled by Pan American Airways, Inc.
Mar. 9–16	Aircraft Show, Pittsburgh, Pa., under auspices of the Aero Club of Pittsburgh.
Mar. 10	David S. Ingalls of Cleveland is appointed Assistant Secretary of the Navy for Aeronautics to succeed Edward P. Warner.
Mar. 12	Admiral William A. Moffett reappointed as Chief of the Bureau of Aeronautics of the Navy Department.
Mar. 16–17	Mrs. Louise McPhetridge Thaden establishes new endurance record for women of 22 hrs. 3 min. 12 sec. (Travel Air, Hispano-Suiza motored.)
Mar. 19	Capt. Einar Lundborg, Swedish aviator who rescued General Nobile in May, 1928, arrives in New York for a lecture tour of the United States.
Mar. 23–30	Aircraft Show, Buffalo, N. Y.
Mar. 24–26	Spanish Flyers, Captain Jiminez and Captain Iglesias, land at Bahia, Brazil, after flight of 4,200 mi. from Seville, Spain, in 43 hrs. 48 min. (Breguet, Hispano-Suiza motored.)
Mar. 27–28	Martin Jensen sets world solo duration record of 35 hrs. 33 min. 20 sec., flying over Roosevelt Field, L. I., N. Y. (Bellanca, Wright motored.)
Mar. 30	Inauguration of the London-India air service, a combination of land plane, seaplane and train service operated by Imperial Airways, Ltd.

Apr. 6–14	Second Annual All-American Aircraft Show, Detroit, Mich.
Apr. 11	Clarence H. Mackay trophy for meritorious flying is awarded to Lieuts. L. J. Maitland and A. F. Hegenberger, Air Corps, for their non-stop flight from Oakland, Calif., to Hawaii, in June, 1927.
Apr. 17	Hermann Steindorf sets a new record for pay load carried to an altitude of 2,000 meters, when he flies a load of 14,220 lbs. at Travemunde, Germany. (Rohrbach, 3 B.M.W. motored.)
Apr. 21	President Hoover appoints William P. MacCracken, Edward P. Warner and Harry F. Guggenheim to the three additional places created by Congress on the National Advisory Committee for Aeronautics.
Apr. 23–24	New endurance record for women of 26 hrs. 21 min. 32 sec. established by Elinor Smith, flying over Long Island, N. Y. (Bellanca, Wright Whirlwind motored.)
Apr. 24–26	First non-stop flight from England to India made by Sqdn. Ldr. A. G. Jones-Williams and Flight Lt. N. H. Jenkins, 4,130 mi. in 50 hrs. 40 min. (Fairey, Napier motored.)
May 1	New coast-to-coast air mail service goes into effect, by which 12 hours is cut off former schedule.
May 2–4	National Elimination Balloon Race, Pittsburgh, Pa., with 12 entrants. Winner: Navy Balloon No. 1, flown by Lieut. T. W. G. Settle and Ensign W. Bushnell, a distance of 952 miles to Savage Harbour, Prince Edward Island, in 43 hrs. 20 min.
May 7	Rolf Starke sets a new seaplane speed record for 100 km., of 161.510 m.p.h. at Warnemunde, Germany; also speed record for 500 km. with a pay load of 1,000 kg. (Heinkel, B.M.W. motored.)
May 8	Lieut. Apollo Soucek sets new world's altitude record of 39,140 ft. over Anacostia, D. C. (Wright Apache, Pratt & Whitney Wasp motored.)
May 10	Announcement by Postmaster General W. F. Brown of the formation of an Inter-Departmental Committee on Airways, at the suggestion of President Hoover.
May 14	Fourth Annual Aircraft Engineering Research Conference, Langley Field, Hampton, Va.
May 15	Italian expedition leaves Bergen, Norway, to search for the lost "Italia" and members of the crew.
May 15	Lieut. de Vaisseau, Paris, sets a new altitude record for seaplanes with pay load of 2,000 kg. when he reached a height of 15,837 ft. at St. Raphael, France. (C.A.M.S., Hispano-Suiza motored.)
May 15–18	First Annual Airport Convention, Cleveland, Ohio, held under auspices of the Aeronautical Chamber of Commerce.
May 15–20	First International Congress on Sanitary Aviation, Paris.
May 16	Start of second trans-Atlantic flight of the "Graf Zeppelin" from Friedrichshafen, Germany. Motor trouble necessitates landing at Cuers, France, the following day.
May 19–26	New record for sustained flight by refueling established by R. L. Robbins and James Kelly, flying over Fort Worth airport. Time: 172 hrs. 32 min. 1 sec. (Ryan Brougham, Wright motored.)
May 20	Start of the second annual Oklahoma State Air Tour, covering twenty cities.
May 21	Junkers all-metal monoplane "Bremen," in which von Huenefeld, Koehl and Fitzmaurice crossed the Atlantic in 1928, is unveiled at the Grand Central Terminal, New York City, where it will be a part of the permanent transportation exhibit.
May 21	Rolf Starke sets a new seaplane speed record for 500 km. of 146.606 m.p.h. at Warnemunde; also speed record for 100 km. with a pay load of 1,000 kg. (Heinkel, B.M.W. motored.)
May 24	Commandants Girler and Weiss establish a new speed record for 5,000 km. of 116.822 m.p.h. at Etampes, France. (Breguet, Hispano-Suiza motored.)
May 25	Curtiss Marine Trophy Race, Anacostia, D. C. Winner: Lieut. W. C. Tomlinson. (Curtiss Hawk, Pratt & Whitney Wasp motored.)
May 25–June 1	Aircraft Show at St. Louis, Mo.
May 26	New world's altitude record of 41,794 ft. established by Willi Neuenhofer, German flyer. (Junkers, Bristol Jupiter motored.)
May 27	Marriage of Col. Charles A. Lindbergh to Miss Anne Morrow at Englewood, N. J.
May 27	Annual meeting of air mail contractors with Post Office Department officials, Washington, D. C.
May 27–30	Third National Aeronautic meeting, St. Louis, Mo., under auspices of the American Society of Mechanical Engineers.
May 27–June 2	Aircraft Show, Indianapolis, Ind.
May 28	New altitude record for women set by Marvel Crosson, flying at Los Angeles, when she reached a height of 24,000 ft. (Ryan, Wright Whirlwind motored.)
May 28	New world altitude record of 25,100 ft. for light planes established by Barney Zimmerley at St. Louis, Mo. (Barling monoplane.)
May 28–30	Gardner Annual Trophy Race, St. Louis, Mo. Winner: Charles W. Holman. (Laird, Wright Whirlwind motored.)

May 29	Herbert J. Fahy establishes new solo endurance record of 36 hrs. 56 min. 36 sec. at Los Angeles, Calif. (Lockheed Vega.)
June 1	Start of First California Air Tour, including eight cities.
June 3–15	Second annual all-Kansas air tour sponsored by the Kansas chapters of the National Aeronautic Association.
June 4	Lieut. Apollo Soucek sets new world's altitude record for seaplanes, of 38,560 ft., at Anacostia, D. C. (Wright Apache, Pratt & Whitney Wasp motored.)
June 5–18	Italian service cruise in the Mediterranean in which 35 seaplanes participate, under command of Colonel de Pinedo.
June 6	French line announces the establishment of a service for the transportation of passengers' airplanes as uncrated baggage to and from Europe.
June 10	Start of the First Michigan Air Tour.
June 12	Mail is successfully picked up from the deck of the "Leviathan" sixty miles at sea by a Fairchild plane equipped with the Adams air mail pick-up device. Pilots: Lt. Comdr. G. R. Pond and L. V. Rawlings.
June 13–16	French flyers, Jean Assolant, Rene Lefevre and Armeno Lotti, fly from Old Orchard, Me., to Comillas, Spain, and later on to Paris. Time of ocean flight: 29 hrs. 52 min. (Bernard, Hispano-Suiza motored.)
June 14	Opening of Universal Aviation Corporation transcontinental air-rail line.
June 19	Inauguration of tests by Guggenheim Fund of planes entered by twelve manufacturers in safety competition.
June 21	Air mail line from Cristobal, under operation of Pan American Airways, Inc., is extended to Curacao, Dutch West Indies, by way of Cartagena and Barranquilla.
June 22	Start of projected round-the-world flight by the Spanish flyer, Maj. Ramon Franco, and a crew of three, in a Dornier-Wal flying boat. Flyers come down near the Azores and are rescued 7 days later by the British aircraft carrier "Eagle."
June 24	Vicomte and Vicomtesse de Sibour land at Roosevelt Field, on the final lap of an air journey around the world, which began at London in September, 1928. (DeHavilland Moth, Gypsy motored.)
June 24	Eleven planes take off from Duke Field, Honolulu, to make a final search of the Island of Hawaii for the "Golden Eagle," flown by John Frost and Gordon Scott, in the Dole race in August, 1927.
June 24–29	Second Annual Iowa Air Tour.
June 25–July 10	"Southern Cross" flies from Australia to London, a distance of 12,000 miles, in 21 hrs. 18 min. Crew: Capt. Sir Charles Kingsford-Smith, Capt. C. T. P. Ulm, H. A. Litchfield and T. H. McWilliam.
June 27–29	Second Annual Air Pageant, Schenectady, N. Y.
June 27–29	Capt. Frank Hawks sets new east-to-west transcontinental speed record of 19 hrs. 10 min. 32 sec., flying from Roosevelt Field to Los Angeles, Calif., airport, and new west-to-east transcontinental speed record of 17 hrs. 38 min. 16⅗ sec., flying from Los Angeles airport to Roosevelt Field. Round trip, 36 hrs. 46 min. 48⅗ sec. (Lockheed, Pratt & Whitney Wasp motored, N.A.C.A. cowling.)
June 27–30	International Light Plane Competition at Rotterdam.
June 29	Dedication and formal opening of the Long Island Aviation Country Club, the first of a nation-wide chain.
June 29	Opening of air mail and passenger route from Buffalo to Toronto, under operation of Colonial Western Airways.
June 29–July 6	Byron K. Newcomb and Roy L. Mitchell set new refueling endurance record of 174 hrs. 59 sec. at Cleveland, Ohio. (Stinson-Detroiter, Wright motored.)
July 2–12	L. W. Mendell and R. B. Reinhart set new refueling endurance record of 246 hrs. 44 min. at Culver City, Calif. (Buhl, Wright motored.)
July 5–6	Eighth King's Cup Race, starting and finishing at Heston, won by Flying Officer R.R.L.R. Atcherley at an average speed of 150.3 m.p.h. (Gloster Grebe, Siddeley Jaguar motored.)
July 7	Inauguration of 48-hour combined rail and air passenger service from coast to coast by Transcontinental Air Transport, Inc.
July 8–9	Roger Q. Williams and Capt. Lewis A. Yancey fly from Old Orchard, Me., to Santander, Spain, approximately 3,400 miles distant, in 30½ hrs. Flight continued to Rome July 10. (Bellanca, Wright motored.)
July 8–10	Western States Air Commerce and Airways Conference, at Boise, Idaho.
July 11	Start of Minnesota State Air Tour.
July 13–14	Attempt of Polish flyers, Majors Kubala and Idzikowski, to fly from Paris to New York fails as machine is wrecked in a forced landing at the Azores, killing the chief pilot, Idzikowski. (Amiot, Dietrich-Lorraine motored.)
July 13–30	New refueling endurance record of 420 hrs. 21 min. 30 sec. set by Dale Jackson and Forest O'Brine, at St. Louis, Mo. (Curtiss Robin, Curtiss Challenger motored.)
July 14	Chicago Tribune amphibion "'Untin' Bowler" is caught in an ice floe and sinks in the Hudson straits, in an attempt to fly from Chicago to Berlin by the Northern Route over Greenland and Iceland. (Sikorsky, Pratt & Whitney Wasp motored.)

July 14	Capt. Dieudonné Costes and Maurice Bellonte, defeated by headwinds, land at Villacoublay after a flight of more than 3,100 miles over the Atlantic in an attempt to make an east-west flight to the United States. (Breguet, Hispano-Suiza motored.)
July 16	Air mail service by Pan American Airways, Inc., is extended from Cristobal to Santiago, Chile.
July 16–28	International Aero Show, at Olympia, London.
July 18	Announcement of first schools to receive Approval Certificates from the Department of Commerce, under the Bingham Amendment to the Air Commerce Regulations.
July 18–21	Capt. Ross G. Hoyt flies from New York to Nome, Alaska, and on return trip as far as Valemount, B. C., where a forced landing overturns his ship. Distance flown, 6,000 miles; time, approximately 50 hrs. (Curtiss Hawk, Curtiss Conqueror motored.)
July 22–26	First All Georgia Air Tour.
Aug. 1	Distinguished Flying Crosses are awarded to Lieuts. James H. Doolittle, Harry A. Sutton, John P. Richter, and Capt. Lowell H. Smith.
Aug. 1–4	"Graf Zeppelin" flies from Friedrichshafen to Lakehurst in 93 hrs. 40 min., preliminary to commencing the round-the-world flight.
Aug. 2–9	The Duchess of Bedford, with Capt. C. D. Barnard, pilot, and Robert F. Little, mechanic, flies from London to India and return, approximately 10,000 miles, establishing a record for the round trip. (Fokker, Bristol Jupiter motored.)
Aug. 3–14	Challenge International de Tourism, annual light plane tour of Europe, in which the 43 contestants covered 3,907 miles through 12 countries, is won by Fritz Morzik, Germany. (B.F.W. M-23, Siemens Sh. 13 motored.)
Aug. 15–20	"Spokane Sun God," piloted by N. B. Mamer and Art Walker, completes non-stop trip from Spokane to New York and return in 115 hrs. 45 min. 10 sec., being refueled at 11 points along the route. (Buhl, Wright motored.)
Aug. 18–23	Goodwill Air Tour, under sponsorship of the Ohio Chamber of Commerce.
Aug. 18–26	Women's Derby, Santa Monica to Cleveland, in which 19 women participate, is won by Mrs. Louise McP. Thaden, in 21 hrs. 29 min. 12 sec. flying time. (Travel Air, Wright motored.)
Aug. 19	ZMC-2, all-metal dirigible constructed by Aircraft Development Co., makes first flight at Detroit, Mich.
Aug. 23–Oct. 31	Russian plane, "Land of the Soviets," is flown on a good will tour from Moscow across the North Pacific, entering the United States at Seattle, then on to New York, having covered 13,300 miles in 142 flying hours.
Aug. 24–Sept. 2	National Air Races and Aeronautical Exposition at Cleveland, Ohio.
Aug. 29	"Graf Zeppelin" lands at Lakehurst, N. J., completing round-the-world-flight, begun Aug. 8, having flown 20,000 miles in 21 days, 7 hrs. (263 hrs. 43 min. actual flying time.)
Aug. 30–31	Eighth Annual Convention of the National Aeronautic Association, held at Cleveland, at which Senator Hiram Bingham is re-elected President.
Sept. 2	Pan American Airways, Inc., extends its Brownsville-Mexico City service to Guatemala City.
Sept. 2–4	"Graf Zeppelin" flies from Lakehurst to Friedrichshafen in 67 hrs. flying time.
Sept. 2–7	Aviation Exposition at Rochester, N. Y.
Sept. 7	Schneider Cup Race at Cowes, England, is won by Flying Officer Henry R. D. Waghorn, flying a Supermarine Rolls Royce S-6, at an average speed of 328.64 m.p.h.
Sept. 9	Nebraska State Air Tour.
Sept. 12	New speed record of 357.7 m.p.h. is set by Sqdn. Leader A. H. Orlebar, Calshot, England. (Supermarine Rolls-Royce S-6.)
Sept. 15	Start of air mail service from Seattle, Portland and Spokane to connect with Pasco-Salt Lake City route operated by Varney Air Lines.
Sept. 16	Capt. H. S. Broad wins the Zenith Carburateur Co. Challenge Cup for 1929 by flying over a prescribed course, Paris, Tours, Bordeaux, Toulouse, Marseilles, Lyons, and return to Paris, a distance of 1,040 miles, in 9 hrs. 13 min., including six compulsory landings. (D. H. Moth, Gypsy motored.)
Sept. 16–18	National Air Traffic Conference, under auspices of Aeronautical Chamber of Commerce, at Kansas City, Mo.
Sept. 16–20	First All-Indiana Air Tour.
Sept. 17–20	Second Annual Arkansas Air Tour.
Sept. 20	Opening of Pan American Airways, Inc., mail service between Miami and Paramaribo, Dutch Guiana.
Sept. 21–29	International Air Circus, Exposition and Pilots Reunion, at Fairfax Airport, Kansas City, Mo.
Sept. 22	Second Alaska Aerial Survey of the U. S. Navy completes mapping of 13,000 square miles in southeastern Alaska.

Sept. 23	New England Regional Airport Conference, sponsored by the Aeronautical Chamber of Commerce, is held at Boston.
Sept. 23–26	International Air Derby from Mexico City to Kansas City, Mo., won by Arthur Goebel. (Travel Air.)
Sept. 24	Lieut. James H. Doolittle makes first public demonstration of three instruments designed to enable a pilot to fly blind, when he took off, made a flight of 15 miles and returned to his starting point, flying a Consolidated, Wright motored plane with an enclosed cockpit.
Sept. 28	Gordon Bennett Balloon Race starting from St. Louis is won by Ward T. Van Orman, who landed near Troy, Ohio, 341 miles distant.
Sept. 30	Conferences begin between Post Office Department and air mail contractors looking toward a revision of rates.
Sept. 30	First flight of a plane propelled by rockets is made at Frankfort, Germany, by Fritz von Opel, who covered 1¼ miles in 75 sec.
Oct. 1	Maj. Clarence M. Young takes oath of office as Assistant Secretary of Commerce for Aeronautics, to succeed William P. MacCracken, resigned.
Oct. 3	Verne Speich establishes new solo endurance record of 38 hrs. 48 sec. at Long Beach, Calif. (Zenith, Wright motored.)
Oct. 4	Opening of Second International Diplomatic Conference on Private Air Law at Warsaw, Poland, at which forty countries are represented.
Oct. 4	Aeronautical sessions of the 18th Annual Safety Congress, Chicago.
Oct. 5	"On to Tulsa" Derby held in connection with the Sixth Annual International Petroleum Exposition is won by William Parker, who flew 500 miles at an average speed of 154.72 m.p.h. (Travel Air, Wright motored.)
Oct. 5–6	Air pageant at Montreal, Quebec.
Oct. 5–21	National Air Tour, starting from Detroit and touching at 21 cities, is won by John Livingston, with a total of 45,672.64 points. (Waco, Wright motored.)
Oct. 7	First convention of Air Medical Association formed at the International Aeronautics Conference in December, 1928, and made up of Army, Navy and civilian physicians who pass on the physical fitness of pilots.
Oct. 7	Sir Alan Cobham returns to London after a 21-week tour of England, Scotland and Wales, in which he covered 60,000 miles in a total of 760 hrs., visiting 110 towns, and carrying 40,000 passengers. (D. H. Giant Moth, Armstrong-Siddeley motored.)
Oct. 14	First trial flight of the British rigid airship R.101, largest constructed to date.
Oct. 14	Mackay Trophy for 1928 is awarded to Lieut. Harry A. Sutton, Air Corps, for his testing of several types of planes for spinning characteristics.
Oct. 14	Southern Airport Conference, sponsored by the Aeronautical Chamber of Commerce, opens at Atlanta, Ga.
Oct. 15	Tests begin on a 35-foot working model of an Armstrong seadrome, in Chesapeake Bay off Cambridge, Md.
Oct. 19	New gliding record is established by Lieutenant Dinor, at Rossitten, when he remains aloft 14 hrs. 44 min.
Oct. 21	Dornier DO-X, world's largest flying boat, makes an hour's flight over Lake Constance, Switzerland, carrying 169 passengers, the largest number of individuals ever carried by air, in a single craft.
Oct. 22	U. F. Diteman takes off from Harbor Grace, N. F., in an attempt to fly to London, but is lost at sea. (Barling, Warner motored.)
Oct. 24–25	Joint Conference of the American Road Builders' Association and the Airport Section of the Aeronautical Chamber of Commerce is held at Washington, D. C.
Oct. 28	Observance of Navy Day at Washington is featured by an extensive program of aerobatics and military maneuvers by the Naval Air Station.
Oct. 28–Nov. 20	Pilots Bailey and Reginensi fly from Le Bourget to Madagascar and return, a distance of 15,000 miles, in 15 days flying time.
Oct. 30	British Government announces that Royal Air Force will no longer compete in Schneider Cup Races.
Oct. 31	Close of Guggenheim Safe Aircraft Competition.
Nov. 2	Inauguration of air-rail-boat service by Transcontinental Air Transport, Pennsylvania and Santa Fe railroads, and Panama Pacific Line, covering 9,000 miles in 16 days.
Nov. 3	Baron Friedrich Warthausen arrives in New York, completing, except for the Pacific Ocean and two short hops in Asia, an 18,000 mile west-east flight from Berlin. (Klemm-Daimler, Mercedes Benz motored.)
Nov. 7	Formal opening of construction work on the world's largest lighter-than-air craft. Admiral Moffett drives a golden rivet into the master ring of the ZRS-4, at Akron, Ohio.
Nov. 7	Completion of First All-California Good-Will Air Tour of 1,200 miles.
Nov. 7–9	All-Western Airport Conference sponsored by the Aeronautical Chamber of Commerce, held at Los Angeles.

Nov. 9–17	Western Aircraft Show, sponsored by the Aeronautical Chamber of Commerce, held at Los Angeles.
Nov. 11	Formation of department of licensing and inspection and department of aeronautic development in Aeronautics Branch of the Department of Commerce.
Nov. 11–15	National Standard Parts Association fifth annual show with aeronautic exhibits, Detroit.
Nov. 18–23	National Glider Week celebration, under auspices of National Glider Association.
Nov. 21	Capt. Dieudonné Coste and Maurice Bellonte complete flight begun September 27, in which they established new distance record of 4,912 miles from Le Bourget to Tsitsikhar, Manchuria, and on the return trip lower Coste's former record from Hanoi, Indo-China, to Paris by 7 hours. (Breguet, Hispano-Suiza motored.)
Nov. 22	Amelia Earhart establishes new speed record for women of 184.17 miles per hour. (Lockheed Vega, Pratt & Whitney motored.)
Nov. 25	Hearing on Southwestern transcontinental air mail route, Post Office Department, Washington, D. C.
Nov. 28–29	Comdr. Richard E. Byrd with Bernt Balchen as pilot, Harold June as radio operator and Capt. A. C. McKinley as photographer, flies over the south pole. (Ford, Wright motored.)
Dec. 4–5	Comdr. Richard E. Byrd discovers new mountain range and maps hitherto unknown territory, east of King Edward VII land.
Dec. 8	Lehigh Airport Competition awards $5,000 prize for designs of modern airports to A. C. Zimmerman and W. H. Harrison.
Dec. 9–14	First Annual Baltimore-Washington Aircraft Show, sponsored by Flying Club of Baltimore and sanctioned by the Aeronautical Chamber of Commerce, held at Baltimore
Dec. 10	W. H. Bowlus sets new American gliding record of 2 hrs. 47 min. 13.5 sec. at San Diego, Calif. (Bowlus glider.)
Dec. 10–16	Aviation Week celebration in Mexico City, under auspices of Mexican Aeronautical Association.
Dec. 12	Langley Medal for Aerodromics awarded by Smithsonian Institution to Comdr. Richard E. Byrd and Charles M. Manly.
Dec. 14	Herbert Schiff Trophy for Naval Aviation awarded to Training Plane Squadron Seven at San Diego, Calif.
Dec. 16	Meeting of airport executives of Northeastern section of Airport Section of the Aeronautical Chamber of Commerce, at Bridgeport, Conn.
Dec. 16	R-100 launched at Howden, England, making trip of 140 miles in 2 hrs.
Dec. 17	Capt. Dieudonné Coste, with Paul Codos, sets closed course record of about 5,015 miles in 52 hrs. 34 min. at Marseilles. (Breguet, Hispano-Suiza motored.)
Dec. 17	Lt. Col. Tadeo Larre-Borges of Uruguay and Lieut. Leon Challe of France forced down near Natal, Brazil, in an attempted flight from Spain to Rio de Janeiro, or Montevideo.
Dec. 21	Comdr. Richard E. Byrd created Rear Admiral of the United States Navy.
Dec. 31	Daniel Guggenheim Fund for the Promotion of Aeronautics closes activities.

APPENDIX

APPENDIX

AERONAUTICAL CHAMBER OF COMMERCE OF AMERICA, Inc.

10 East Fortieth Street, New York

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Growth of Chamber

The Aeronautical Chamber of Commerce of America, Inc., is the national trade association of the aircraft industry. Since its establishment in 1921 to promote the use of aircraft, the Chamber has been leading the nation into flight. It provides the only central organization which serves every branch of the growing industry, and is unique in that it is really a federation of aeronautical interests.

The phenomenal expansion of 1929 was reflected in the growth of the Chamber, which increased its membership under the presidency of Frederick B. Rentschler from 456 to 966 during the year. The sectional organization approved by the Board of Governors in 1928 was rounded out in 1929 with the formation of the Air Transport Section, Distributor-Dealer Section and Finance-Insurance Section, in addition to those already existing to serve the interests of flying schools, commercial airplane manufacturers, motor manufacturers, airship manufacturers, airport operators and equipment manufacturers, fuel and lubricant manufacturers, accessory and material manufacturers, and aeronautical publishers. The activities of the sections are reviewed in relation to the general story of aviation progress in 1929 throughout the preceding chapters.

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The MANUFACTURERS AIRCRAFT ASSOCIATION, INC., organized in July, 1917, had for its primary purpose, the administration of a cross-licensing agreement between manufacturers of airplanes owning a large group of patents, including those covering the basic Wright and Curtiss inventions.

The Cross-License Agreement of July 24, 1917, was available to any responsible manufacturer of airplanes, and under it about 19,000 planes were manufactured and licensed. During the latter part of 1928, however, the Agreement was revised to meet the needs of makers of commercial airplanes, and it was superseded by "The Amended Cross-License Agreement of Dec. 31, 1928."

The latter (as printed in full in the 1929 Aircraft Year Book) was approved by the War, Navy and Commerce Departments of the Government, and during the year it has been accepted by a large number of airplane manufacturing companies. The War and Navy Departments have also contracted with the Association for a Special License on the same terms of royalty as accorded to members of the Association.

The Amended Agreement also provides for the cross-licensing of future airplane patents acquired by members, upon royalties to be determined by arbitration. At the end of 1929, a total of nearly 400 patents covering practically all features of the airplane art, had become embraced in the Agreement and subject to cross-licensing to all members and the Government.

The Association has a Patent Research Division for the purpose of assisting members in patent matters and from which information can be obtained regarding all airplane patents.

Licenses under the patents included in the Agreement have been applied for, or issued, to the following:

Aeromarine Plane & Motor Co., Inc., Keyport, N. J.
Alexander Industries, Inc., Colorado Springs, Colo.
Alliance Aircraft Corp., Alliance, Ohio
Bach Aircraft Co., Inc., Van Nuys, Calif.
Boeing Airplane Co., Seattle, Wash.
Breese Aircraft Corp., Portland, Ore.
Buhl Aircraft Co., Marysville, Mich.
Butler Aircraft Corp., Kansas City, Mo.
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In addition to the companies listed above, the following, having ceased to manufacture airplanes, have withdrawn from the Association: Burgess Co., Marblehead, Mass.; Engle Aircraft Corp., Niles, Ohio; Fisher Body Corp., Detroit, Mich.; Gallaudet Aircraft Corp., East Greenwich, R. I.; L.W.F. Engineering Co., Inc., College Point, L. I.; Springfield Aircraft Corp., Springfield, Mass.; St. Louis Aircraft Corp., St. Louis, Mo.; Standard Aero Corp., Plainfield, N. J.; Standard Aircraft Corp., Elizabeth, N. J.; and West Virginia Aircraft Corp., Wheeling, W. Va.

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The purpose of the National Aeronautic Association is to foster the development of aeronautics in all its phases, to further the economic welfare of the nation through the application of aircraft in business, and to further the national defense through the application of aircraft for military purposes.

The N. A. A., since its organization in 1922, has adopted a course leading to this goal which includes the establishment of chapters and affiliated aero clubs throughout the country; the conduct, supervision, and sanctioning of aircraft contests, races, and other aerial competitions; through the establishment of private flying clubs, and through the work of its members individually.

The Association has close to 200 chapters throughout the United States, all of which are endeavoring to bring about a better understanding on the part of the public, of the science and profession of aeronautics, and the activities are coordinated through a central body located in Washington, known as National Headquarters. The Association also publishes a magazine exclusively for the membership and is received by the members as part of their dues.

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Iowa City—Chamber of Commerce, Carl Cone.
Keokuk—Chamber of Commerce, W. A. Logan.
Marshalltown—Chamber of Commerce, Dr. G. E. Hermence.
Mason City—Chamber of Commerce, W. Earl Hall.
Muscatine—Chamber of Commerce, S. G. Stein.
Newton—Chamber of Commerce, John Warburton.
Oskaloosa—Chamber of Commerce, D. H. Lamberson.
Shenandoah—Chamber of Commerce, L. L. Hunter.
Sioux City—Chamber of Commerce, Ryal Miller.

KANSAS

Abilene—Chamber of Commerce, G. W. Rees.
Arkansas City—Chamber of Commerce, W. C. Robinson, Jr.
Coffeyville—Chamber of Commerce, Douglas Brown.
Holton—Jackson County Chamber of Commerce, Roy Metzker.
Horton—Chamber of Commerce, W. L. Phiffer.
Hutchinson—Chamber of Commerce, R. G. Streeter.
Iola—Chamber of Commerce, Victor Kirk.
Kansas City—Chamber of Commerce, Dr. C. C. Nesselrode.
McPherson—Chamber of Commerce, Ray Wright.
Olathe—Chamber of Commerce, H. E. Julian.
Ottawa—Chamber of Commerce, R. W. Mitchell.
Parsons—Chamber of Commerce, Wayne E. Burnette.
Pittsburgh—Chamber of Commerce, L. M. Atkinson.
Salina—Chamber of Commerce, A. W. Dodge.
Topeka—Chamber of Commerce, J. R. Burrow, Jr.
Wichita—Chamber of Commerce, Marcellus M. Murdock.

KENTUCKY

Harrodsburg—Mercer Chamber of Commerce, B. F. Norfleet.
Hopkinsville—Chamber of Commerce, Ed L. Weathers.
Lexington—Board of Commerce, Jesse O. Creech.
Owensboro—Chamber of Commerce, W. D. Haley.

LOUISIANA
Abbeville—Vermilion Chamber of Commerce, C. W. Howard
Alexandria—Chamber of Commerce, C. W. Kellam.
Baton Rouge—Chamber of Commerce, Jos. Gebelin.
Lafayette—Chamber of Commerce, R. E. Chaplin.
Mansfield—Chamber of Commerce, T. B. Herndon, Jr.
Monroe—Chamber of Commerce, Travis Oliver.
Shreveport—Chamber of Commerce, D. W. Spurlock.

MAINE
Biddeford—Chamber of Commerce, Cecil F. Clark.
Lewiston—Chamber of Commerce, Capt. J. O. Fisher.
Portland—Chamber of Commerce, Philips M. Payson.

MASSACHUSETTS
Beverly—Chamber of Commerce, Robert Robertson.
Boston—Chamber of Commerce, James D. Brennan.
Gardner—Chamber of Commerce, Chas. H. Hartshorn.
Great Barrington—Chamber of Commerce, R. K. Wheeler.
Lowell—Chamber of Commerce, Walter W. Wilson.
Northampton—Chamber of Commerce, Norman E. Horn.
Springfield—Chamber of Commerce, Andrew B. Wallace.
Turners Falls—Chamber of Commerce, C. F. Mosher.
Westfield—Chamber of Commerce, L. M. Fuller.

MICHIGAN
Battle Creek—Chamber of Commerce, E. H. McKay.
Bay City—Chamber of Commerce, Maynard L. Smith.
Bessemer—Chamber of Commerce, Conrad Velin.
Grand Rapids—Association of Commerce, F. F. Wood.
Jackson—Chamber of Commerce, S. M. Schram.
Kalamazoo—Chamber of Commerce, Claude Carney.
Menominee—Chamber of Commerce, Seymour Justema.
Monroe—Industrial Commission, John Weisel.
Mount Clemens—Board of Commerce, A. Wayne Brown.
Munising—Development Club, O. E. Brown.
Muskegon—Greater Muskegon Chamber of Commerce, C. E. Johnson.
Pontiac—Board of Commerce, Judge Glenn C. Gillespie.
Saginaw—Junior Board of Commerce, Waldo H. Neumann.
St. Joseph—Chamber of Commerce, John M. Fay, Sr.
Sault Ste. Marie—Chamber of Commerce, Louis F. Levin.
South Haven—Chamber of Commerce, T. P. McKinnine.
Traverse City—Chamber of Commerce, J. T. Milliken.
Wyandotte—Board of Commerce, Arthur E. Baisley.

MINNESOTA
Crockston—Chamber of Commerce, Ralph Lycan.
Fairmont—Chamber of Commerce, Arthur Einen.
Faribault—Chamber of Commerce, F. H. Klemer.
Mankato—Chamber of Commerce, M. E. Bowen.
Minneapolis—Civic and Commerce Association, Stanley Partridge.
Saint Paul—Association of Commerce, Julius L. Perlt.
Virginia—Chamber of Commerce, W. W. Reinfeld.

MISSISSIPPI
Aberdeen—Chamber of Commerce, C. C. Day.
Clarksdale—Chamber of Commerce, George Sugg.
Gulfport—Chamber of Commerce, J. Beeman.
Jackson—Chamber of Commerce, Joseph H. Morris.
Laurel—Chamber of Commerce, H. T. Smallwood.
Meridian—Chamber of Commerce, Karl Brittain.
Yazoo City—Chamber of Commerce, J. W. Woolwine.

MISSOURI
Boonville—Chamber of Commerce, G. W. Sombart.
Cape Girardeau—Chamber of Commerce, Julian Friant.
Chillicothe—Chamber of Commerce, Burt V. Gill.
Columbia—Chamber of Commerce, L. M. Price.
Fulton—Chamber of Commerce, Waldo F. Smith.
Jefferson City—Chamber of Commerce, A. Linxwiler.
Kansas City—Chamber of Commerce, Roy Godsey.
Marshall—Chamber of Commerce, Geo. T. Duggins.
Sedalia—Chamber of Commerce, David H. Powell.
Springfield—Chamber of Commerce, Jack Cooper.

MONTANA
Billings—Commercial Club, H. E. Reckard.
Bozeman—Chamber of Commerce, E. E. McMahon.
Havre—Chamber of Commerce, Dr. A. A. Husser.
Helena—Chamber of Commerce, Fred B. Sheriff.
Kalispell—Chamber of Commerce, W. H. Bally.
Miles City—Chamber of Commerce, E. B. Winters.
Missoula—Chamber of Commerce, H. O. Bell.

NEBRASKA
Kearney—Chamber of Commerce, Guy N. Henninger.

Nebraska City—Chamber of Commerce, Ted Holmberg.

NEW HAMPSHIRE
Manchester—Chamber of Commerce, B. F. Worcester.

NEW JERSEY
Cape May—County Chamber of Commerce, Harry F. Greaves.
East Orange—Chamber of Commerce and Civics of the Oranges and Maplewood, A. W. Almquist.
Hackensack—Bergen County Chamber of Commerce, Chas. L. Lawrance.
Newark—Chamber of Commerce, Dean Allen R. Callimore.
Newton—Board of Trade: Harvey S. Hopkins.
Trenton—Chamber of Commerce, S. Leslie Tattersall.
Union City—Chamber of Commerce, Fred L. Wehrhan.

NEW MEXICO
Albuquerque—Chamber of Commerce, Clyde Tingler.
Carlsbad—Chamber of Commerce, Dr. F. F. Doepp.
Clovis—Chamber of Commerce, W. H. Bowman.
Roswell—Chamber of Commerce, R. L. Malone.
Santa Fe—Chamber of Commerce, O. S. Emblem.

NEW YORK
Albany—Chamber of Commerce, H. Robert Hughes.
Amsterdam—Chamber of Commerce, Amos A. Strobeck.
Buffalo—Chamber of Commerce, Wm. T. Jebb.
Catskill—Chamber of Commerce, W. I. Van Dusen.
Corning—Chamber of Commerce, Lloyd D. Sprague.
Cortland—Chamber of Commerce, John S. Maxson.
Flushing—Flushing United Association, Eugene L. Sullivan.
Glens Falls—Chamber of Commerce, George S. Jamison.
Hornell—Chamber of Commerce, Howard P. Babcock.
Huntington—Chamber of Commerce, Arnold F. Sammis.
Long Island City—Chamber of Commerce, Cord Meyer.
New York—Chamber of Commerce of State of New York, Sherman Fairchild.
Newburgh—Chamber of Commerce, Augustus W. Bennet.
Norwich—Chamber of Commerce, Warren E. Eaton.
Olean—Chamber of Commerce, R. M. Forbes.
Oneonta—Chamber of Commerce, Daniel Franklin.
Plattsburg—Chamber of Commerce, H. P. Mason.
Rochester—Chamber of Commerce, Roger D. DeWolf.
Schenectady—Chamber of Commerce, A. R. Stevenson, Jr.
Sidney—Chamber of Commerce, W. W. Bates.
Watertown—Chamber of Commerce, Harold W. Conde.

NORTH CAROLINA
Burlington—Chamber of Commerce, W. S. Coulter.
Charlotte—Chamber of Commerce, C. O. Kuester.
Gastonia—Chamber of Commerce, J. O. Durham.
Greensboro—Chamber of Commerce, E. B. Jeffress.
Hendersonville—Chamber of Commerce, J. A. Richbourg.
High Point—Chamber of Commerce, J. P. Rawley.
Lenoir—Chamber of Commerce, J. Robertson.
Marion—Chamber of Commerce, W. S. Shifflett.
North Wilkesboro—Chamber of Commerce, C. S. Coffey.

NORTH DAKOTA
Bismarck—Chamber of Commerce, R. B. Webb.
Devils Lake—Civic and Commerce Association, Edgar T. Rutten.
Grand Forks—Commercial Club, J. H. McNicol.
Mandan—Chamber of Commerce, Dr. George H. Spielman.
Wahpeton—Chamber of Commerce, Dr. H. H. Pfister.
Williston—Commercial Club, Dr. H. J. Baker.

OHIO
Canton—Chamber of Commerce, Fred W. Witter.
Cleveland—Chamber of Commerce, E. G. Thompson.
Coshocton—Business Men's Association, Russell C. Jacobs.
Cuyahoga Falls—Chamber of Commerce, George Elliott.
Defiance—Chamber of Commerce, R. C. Albertus.
Geneva—Chamber of Commerce, E. L. Manthey.
Greenville—Chamber of Commerce, E. J. Seiler.
Hamilton—Chamber of Commerce, Herbert T. Randall.
Kent—Chamber of Commerce, W. A. Walk.
Kenton—Chamber of Commerce, E. H. McFarland.
Lancaster—Chamber of Commerce, Russel Rising.
Marietta—Chamber of Commerce, F. W. Hart.
Massillon—Chamber of Commerce, C. M. Shafer.
Springfield—Chamber of Commerce, E. E. Greiner.
Steubenville—Chamber of Commerce, Ollie Probert.
Toledo—Chamber of Commerce, James E. Aitken.

OKLAHOMA
Ardmore—Chamber of Commerce, H. T. Vernon.
Bartlesville—Chamber of Commerce, M. E. Foster.
Chickasha—Chamber of Commerce, Joe Hart, Jr.

Enid—Chamber of Commerce, Waldo Clegg.
Muskogee—Chamber of Commerce, J. F. Darby.
Oklahoma City—Chamber of Commerce, H. C. Martin.
Pauls Valley—Chamber of Commerce, Earl Witten.
Ponca City—Chamber of Commerce, H. C. Mulroy.

OREGON
Albany—Chamber of Commerce, F. Bloom.
Ashland—Chamber of Commerce, Mayor J. E. Thornton.
Baker—Chamber of Commerce, E. L. Crockatt.
Corvallis—Chamber of Commerce, E. Paul Walters.
Dallas—Chamber of Commerce, J. R. Allgood.
The Dalles—Chamber of Commerce, L. E. Emmerson.
Grants Pass—Josephine County Chamber of Commerce, Gladwin C. Smith.
Klamath Falls—County Chamber of Commerce, G. A. Krause.
McMinnville—Chamber of Commerce, Roy Farley.
Medford—Chamber of Commerce, S. V. Hall.
Salem—Chamber of Commerce, B. Small.

PENNSYLVANIA
Allentown—Chamber of Commerce, L. J. Holmes.
Altoona—Chamber of Commerce, Maj. T. W. Arter, Jr.
Ambridge—Board of Trade, S. D. Ritchey.
Bedford—Chamber of Commerce, J. C. West.
Butler—Board of Commerce, A. C. Moxey.
Coatesville—Chamber of Commerce, F. A. Breuninger.
Franklin—Chamber of Commerce, Dr. J. Irwin Zerbe.
Huntingdon—Chamber of Commerce, Dr. F. R. Hutchison.
Johnstown—Chamber of Commerce, Robert S. Waters.
Lancaster—Chamber of Commerce, Wm. S. Raub.
Latrobe—Chamber of Commerce, E. H. William.
Lebanon—Chamber of Commerce, S. B. Patterson.
McKeesport—Chamber of Commerce, G. D. Theleen.
Meadville—Chamber of Commerce, W. L. Gilmore.
Milton—Chamber of Commerce, Oscar Miles.
Punxsutawney—Board of Trade, Leonard McQuown.
Reading—Chamber of Commerce, John P. Wolfinger.
Shamokin—Chamber of Commerce, Miles Kirchner.
Sharon—Chamber of Commerce, Wm. M. McConahey.
Sunbury—Chamber of Commerce, W. R. Rohrbach.
Waynesboro—Chamber of Commerce, W. E. Bowers.
Waynesburg—Chamber of Commerce, E. M. Powell, Jr.
York—Chamber of Commerce, Frank H. Wogan.

RHODE ISLAND
Cranston—Business Men's Association, Arthur Griess.
Newport—Chamber of Commerce, H. W. Smith.
Warwick—Chamber of Commerce, C. G. Perreault.
Woonsocket—Chamber of Commerce, Paul L. Smith.

SOUTH CAROLINA
Charleston—Chamber of Commerce, C. S. Chisolm.
Columbia—Chamber of Commerce, L. B. Owens.
Greenville—Chamber of Commerce, Milton G. Smith.
Spartanburg—Chamber of Commerce, J. C. Grier.
Sumter—Board of Trade, R. L. McLeod.

SOUTH DAKOTA
Aberdeen—Chamber of Commerce, Clyde Fulleton.
Huron—Chamber of Commerce, C. R. Smith.
Pierre—Commercial Club, G. M. Roberts.
Redfield—Chamber of Commerce, A. I. Olding.
Watertown—Chamber of Commerce, P. R. Wigton.
Yankton—Chamber of Commerce, H. C. Danforth.

TENNESSEE
Chattanooga—Chamber of Commerce, John E. Lovell.
Clarksville—Chamber of Commerce, Callen Goodlett.
Jackson—Chamber of Commerce, R. H. Bond.
Johnson City—Chamber of Commerce, H. D. Gump.
Memphis—Chamber of Commerce, Maj. Robert Haverty.

TEXAS
Abilene—Chamber of Commerce, George L. Paxton, Jr.
Amarillo—Chamber of Commerce, W. E. Herring.
Austin—Chamber of Commerce, Max Bickler.
Beaumont—Chamber of Commerce, R. B. Davis.
Breckenridge—Chamber of Commerce, Ben J. Dean.
Brownsville—Chamber of Commerce, Charles Burton.
Cisco—Chamber of Commerce, P. P. Shepard.
Cleburne—Chamber of Commerce, I. T. Ward.
Corsicana—Chamber of Commerce, W. C. Strube.
Dallas—Chamber of Commerce, E. R. Brown.
Electra—Chamber of Commerce and Agriculture, W. A. Asbill.
Fort Worth—Association of Commerce, J. R. Penn.
Huntsville—Chamber of Commerce, F. H. Smith.

Laredo—Chamber of Commerce, R. L. Champion.
Lubbock—Chamber of Commerce, Geo. E. Benson.
Lufkin—Chamber of Commerce, J. H. Kurth.
Marlin—Chamber of Commerce, Dr. W. S. Smith.
Mt. Pleasant—Chamber of Commerce, Dr. J. E. Witt.
Paris—Chamber of Commerce, Noble Thompson.
Plainview—Chamber of Commerce and Agriculture, R. E. Story.
San Angelo—Chamber of Commerce, Walter Yaggy.
San Benito—Chamber of Commerce, L. L. Zenor.
Taylor—Chamber of Commerce, Crawford Booth.
Temple—Chamber of Commerce, Frank Daering.
Vernon—Chamber of Commerce, M. K. Berry.
Victoria—Chamber of Commerce, Chas. L. Grunder.

UTAH

Brigham City—Box Elder Commercial Club and Chamber of Commerce, W. L. Holst.
Nephi—Kiwanis Club, S. E. Forrest.
Provo—Chamber of Commerce, L. W. Nims.
Salt Lake City—Chamber of Commerce, Rudolph Orlob.

VERMONT

Bennington—Chamber of Commerce, E. W. Williams.
Montpelier—Chamber of Commerce, Charles F. McKenna.
Springfield—Chamber of Commerce, H. T. Laffin.

VIRGINIA

Charlottesville—Chamber of Commerce, C. Nelson Beck.
Roanoke—Chamber of Commerce, J. W. Hancock.
Staunton—Chamber of Commerce, Maj. E. W. Opie.

WEST VIRGINIA

Clarksburg—Chamber of Commerce, J. M. Carskadon.
Morgantown—Chamber of Commerce, W. E. Brooks.

WASHINGTON

Hoquiam—Chamber of Commerce, E. R. Donner.
Olympia—Chamber of Commerce, Peter G. Schmidt.
Pasco—Chamber of Commerce, Ray Chenoweth.
Port Angeles—Chamber of Commerce, A. J. Hartzler.
Seattle—Chamber of Commerce, Wm. O. McKay.
Spokane—Chamber of Commerce, J. A. Reinhardt.
Vancouver—Chamber of Commerce, Joe Knapp.
Walla Walla—Chamber of Commerce, A. C. Thomas.
Yakima—Chamber of Commerce, Earnest Synder.

WISCONSIN

Ashland—Chamber of Commerce, Howard Bretting.
Beaver Dam—Chamber of Commerce, H. C. Reckner.
Berlin—Chamber of Commerce, Frank Whiting.
Eau Claire—Chamber of Commerce, E. M. Hale.
Manitowoc—Lions Club, E. J. Nelson.
Portage—Chamber of Commerce, John Gay.
Rhinelander—Chamber of Commerce, Frank P. Kennedy.

WYOMING

Buffalo—Chamber of Commerce, L. A. Todd.
Casper—Chamber of Commerce, R. H. Nichols.
Cheyenne—Chamber of Commerce, Cal Holliday.

FLYING IN THE UNITED STATES

Calendar Year 1929

Air Transport Summary

	1926	1927	1928	1929
Operators	19	24	32	27
Planes in service	95	144	294	619
Miles flown	4,608,880a	5,242,839b	10,472,024	20,242,891
Passengers	5,782	12,594	52,934	165,263
Express, lbs.	1,733,092c	2,307,579c	2,148,059c	197,538f
Mail, lbs.	433,649	1,222,843d	3,632,059e	7,096,930

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.
f—Includes only express poundage carried on regular schedules.

Aerial Service Summary

	1926	1927	1928	1929
Operators reporting	420	357	168	800*
Planes in service	969	768	489	7,408
Miles flown	7,656,492	8,341,517	8,411,889	104,336,560
Passengers carried	380,201	476,724	526,203	2,995,530

*Statistical estimates based on typical reports.

Private Flying Summary

(Corporate and Personal)

Estimated

	1928	1929
Miles flown	12,000,000	25,000,000

Government Operations

	1926 Miles	1927 Miles	1928 Miles	1929 Miles
U. S. Army	16,764,540	14,871,870	19,546,450a	27,405,790a
U. S. Navy	8,352,800	10,452,720	14,135,490b	19,513,095b
U. S. Coast Guard	16,300	28,960	83,083	48,254
U. S. Department of Commerce	.....	.....	900,000	1,000,000

a—Includes National Guard.
b—Includes Marine Corps and Naval Reserve.

General Summary for 1929

Civilian and Commercial	149,579,451 miles
Government	47,967,139 miles
Total	197,546,590 miles

PRODUCTION OF AIRCRAFT IN THE UNITED STATES

COMMERCIAL AND MILITARY*

Types	*Number Produced in 1928*	*Retail Value Less Motors 1928*	*Number Produced in 1929*	*Retail Value Less Motors 1929*
Monoplanes				
Open cockpit	171		320	$ 871,890.00
Closed cockpit	850		1,562	10,557,635.00
Multi-engined trans.	58		178	6,122,742.00
Total	1,079	$8,738,683	2,060	$17,552,267.00
Biplanes				
Open cockpit	2,348		3,071	$10,415,599.60
Closed cockpit	69		47	598,040.00
Multi-engined trans.	5		8	505,000.00
Total	2,422	$7,541,615	3,126	$11,518,639.60
Miscellaneous				
Flying boats and seaplanes	11		32	$ 834,950.00
Amphibians	30		139	3,718,900.00
Total	41	$914,000	171	$4,553,850.00
GRAND TOTALS				
Commercial	3,542	$17,194,298	5,357	$33,624,756.60
Military	1,219		677	10,832,544.00
GRAND TOTALS				
Commercial and military	4,761		6,034	$44,457,300.60

*53 Commercial manufacturers reported in 1928.
95 Commercial manufacturers reported in 1929.
9 Military manufacturers reported in 1928.
13 Military manufacturers reported in 1929.

PRODUCTION OF AIRCRAFT ENGINES IN THE UNITED STATES

COMMERCIAL AND MILITARY*

Type	*Number Produced in 1929*	*Retail Value*
Commercial		
0-75 h.p.	479	$ 367,950.00
76-125 h.p.	1,300	2,013,750.00
126-175 h.p.	1,208	3,158,000.00
176-225 h.p.	565	1,638,500.00
226-300 h.p.	552	1,990,000.00
301 h.p. and up	1,404	8,727,100.00
TOTALS		
Commercial	5,517	$17,895,300.00
Military engines	1,861	8,600,530.15
Total engines	7,378	$26,495,830.15

*25 Commercial manufacturers and 5 military manufacturers reported in 1929.

LICENSED AND IDENTIFIED AIRCRAFT BY STATES IN 1929

State	*Aircraft Licensed*	*Aircraft Identified*
Alabama	22	11
Arizona	27	29
Arkansas	48	38
California	961	515

State	Aircraft Licensed	Aircraft Identified
Colorado	79	29
Connecticut	95	36
Delaware	43	6
District of Columbia	70	8
Florida	57	79
Georgia	27	54
Idaho	21	17
Illinois	542	375
Indiana	142	150
Iowa	97	95
Kansas	293	221
Kentucky	27	34
Louisiana	81	48
Maine	6	18
Maryland	79	41
Massachusetts	293	91
Michigan	374	208
Minnesota	126	102
Mississippi	22	16
Missouri	431	262
Montana	35	71
Nebraska	108	114
Nevada	2	8
New Hampshire	15	9
New Jersey	184	125
New Mexico	13	12
New York	1,429	351
North Carolina	38	75
North Dakota	30	40
Ohio	451	183
Oklahoma	252	147
Oregon	69	82
Pennsylvania	401	144
Rhode Island	25	20
South Carolina	20	29
South Dakota	53	40
Tennessee	60	53
Texas	297	200
Utah	30	13
Vermont	12	5
Virginia	41	46
Washington	176	110
West Virginia	17	27
Wisconsin	180	111
Wyoming	14	13
	7,843	4,529

PILOTS AND MECHANICS BY STATES IN 1929

State	Pilots	Mechanics
Alabama	53	47
Arizona	42	24
Arkansas	63	45
California	1,951	1,317
Colorado	120	62
Connecticut	102	60
Delaware	21	10
District of Columbia	252	123
Florida	171	200
Georgia	56	35
Idaho	21	14
Illinois	629	488
Indiana	227	110
Iowa	158	121
Kansas	203	139
Kentucky	59	31
Louisiana	60	60
Maine	28	14
Maryland	114	86
Massachusetts	278	154
Michigan	488	201
Minnesota	196	108

State	Pilots	Mechanics
Mississippi	47	15
Missouri	319	194
Montana	47	36
Nebraska	144	97
Nevada	13	21
New Hampshire	24	14
New Jersey	212	239
New Mexico	13	7
New York	1,004	695
North Carolina	49	40
North Dakota	41	23
Ohio	409	395
Oklahoma	270	129
Oregon	89	81
Pennsylvania	475	359
Rhode Island	29	16
South Carolina	25	16
South Dakota	66	27
Tennessee	100	62
Texas	533	401
Utah	52	53
Vermont	22	5
Virginia	173	240
Washington	205	151
West Virginia	27	19
Wisconsin	198	82
Wyoming	32	37
	9,973	6,903

EXPORTS OF AIRCRAFT, ENGINES AND PARTS FROM THE UNITED STATES IN 1929

Compiled by the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

Airplanes, Seaplanes and Amphibians

Country of Destination	Full Year, 1928 No.	Full Year, 1928 Value	Full Year 1929* No.	Full Year 1929* Value
Mexico	20	$ 190,133	83	$1,574,501
Canada	62	685,712	80	799,353
Chile	...	.....	40	721,750
China	0	102,175	20	402,741
Argentina	5	55,052	21	365,188
Japan	3	63,000	17	291,767
Ecuador	...	.....	5	187,237
Brazil	5	66,340	11	184,951
Panama	1	23,844	8	162,353
Peru	24	199,810	7	115,652
Hong Kong	...	.....	11	104,600
Italy	2	84,950	5	99,319
Philippine Islands	2	34,500	5	88,622
United Kingdom	3	22,263	3	77,080
Colombia	1	19,250	1	60,000
Cuba	4	54,887	3	33,670
Salvador	...	.....	3	27,840
Honduras	1	9,000	3	22,761
Netherlands	...	.....	3	16,000
Guatemala	3	36,400	4	10,000
Norway	...	.....	2	8,053
French Oceania	1	6,000	1	7,000
New Zealand	...	.....	1	3,954
Australia	7	50,872	1	3,600
Dominican Republic	...	.....	1	2,525
Uruguay	...	.....	1	1,800
Germany	1	5,500	...	.....
Belgium	1	4,183	...	.....
Siam	4	38,400	...	.....
Switzerland	2	4,532	...	.....
Bermuda	1	2,850	...	*
Total	162	$1,759,653	341	$5,372,217

*Preliminary totals subject to slight revision.

Aircraft Engines

Country of Destination	Full Year, 1928 No.	Full Year, 1928 Value	First 11 Months, 1929 No.	First 11 Months, 1929 Value
Germany	23	$ 132,510	49	$ 321,471
Panama	1	150	31	165,869
Poland and Danzig	1	3,574	35	121,015
Mexico	10	24,773	39	109,605
Canada	48	177,946	26	105,418
Japan	10	41,281	24	75,098
Philippine Islands	...	.....	5	52,271
Netherlands	14	62,712	14	46,366
Peru	2	8,002	7	43,242
China	5	38,900	9	39,000
Argentina	7	23,315	12	32,132
Chile	...	.....	6	30,577
France	3	6,223	9	30,061
Colombia	...	.....	3	20,021
Soviet Russia in Europe	...	.....	2	19,643
Switzerland	...	.....	1	19,375
United Kingdom	29	75,780	3	12,100
Belgium	1	10,000	1	12,000
Brazil	8	6,200	3	10,163
New Zealand	...	.....	2	8,266
Guatemala	...	.....	4	7,150
Italy	4	8,338	3	5,660
Honduras	...	.....	2	4,949
Cuba	3	250	1	4,827
Nicaragua	...	.....	1	4,000
Dutch Guiana	...	.....	1	4,000
Sweden	2	10,911	3	1,810
Australia	2	1,525	2	1,529
Salvador	...	.....	1	913
Trinidad	...	.....	1	766
Norway	...	.....	1	200
French Oceania	...	.....	1	150
Denmark	1	19,345	...	.....
Spain	1	3,111	...	.....
Hong Kong	4	980	...	.....
Total	179	$664,826	302	$1,309,647

Aircraft Parts, Except Tires

Country of Destination	Full Year, 1928	First 11 Months, 1929
Canada	$540,215	$818,283
Soviet Russia in Europe	155,313	187,097
China	86,888	134,405
Peru	15,693	113,948
Mexico	21,162	108,637
Germany	70,548	87,544
Japan	31,797	67,535
United Kingdom	58,166	58,461
Argentina	15,499	41,583
Cuba	24,184	30,496
Chile	17,443	37,477
Panama	22,705	37,424
Netherlands	20,483	30,874
Siam	1,101	30,023
Brazil	40,686	25,136
Poland and Danzig	4,575	24,340
Colombia	10,482	23,972
Belgium	.....	22,660
Italy	6,546	20,529
Philippine Islands	53,630	20,110
France	1,303	20,036
Australia	2,741	13,462
Hong Kong	2,182	5,500
Bermuda	.....	4,575
Finland	.....	4,050
Haiti	.....	3,152
Nicaragua	990	2,865
Denmark	.....	2,742
Sweden	4,455	1,946
Salvador	.....	1,913
British West Indies	.....	1,625
Virgin Islands	.....	1,603
Norway	1,925	1,500

Country of Destination	*Full Year, 1928*	*First 11 Months, 1929*
New Zealand	.....	1,363
Honduras	2,253	1,331
Czechoslovakia	3,890	1,096
Ecuador	.....	1,030
Switzerland	950	985
French Oceania	.....	860
Dutch Guiana	.....	655
Bolivia	.....	567
Trinidad	.....	396
French West Indies	.....	300
Dominican Republic	.....	231
Guatemala	1,517	50
British India	.....	31
Venezuela	.....	17
Java and Mandura	3,250	67
Spain	15,940	.....
Other Countries	1,732	4,637
Total	$1,240,244	$2,008,119

COMPARATIVE TABULATION OF ACCIDENTS—CIVIL AERONAUTICS FOR THE YEARS 1927, 1928 AND THE FIRST SIX MONTHS OF 1929

(Compiled by Aeronautics Branch, Department of Commerce)

Mileage Flown Per Accident

	Jan.-Dec. 1927	*Jan.-June [1]1928*	*July-Dec. 1928*	*Jan.-June [1]1929*
Miles flown in scheduled transport operations	5,870,489	4,484,612	6,188,838	9,201,338
Miles flown in miscellaneous operations, including student instruction and experimental flying	[2]30,000,000	12,000,000	48,000,000	47,000,000
Total miles flown, all services	35,870,489	16,484,612	54,188,838	56,201,338
Total accidents, all services	[3]278	430	692	774
Total miles flown per accident	[3]129,031	38,337	78,308	72,612
Total accidents scheduled transport operations	[3]25	35	51	60
Miles flown per accident, scheduled operations	[3]234,820	128,132	121,350	153,306
Total accidents miscellaneous operations	[3]253	395	641	714
Miles flown per accident, miscellaneous operations	[3]118,577	30,380	74,883	65,826
Total fatal accidents, all services	[3]99	97	130	127
Total miles flown per fatal accident, all services	[3]362,328	169,944	416,837	442,530
Fatal accidents, scheduled transport operations	[3]4	5	7	9
Miles flown per fatal accident, scheduled transport operations	[3]1,467,622	896,922	884,120	1,022,371
Fatal accidents, miscellaneous operations	[3]95	92	123	118
Miles flown per fatal accident, miscellaneous operations	[3]315,789	130,435	390,244	398,305

[1]It should be borne in mind that weather conditions during the last six months of the calendar year are more favorable for flying than during the first six months, hence in making comparisons, figures for corresponding periods should be used in each case.

[2]The figure of 30,000,000 miles listed under miscellaneous operations for 1927 was estimated from reports received on flying operations for 1928 as no operations reports were made for 1927.

[3]The 1927 figures should not be used for comparative purposes as the accident reports for that period apparently were incomplete due to the fact that the inspection service was in the formative stage with a shortage of field personnel to carry on the work. For the same reason there were doubtless some unreported accidents in 1928.

Causes of Accidents

Cause	Percentages			
	Jan.-Dec. 1927	*Jan.-June 1928*	*July-Dec. 1928*	*Jan.-June 1929**
PERSONNEL:				
Pilot:				
Error of judgment	6.91	8.45	12.64	12.70
Poor technique	39.50	22.95	29.80	32.49
Disobedience of orders	2.65	4.95	2.65	1.92
Carelessness or negligence	2.63	6.32	10.12	9.57
Miscellaneous	.27	.62	.58	.54
TOTAL PILOT ERRORS	51.96	43.29	55.79	57.31
Other Personnel:				
Supervisory	.70	.35	.50	.25
Miscellaneous	.20	3.10	1.68	1.48
TOTAL ERRORS OF PERSONNEL	52.86	46.74	57.97	59.04
MATERIEL:				
Power Plant:				
Fuel system	5.18	5.12	3.78	6.15
Cooling system	.18	.57	.74	.84
Ignition system	2.14	4.09	2.48	2.75
Lubrication system	.40	.13	.30	.35
Engine structure	.74	1.20	1.75	1.68
Propellers and accessories	.54	.44	.56	.78
Engine-control system	0	0	.58	.06
Miscellaneous	.27	.45	0	.26
Undetermined	5.05	4.59	5.55	5.21
TOTAL POWER PLANT FAILURES	14.50	16.59	15.74	18.08
Structural:				
Flight control system	.18	.85	.29	.26
Movable surfaces	1.03	.35	.07	.13
Stabilizing surfaces	0	0	0	.13
Wing, struts and bracing	3.05	1.09	1.15	1.23
Undercarriage	1.87	1.64	1.87	2.94
Wheels, tires and brakes	.55	.10	.85	1.10
Pontoons or boats	.35	.03	0	0
Fuselage, engine mount and fittings	.70	.75	.07	.33
Tail-skid assembly	0	.10	.14	0
Miscellaneous	0	.23	0	.26
Undetermined	.18	0	.03	0
TOTAL STRUCTURAL FAILURES	7.91	5.32	4.47	6.38
Handling qualities	.95	.44	.25	2.36
Instruments	0	0	0	.06
TOTAL AIRPLANE FAILURES	8.86	5.76	4.72	8.80
MISCELLANEOUS:				
Weather	7.40	10.23	4.67	5.02
Darkness	1.62	1.28	.50	.51
Airport and terrain	5.50	8.72	3.70	2.78
Other	3.68	3.90	3.25	1.04
TOTAL MISCELLANEOUS CAUSES	18.20	24.13	12.12	9.35
UNDETERMINED AND DOUBTFUL	5.58	6.78	9.45	4.73

*Figures prior to 1929 include some minor mishaps.

Injuries Classified

1929

January to June, Inclusive

		Pilots			Passengers		
	Per cent	*Fatal Injury*	*Severe Injury*	*Minor Injury*	*Fatal Injury*	*Severe Injury*	*Minor Injury*
Schedule Flying (Airways)	7.75	9	4	4	9	14	0
Student Instruction	10.34	12	12	9	9	8	10
Experimental	3.49	2	3	6	1	1	1
Miscellaneous Commercial	22.48	11	28	29	37	34	29
Miscellaneous Pleasure	55.94	53	52	85	60	32	40

AIR MAIL SERVICE

POST OFFICE DEPARTMENT

Washington, D. C.

Postmaster General.....Walter F. Brown
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

Air Mail Operations by Routes During Calendar Year 1929

	Length of Route (Miles)	Miles of Service: Scheduled	Miles of Service: Actually Flown	Total Weight of Mails Dispatched (Pounds)	Amount Paid to Contractor
1. Boston-New York	192	134,508	118,375	116,176	$ 348,483.05
2. Chicago-St. Louis	278	338,604	320,338	77,298	143,663.80
3. Chicago-Dallas	1,059	1,305,686	1,165,833	391,508	1,174,445.72
4. Salt Lake City-Los Angeles	600	737,099	711,517	757,684	2,272,973.61
5. Salt Lake City-Pasco	530	506,886	474,354	236,459	708,046.16
8. Seattle-Los Angeles	1,141	777,794	762,503	254,811	721,217.85
9. Chicago-Minneapolis	503	756,106	706,404	179,654	493,901.12
11. Cleveland-Pittsburgh	123	154,363	141,892	97,026	290,949.09
12. Cheyenne-Pueblo	100	157,224	149,879	99,148	82,043.98
16. Cleveland-Louisville	345	396,942	354,786	95,944	116,999.56
17. New York-Chicago	718	1,351,165	1,213,852	1,620,017	1,391,038.63
18. Chicago-San Francisco	1,932	2,571,214	2,494,099	1,790,576	3,670,898.49
19. New York-Atlanta	763	624,637	555,216	340,073	1,020,217.27
20. Albany-Cleveland	446	355,221	323,732	102,099	113,314.46
21. Dallas-Galveston	320	237,006	230,962	45,393	131,175.22
22. Dallas-Brownsville	529	375,944	364,703	83,700	241,848.49
23. Atlanta-New Orleans	483	339,887	315,080	86,610	151,516.01
24. Chicago-Cincinnati	270	397,842	362,852	79,422	117,720.71
25. Atlanta-Miami	736	481,862	467,233	121,511	177,385.24
26. Great Falls-Salt Lake City	489	435,995	409,063	69,368	171,543.33
27. Bay City-Chicago	773	545,262	479,203	173,276	154,141.74
28. St. Louis-Omaha	404	272,648	254,220	65,278	51,196.78
29. New Orleans-Houston	319	209,504	204,192	42,145	42,147.05
30. Chicago-Atlanta	768	564,383	524,014	98,221	76,613.35
31. Chicago-Municipal Airport, Grant Park Ramp, Chicago	9	963	756	19,328	1,245.00
32. Pasco-Seattle	449	115,454	100,576	54,205	4,876.45
Totals	14,369	14,145,079	13,205,640	7,096,930	$13,869,606.16

Note—Figures are subject to very slight revisions as the result of late corrections sometimes filed by operators.

Contract Air Mail Operators on December 31, 1929

CAM-1 Boston, Mass., to New York, N. Y., 192 miles.
Contractor: **Colonial Air Transport, Inc., 270 Madison Ave., New York, N. Y.**
Compensation: $3.00 per pound.

Southbound	(Eastern Time)	*Northbound*
6:15 pm	Lv.....Boston, Mass.....Ar	7:50 am
7:30 pm	.....Hartford, Conn.....	6:35 am
8:40 pm	Ar.....New York, N. Y. (Newark Airport).....Lv	5:15 am

(Daily except Sundays and holidays.)

CAM-2 Chicago, Ill., to St. Louis, Mo., 278 miles.
Contractor: **Robertson Aircraft Corporation, Anglum, Mo.**
Compensation: $2.53125 per pound.

Southbound		(Central Time)	*Northbound*	
1:00 pm	6:10 am	Lv.....Chicago, Ill.....Ar	7:30 pm	3:15 pm
....	7:25 am	.....Peoria, Ill.....	6:10 pm	....
....	8:15 am	..... Springfield, Ill.	5:20 pm	....
3:50 pm	9:15 am	Ar.....St. Louis, Mo.....Lv	4:15 pm	12:45 pm

(Daily.)

CAM-3 Chicago, Ill., to Dallas, Tex., 1,059 miles.
Contractor: **National Air Transport, Inc., Chicago, Ill.**
Compensation: $3.00 per pound.

Southbound		(Central Time)	*Northbound*	
8:00 pm	6:10 am	Lv.....Chicago, Ill.....Ar	7:20 pm	5:40 am
9:50 pm	8:10 am	.....Moline, Ill.....	5:30 pm	4:20 am
....	11:10 am	.....St. Joseph, Mo.....	2:55 pm	....
1:10 am	11:50 am	.....Kansas City, Mo.....	2:30 pm	1:10 am
3:15 am	....	.....Wichita, Kan.....	....	11:10 pm
4:10 am	....	.....Ponca City, Okla.....	....	10:20 pm
....	2:30 pm	.....Tulsa, Okla.....	12:30 pm	....
5:25 am	....	.....Oklahoma City, Okla.....	....	9:20 pm
7:35 am	5:30 pm	.....Fort Worth, Tex.....	9:55 am	8:00 pm
8:00 am	5:50 pm	Ar.....Dallas, Tex.....Lv	9:30 am	7:30 pm
4:10 am	....	Lv.....Ponca City, Okla.....Ar	....	10:15 pm
5:20 am	....	Ar.....Tulsa, Okla.....Lv	....	9:20 pm

(Daily.)

CAM-4 Salt Lake City, Utah, to Los Angeles, Calif., 600 miles.
Contractor: **Western Air Express, Inc., Los Angeles, Calif.**
Compensation: $3.00 per pound.

† *Westbound* *		(Pacific Time)	* *Eastbound* †	
9:30 pm	9:10 am	Lv.....Salt Lake City, Utah.....Ar	1:45 am	1:45 pm
2:45 am	2:25 pm	.....Las Vegas, Nev.....	10:05 pm	10:40 am
4:15 am	5:25 pm	Ar.....Los Angeles, Calif.....Lv	7:00 pm	7:35 am

†Daily except Monday. *Daily.

CAM-5 Salt Lake City, Utah, to Pasco, Wash., 530 miles.
Contractor: **Walter T. Varney, Boise, Idaho.**
Compensation: $3.00 per pound.

Westbound		(Pacific Time)	*Eastbound*	
9:30 pm	9:30 am	Lv.....Salt Lake City, Utah.....Ar	2:00 pm	2:00 am
12:45 am	12:45 pm	..... Boise, Idaho	10:45 am	10:45 pm
3:45 am	3:45 pm	Ar.....Pasco, Wash.....Lv	8:15 am	8:15 pm

(Daily.)

CAM-8 Seattle, Wash., to Los Angeles, Calif., 1,141 miles.
Contractor: **Pacific Air Transport, Inc., San Francisco, Calif.**
Compensation: $2.8125 per pound.

Southbound	(Pacific Time)	*Northbound*
*11:45 pm	Lv.....Seattle, Wash.....Ar	1:00 pm
* 1:30 am	.....Tacoma, Wash.....	12:25 pm
7:25 am	.....Vancouver, Wash. (Portland, Ore).....	10:30 am
9:30 am	.....Medford, Ore.....	8:00 am
12:45 pm	Ar.....San Francisco, Calif. (Crissy Field).....	
12:50 pm	Lv..... Crissy Field	
1:00 pm	Ar.....Oakland, Calif.....Lv	4:00 am
1:15 pm	Lv..... Oakland, Calif. .....Ar	3:45 am
2:45 pm	.....Fresno, Calif.....Lv	2:00 am
3:50 pm	.....Bakersfield, Calif.....	12:55 am
5:00 pm	Ar.....Los Angeles, Calif.....Lv	11:45 pm
5:00 am	Lv.....San Francisco, Calif.....Ar	7:25 pm
5:25 am	Ar.....San Jose, Calif.....Lv	7:00 pm

*Dispatch is by train to Portland Field.

(Daily.)

CAM-9 Chicago, Ill., to Minneapolis, Minn., 503 miles.
Contractor: **Northwest Airways, Inc., St. Paul, Minn.**
Compensation: $2.75 per pound.

Westbound			(Central)		*Eastbound*	
11:30 pm	2:00 pm	6:10 am	Lv..... Chicago, Ill. .....Ar	7:25 pm	12:25 pm	3:45 am
....	....	6:58 am	Ar....Milwaukee, Wis....Lv	6:57 pm	....	3:05 am
		7:30 am	Lv....Milwaukee, Wis....Ar	6:06 pm		
		8:10 am	...Fond du Lac, Wis...	5:20 pm		
		8:25 am	.....Oshkosh, Wis.....	5:05 pm		
		8:40 am	.... Appleton, Wis.	4:50 pm		
		9:00 am	Ar....Green Bay, Wis....Lv	4:30 pm		
12:20 am	....	7:10 am	Lv....Milwaukee, Wis....Ar	6:35 pm	....	....
....	....	8:05 am	.....Madison, Wis.....	5:30 pm	....	....
....	....	9:20 am	....La Crosse, Wis....	4:20 pm	....	....
3:30 am	5:40 pm	10:40 am	....St. Paul, Minn....	3:00 pm	8:55 am	11:45 pm
3:45 am	5:55 pm	10:50 am	Ar..Minneapolis, Minn...Lv	2:45 pm	8:45 am	11:30 pm

(Daily.)

CAM-11 Cleveland, Ohio, to Pittsburgh, Pa., 123 miles.
Contractor: **Clifford Ball, McKeesport, Pa.**
Compensation: $3.00 per pound.

Southbound		(Eastern Time)	*Northbound*	
12:15 am	12:15 pm	Lv.....Cleveland, Ohio.....Ar	4:00 pm	1:30 pm
....	1:00 pm	.....Youngstown, Ohio.....	3:15 pm	....
1:45 am	1:45 pm	Ar.McKeesport, Pa. (Pittsburgh, Pa.).Lv	2:30 pm	12:00 pm

(Daily.)

CAM-12 Cheyenne, Wyo., to Pueblo, Colo., 199 miles.
Contractor: **Western Air Express, Inc., Los Angeles, Calif.**
Compensation: $.083 per pound.

Southbound	(Mountain Time)	*Northbound*
5:00 am	Lv..... Cheyenne, Wyo. .....Ar	7:00 pm
6:20 am	..... Denver, Colo.	6:00 pm
7:20 am	.....Colorado Springs, Colo.....	4:50 pm
7:45 am	Ar.....Pueblo, Colo.....Lv	4:15 pm

(Daily.)

CAM-16 Cleveland, Ohio, to Louisville, Ky., 345 miles.
Contractor: **Continental Air Lines, Inc., Cincinnati, Ohio.**
Compensation: $1.22 per pound.

† *Southbound* *		(Eastern Time)	* *Northbound* †	
12:45 pm	2:45 am	Lv.....Cleveland, Ohio.....Ar	11:30 pm	4:10 pm
1:10 pm	3:20 am	..... Akron, Ohio	11:05 pm	3:45 pm
....	4:40 am	.....Columbus, Ohio.....	9:45 pm	....
....	5:15 am	.....Springfield, Ohio.....	9:25 pm	....
....	5:25 am	.....Dayton, Ohio.....	9:00 pm	....
....	6:05 am	.....Cincinnati, Ohio.....	8:20 pm	....
		(Central Time)		
....	6:15 am	Ar.....Louisville, Ky.....Lv	6:00 pm	....

*Daily. †Daily except Sundays and holidays.

CAM-17 New York, N. Y., to Chicago, Ill., 718 miles.
Contractor: **National Air Transport, Inc., Chicago, Ill.**
Compensation: $1.25 per pound, 5% reduction for each 500 pounds over 1,500 pounds, and up to 5,000 pounds.

Westbound		Eastern Time)	*Eastbound*	
N. Y. Night Transc.	N. Y. Day Transc.			
8:00 pm	11:00 am	Lv.New York, N. Y. (P.R.R. Station).Ar	6:43 am	6:40 pm
9:35 pm	12:15 pm	New Brunswick, N. J. (Hadley Field)	4:45 am	4:45 pm
2:15 am	4:20 pm	Ar.....Cleveland, Ohio.....Lv	12:15 am	12:15 pm
2:30 am	4:35 pm	Lv.....Cleveland, Ohio.....Ar	12:00 pm	12:00 m
3:20 am	5:20 pm	.....Toledo, Ohio.....	10:50 pm	10:50 am
		(Central Time)		
5:35 am	7:00 pm	Ar.....Chicago, Ill.....Lv	8:30 pm	8:00 am

(Daily.)

CAM-18 Chicago, Ill., to San Francisco, Calif., 1,931 miles.
Contractor: **Boeing Air Transport, Inc., Seattle, Wash.**
Compensation: $1.50 per pound first 1,000 miles, 15c additional for each 100 miles over 1,000.

† *Southbound*	*	(Central Time)	* *Northbound*	†
8:00 am	8:00 pm	Lv.....Chicago, Ill.....Ar	6:00 pm	6:00 am
....	10:15 pm	.....Iowa City, Iowa.....	....	....
10:15 am	....	.....Cedar Rapids, Iowa.....	....	3:00 am
11:30 am	....	.....Des Moines, Iowa.....	2:00 pm	2:00 am
12:40 pm	12:30 am	Ar.....Omaha, Nebr.....Lv	1:00 pm	1:00 am
1:00 pm	1:00 am	Lv.....Omaha, Nebr.....Ar	12:40 pm	12:30 am
1:30 pm	....	.....Lincoln, Nebr.....	12:05 pm	....
3:30 pm	3:15 am	Ar.....North Platte, Nebr.....Lv	....	11:00 pm
		(Mountain Time)		
2:45 pm	2:30 am	Lv.....North Platte, Nebr.....Ar	....	9:45 pm
4:45 pm	4:30 am	Ar.....Cheyenne, Wyo.....Lv	7:45 am	7:45 pm
5:00 pm	4:45 am	Lv.....Cheyenne, Wyo.....Ar	7:30 am	7:30 pm
7:30 pm	7:15 am	.....Rock Springs, Wyo.....	....	....
9:30 pm	9:30 am	Ar.....Salt Lake City, Utah.....Lv	4:00 am	4:00 pm
		(Pacific Time)		
9:00 pm	9:00 am	Lv.....Salt Lake City, Utah.....Ar	2:30 am	2:30 pm
11:00 pm	11:00 am	.....Elko, Nev.....	12:30 am	12:30 pm
1:15 am	1:15 pm	Ar.....Reno, Nev.....Lv	10:15 pm	10:15 am
1:30 am	1:30 pm	Lv.....Reno, Nev.....Ar	10:00 pm	10:00 am
2:30 am	2:30 pm	.....Sacramento, Calif.....	8:50 pm	8:50 am
4:30 am	4:30 pm	Ar.....Oakland, Calif.....Lv	8:00 pm	8:00 am
		(San Francisco, Calif.)		
			S. F. Night Transc.	S. F. Day Transc.

†Daily except Monday. *Daily.

CAM-19 New York, N. Y., to Atlanta, Ga., 763 miles.
Contractor: **Pitcairn Aviation, Inc., Brooklyn, N. Y.**
Compensation: $3.00 per pound.

† *Southbound*	*	(Eastern Time)	* *Northbound*	†
5:00 am	9:10 pm	Lv.New York, N. Y. (Landing Field).Ar	5:05 am	9:00 pm
5:40 am	9:55 pm	..Philadelphia, Pa. (Camden, N. J.)..	4:25 am	8:25 pm
6:40 am	....	.....Baltimore, Md.....	....	7:15 pm
7:10 am	11:15 pm	.....Washington, D. C.....	3:05 am	6:50 pm
....	12:30 am	.....Richmond, Va.....	2:00 am	....
....	2:25 am	.....Winston-Salem, N. C.....	11:50 pm	....
		(Greensboro, N. C.)		
....	4:00 am	.....Spartanburg, S. C.....	10:20 pm	....
....	6:10 am	Ar.....Atlanta, Ga.....Lv	8:30 pm	....

†Daily except Sundays and holidays. *Daily.

CAM-20 Albany, N. Y., to Cleveland, Ohio, 446 miles.
Contractor: **Colonial Western Airways, Inc., New York, N. Y.**
Compensation: $1.11 per pound.

Westbound	(Eastern Time)	*Eastbound*
3:40 pm	Lv.....Albany, N. Y.....Ar	8:10 am
3:50 pm	.....Schenectady, N. Y.....	8:00 am
4:45 pm	.....Utica, N. Y. (Rome, N. Y.).....	7:10 am
5:15 pm	.....Syracuse, N. Y.....	6:40 am
6:15 pm	.....Rochester, N. Y.....	5:45 am
7:05 pm	Ar.....Buffalo, N. Y.....Lv	5:00 am
10:30 pm	Lv.....Buffalo, N. Y.....Ar	2:30 am
1:00 am	Ar.....Cleveland, Ohio.....Lv	12:30 am

(Daily except Sunday)

CAM-21 Dallas to Galveston, Tex., 320 miles.
Contractor: **Texas Air Transport, Inc., Fort Worth, Tex.**
Compensation: $2.89 per pound.

Southbound	(Central Time)	*Northbound*
7:45 am	Lv.....Dallas, Tex.....Ar	7:37 pm
8:15 am	.....Fort Worth, Tex.....	7:15 pm
9:20 am	.....Waco, Tex.....	6:15 pm
10:50 am	.....Houston, Tex.....	4:45 pm
11:30 am	Ar.....Galveston, Tex.....Lv	4:00 pm

(Daily.)

CAM-22 Dallas to Brownsville, Tex., 529 miles.
Contractor: **Texas Air Transport, Inc., Fort Worth, Tex.**
Compensation: $2.89 per pound.

Southbound		(Central Time)	*Northbound*
7:45 am	Lv	Dallas, Tex	Ar 7:35 pm
8:15 am		Fort Worth, Tex	7:15 pm
9:20 am		Waco, Tex	6:15 pm
10:25 am		Austin, Tex	5:10 pm
11:20 am		San Antonio, Tex	4:15 pm
2:05 pm	Ar	Brownsville, Tex	Lv 1:25 pm

(Daily.)

CAM-23 Atlanta, Ga., to New Orleans, La., 483 miles.
Contractor: **St. Tammany Gulf Coast Airways, Inc., New Orleans, La.**
Compensation: $1.75 per pound.

Southbound		(Central Time)	*Northbound*
5:30 am	Lv	Atlanta, Ga	Ar 6:30 pm
7:10 am		Birmingham, Ala	4:55 pm
9:30 am		Mobile, Ala	2:35 pm
11:00 am	Ar	New Orleans, La	Lv 1:00 pm

(Daily.)

CAM-24 Chicago, Ill., to Cincinnati, Ohio, 270 miles.
Contractor: **Embry-Riddle Company, Cincinnati, Ohio.**
Compensation: $1.47 per pound.

Southbound			(Central Time)	*Northbound*	
8:30 am	9:00 pm	Lv	Chicago, Ill	Ar 6:30 am	7:00 pm
10:15 am	10:45 pm		Indianapolis, Ind	4:45 am	5:15 pm
			(Eastern Time)		
12:30 pm	1:00 am	Ar	Cincinnati, Ohio	Lv 4:30 am	5:00 pm

(Daily.)

CAM-25 Atlanta, Ga., to Miami, Fla., 754 miles.
Contractor: **Pitcairn Aviation, Inc., Brooklyn, N. Y.**
Compensation: $1.46 per pound.

Southbound		(Eastern Time)	*Northbound*
6:45 am	Lv	Atlanta, Ga	Ar 7:30 pm
7:40 am		Macon, Ga	6:40 pm
10:00 am		Jacksonville, Fla	4:25 pm
11:00 am	Ar	Daytona Beach, Fla	Lv 3:15 pm
11:05 am	Lv	Daytona Beach, Fla	Ar 3:05 pm
11:45 am		Orlando, Fla	2:35 pm
12:50 pm		Tampa, Fla	1:25 pm
1:15 pm	Ar	St. Petersburg, Fla	Lv 1:00 pm
11:05 am	Lv	Daytona Beach, Fla	Ar 3:05 pm
1:45 pm	Ar	Miami, Fla	Lv 12:30 pm

(Daily.)

CAM-26 Great Falls, Mont., to Salt Lake City, Utah, 489 miles.
Contractor: **National Parks Airways, Inc., Salt Lake City, Utah.**
Compensation: $2.475 per pound.

Southbound		(Mountain Time)	*Northbound*	
....	9.00 am	Lv Great Falls, Mont	Ar 12:10 pm	....
....	9:55 am	Helena, Mont	11:25 am	....
....	10:40 am	Butte, Mont	10:40 am	....
7:00 am	1:15 pm	Pocatello, Idaho	8:20 am	5:40 pm
8:20 am	2:35 pm	Ogden, Utah	6:30 am	4:20 pm
9:00 am	3:05 pm	Ar Salt Lake City, Utah	Lv 6:00 am	4:00 pm

(Daily.)

CAM-27 Bay City, Mich., to Chicago, Ill., 773 miles.
Contractor: **Thompson Aeronautical Corporation, Kalamazoo, Mich.**
Compensation: $0.89 per pound.

† *Westbound*		† *Eastbound*
4:25 pm (ET)	Lv Bay City, Mich	Ar 12:05 pm (ET)
4:35 pm (ET)	Saginaw, Mich	11:55 am (ET)
5:05 pm (ET)	Flint, Mich	11:25 am (ET)
5:45 pm (ET)	Lansing, Mich	10:40 am (ET)
5:35 pm (CT)	Ar Kalamazoo, Mich	Lv 8:55 am (CT)

†Daily except Sunday and holidays.

† *Westbound*		† *Eastbound*
4:20 pm (ET)	Lv..... Pontiac, Mich. .....Ar	12:00 m (ET)
4:40 pm (ET)	.....Detroit, Mich..... (Dearborn, Mich.)	11:40 am (ET)
5:05 pm (ET)	.....Ann Arbor, Mich.....	11:15 am (ET)
5:45 pm (ET)	.....Jackson Mich.....	10:45 am (ET)
6:15 pm (ET)	.....Battle Creek, Mich.....	10:15 am (ET)
5:35 pm (CT)	Ar.....Kalamazoo, Mich.....Lv	8:55 am (CT)
4:40 pm (CT)	Lv.....Muskegon, Mich.....Ar	9:55 am (CT)
5:00 pm (CT)	.....Grand Rapids, Mich.....	9:35 am (CT)
5:35 pm (CT)	Ar.....Kalamazoo, Mich.....Lv	8:55 am (CT)
*		*
3:00 am (ET)	Lv.....Cleveland, Ohio.....Ar	11:30 pm (ET)
4:00 am (ET)	.....Toledo, Ohio.....	10:35 pm (ET)
4:40 am (ET)	.....Detroit, Mich.....	9:55 pm (ET)
5:10 am (ET)	.....Pontiac, Mich.....	9:30 pm (ET)
6:25 am (ET)	.....Saginaw, Mich.....	8:30 pm (ET)
6:35 am (ET)	Ar.....Bay City, Mich.....Lv	8:15 pm (ET)
†		† *
5:40 pm (CT)	Lv.....Kalamazoo, Mich.....Ar	8:50 am (CT) 10:05 pm
6:25 pm (CT)	.....South Bend, Ind.....	8:10 am (CT)
7:20 pm (CT)	Ar..... Chicago, Ill. Lv	7:15 am (CT) 8:30 pm

†Daily except Sundays and holidays. *Daily.

CAM-28 St. Louis, Mo., to Omaha, Neb., 404 miles.
Contractor: **Robertson Aircraft Corp., Anglum, Mo.**
Compensation: $0.785 per pound.

Westbound		(Central Time)	*Eastbound*	
7:25 am	7:30 pm	Lv.....St. Louis, Mo.....Ar	5:50 pm	6:15 am
10:10 am	10:00 pm	.....Kansas City, Mo.....	3:10 pm	3:35 am
10:50 am	10:40 pm	.....St. Joseph, Mo.....	2:45 pm	2:55 am
12:05 pm	12:20 am	Ar..... Omaha, Neb. Lv	1:10 pm	1:10 am

(Daily.)

CAM-29 New Orleans, La., to Houston, Tex., 319 miles.
Contractor: **St. Tammany Gulf Coast Airways, Inc., New Orleans, La.**
Compensation: $1.00 per pound.

Westbound	(Central Time)	*Eastbound*
11:30 am	Lv.....New Orleans, La.....Ar	12:30 pm
2:25 pm	..... Beaumont, Tex.	9:40 am
3:15 pm	Ar.....Houston, Tex.....Lv	8:45 am

(Daily.)

CAM-30 Chicago, Ill., to Atlanta, Ga., 768 miles.
Contractor: **Interstate Air Lines, Inc., Chicago, Ill.**
Compensation: $0.78 per lb.

Southbound	(Central Time)	*Northbound*
9:00 am	Lv.....Chicago, Ill.....Ar	5:30 pm
11:05 am	..... Terre Haute, Ind.	3:30 pm
12:05 pm	Ar..... Evansville, Ind. Lv	2:30 pm
10:30 pm	Lv.....St. Louis, Mo.....Ar	3:00 pm
12:05 pm	Ar..... Evansville, Ind. Lv	1:10 pm
12:20 pm	Lv..... Evansville, Ind. .....Ar	1:00 pm
1:45 pm	Ar.....Nashville, Tenn.....	11:35 am
2:30 pm	Lv.....Nashville, Tenn.....	....
3:45 pm	.....Chattanooga, Tenn.....	10:30 am
5:10 pm	Ar.....Atlanta, Ga.....Lv	9:25 am

(Daily.)

CAM-32 Pasco, Wash, to Spokane and Seattle, Wash., 449 miles.
Contractor: **Varney Air Lines, Inc., San Francisco, Calif.**
Compensation: $0.09 per pound.

Westbound	(Pacific Time)	*Eastbound*	
4:15 am	Lv.....Pasco, Wash.....Ar	4:20 pm	8:00 am
6:15 am	..... Portland, Ore.	2:40 pm	6:15 am*
7:35 am	.....Tacoma, Wash.....	1:20 pm	
7:50 am	Ar..... Seattle, Wash. Lv	1:00 pm	
5:14 am	Lv.....Pasco, Wash.....Ar	4:20 pm	
5:45 am	Ar.....Spokane, Wash.....Lv	3:00 pm	

*Departs from Vancouver Field.

(Daily.)

F. A. M. Routes in Operation in 1929

F. A. M. 1, New York, N. Y. to Montreal, Canada, 334 Miles

(Eastern Time)
(Daily except Sunday)

Northbound		*Southbound*
7:00 am	Lv.....New York, N. Y. (Air Field).....	*
8:45 am	.....Albany, N. Y.....Ar	2:30 pm
11:15 am	Ar..... Montreal, Canada Lv	12:15 pm

*Dispatched by train from Albany, N. Y.

F. A. M. 4, Miami, Fla., to Havana, Cuba, 261 Miles

(Daily)
(Eastern Time)

Southbound		*Northbound*
8:00 am	Lv..... Miami, Fla. .....Ar	5:15 pm
10:15 am	Ar..... Havana, Cuba Lv	3:00 pm

F. A. M. 5, Miami, Fla., to Cristobal, C. Z., 2,074 Miles; to Curacao, 3,097 Miles

(Tuesday, Thursday, Saturday)
(Eastern Time)

Southbound		*Northbound*
7:00 am	Lv.....Miami, Fla.....Ar	5:30 pm
9:45 am	Ar.....Havana, Cuba.....Ar	2:45 pm
4:30 pm (CT)	Ar.....Belize, British Honduras.....Lv	6:00 am (CT)
7:00 am (CT)	Lv.....Belize, British Honduras.....Ar	1:00 pm (CT)
8:30 am (CT)	Ar.....Tela, Republic of Honduras.....Ar	11:30 am (CT)
1:00 pm (CT)	Ar.....Managua, Nicaragua.....Lv	7:00 am (CT)
7:00 am (CT)	Lv.....Managua, Nicaragua.....Ar	3:00 pm (CT)
11:30 am (CT)	Ar.....David, Panama.....Ar	9:30 am (CT)
3:00 pm (CT)	Ar.....Cristobal, Canal Zone.....Lv	7:00 am (CT)
	(Weekly)	
Tues. 8:00 am	Lv.....Cristobal, Canal Zone.....Ar	6:00 pm Thur.
" 2:30 pm	Ar..... Barranquilla, Colombia Lv	1:15 pm "
Wed. 8:00 am	Lv..... Barranquilla, Colombia .....Ar	12:45 pm "
" 2:30 pm	Ar.....Curacao, Dutch West Indies.....Lv	8:30 am "

F. A. M. 6, Miami, Fla., to Port-of-Spain, Trinidad, 2,197 Miles

(Monday, Wednesday, Friday)
(Eastern Time)

Southbound		*Northbound*
9:15 am	Lv.....Miami, Fla.....Ar	5:45 pm
11:30 am	Ar.....Havana, Cuba.....Lv	3:30 pm
12:15 pm	Lv.....Havana, Cuba.....Ar	1:15 pm
	(Stop over night in Eastern Cuba)	
10:00 am (next day)	Ar.....Port au Prince, Haiti.....Lv	2:00 pm
10:30 am	Lv.....Port au Prince, Haiti.....Ar	1:30 pm
12:30 pm	Ar.....Santo Domingo City.....Lv	11:30 am
1:00 pm	Lv.....Santo Domingo City.....Ar	11:00 am
4:00 pm	Ar.....San Juan, Porto Rico.....Lv	8:00 am
	(Weekly)	
7:00 am Sun.	Lv.....San Juan, Porto Rico.....Ar	4:00 pm Thur.
7:55 am "	Ar.....St. Thomas, U. S., Virgin Is.....Lv	3:00 pm "
8:15 am "	Lv.....St. Thomas, U. S., Virgin Is.....Ar	2:30 pm "
9:45 am "	Ar..... St. Johns, Antigua Lv	1:00 pm "
10:30 am "	Lv..... St. Johns, Antigua .....Ar	12:45 pm "
1:00 pm "	Ar.....Castries, St. Lucia.....Lv	10:00 am "
1:30 pm "	Lv.....Castries, St. Lucia.....Ar	9:30 am "
4:15 pm "	Ar..... Port-of-Spain, Trinidad Lv	7:00 am "
7:00 am Mon.	Lv.....*Port-of-Spain, Trinidad.....Ar	2:15 pm Wed.
11:15 am "	Ar.....*Georgetown, British Guiana.....Lv	10:00 am "
11:45 am "	Lv.....*Georgetown, British Guiana.....Ar	9:20 am "
2:05 pm "	Ar..... *Paramaribo, Dutch Guiana Lv	7:00 am "

*Service between Port-of-Spain and Paramaribo (590 miles) is on F. A. M. Route No. 5.

F. A. M. 7, Miami, Fla., to Nassau, Bahamas Islands, 200 Miles

(January 1 to April 30)
(Daily) (Eastern Time)

Eastbound		*Westbound*
9:40 am	Lv..... Miami, Fla. .....Ar	2:45 pm
11:40 am	Ar..... Nassau, Bahamas Lv	12:45 pm

F. A. M. 8, Brownsville, Tex., to Mexico City, 472 Miles
Brownsville, Tex., to Guatemala City, 1,028 Miles

Southbound	(Daily) (Central Time)	*Northbound*
8:15 am	Lv.....Brownsville, Tex.....Ar	1:15 pm
11:00 am	Ar.....Tampico, Mexico.....Lv	10:45 am
11:30 am	Lv.....Tampico, Mexico.....Ar	10:15 am
1:55 pm	Ar.....Mexico City, Mexico.....Lv	7:45 am
Monday, Wednesday, and Friday	(Central Time)	Monday, Thursday, and Saturday
8:15 am	Lv.....Brownsville, Tex.....Ar	1:30 pm
1:00 pm	Ar....Vera Cruz (Tejeria), Mexico....Lv	(next day) 8:00 am
8:00 am (next day)	Lv....Vera Cruz (Tejeria), Mexico....Ar	3:15 pm
10:00 am	Ar.....San Geronimo, Mexico.....Ar	1:15 pm
1:00 pm	Ar.....Tapachula, Mexico.....Ar	9:45 am
3:15 pm	Ar.....Guatemala City, Guatemala.....Lv	8:00 am

F. A. M. 9, Cristobal, C. Z., to Buenos Aires, Argentina, 4,442 Miles
(Connects at Cristobal with F. A. M. 5)
(Weekly) (All times United States Eastern Standard)

Southbound			*Northbound*	
Tues.	7:00 am	Lv.....Cristobal, Canal Zone.....Ar	1:30 pm	Fri.
"	12:15 pm	Lv.....Buenaventura, Colombia.....Lv	9:15 am	"
"	2:30 pm	Ar..... Tumaco, Colombia Lv	6:30 am	"
Wed.	6:00 am	Lv..... Tumaco, Colombia .....Ar	11:30 am	Thur.
"	11:00 am	Ar.....Guayaquil, Ecuador.....Lv	7:00 am	"
Thur.	7:00 am	Lv.....Guayaquil, Ecuador.....Ar	5:30 pm	Wed.
"	8:20 am	Lv.....Puerto Pizarro, Peru.....Lv	4:25 pm	"
"	10:00 am	Lv.....Talara, Peru.....Lv	3:00 pm	"
"	10:50 am	Lv..... Piura, Peru Lv	2:00 pm	"
"	12:30 pm	Lv.....Pimentel, Peru.....Lv	12:35 pm	"
"	2:05 pm	Lv..... Trujillo, Peru Lv	11:15 am	"
"	5:20 pm	Ar..... Lima, Peru Lv	8:00 am	"
Fri.	8:00 am	Lv..... Lima, Peru .....Ar	4:30 pm	Tues.
"	12:35 pm	Lv..... Camana, Peru Lv	12:25 pm	"
"	1:35 pm	Lv.....Arequipa, Peru.....Lv	11:25 am	"
"	2:50 pm	Lv.....Mollendo, Peru.....Lv	10:20 am	"
"	3:55 pm	Lv..... Ilo, Peru Lv	9:20 am	"
"	4:45 pm	Lv.....Tacna, Chile.....Lv	8:30 am	"
"	5:05 pm	Ar..... Arica, Chile Lv	8:00 am	"
Sat.	8:00 am	Lv..... Arica, Chile Lv	3:30 pm	Mon.
"	1:15 pm	Lv..... Antofogasta, Chile Lv	10:30 am	"
"	3:30 pm	Ar..... Copiapo, Chile Lv	8:00 am	"
Sun.	8:00 am	Lv..... Copiapo, Chile .....Ar	1:30 pm	Sun.
"	10:50 am	Lv.....Ovalle, Chile.....Lv	11:00 am	"
"	1:20 pm	Ar.....Santiago, Chile.....Lv	8:00 am	"
Mon.	7:00 am	Lv.....Santiago, Chile.....Ar	3:30 pm	Sat.
"	9:30 am	Lv..... Mendoza, Argentina Lv	1:30 pm	"
"	3:30 pm	Ar.....Buenos Aires, Argentina.....Lv	7:00 am	"

RATES

(Postage plus fee for air mail service) for each half ounce or fraction, are as follows. (Effective Jan. 1, 1930.)

	Each Half Ounce
Argentina	55 cents
Bahamas (service January 1 to April 30)	5 cents
Barbados	20 cents
Bolivia (by ordinary means from Mollendo)	40 cents
Canal Zone	20 cents
Chile	50 cents
Colombia	30 cents
Costa Rica (by ordinary means from Cristobal)	20 cents
Cuba	5 cents
Dominican Republic	10 cents
Dutch West Indies:	
Curacao, Bonaire, Aruba	30 cents
St. Martins, St. Eustatius, Saba	20 cents
Ecuador	30 cents

	Each Half Ounce
Guadeloupe (including Desirade, Les Saintes, Marie Galente, Petite Terre, St. Bartholomew (Barthelemy) and the French part of St. Martins)	20 cents
Guatemala	15 cents
Guianas (British, Dutch, French)	30 cents
Haiti	10 cents
Honduras, British	15 cents
Honduras, Republic of	15 cents
Leeward Islands:	
Anguilla, Antigua, Barbuda, Dominica, Montserrat, Nevis, St. Kitts, Redonda, St. Christopher	20 cents
British Virgin Islands	10 cents
Martinique	20 cents
Nicaragua	15 cents
Panama	20 cents
Paraguay	55 cents
Peru	40 cents
Porto Rico	10 cents
Salvador (El)	15 cents
Trinidad	20 cents
Uruguay	55 cents
Venezuela	30 cents
Virgin Islands, U. S.	10 cents
Windward Islands:	
Grenada, Grenadines, St. Lucia, St. Vincent	20 cents

The rate (postage plus fee) for air service to CANADA and MEXICO is 5 cents for the first ounce or fraction and 10 cents for each additional ounce or fraction.

The above rates include dispatch by the United States domestic air routes, where available, as well as by the international routes, and, in the case of articles for delivery in Canada and Mexico, dispatch by the domestic air routes of Canada and Mexico, respectively, where available.

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AIRCRAFT HAVING APPROVED TYPE CERTIFICATES

Dec. 31, 1929

KEY: P—Place; O—Open; C—Closed; L—Landplane; S—Seaplane; Am—Amphibian; FB—Flying boat; B—Biplane; M—Monoplane; *—No longer manufactured.

A.T.C. No.	Date Issued	Airplane	Weight Empty	Useful Load	Gross Weight
	1927				
1	3-29	Buhl Airster, C-3A, 3POLB, J4 200 h.p.	1,686	1,383	3,069
2	7-26	Boeing 40A (Mail), 3PCLB, Wasp 425 h.p.	3,531	2,469	6,000
*3	3-29	Johnson Twin 60, 2POLB, 2 Bristol Cherubs 36 h.p.	800	520	1,320
*4	6- 8	Douglas O2, 2POLB, Liberty 12 400 h.p.	2,885	1,870	4,755
*5	6- 8	Douglas M2, 3POLB, Liberty 12 400 h.p.	2,885	1,870	4,755
*6	6- 8	Douglas M4, 3POLB, Liberty 12 400 h.p.	3,400	1,455	4,855
*7	4- 7	Alexander Comb. Wing, 3POLB, OX5 90 h.p. or OXX6 102 h.p.	1,470	760	2,230
*8	4- 7	Alexander Long Wing, 3POLB, OX5 90 h.p. or OXX6 102 h.p.	1,470	760	2,230
9	6-17	Atlantic Universal 7PCL-SM, WW 220 h.p Landplane..	2,192	1,808	4,000
		(Hamilton Pontoons) Seaplane....	2,653	1,347	4,000
*10	7- 2	Fairchild FC2, 5PCL-SM, WW 220 h.p. Landplane	2,160	1,440	3,600
		(Fairchild Pontoons) Seaplane....	2,427	1,573	4,000
11	7-19	Advance Waco-9, 3POLB, OX5 90 h.p. or OXX6 102 h.p.	1,320	780	2,100
*12	9-27	Buhl Airsedan, 5PCLB, WW 220 h.p.	2,072	1,628	3,700
13	10- 6	Advance Waco-10, 3POLB, OX5 90 h.p. or OXX6 102 h.p.	1,200	825	2,025
14	10- 6	Douglas C1 Transport, 10PCLB, Liberty 12 400 h.p.	3,800	2,600	7,400
*15	10-26	Driggs Dart No. 2, 2POLB, Anzani 35 h.p.			
*16	11- 1	Stinson SM1, 6PCLM, WW 220 h.p.	1,970	1,515	3,485
*17	11-10	American Eagle, 3POLB, OX5 90 h.p. or OXX7 102 h.p.	1,227	814	2,041
18	11-15	Pitcairn PA5, 1POLB, WW 220 h.p.	1,742	1,070	2,812
19	12- 1	Kreider-Reisner Challenger, 3POLB, OX5 90 h.p. or OXX6 102 h.p.	1,236	764	2,000
*20	12- 1	Fairchild FC2W, 5PCL-SM, Wasp 425 h.p.			
		(Fairchild Pontoons) Seaplane....	2,770	1,830	4,600
		Landplane..	2,418	2,182	4,600
		Skiplane....	3,030	1,570	4,600
*21	12- 8	Swallow, 3POLB, OX5 90 h.p. or OXX6 102 h.p..	1,447	753	2,200
	1928				
*22	1- 4	Mono-Aircraft Monocoupe, 2PCLM, Anzani 60-80 h.p.	700	475	1,175
		or Siemens 70 h.p.	749	426	1,175
23	4-30	Boeing B1D, 4PCFbB, WW 220 h.p.	2,588	1,155	3,743
*24	1- 6	Stinson SB1, 5PCLB, WW 220 h.p.	1,815	1,465	3,280
*25	1-27	Mahoney-Ryan B1, 5PCLM, WW 220 h.p.	1,870	1,430	3,300
26	2- 8	Advance Waco-10, 3POLB, Siemens 100-122 h.p.	1,349	676	2,025
27	2-25	Boeing 40B, 3PCLB, Hornet 525 h.p.	3,506	2,573	6,079
*28	3-12	Lincoln Page 1928, 3POLB, OX5 90 h.p. or OXX6 102 h.p.	1,250	950	2,200
*29	4- 2	National Airways Air King, 3POLB, OX5 90 h.p...	1,380	755	2,135
30	3-22	Travel Air 2000, 3POLB, OX5 90 h.p. or OXX6 100 h.p.	1,347	833	2,180
31	3-22	Travel Air 3000, 3POLB, Hisso 150-180 h.p.	1,664	926	2,590
*32	3-22	Travel Air 4000, 3POLB, WW 220 h.p.	1,660	740	2,400
33	4- 3	Buhl CA5A, 5PCLB, WW 220 h.p.	2,100	1,600	3,700
*34	4- 4	Loening 7PCAmB, Wasp 425 h.p.	3,730	2,170	5,900
35	4- 4	International F17, 3POLB, OX5 90 h.p. or OXX6 102 h.p.	1,480	620	2,100
*36	4- 7	Pheasant, 3POLB, OX5 90 h.p.	1,351	675	2,026
*37	4-11	Travel Air 8000, 3POLB, Caminez 120 h.p.	1,475	825	2,300
*38	4-11	Travel Air 9000, 3POLB, Siemens 122 h.p.	1,475	825	2,300
39	5- 9	Berliner CM-4, 3POLM, OX5 90 h.p.	1,490	810	2,300
40	5-28	Curtiss Robin, 3PCLM, OX5 90 h.p.	1,489	728	2,217
41	6-18	Advance Waco-10, 3POLB, WW 220 h.p.	1,411	899	2,310
42	6-18	Advance Waco-10, 3POLB, Hisso 150-180 h.p.	1,508	896	2,404
43	6-14	Simplex Red Arrow, 2POLM, Kinner 90 h.p.	1,020	572	1,592
44	6-14	Simplex Red Arrow, 2PCLM, Kinner 90 h.p.	1,020	572	1,592
45	6-23	Texas Temple, 1POLM, WW 220 h.p.	1,350	900	2,250
46	6-16	Buhl CA-3C, 3PCLB, WW 220 h.p.	1,760	1,440	3,200
47	6-18	Bellanca CH, 8PCLM, WW 220 h.p.	2,190	1,860	4,050
48	11-22	Stinson SM-2, 4PCLM, Warner 110 h.p.	1,547	953	2,500
49	7- 9	Lockheed Vega, 5PCLM, WW 220 h.p.	1,875	1,595	3,470
50	7- 9	Swallow, 3POLB, Hisso 150-180 h.p.	1,728	972	2,700
51	7- 9	Swallow, 3POLB, WW 220 h.p.	1,716	984	2,700

A.T.C. No.	Date Issued	Airplane	Weight Empty	Useful Load	Gross Weight
	1928				
52	7- 9	Atlantic Super Universal 7PCL-SM, Wasp 425 h.p. Landplane..	3,000	2,150	5,150
		(Hamilton Pontoons) Seaplane....	3,550	1,600	5,150
53	7- 9	Arkansas 303 Commandaire, 3POLB, OX5 90 h.p. or OXX6 102 h.p.	1,492	794	2,286
54	7-14	Boeing 40C, 5PCLB, Wasp 425 h.p.	3,522	2,553	6,075
55	7-27	Stearman C-3B, 3POLB, WW 220 h.p.	1,625	1,025	2,650
56	7-30	Atlantic FX, 14PCLM, 3 Wasps @ 425 h.p.	7,390	5,110	12,500
57	8- 6	Alexander A1, 3POLB, WW 220 h.p.	1,705	786	2,491
58	8- 6	Alexander A2, OX5 90 h.p. or OXX6 102 h.p.	1,459	982	2,441
59	8- 6	Alexander A3 & A4, 3POLB, Hisso 150-180 h.p.	1,877	741	2,618
60	8- 8	Sikorsky S38A, 11 PCamB, 2 Wasps @ 425 h.p.	6,000	4,480	10,480
61	8- 9	Fairchild FC2W2, 5PCL-SM, Wasp 425 h.p. Landplane..	2,732	2,768	5,500
		(Fairchild Pontoons) Seaplane....	3,072	2,428	5,500
62	8-15	Stearman C30, 3POLB, Hisso 150-180 h.p.	1,790	960	2,750
63	8-15	Curtiss Robin, 3PCLM, Challenger 170 h.p.	1,576	864	2,440
64	8-24	Boeing B1E, 4PCFbB, Wasp 425 h.p.	2,090	1,510	4,500
65	8-27	Cessna A, 4PCLM, Anzani 120 h.p.	1,304	956	2,260
66	8-27	Loening, 5PCAmB, Hornet 525 h.p.	3,867	2,033	5,900
67	8-27	Loening, 6PCAmB, Cyclone 525 h.p.	3,849	2,051	5,900
68	8-29	Curtiss-Robertson Robin, 3PCLM, OX5 90 h.p.	1,489	728	2,217
69	8-29	Curtiss-Robertson Robin, 3PCLM, Challenger 170 h.p.	1,576	864	2,440
70	9- 5	Mono-Aircraft Monocoupe, 2PCLM, Velie 55 h.p..	795	555	1,350
*71	9- 6	Spartan C-3, 3POLB, Siemens 122 h.p.	1,355	795	2,150
72	9- 7	Cessna AW, 4PCLM, Warner 110 h.p.	1,225	1,035	2,260
73	10-12	Spartan C-3, 3POLB, Walter 120 h.p.	1,310	840	2,150
74	10-16	Stinson SM-1DA, 6PCLM, WW 220 h.p.	2,432	2,068	4,500
75	10-24	Fairchild FC2, 5PCLM, Challenger 170 h.p.	2,239	1,361	3,600
76	10-29	Stinson SM-1DB, 6PCLM, WW 220 h.p.	2,522	1,978	4,500
77	10-29	Stinson SM-1DC, 2PCLM, WW 220 h.p.	2,514	1,986	4,500
78	10-29	Stinson SM-1DD, 2PCLM, WW 220 h.p.	2,280	2,220	4,500
79	11- 7	Consolidated PT-1, 2POLB, Hispano 150-180 h.p..	1,805	713	2,518
80	11- 7	Consolidated NY-1, 2POLB, WW 220 h.p.	1,773	722	2,495
81	11- 7	Consolidated NY-2, 2POL-SB, WW 220 h.p. Landplane..	1,800	698	2,498
		Seaplane....	2,145	698	2,843
82	11- 7	Consolidated O-17, 2POLB, WW 220 h.p.	1,881	842	2,723
83	11- 7	Consolidated PT-3 and PT-3A, 2POLB, WW 220 h.p.	1,747	698	2,445
84	11-10	Consolidated Model 14, 2POLB, Warner 110 h.p...	976	474	1,450
85	11-13	Hamilton H-45, 8PCLM, Wasp 425 h.p.	3,342	2,408	5,750
86	11-17	Laird LC-B, 3POLB, WW 220 h.p.	1,812	1,038	2,850
*87	11-19	Ford 4-AT, 14PCLM, 3 WW @ 220 h.p.	6,169	3,961	10,130
88	11-23	Kreider-Reisner C-4, 3POLB, Comet 130 h.p.	1,331	1,069	2,400
89	11-24	Fairchild 71, 7PCL-SM, Wasp 425 h.p. Landplane..	2,930	2,570	5,500
		Seaplane....	3,270	2,230	5,500
90	11-24	Loening C2-C, 8PCAmB, Cyclone 525 h.p.	3,894	2,356	6,250
91	11-24	Loening C2-H, 8PCAmB, Hornet 525 h.p.	3,894	2,356	6,250
92	12- 1	Pitcairn PA-6, 1POLB, WW 220 h.p.	1,892	1,158	3,050
93	12- 1	Lockheed Vega, 5PCLM, Wasp 425 h.p.	2,492	1,541	4,033
94	12- 1	Hamilton H-47, 8PCLM, Hornet 525 h.p.	3,450	2,300	5,750
95	12- 4	Mohawk Pinto MLV, 2POLM, Velie 55 h.p.	858	474	1,332
96	1-29	Atlantic FXA, 14PCLM, 3 Wasps @ 425 h.p.	7,780	4,720	12,500
97	12-28	Kreider-Reisner C-3, 3POLB, Warner 110 h.p.	1,165	835	2,000
	1929				
98	1- 3	Buhl CA-8A, 8PCLB, Cyclone 525 h.p.	3,542	2,558	6,100
99	1- 3	Buhl CA-8B, 8PCLB, Hornet 525 h.p.	3,542	2,558	6,100
100	1- 3	Travel Air Model 6000, 6PCLM, WW 220 h.p.	2,430	1,670	4,100
101	1- 5	Brunner-Winkle A, 3POLB, OX5 90 h.p.	1,319	831	2,150
102	1-11	Lockheed Air Express, 5PCLM, Wasp 425 h.p.	2,533	1,842	4,375
103	1-22	Curtiss Falcon Mail Plane, 1POLB, Liberty 400 h.p.	3,179	1,931	5,110
104	1-24	Mahoney-Ryan B-3, 6PCLM, WW 220 h.p.	2,114	1,590	3,704
105	1-28	Swallow TP 2POLB, OX5 90 h.p.	1,283	542	1,825
106	1-30	Boeing 95, 1POLB, Hornet 525 h.p.	3,196	2,644	5,840
107	2- 5	New Standard D-24, 5POLB, Hisso 180 h.p.	2,066	1,334	3,400
108	2- 5	New Standard D-25, 5POLB, WW 220 h.p.	2,010	1,390	3,400
109	2- 5	New Standard D-26, 3POLB, WW 220 h.p.	2,010	1,390	3,400
110	2- 5	New Standard D-27, 1POLB, WW 220 h.p.	2,010	1,390	3,400
111	2- 9	Travel Air SC-2000, 3POLB, Curtiss C-6 160 h.p..	1,659	941	2,600
112	2-15	Travel Air W-4000, 3POLB, Warner Scarab 110 h.p.	1,370	906	2,276

A.T.C. No.	Date Issued	Airplane	Weight Empty	Useful Load	Gross Weight
	1929				
113	2-20	Mono-Aircraft Monocoupe 113, 2PCLM, Velie 55 h.p.	848	502	1,350
114	2-25	Bach 3-CT-6, 10PCLM, 1 Hornet, 2 Comets 785 h.p.	4,739	3,261	8,000
115	2-26	Arrow Sport, 2POLB, LeBlond 60-65 h.p.	811	459	1,270
116	2-27	Travel Air A-6000-A, 6PCLM, Wasp 450 h.p.	3,225	2,025	5,250
117	3- 7	General Aristocrat 102-A, 3PCLB, Warner 110 h.p.	1,327	783	2,110
118	3- 7	Command-Aire 3-C-3A, 3POLB, Warner 110 h.p.	1,282	865	2,147
119	3- 7	Wallace Touroplane B, 3PCLM, Kinner K-5 90 h.p.	1,320	780	2,100
120	3- 9	Command-Aire 3-C-3B, 3POLB, SH-14 105 h.p.	1,320	808	2,128
121	3-12	Aeromarine Klemm L-25-A, 2POLM, Salmson AD-9 40 h.p.	815	510	1,325
122	6-15	Fleet Model 1, 2POLB, Warner Scarab 110 h.p.	1,022	558	1,580
		With Belly Tank	1,075	745	1,820
123	3-15	Advance Waco 10-T, 3POLB, Wright J-5 220 h.p.	1,787	813	2,600
124	3-18	American Eagle A1-29, 3POLB, Kinner 90 h.p.	1,220	800	2,020
125	3-20	Swallow F-28-AX, 3POLB, Axelson 115 h.p.	1,574	923	2,497
126	5-15	Sikorsky S-38-B, 10PCAmB, 2 Wasps @ 450 h.p.	6,432	4,048	10,480
127	3-23	Stearman M-2, 1POLB, Cyclone 525 h.p.	3,442	2,136	5,578
128	5- 6	Buhl CA-6, 6PCLB, Wright R-975-A 300 h.p.	2,478	1,722	4,200
129	5-29	Bellanca CH300, 6PCL-SM, Wright R-975-A 300 h.p. Landplane	2,253	1,797	4,050
		Seaplane	2,833	1,772	4,605
130	3-30	Travel Air B-6000, 6PCLM, Wright R-975-A 300 h.p.	2,608	1,622	4,230
131	6-15	Fleet Model 2, 2POLB, Kinner 90 h.p.	1,010	565	1,575
		With Belly Tank	1,063	757	1,820
132	3-30	Ford 4-AT-E, 14PCLM, 3 Wright R-975-A @ 300 h.p.	6,696	3,434	10,130
133	4- 1	Boeing Model 100, 1POLB, Wasp 450 h.p.	1,805	895	2,700
134	4- 1	Bourdon B-2, 3POLB, SH-14 105 h.p.	1,142	808	1,950
135	4- 2	Butler Black Hawk, 3POLB, Wright J-5 220 h.p.	1,885	1,015	2,900
136	4- 2	Stinson SM-1F, 6PCLM, R-975-A 300 h.p.	2,614	1,684	4,300
137	4- 4	Stearman C3-MB, 1POLB, Wright J-5 220 h.p.	1,895	935	2,830
138	4-12	Star Cavalier, 2POLM, Velie 55 h.p.	862	538	1,400
139	4-15	Alexander A-12, 3POLB, Comet 130 h.p.	1,627	953	2,580
140	4-29	Lockheed Vega, 5PCLM, Wright R-975 300 h.p.	2,140	1,713	3,853
141	5- 4	Alexander A-13, 3POLB, Challenger 170 h.p.	1,705	945	2,650
142	6-13	Mahoney-Ryan B5, 6PCL-SM, Wright R-975 300 h.p. Landplane	2,251	1,749	4,000
		Seaplane	2,582	1,518	4,100
143	6-17	Curtiss-Robertson C1, 3PCL-SM, Challenger 170 h.p. Landplane	1,638	962	2,600
		Seaplane	1,885	775	2,660
144	5-16	Curtiss-Robertson C2, 3PCLM, Challenger 170 h.p.	1,667	933	2,600
145	5-20	Stinson SM-2AA, 4PCLM, Wright R-540 165 h.p.	1,972	1,180	3,152
146	6-11	Travel Air B-4000, 3POLB, Wright J-5 220 h.p.	1,893	1,007	2,900
147	5-21	Travel Air BM-4000, 1POLB, Wright J-5 220 h.p.	1,928	1,072	3,000
148	5-21	Travel Air A-4000, 3POLB, Axelson 115 h.p.	1,655	995	2,650
149	5-21	Travel Air C-4000, 3POLB, Challenger 170 h.p.	1,590	1,007	2,597
150	5-22	Command-Aire 3C-3 Trainer, 2POLB, OX5 90 h.p.	1,439	670	2,109
151	5-22	Command-Aire 3C-3A Trainer, 2POLB, Warner 110 h.p.	1,284	706	1,990
152	5-27	Laird LCR, 3POLB, Wright J-5 220 h.p.	1,848	1,066	2,914
153	5-25	Ireland N-2-B, 5PO-CAmB, Wright R-975 300 h.p.	2,949	1,451	4,400
154	5-31	International F-17-W, 3POLB, Wright J-5 220 h.p.	1,780	920	2,700
155	5-31	International F-17-H, 3POLB, Hisso 150-180 h.p.	1,755	951	2,706
156	6- 4	Stout (Ford) 5-AT-B, 17PCLM, 3 Wasps @ 450 h.p	7,576	5,674	13,250
157	6- 6	Boeing 204, 6PCFbB, Wasp 450 h.p.	3,371	1,629	5,000
158	6-10	Sikorsky S-38-B, 12PCAmB, 2 Wasps @ 450 h.p.	6,460	4,020	10,480
159	6-10	Curtiss Thrush, 6PCLM, Challenger 170 h.p.	2,232	1,468	3,700
160	6-10	Curtiss-Robertson Thrush, 6PCLM, Challenger 170 h.p.	2,232	1,468	3,700
161	6-11	Stinson SM-2A-B, 4PCLM, Wright J-5 220 h.p.	2,169	1,031	3,200
162	6-11	Kreider-Reisner C-4-C, 3POLB, Wright R-450 165 h.p.	1,457	885	2,342
163	6-12	Buhl CA-3-D, 3PCLB, Wright R-975 300 h.p.	2,017	1,183	3,200
164	6-29	Fokker Stand. Universal, 6PCLM, Wright R-975 300 h.p.	2,482	1,518	4,000
165	6-14	Stout (Ford) 5-AT-C, 17PCLM, 3 Wasps @ 450 h.p.	7,500	6,000	13,500
166	6-21	Bourdon B-4, 3POLB, Kinner K-5 90 h.p.	1,107	768	1,875
167	6-25	Great Lakes 2T1, 2POLB, Cirrus Mark III 85 h.p.	1,002	578	1,580
168	6-25	Waco 165, 3POLB, Wright R-540 165 h.p.	1,529	956	2,485
169	6-28	Lockheed Vega, 6PCLM, Wasp 450 h.p.	2,465	1,568	4,033
170	6-29	Kreutzer K-3, 6PCLM, 3 LeBlonds @ 90 h.p.	2,846	1,654	4,500
171	7-25	Kreutzer K-2, 6PCLM, 2 LeBlond 60's @ 65 h.p. 1 LeBlond 90 @ 90 h.p. With Starter Equipment	2,697	1,748	4,445
			2,807	1,693	4,500

A.T.C. No.	Date Issued	Airplane	Weight Empty	Useful Load	Gross Weight
	1929				
172	7- 2	Bach 3-CT-8, 1oPCLM, 2 R-540's & 1 Hornet 855 h.p.	4,785	3,195	7,980
173	7-26	Stout (Ford) 6-AT, 15PCLM, 3 R-975's @ 300 h.p.	7,048	5,096	12,144
		(with 231 gals. fuel)	7,009	4,721	11,730
174	7-10	Nicholas-Beazley NB-3, 3POLM, LeBlond 65 h.p..	744	629	1,373
175	7-16	Travel Air SA-6000-A, 6PCSM, Wasp 450 h.p. Edo J Fl.	3,576	1,824	5,500
176	7-17	Laird LCR-300, 3POLB, Wright R-975 300 h.p....	1,922	1,088	3,010
177	7-19	Cunningham-Hall PT-6, 6PCLB, Wright R-975 300 h.p.	2,680	1,670	4,350
178	7-20	Alliance "Argo," 2POLB, Hess Warrior 115 h.p....	1,077	538	1,615
179	7-23	Parks P-1, 3POLB, OX-5 90 h.p.	1,331	747	2,078
180	7-24	Timm Collegiate, 2POLM, Kinner K-5 90 h.p.....	1,309	643	1,952
181	7-26	Lincoln PT, 2POLB, OX-5 90 h.p.	1,428	540	1,968
182	7-26	Curtiss Fledgling Junior, 2POLB Challenger 170 h.p.	1,921	671	2,592
183	7-26	Boeing 40-B-4, 5PCLB, Hornet 525 h.p.	3,809	2,271	6,080
184	7-27	Command-Aire 5-C-3, 3POLB, Challenger 170 h.p..	1,482	878	2,360
185	7-27	Command-Aire 5-C-3A, 3POLB, Hisso 150 h.p.....	1,610	913	2,523
186	7-30	Swallow TP-K, 2POLB, Kinner 90 h.p.	1,170	530	1,700
187	7-30	Stearman LT-1, 5PCLB, Hornet 525 h.p.	3,890	2,360	6,250
188	7-30	Travel Air BE-4000, 3POLB, Wright R-540 165 h.p.	1,695	1,007	2,702
189	7-31	Travel Air BC-4000, 3POLB, Challenger 170 h.p...	1,793	1,007	2,800
190	7-30	Alexander A-15, 3POLB, Kinner 90 h.p.	1,423	838	2,261
191	8- 2	Curtiss Fledgling, 2POLB, Challenger 170 h.p....	1,990	696	2,686
		(with modifications for military planes)	2,005	696	2,701
192	8- 5	Metal Aircraft G-2-W Flamingo, 8PCLM, Wasp 450 h.p.	3,370	2,430	5,800
193	8- 8	Curtiss Condor CO, 21PCLB, 2 G. Conqueror's @ 600 h.p.	11,352	6,326	17,678
194	8- 9	Stinson SM-2AC, 4PCLM, Wright R-760 225 h.p.	2,091	1,126	3,217
195	8- 9	Spartan C3-5, 3POLB, Wright R-540 165 h.p.....	1,617	968	2,585
196	8-13	Pitcairn PA-6B, 3POLB, Wright R-760 225 h.p...	1,820	1,200	3,020
197	8-16	Moth 60-GM, 2POLB, DH Gypsy 85 h.p.	1,027	623	1,650
198	8-15	New Standard D-29, 2POLB, Cirrus Mark III 85 h.p.	1,097	535	1,632
199	8-16	Crown B-3, 2POLB, Kinner 90 h.p.	1,243	513	1,756
200	8-16	Parks P-2, 3POLB, Axelson 115 h.p.	1,458	860	2,318
201	8-16	Mono Aircraft Monocoach, 4PCLM, Wright J-5 220 h.p.	1,919	1,173	3,092
202	8-16	Golden Eagle Chief, 2POLM, LeBlond 90 90 h.p..	966	513	1,479
203	8-23	Aeromarine-Klemm AKL-26, 2POL-SM, LeBlond 60 65 h.p. Landplane..	940	500	1,440
		(Edo H Floats) Seaplane....	1,090	500	1,590
204	8-23	Aeromarine-Klemm AKL-26-A, 2POL-SM, LeBlond 65 h.p. Landplane..	954	576	1,530
		(Edo H Floats) Seaplane....	1,090	500	1,590
205	8-17	Travel Air K-4000, 3POLB Kinner 90 h.p.	1,340	940	2,280
206	8-20	Boeing 80-A, 20PCLB, 3 Hornets @ 525 h.p.....	10,582	6,918	17,500
207	8-19	Cessna DC-6, 4PCLM, Challenger 170 h.p.	1,767	1,221	2,988
208	8-20	Kreider-Reisner C-4-D, 3POLB, Challenger 170 h.p.	1,462	901	2,363
209	8-22	Command-Aire 3C-3B Trainer, 2POLB, SH-14 113 h.p.	1,340	682	2,022
210	8-23	General 102-E, 3PCLM, Wright R-450 165 h.p....	1,524	776	2,300
211	8-24	Boeing 203-A, 3POLB, Wright R-540 165 h.p.....	1,789	788	2,577
212	8-24	Stinson SM-1-FS, 6PCSM, Wright R-975 300 h.p. (Edo J Floats)	3,198	1,502	4,700
213	8-26	Curtis Falcon, 2POLB, Geared Conquerer 600 h.p.	3,367	1,898	5,265
214	8-26	Command-Aire 5C-3B, 3POLB, Axelson 115 h.p....	1,503	869	2,372
215	8-26	Kreider-Reisner C6-B, 2POLB, Kinner 90 h.p.....	1,015	535	1,550
216	8-28	New Standard D-29-A, 2POLB, Kinner 90 h.p.....	1,075	535	1,610
217	8-28	Stinson SM-6B, 8PCLM, Wasp 450 h.p.	3,496	1,854	5,350
218	8-30	Mono Aircraft Monoprep, 2POLM, Velie 55 h.p...	783	505	1,288
219	9- 4	Loening Commuter, 4PCAmB, Wright R-975 300 h.p.	2,780	1,220	4,000
220	9- 5	Curtiss-Robertson Robin J-1, 3PCL-SM, Wright R-540 165 h.p. Landplane..	1,542	898	2,440
		(Edo DeLuxe) Seaplane....	1,790	870	2,660
221	9- 5	Curtiss-Robertson Robin J-2, 3PCLM, Wright R-540 165 h.p.	1,565	1,035	2,600
222	9- 5	Fokker F-XI-A, 8PCAmM, Cyclone 525 h.p.	4,470	2,430	6,900
223	9- 6	Kreutzer K-5, 6PCLM, 3 Kinners @ 90 h.p.	2,745	1,698	4,443
224	9- 7	New Standard D-25-A, 5POLB, Wright R-760 225 h.p.	2,055	1,290	3,345
225	9- 7	New Standard D-26-A, 3POLB, Wright R-760 225 h.p.	2,055	1,345	3,400

A.T.C. No.	Date Issued 1929	Airplane	Weight Empty	Useful Load	Gross Weight
226	9- 7	New Standard D-27-A, 1POLB, Wright R-760 225 h.p.	2,055	1,345	3,400
227	9- 9	Lockheed Wasp Vega, 7PCLM, Wasp 450 h.p.	2,490	1,775	4,265
228	9-17	Great Lakes 2T-1A, 2POLB, American Cirrus Mark III 90 h.p.	1,002	578	1,580
229	9-17	General 111-C, 2POLM, Warner 110 h.p.	1,206	535	1,741
230	9-18	Nicholas-Beazley NB-3V, 3POLM, Velie 55 h.p.	772	629	1,401
231	9-18	Nicholas-Beazley NB-3G, 3POLM, Genet 80 h.p.	735	629	1,364
232	9-18	Rearwin 2000-C, 3POLB, Challenger 170 h.p.	1,495	885	2,380
233	9-18	Command-Aire 5C-3C, 3POLB, Wright R-540 165 h.p.	1,559	931	2,490
234	9-21	Fokker F-XIV, 7PCLM, Hornet 525 h.p.	4,346	2,854	7,200
		1PCLM, Hornet 525 h.p. (Mail Plane)	4,245	2,955	7,200
235	9-21	Mercury Chic T-2, 2POLM, LeBlond 90 h.p.	935	578	1,513
236	9-25	Curtiss Thrush "J," 6PCLM, Wright R-760 225 h.p.	2,260	1,540	3,800
237	9-25	Curtiss Carrier Pigeon, 1POLB, Geared Conqueror 600	4,210	3,390	7,600
238	9-26	Simplex W-2-S, 2POLM, Warner 110 h.p.	1,152	627	1,779
239	9-26	Brunner-Winkle Bird B, 3POLB, Kinner 90 h.p.	1,199	781	1,980
240	9-30	Waco CS225, 3POLB, Wright R-760 225 h.p			
		Without Center Section Tank	1,628	972	2,600
		With Center Section Tank	1,662	938	2,600
241	9-28	Moreland M-1, 3POLM, J-5 220 h.p.	2,000	800	2,800
242	9-30	Fairchild Model 42, 4PCLM, Wright R-975 300 h.p.	2,852	1,448	4,300
243	9-30	Cessna DC6A, 4PCLM, Wright R-975 300 h.p.	1,932	1,248	3,180
244	9-30	Cessna DC6B, 4PCLM, Wright R-760 225 h.p.	1,871	1,229	3,100
245	9-30	Bellanca PM300, 4PCLM, Wright R-975 300 h.p.	2,290	2,310	4,600
246	9-30	Ford (Stout) 7AT, 15PCLM, 2 Wright R-975's @ 300 h.p.; 1 Wasp 450 h.p.			
		Without Center Section Tanks	7,230	5,330	12,560
		With Center Section Tanks	7,280	5,630	12,910
247	10- 2	Doyle O2, 2POLM, LeBlond 65 h.p.	792	529	1,321
248	10- 4	Ireland N2C, 5PO-CAmB, P & W Wasp 450 h.p.	3,294	1,566	4,860
249	10- 4	Mono Aircraft Monosport 1, 2PCLM, Warner 110 h.p.	1,056	594	1,650
250	10- 4	Mono Aircraft Monosport 2, 2PCLM, Kinner 90 h.p.	1,053	597	1,650
251	10- 7	Stearman C3R, 3POLB, Wright R-760 225 h.p.	1,741	959	2,700
252	10- 7	Lockheed Vega, 7PCLM, Wright R-975, 300 h.p.	2,305	1,915	4,220
253	10- 9	Swallow TPW, 2POLB, Warner 110 h.p.	1,201	538	1,739
254	10-12	Travel Air 4D, 3POLB, Wright R-760 225 hp.	1,837	1,043	2,880
255	10-12	Star Model C, 2PCLM, LeBlond 65 h.p.	861	539	1,400
256	11- 8	Davis D-1, 2POLM, LeBlond 65 h.p.	839	495	1,334
257	10-16	Waco CT225, 3POLB, Wright R-760 225 h.p.	1,677	923	2,600
258	11-20	Consolidated Commodore, 25PCFbM, 2 Hornet B's 575 h.p.	9,620	7,980	17,600
259	10-19	Inland Sport, 2POLM, LeBlond 65 h.p.	768	524	1,290
260	10-30	Keystone K-78-D Patrician, 20PCLM, 3 Cyclones 525 h.p.	10,224	5,776	16,000
261	10-24	Curtiss-Robertson Thrush J, 6PCLM, Wright R-760 225 h.p.	2,260	1,540	3,800
262	10-26	Ryan B-7, 6PCLM, Wasp 450 h.p.	2,503	1,780	4,283
263	10-28	Mohawk M-1-C, 2POLM, Kinner 90 h.p.	1,142	618	1,760
264	11-14	St. Louis Cardinal C-2-90, 2PCLM, LeBlond 90 h.p.	995	528	1,523
265	11- 2	Paramount Cabinaire, 4PCLB, Wright R-540 165 h.p.	1,620	1,010	2,630
266	11-14	Curtiss Fledgling J-1, 2POLB, Wright R-540 165 h.p.	2,009	691	2,700
267	11- 2	Verville 104, 4PCLM, Wright R-760 225 h.p.	2,125	1,275	3,400
268	11- 4	Curtiss-Robertson Robin W, 3PCLM, Warner 110 h.p.	1,520	780	2,300
269	11- 6	Curtiss Fledgling J-2, 2POLB, Wright R-760 225 h.p.	2,117	888	3,005
270	11- 6	Curtiss-Robertson Robin 4-C, 4PCLM, Challenger 170 h.p.	1,676	924	2,600
271	11- 8	Bach 3-CT-9, 10PCLM, 2 Wright R-760's @ 225 h.p.; 1 Wasp 450 h.p.	5,010	2,990	8,000
272	11-12	Davis D-1-K, 2POLM, Kinner 90 h.p.	925	536	1,461
273	11-13	St. Louis Cardinal C-2, 2PCLM, LeBlond 65 h.p.	929	521	1,450
274	11-14	Rogers RB-X, 4POFbB, Wright R-760 225 h.p.	2,396	1,034	3,430
275	11-13	Mono Aircraft Monocoach 275, 4PCLM, Wright R-760 225 h.p.	1,883	1,217	3,100
276	11-14	Parks P-2-A, 3PCLB, Wright R-540 165 h.p.	1,483	897	2,380

A.T.C. No.	Date Issued	Airplane	Weight Empty	Useful Load	Gross Weight
	1928				
84	11-10	Consolidated Model 14, 2POLB, Warner 110 h.p...	976	554	1,530
	1929				
6	7-10	Douglas M-4, 3POLB, Liberty 12 400 h.p.			
		Small wings...	3,405	1,495	4,900
		Large wings...	3,580	2,195	5,775
27	7- 6	Boeing 40-B, 3PCLB, Hornet 525 h.p.....	3,714	2,365	6,079
73	10-30	Spartan C-3-120, 3POLB, Walter 120 h.p.....	1,310	840	2,150
85	5-13	Hamilton H-45, 8PCLM, Wasp 450 h.p.....	3,639	2,111	5,750
92	4- 4	Pitcairn PA-6, 1-3POLB, Wright J-5 220 h.p.....	1,892	1,158	3,050
93	9- 5	Lockheed Vega, 5-PCL-SM, Wasp 450 h.p.			
		Landplane..	2,492	1,541	4,033
		(Edo Floats) Seaplane....	2,977	1,721	4,698
94	4-26	Hamilton H-47, 8PCLM, Hornet 525 h.p.....	3,699	2,051	5,750
96	4- 4	Fokker FX-A, 14PCLM, 3 Wasps @ 450 h.p.....	7,780	5,320	13,100
103	7-26	Curtiss Falcon Mail Plane, 1POLB, Liberty 12A 400 h.p.	3,341	1,924	5,265
106	8-15	Boeing Model 95, 1-POLB, Hornet 525 h.p.....	3,196	2,644	5,840
		(With 25 gals. extra fuel)..	3,222	2,618	5,840
117	3- 7	General Aristocrat 102-A, 3PCLM, Warner 110 h.p.	1,327	783	2,110
129	10-11	Bellanca CH-300 Pacemaker, 6PCL-SM, R-975 300 h.p. .....Landplane..	2,275	1,800	4,075
		Landplane with extra tank..	2,387	1,913	4,300
		Seaplane....	2,810	1,800	4,610
		Seaplane with extra tank..	2,922	1,913	4,835
130	7-16	Travel Air S-6000-B, 6PCL-SM, Wright R-975 300 h.p. .....Landplane..	2,608	1,622	4,230
		(Edo K Floats) Seaplane....	3,030	1,590	4,620
131	10-25	Fleet 2, 2POL-SB, Kinner 90 h.p.....Landplane..	1,010	565	1,575
		With Belly Tank..	1,063	757	1,820
		Seaplane....	1,183	543	1,726
		With Belly Tank..	1,223	728	1,951
133	6-21	Boeing Model 100, 1POLB, Wasp 450 h.p.....	1,882	817	2,699
134	9-11	Bourdon B-2, 3POLB, SH-14 113 h.p.....	1,139	760	1,899
161	11- 5	Stinson SM-2-AB, 4PCLM, Wright J-5, 220 h.p...	2,169	1,031	3,200
177	9-11	Cunningham-Hall PT-6, 6PCLB, Wright R-975 300 h.p.	2,680	1,670	4,350
		With Single Controls..	2,670	1,680	4,350
179	11-11	Parks P-1, 3POLB, OX-5 90 h.p.....	1,331	747	2,078
188	10- 3	Travel Air E-4000, 3POLB, Wright R-540 165 h.p..	1,695	1,007	2,702
193	10-23	Curtiss Condor CO, 21PCLB, Geared Conqueror 600 h.p.....11,574		6,326	17,900
194	11-15	Stinson SM-2AC 4PCLM Wright R-760 225 h.p....	2,091	1,126	3,217
		SM-2ACS, 4PCSM, Wright R-760 225 h.p....	2,396	1,126	3,522
195	10-30	Spartan C3-165, 3POLB, Wright R-540 165 h.p....	1,617	968	2,585
		(Without Fuselage Tank)..	1,600	878	2,478
196	11- 7	Pitcairn PA-7, 3POLB, Wright R-760 225 h.p.....	1,820	1,200	3,020
200	11-11	Parks P-2, 3POLB, Axelson 115 h.p.....	1,458	860	2,318
220	10-21	Curtiss-Robertson Robin J-1, 3PCL-SM, Wright R-540 165 h.p.....Landplane..	1,625	898	2,523
		Seaplane....	1,790	870	2,660
279		Lincoln Aircraft Co. Model PT, 2POLB (Kinner 90)	1,176	591	1,767
280		Travel Air, 4PT, 3POLB (A.C.E. La-1, 140).....	1,531	857	2,388
281		Fokker, F-32, 32PCLM (4 P&W 425).....14,206		8,294	22,500
282		American Eagle R-540, 3POLB (Wright 165).....	1,759	801	2,560

AIRCRAFT APPROVED FOR LICENSE WITHOUT APPROVED TYPE CERTIFICATES

Dec. 31, 1929

Memo No.	Date Approved	Airplane	Gross Weight	Mfrs. Nos.
2- 1	1- 1-29	Alexander A-7, 3POLB, SH-12 128 h.p.....	2,500	451
2- 2	5- 7-29	Fokker FX, 14PCLM, 3 Wasps @ 450 h.p...12,500		1000-1004
2- 3	5-22-29	Fokker Super-Universal, 4PCLM, Wasp 450 h.p.	4,500	800-801
2- 4	10-22-28	Boeing 80, 14PCLB, 3 Wasps @ 450 h.p.....15,660		1030-1033
2- 5	6- 1-28	Breese 5, 5PCLM, Wright J5 220 h.p.....	3,100	All
2- 6	3- 1-29	Buhl Army Training, 2POLB, Wright J5 220 h.p.	2,583	One only

Memo No.	Date Approved	Airplane	Gross Weight	Mfrs. Nos.
2- 7	12-16-28	Cessna, 4PCLM, Wright J5 220 h.p.	2,435	113, 116, 117, 118, 120, 121, 125, 135, 138, 142, 143, 144, 147
2- 8	1- 5-29	Cessna, 4PCLM, SH-12 128 h.p.	2,260	All
2- 9	9-25-28	Stout (Ford) 4-AT-A, 14PCLM, 3 Wright J5's @ 220 h.p.	9,300	1-14
2- 10		Superseded by A.T.C. No. 87.		
2- 11	10-27-28	Stout (Ford) 4-AT-C, 14PCLM, 2 Wright J5's @ 220 h.p.; 1 Wasp @ 450 h.p.	10,000	47
2- 12	2-16-29	Stout (Ford) 5-AT-B, 14PCLM, 3 Wasps @ 450 h.p.	12,650	4 and up if built for NAT or TAT
2- 13	8-27-28	Hamilton 43, 8PCLM, Wasp 450 h.p.	6,000	One only
2- 14		Superseded by A.T.C. No. 94.		
2- 15	3- 1-29	International F-18, 5PCLB, Wright J5 220 h.p.	4,000	11-12
2- 16	11-16-28	Ireland N-2, 5POAmB, Wright J5 220 h.p.	3,620	16 and up
2- 17	8-27-28	Laird LCB, 3POLB, Wright J5 220 h.p.	2,850	Mfg. before Oct. 1, 1928
2- 18	7-18-28	Mahoney-Ryan B-1, 5PCL-SM, Wright J5 220 h.p. (Fairchild floats)	3,300	61
2- 19	9-22-28	Metal Aircraft G-1, 5PCLM, Wasp 450 h.p.	5,000	1
2- 20	11- 1-27	Pitcairn PA-3, 3POLB, OX5 90 h.p.	1,965	All
2- 21	11- 1-27	Pitcairn PA-4, 3POLB, OX5 90 h.p.	1,880	All
2- 22		Superseded by A.T.C. No. 92.		
2- 23	6-15-28	Sikorsky UN-4 Wing on JN-4D, 2POLM, OX5 90 h.p.	2,100	All
2- 24	10-24-28	Stinson SM-1B, 6PCLM, Wright J5 220 h.p.	3,485	All
2- 25	7- 6-28	Travel Air Smith Incubator, 3POLB, Anzani 120 h.p.	2,180	277
2- 26	6-14-28	Travel Air Huff-Daland, 3POLB, OX5 90 h.p.	2,180	501-502
2- 27	2-23-29	Travel Air 5000, 5PCLM, Wright J5 220 h.p.	3,600	Only relicensing
2- 28		Superseded by A.T.C. No. 109.		
2- 29	12- 1-28	Thaden T-1, 7PCLM, Wasp 450 h.p.	5,320	All
2- 30	12-21-28	Boeing 40-B Modified, 4POLB, Hornet 525 h.p.	6,079	1095
2- 31		Superseded by A.T.C. No. 103.		
2- 32	2- 7-29	Stout (Ford) 5-AT-A, 14PCLM, 3 Wasps @ 450 h.p.	12,150	1-3
2- 33	1-12-29	Brunner-Winkle Bird-A, 3POLB, OX5 90 h.p.	2,150	1000-1008
2- 34	1- 4-29	Fokker F-7, 10PCLM, Hornet 525 h.p.	7,553	617
2- 35	2-16-29	Travel Air, W-4000, 3POLB, Warner 110 h.p.	2,276	All
2- 36	12-17-28	Sikorsky S-38-AH, 6PCAmB, 2 Hornets @ 525 h.p.	10,480	14-6
2- 37	2- 2-29	Curtiss Falcon Cargo, 2POLB, D-12-D 435 h.p.	4,658	3 and 5
2- 38	1-19-29	New Standard D-24, 5POLB, Hisso 180 h.p.	3,400	101, 102, 104
2- 39	2-25-29	Air Associates Avro Avian, 2POLB, Cirrus 85 h.p.	1,450	135-143, 157, 166, 186-190, 194-197, 242-281
2- 40	2- 2-29	Fairchild FC-2C, 5PCLM, Curtiss C-6A 160 h.p.	3,300	57, 58, 87, 89
2- 41	8- 2-29	Moth (British), 2POLB, DH Gypsy, 85 h.p.	1,650	341, 814, 885, 886, 910-913, 924-926, 978-980, 1044, 1063, 1064, 2A-6A
2- 42	2-16-29	Travel Air 2000, 3POSB, OX5 90 h.p. (Edo Floats)	2,351	280
	1929			
2- 43	2-21	Boeing 64 Navy Training, 2POLB, Wright J5 220 h.p.	2,735	Two only
2- 44	2-23	Kreider-Reisner C-5, 3POLB, Warner 110 h.p.	1,255	179, 181, 255
2- 45	3- 1	Douglass M-4, 3POLB, Hornet 525 h.p.		314
2- 46	6-28	Buhl CA-8, 6PCLB, Wasp 450 h.p.	6,100	34 and 39
2- 47	3-23	Aeromarine-Klemm L-25-A, 2POLM, Salmson AD9 40 h.p.	1,325	1, 2, 4
2- 48	3-19	American Eagle A-1, 3POLB, SH-12 128 h.p.	1,960	150
2- 49	3-22	Butler Black Hawk, 3POLB, Wright J5 220 h.p.	2,859	103
2- 50	3-26	Mahoney-Ryan B-3, 5PCLM, Wright R-975 300 h.p.	3,704	184-186
2- 51	5- 2	Buhl CA-6 Special, 4PCLB, Wright R-975 300 h.p.	4,050	43

Memo No.	Date Approved 1929	Airplane	Gross Weight	Mfrs. Nos.
2- 52	3-28	Bellanca CH-300, 6PCLM, Wright R-975 300 h.p.	4,050	129
2- 53	3-29	Stearman C2-K, 3POLB, SH-12 128 h.p.	2,400	117
2- 54	3-30	Keystone K-47-A, 11PCLB, 3 Wright J5's @ 220 h.p.	10,600	137
2- 55	4-15	American Eagle "A," 3POLB, Hisso 150-180 h.p.	2,463	103, 168, 171, 181, 200, 206, 230, 240, 255-259, 276, 286, 290, 291, 297, 313, 315, 392
2- 56	4- 1	Bourdon B-2, 3POLB, SH-14 105 h.p.	1,950	2-7
2- 57	6-12	International F-17-H, 3POLB, Hisso 150-180 h.p.	2,706	34-68
2- 58	4-12	Stearman C3-L, 3POLB, Comet 130 h.p.	2,525	169
2- 59	7- 9	Curtiss Fledgling, 2POLB, Challenger 170 h.p. (Convertible military planes permissible gr. wt. 2,701).	2,686	1 and up and B1 and up
2- 60	4-13	Stinson SM-1D, 6PCLM, Wright R-975 300 h.p.	4,300	300-307
2- 61	4-19	Crown B-3, 2POLB, Kinner 90 h.p.	1,800	37
2- 62	7-31	Metal Aircraft G2-W Flamingo, 8PCLM, Wasp 450 h.p.	5,800	4-11
2- 63	5-14	Metal Aircraft G-2 Flamingo, 6PCLM, Wasp 450 h.p.	5,718	2
2- 64	6-10	Boeing 40-B Modified 5PCLB, Hornet 525 h.p.	6,075	All
2- 65	6-24	Moth (American) 60-G, 2POLB, DH Gypsy 85 h.p.	1,550	1a, 1b, 1c, etc.
2- 66	5-13	Lincoln 3-A, 3POLB, Hisso 150 h.p.	2,718	250 and up
2- 67	5-13	Metal Aircraft G2-H, 6PCLM, Hornet 525 h.p.	5,890	3
2- 68	5-15	Sikorsky S-38-B Special, 11PCAmB, 2 Wasps @ 450 h.p.	10,480	114-7—114-8
2- 69	6-16	Sikorsky S-38-B Special, 4PCAmB, 2 Wasps @ 450 h.p.	10,480	114-9
2- 70	5-22	Stearman C3-K, 3POLB, SH-14 128 h.p.	2,400	109
2- 71	5-31	Curtiss Falcon, 2POLB, Conqueror 600 h.p.	4,560	6
2- 72	7-24	Buhl CA-3D Special, 4PCLB, Wright R-975 300 h.p.	3,200	45 and up
2- 73	5-31	Stinson SM-2AA, 4PCLM, Wright R-540 165 h.p.	3,152	1046-1055
2- 74	6- 4	Sikorsky S-38-B, Special, 6PCAmB 2 Wasps @ 450 h.p.	10,480	114-14
2- 75	6-12	Metal Aircraft G2-H, 8PCLM, Hornet 525 h.p.	6,000	9 and up
2- 76	6-11	Travel Air A-6000-A Overland Airway, 7PCLM, Wasp 450 h.p.	5,500	1,078
2- 77	6-14	Spartan C3-3, 3POLB, Challenger 170 h.p.	2,606	101 and up
2- 78	6-14	Spartan C3-4, 3POLB, Axelson 115 h.p.	2,486	101 and up
2- 79	6-14	Spartan C3-5, 3POLB, Wright R-540, 165 h.p.	2,587	101 and up
2- 80	6-14	Stout (Ford) 6-AT-S Special, 2PCSM, 3 Wright (Brewster floats) R-975's @ 300 h.p.	12,500	6-ATS-1
2- 81	6-18	Kari-Keen Coupe, 2PCLM, Velie 55 h.p.	1,400	210 and up
2- 82	6-27	Moth (American) 60-GM, 2POLB, DH Gypsy 85 h.p.	1,650	1C and up and 41 and up
2- 83	6-21	Boeing 100 Special, 2POLB, Wasp 450 h.p.	2,694	1094
2- 84	7- 2	Travel Air D-4000, 3POLB, Wright J5 220 h.p.	2,650	690 and up
2- 85	6-24	Keystone K-78, 20PCLM, 3 Cyclones @ 525 h.p.	15,000	186
2- 86	6-28	Fairchild 51, 5PCLM, Wright R-975 300 h.p.	4,000	FC-2's under ATC 10 after reworking at factory
2- 87	7- 1	Aeromarine-Klemm, AKL-25, 2POSM, Salmson AD9 40 h.p. (Edo floats)	1,490	2 and up
2- 88	7-17	Doyle O-2, 2POLM, LeBlond 60 65 h.p.	1,321	A-8—A-14
2- 89	7- 3	Stinson SM-6B, 7PCLM, Wasp 450 h.p.	5,000	2000-2001
2- 90	8- 7	Mono Aircraft Monoprep, 2POLM, Velie 55 h.p.	1,360	6004-6006, 6013-6017, 6050 up
2- 91	7- 8	Curtiss-Robertson "C" Robin Special, 3PCLM, Challenger 170 h.p.	2,440	180 and 210
2- 92	7-15	St. Louis Cardinal C-2, 2PCLM, LeBlond 60 65 h.p.	1,450	103 and up (without dual controls)
2- 93	7-17	Laird LCA-A, 6PCLB, Wasp 450 h.p.	5,338	163

Memo No.	Date Approved 1929	Airplane	Gross Weight	Mfrs. Nos.
2- 94	7-22	Kreutzer K-2, 6PCLM, 2 LeBlond 60's @ 65 h.p.; 1 LeBlond 90 @ 90 h.p.	4,445	104
2- 95		Pending.		
2- 96	8- 2	American Aeronautical Savoia Marchetti S-56, 2POAmB, Kinner 90 h.p.	1,870	50603
2- 97	7-23	Stout (Ford) 6-AT, 16PCLM, 3 Wright R-975's @ 300 h.p.	12,176	3 and up
2- 98	7-27	Bach 3-CT-5, 10PCLM, 2 Comets @ 130 h.p.; 1 Wasp @ 450 h.p.	8,000	2
2- 99	7-24	Parks P-2, 3POLB, Axelson 115 h.p.	2,318	2951 and up
2-100	7-27	International F-17, 3POLB, OX5 90 h.p. or OXX6 102 h.p.	2,356	40-100
2-101	7-26	Waco 220, 3POLB, Wright J5 220 h.p.	2,310	A1:7 and up
2-102	7-30	Waco 220, 3POSB, Wright J5 220 h.p. (Edo DeLuxe Floats)	2,660	818
2-103	7-31	Alexander A-14, 3POLB, Wright R-540 165 h.p.	2,588	849 and up
2-104	7-31	Bach 3-CT-S, 9PCLM, 2 Wright J5's @ 220 h.p.; 1 Wasp @ 450 h.p.	8,000	8
2-105	7-31	Mahoney-Ryan B-3A, 6PCLM, Wright J5 220 h.p.	3,700	210 and up
2-106	8- 9	Rearwin 2000-C, 3POLB, Challenger 170 h.p.	2,380	101 and up
2-107	8-12	Golden Eagle Chief, 2POLM, LeBlond 90 90 h.p.	1,480	803 and up
2-108	8-15	Atlantic Coast F5-L, 14PCSB, 2 Liberty's @ 400 h.p.	13,600	1-5
2-109	8-16	Mono Aircraft Monocoach, 4PCLM, Wright J5 220 h.p.	3,092	5002-5007
2-110	8-16	Arrow Sport, 2POLB, Kinner 90 90 h.p.	1,529	412 and up
2-111	8-22	Aeromarine-Klemm AKL-26 Special, 2POSM, LeBlond 60 65 h.p.	1,590	2-32 and up
2-112	8-23	Fleet Model 3, 2POLB, Wright R-540 165 h.p.	2,000	166
2-113	8-27	Viking (Schreck) 17-HT-4, 4POFbB, Hisso 180 h.p.	3,303	133
2-114	8-27	Taylor Chummy B-2, 2POLM, Kinner 90 90 h.p.	1,643	9 and up
2-115	8-29	Moth 60-GM, 2POSB, DH Gypsy 85 h.p.	1,640	49 and up
2-116	9- 4	Loening Gorst Planes C-2-C, 9PCAmB, Cyclone 525 h.p.	6,135	216 and 232
2-117	9- 6	Command-Aire 5C-3C, 3POLB, Wright R-540 165 h.p.	2,490	W-92
2-118	9- 6	Avileo Liore et Olivier Le'O 180, 2PCFbM, Salmson 9Ac 180 h.p.	2,165	2 and 3
2-119	9- 6	Davis V-3, 2POLM, LeBlond 65 h.p.	1,328	101-123
2-120	9- 6	Mono Aircraft Monocoupe 113 Special, 2PCLM, Warner 110 h.p.	1,650	321
2-121	9- 6	American Eagle Phaeton, 3POLB, Wright R-760, 225 h.p.	2,789	550
2-122	9- 6	Curtiss Kingbird C, 7PCLM, 2 Challengers @ 170 h.p.	5,600	1
2-123	9- 7	American Eagle Phaeton R-540, 3POLB, Wright R-540 165 h.p.	2,609	550 and up
2-124	9- 7	Stearman C3-B, 2POSB, Wright J5 220 h.p. (Edo Floats)	2,660	245
2-125	9- 7	Hamilton H-47, 7PCSM, Hornet 525 h.p.	6,375	58
2-126		Superseded by A.T.C. No. 235.		
2-127	9-10	Fairchild 42, 4PCLM, Wright R-975 300 h.p.	4,300	1-3
2-128	9-10	Mono Aircraft Monoprep, 2POLM, Velie 55 h.p.	1,288	6050-6055
2-129	2-28	Hamilton H-47, 8PCLM, Cyclone 525 h.p.	5,750	All
2-130	9-23	Stout Dornier Superwal Do R Cas, 29PCFbM, 4 Hornets @ 525 h.p.	31,150	189 and 191
2-131	9-26	Courier PB-1, 3PCLM, Kinner 90 h.p.	2,095	100
2-132	9-26	Curtiss-Robertson Robin Hisso, 3PCLM, Hisso 150 h.p.	2,560	112
2-133	10- 4	Buhl CA6 Special No. 48, 4PCLB, P&W Wasp 450 h.p.	4,200	48
2-134	10- 4	Mono Aircraft Monosport 1, 2PCLM, Warner 110 h.p.	1,650	2000-2001, 2002, 2005
2-135	10- 4	Mono Aircraft Monosport 2, 2PCLM, Kinner 90 h.p.	1,650	2003 and 2004
2-136	10- 4	Stinson SM-2, 3PCLM, Kinner 90 h.p.	2,500	1029, 1033, 1037
2-137	10- 4	Command-Aire 3C3A, 3POSB, Warner 110 h.p. (Edo DeLuxe Floats)	2,305	W-79

Memo No.	Date Approved 1929	Airplane	Gross Weight	Mfrs. Nos.
2-138	10- 5	Travel Air 6000-B, 7PCLM, Wright R-975 300 h.p.	4,230	All
2-139	10- 9	Boeing Model 203, 3POLB, Axelson 115 h.p.	2,708	1137
2-140	10- 9	Corman 3000, 7PCLM, 3 Wright J-5's @ 220 h.p.	7,652	2
2-141	10-21	Thunderbird W-14, 3POLB, OX-5 90 h.p.	2,361	284
2-142	10-23	Stinson SM-1D Special, 4PCLM, Wright J5 220 h.p.	4,500	All
2-143	10-23	Stinson SM-2AC, 4PCSM, Wright R-760 225 h.p. (Edo P2 Modified Floats)	3,522	1093
2-144	10-30	Monarch "A," 3POLB, OX-5 90 h.p.	2,150	6 and up
2-145	11- 1	Coffman "A," 3PCLM, OX-5 90 h.p.	2,132	3 and 100-110
2-146	11- 1	Mono Aircraft Monocoupe, 2PCLM, Genet 80 h.p.	1,362	317
2-147	11- 2	Boeing 81-B, 2POLB, Axelson 115 h.p.	2,230	1037
2-148	11-15	Davis D-1-K, 2POLM, Kinner 90 h.p.	1,476	501
2-149	11-14	Stearman M-2 Special, 2POLB, Hornet 525 h.p.	5,558	1007
2-150	11-14	Moth 60-X, 2POLB, Cirrus Mark II 76 h.p.	1,402	547 and 626
2-151	11-15	Aircraft Industries Sierra BLW-2, 3PCLM, Comet 130 h.p.	2,131	2 and up
2-152	11-15	Fleet 5, 2POLB, Brownback C-400 90 h.p.	1,620	206 and up
2-153	11-18	Travel Air 6000-B Special, 4PCLM, Wright R-975 300 h.p.	4,230	6-B-2028
2-154	11-20	Travel Air SBC-4000, 3POSB, Challenger 170 h.p. (Edo "F" Floats)	2,900	1041
2- 39	10-11	Air Associates (A. V. Roe & Co.) Avian, 2POLB, A.D.C. Cirrus Mark III A 86 h.p.	1,450	135-143, 147, 157, 166, 169, 186-190, 194-197, 242-281
2- 60	11- 7	Stinson SM-1D-300, 6PCLM, Wright R-975 300 h.p.	4,300	300-307
2- 61		Superseded by A.T.C. No. 199.		
2- 65	11- 4	Moth 60-G, 2POLB, DH Gypsy 85 h.p. (American)	1,550	1a and 1b
2- 66	9- 5	Lincoln 3-A, 3POLB, Hisso 150-180 h.p.	2,718	250 and up
2- 76	11-14	Travel Air A6000A, 7PCLM, Wasp 450 h.p.	5,500	840, 892, 963, 1078, 2003
2- 80	11- 8	Ford 6-ATS (Special), 12PCSM, 3 Wright R-975's @ 300 h.p. (Brewster Floats)	12,500	6-ATS-1
2- 82		Superseded by A.T.C. No. 197.		
2- 90	10-15	Mono Aircraft Monoprep, 2POLM, Velie 55 h.p.	1,360	6004, 6005, 6006, 6013-6017, 6021, 6025-6035
2- 92		Superseded by A.T.C. No. 273.		
2- 95	10-26	American Aeronautical Savoia Marchetti S-56, 2POAmB, Kinner 90 h.p.	2,100	2-20
2- 99		Superseded by A.T.C. No. 200.		
2-102	11-16	Waco 10, 3POSB, Wright J-5 220 h.p. (Edo DeLuxe Floats)	2,660	All
2-124	11- 2	Stearman C3B, 3POSB, Wright J-5 220 h.p. (Edo P Floats)	2,850	245

ENGINES HAVING APPROVED TYPE CERTIFICATES

Dec. 31, 1929

KEY: 4—number of cylinders; R—radial (arrangement); V—vee (arrangement); L—in line (arrangement); I—inverted; A—air cooled; W—water cooled; G—gear drive.

A.T.C. No.	Date	Description		Rated H.P.	Rated R.P.M.
1.	6- 1-28	Fairchild Caminez 447-C	4RA	120	960
2.	4- 2-28	Warner Scarab	7RA	110	1850
3.	6-18-28	Kinner K-5	5RA	90	1810
4.	6-22-28	Velie	5RA	55	1815
5.	7-26-28	Curtiss Challenger R-600	6RA	170	18
6.	8-31-28	Curtiss Conqueror V-1550	12VW	600	2400
7.	9-13-28	Curtiss Conqueror GV-1570	12VW-geared	600	2400
8.	9-13-28	Curtiss Chieftain H-1640	12RA	600	2200

A.T.C. No.	Date	Description		Rated H.P.	Rated R.P.M.
9.	9-19-28	Aircraft Comet	7RA	130	1825
10.	10-11-28	Curtiss D-12	12VW	435	2300
11.	4- 4-29	Dayton Bear	4LA	100	1500
12.	11-30-28	LeBlond 60	5RA	65	1950
13.	1-26-29	Wright J-5 Whirlwind	9RA	220	2000
14.	1-22-29	Pratt & Whitney Wasp	9RA	450	2100
15.	12-19-28	Pratt & Whitney Hornet	9RA	525	1900
16.	2- 5-29	Axelson Axelson	7RA	115	1800
17.	1-26-29	Wright Cyclone R-1750-A	9RA	525	1900
18.	1-26-29	Packard 3A-1500 Direct	12VW	525	2100
19.	1-26-29	Packard 3A-2500 Direct	12VW	800	2000
20.	2- 6-29	LeBlond 90	7RA	90	1975
21.	2-15-29	Wright J-6 R-975	9RA	300	2000
22.	3-11-29	Arnold Harris	8VW	90	1400
23.	3-27-29	Wright J-6 R-540	5RA	165	2000
24.	6- 3-29	Alliance Hess Warrior	7RA	115	1925
25.	6- 8-29	Michigan Rover	4LAI	55	1900
26.	7- 9-29	Wright J-6 R-760	7RA	225	2000
27.	8-14-29	Lycoming R-645	9RA	185	2000
28.	8-30-29	Pratt & Whitney Hornet R-1860, Series B	9RA	575	1950
29.	8-30-29	Pratt & Whitney Hornet R-1690-A, Geared 2:1	9RA	500	1900
30.	9-13-29	American Cirrus Mark III	4LA	90	2100
31.	9-23-29	Aircraft Engines LA-1 A.C.E.	7RA	140	1800
32.	10- 5-29	Continental A-70	7RA	105	2000
33.	11-16-29	Brownback C-400	6RA	90	1700
34.	11-14-29	Kimball Beetle K	7RA	120	1850

PROPELLERS HAVING APPROVED TYPE CERTIFICATES

Dec. 31, 1929

KEY: W—Wood; A—Aluminum alloy; S—Steel; C—Special non-metallic composition.

A.T.C. No.	Date Issued	Propeller	M'f'l	Diameter	Pitch	H.P. R.P.M.
1.	9- 6-28	Standard Steel No. 1609	A	8′ 6″	Adj.	100 @ 1,800
2.	9- 7-28	Paragon Monoid	C	8′ 8″	5′ 5⅜″	100 @ 1,600
3.	1-23-29	Hamilton H-1207	A	9′ 0″	Adj.	330 @ 2,000
4.	12-14-28	Hamilton H-1407	A	9′10″	Adj.	500 @ 2,000
5.	12-14-28	Hamilton H-1409	A	10′ 1″	Adj.	490 @ 2,000
6.	3-14-29	Westinghouse Micarta	C	8′10″	6′ 6¼″	250 @ 2,000
7.	3-14-29	Westinghouse Micarta	C	8′ 6″	5′ 8¼″	100 @ 1,400
8.	3-18-29	Supreme No. 750	W	8′ 6″	5′ 6″	100 @ 1,400
9.	4-22-29	American No. 1	W	8′ 5⅞″	5′ 3″	90 @ 1,400
10.	10-19-28	Dakota Fahlin	W	8′ 4″	5′ 3″	100 @ 1,400
	1929					
11.	3-30	Dakota Fahlin D-5000	W	7′ 0″	3′ 8″	55 @ 1,815
12.	4-22	American No. 12	W	8′ 9½″	5′ 6″	180 @ 1,800
13.	4-24	Paragon No. 60-A	W	8′ 8″	5′ 0″	90 @ 1,400
14.	4-24	Paragon No. 60-B	W	8′ 0″	4′6″ to 5′0″	120 @ 2,000
15.	5-11	Hamilton H-403	W	6′ 0″	4′ 9⅝″	65 @ 1,950
16.	5-22	Master No. 103	W	8′ 6″	5′ 4″	90 @ 1,400
17.	6-10	Standard Steel No. 6001	A	9′ 0″	Adj.	220 @ 2,000
18.	6-13	Hamilton HB-1215—H-5149-A	A	9′ 0″	Adj.	225 @ 2,000
19.	6-13	Hamilton HB-1215—H-5153-A	A	9′ 0″	Adj.	170 @ 1,800
20.	6-13	Hamilton HB-1215—H-5090	A	9′ 0″	Adj.	220 @ 2,000
21.	6-13	Hamilton HB-1301—H-5144	A	9′ 3″	Adj.	525 @ 1,900
22.	6-13	Hamilton HB-1311—H-5149-A	A	8′ 6″	Adj.	450 @ 2,100
23.	6-13	Hamilton HB-1501—H-5149-A	A	10′ 6″	Adj.	450 @ 2,100
24.	6-13	Hamilton HB-1501—H-5144	A	10′ 6″	Adj.	525 @ 1,900
25.	6-13	Hamilton HB-1503—P&W	A	10′ 6″	Adj.	525 @ 1,900
26.	6-13	Hamilton HB-1506—P&W	A	12′ 0″	Adj.	525 @ 950
27.	6-13	Hamilton HB-1511—P&W	A	12′ 6″	Adj.	525 @ 950
28.	6-13	Hamilton HB-1301—H-5149-A	A	9′ 3″	Adj.	450 @ 2,100
29.	7- 1	Hartzell No. 368	W	8′ 6″	5′ 0″	90 @ 1,400
30.	7- 1	Hartzell No. 50	W	8′ 6″	5′ 4″	220 @ 2,000
31.	7- 2	Standard Steel 1A1-O	A	10′ 0″	Adj.	700 @ 2,500
32.	7- 2	Standard Steel 1A1-2	A	9′10″	Adj.	690 @ 2,500
33.	7- 2	Standard Steel 1A1-4	A	9′ 8″	Adj.	680 @ 2,500
34.	7- 2	Standard Steel 1A1-4A	A	9′ 8″	Adj.	680 @ 2,500
35.	7- 2	Standard Steel 1A1-4B	A	9′ 8″	Adj.	680 @ 2,500
36.	7- 2	Standard Steel 1A1-6	A	9′ 6″	Adj.	675 @ 2,500

A.T.C. No.	Date Issued 1929	Propeller	M't'l	Diameter	Pitch	H.P. R.P.M.
37.	7- 2	Standard Steel 1A1-6A	A	9′ 6″	Adj.	675 @ 2,500
38.	7- 2	Standard Steel 1A1-6B	A	9′ 6″	Adj.	675 @ 2,500
39.	7- 2	Standard Steel 1A1-6½	A	9′ 5½″	Adj.	670 @ 2,500
40.	7- 2	Standard Steel 1A1-8	A	9′ 4″	Adj.	665 @ 2,500
41.	7- 2	Standard Steel 1A1-9	A	9′ 3″	Adj.	660 @ 2,500
42.	7- 2	Standard Steel 1A1-10	A	9′ 2″	Adj.	655 @ 2,500
43.	7- 2	Standard Steel 1A1-12	A	9′ 0″	Adj.	650 @ 2,500
44.	7- 2	Standard Steel 1A1-12A	A	9′ 0″	Adj.	650 @ 2,500
45.	7- 2	Standard Steel 1A1-18	A	8′ 6″	Adj.	620 @ 2,500
46.	7- 2	Standard Steel 1A1-22	A	8′ 2″	Adj.	605 @ 2,500
47.	7- 2	Standard Steel 1A1-24	A	8′ 0″	Adj.	600 @ 2,500
48.	7- 2	Standard Steel 1A1½-O	A	10′ 0″	Adj.	700 @ 2,500
49.	7-11	Standard Steel 3A1-O	A	10′ 0″	Adj.	700 @ 2,500
50.	7-11	Standard Steel 3A1-4	A	9′ 8″	Adj.	680 @ 2,500
51.	7-11	Standard Steel 3A1-6	A	9′ 6″	Adj.	675 @ 2,500
52.	7-11	Standard Steel 3A1-8	A	9′ 4″	Adj.	665 @ 2,500
53.	7-11	Standard Steel 3A1-9	A	9′ 3″	Adj.	660 @ 2,500
54.	7-11	Standard Steel 3A1-12	A	9′ 0″	Adj.	650 @ 2,500
55.	7-11	Standard Steel 3A1-20	A	8′ 4″	Adj.	610 @ 2,500
56.	7-11	Standard Steel 3A1-24	A	8′ 0″	Adj.	600 @ 2,500
57.	7-16	Standard Steel 5B1-0	A	9′ 0″	Adj.	250 @ 2,400
58.	7-16	Standard Steel 5B1-1	A	8′11″	Adj.	250 @ 2,400
59.	7-16	Standard Steel 5B1-2	A	8′10″	Adj.	245 @ 2,400
60.	7-16	Standard Steel 5B1-3	A	8′ 9″	Adj.	245 @ 2,400
61.	7-16	Standard Steel 5B1-4	A	8′ 8″	Adj.	240 @ 2,400
62.	7-16	Standard Steel 5B1-6	A	8′ 6″	Adj.	235 @ 2,400
63.	7-16	Standard Steel 5B1-6A	A	8′ 6″	Adj.	235 @ 2,400
64.	7-16	Standard Steel 5B1-6B	A	8′ 6″	Adj.	235 @ 2,400
65.	7-16	Standard Steel 5B1-7	A	8′ 5″	Adj.	230 @ 2,400
66.	7-16	Standard Steel 5B1-8	A	8′ 4″	Adj.	230 @ 2,400
67.	7-16	Standard Steel 5B1-10	A	8′ 2″	Adj.	230 @ 2,400
68.	7-16	Standard Steel 5B1-11	A	8′ 1″	Adj.	225 @ 2,400
69.	7-16	Standard Steel 5B1-12	A	8′ 0″	Adj.	225 @ 2,400
70.	7-16	Standard Steel 5B1-14	A	7′10″	Adj.	220 @ 2,400
71.	7-16	Standard Steel 5B1-15	A	7′ 9″	Adj.	215 @ 2,400
72.	7-16	Standard Steel 5B1-24	A	7′ 0″	Adj.	200 @ 2,400
73.	7-16	Standard Steel 7C1-O	A	10′ 9″	Adj.	550 @ 2,200
74.	7-16	Standard Steel 7C1½-O	A	10′ 0″	Adj.	550 @ 2,200
75.	7-16	Standard Steel 7C1-1	A	10′ 8″	Adj.	550 @ 2,200
76.	7-16	Standard Steel 7C1-3	A	10′ 6″	Adj.	540 @ 2,200
77.	7-16	Standard Steel 7C1-5	A	10′ 4″	Adj.	535 @ 2,200
78.	7-16	Standard Steel 7C1-9	A	10′10″	Adj.	530 @ 2,200
79.	7-16	Standard Steel 7C1-15	A	9′ 6″	Adj.	520 @ 2,200
80.	7-16	Standard Steel 7C1-17	A	9′ 4″	Adj.	515 @ 2,200
81.	7-16	Standard Steel 7C1-21	A	9′ 0″	Adj.	505 @ 2,200
82.	7-16	Standard Steel 7C1-23	A	8′ 0″	Adj.	500 @ 2,200
83.	7-16	Standard Steel 7C1-24	A	8′ 9″	Adj.	500 @ 2,200
84.	7-16	Standard Steel 7C1½-3	A	10′ 6″	Adj.	540 @ 2,200
85.	7-16	Standard Steel 7C1½-24	A	8′ 9″	Adj.	500 @ 2,200
86.	7-22	Paragon Engineers 40-F	W	6′ 6″	4.50′	95 @ 2,200
87.	7-22	Paragon Engineers 80-A	W	9′ 0″	5.0′ to 5.50′	325 @ 2,000
88.	8- 1	Gardner No. 567	W	8′ 6″	4.67′	95 @ 1,500
89.	9- 7	Jacuzzi No. 3	W	9′ 0″	5′ 6″	250 @ 2,000
90.	9- 7	Flottorp Standard OX-5	W	8′ 6¼″	5′ 0″	95 @ 1,400
91.	9-12	Standard Steel 9C1½-24	A	8′ 6″	Adj.	510 @ 2,200
92.	9-12	Standard Steel 9C2-6	A	10′ 0″	Adj.	540 @ 2,200
93.	9-12	Standard Steel 9C2-9	A	9′ 9″	Adj.	535 @ 2,200
94.	9-12	Standard Steel 9C2-24	A	8′ 6″	Adj.	500 @ 2,200
95.	9-12	Standard Steel 9C1-2	A	10′ 4″	Adj.	545 @ 2,200
96.	9-12	Standard Steel 9C1-6	A	10′ 0″	Adj.	540 @ 2,200
97.	9-12	Standard Steel 9C1-8	A	9′10″	Adj.	540 @ 2,200
98.	9-12	Standard Steel 9C1-9	A	9′ 9″	Adj.	535 @ 2,200
99.	9-12	Standard Steel 9C1-5½	A	10′ ½″	Adj.	540 @ 2,200
100.	9-20	Standard Steel 5B1-6C	A	8′ 6″	Adj.	235 @ 2,400
101.	9-12	Standard Steel 9C1-12	A	9′ 6″	Adj.	530 @ 2,200
102.	9-12	Standard Steel 9C1-12½	A	9′ 5½″	Adj.	530 @ 2,200
103.	9-12	Standard Steel 9C1-18	A	9′ 0″	Adj.	520 @ 2,200
104.	9-12	Standard Steel 9C1-20	A	8′10″	Adj.	520 @ 2,200
105.	9-12	Standard Steel 9C1-24	A	8′ 6″	Adj.	510 @ 2,200
106.	9-12	Standard Steel 9C1-29	A	8′ 1″	Adj.	500 @ 2,200
107.	9-12	Standard Steel 9C1-30	A	8′ 0″	Adj.	500 @ 2,200
108.	9-20	Standard Steel 9C2-O	A	10′ 6″	Adj.	550 @ 2,200
109.	9-12	Standard Steel 9C1-O	A	10′ 6″	Adj.	550 @ 2,200
110.	9-12	Standard Steel 9C1-OA	A	10′ 6″	Adj.	550 @ 2,200
111.	9-12	Standard Steel 9C1½-O	A	10′ 6″	Adj.	550 @ 2,200

A.T.C. No.	Date Issued 1929	Propeller	M't'l	Diameter	Pitch	H.P. R.P.M.
112.	9-26	Curtiss Curtiss-Reed Type R EX-33505	A	10′ 0″	7′ 9″	525 @ 1,600
113.	9-26	Curtiss Curtiss-Reed Type R EX-33073	A	8′ 9″	6′ 6″	525 @ 2,000
114.	9-26	Curtiss Curtiss-Reed Type R EX-33079	A	9′ 3″	7′ 9″	525 @ 1,775
115.	9-26	Curtiss Curtiss-Reed Type R EX-33525	A	9′ 0″	5′ 6″	575 @ 2,000
116.	9-26	Curtiss Curtiss-Reed Type R EX-32934	A	9′ 0″	5′ 6″	160 @ 1,750
117.	9-26	Curtiss Curtiss-Reed Type R EX-32923	A	8′ 6″	4′ 9″	160 @ 1,750
118.	9-25	Standard Steel 11C1-O	A	9′ 0″	Adj.	325 @ 2,300
119.	9-25	Standard Steel 11C1-2	A	8′10″	Adj.	320 @ 2,300
120.	9-25	Standard Steel 11C1-3	A	8′ 9″	Adj.	315 @ 2,300
121.	9-25	Standard Steel 11C1-4	A	8′ 8″	Adj.	310 @ 2,300
122.	9-25	Standard Steel 11C1-4A	A	8′ 8″	Adj.	310 @ 2,300
123.	9-25	Standard Steel 11C1-6	A	8′ 6″	Adj.	305 @ 2,300
124.	9-25	Standard Steel 11C1-6A	A	8′ 6″	Adj.	305 @ 2,300
125.	9-25	Standard Steel 11C1-8	A	8′ 4″	Adj.	300 @ 2,300
126.	9-25	Standard Steel 11C1-10	A	8′ 2″	Adj.	295 @ 2,300
127.	9-25	Standard Steel 11C1-11	A	8′ 1″	Adj.	290 @ 2,300
128.	9-25	Standard Steel 11C1-12	A	8′ 0″	Adj.	285 @ 2,300
129.	9-25	Standard Steel 11C1-15	A	7′ 9″	Adj.	275 @ 2,300
130.	9-25	Standard Steel 11C1-24	A	7′ 0″	Adj.	250 @ 2,300
131.	10- 2	Standard Steel 11C1-9	A	8′ 3″	Adj.	295 @ 2,300
132.	10-10	Curtiss Curtiss-Reed Type R EX-33570	A	8′10″	5′ 3″	170 @ 1,800
133.	10-24	Aircraft Specialties Gunn Steel	S	8′ 6″	47″ to 64″ at tip	90 @ 1,400
134.	10-24	Aeromarine-Klemm LB (No. 1134).	W	7′ 2½″	6′ ¼″	65 @ 1,650

PONTOONS APPROVED FOR USE ON LICENSED AIRCRAFT

Dec. 31, 1929

Date	Manufacturer	Model	No. per Airplane	Max. Allowable Airplane Weight
5- 9-28	Edo	C	2	2,580
5- 9-28	Edo	DeLuxe	2	2,660
5- 9-28	Edo	E-3	2	4,100
7- 9-28	Hamilton	Series F	2	5,230
7-16-28	Hamilton	Series D	2	3,840
8- 9-28	Fairchild	P-6	2	5,470
1- 8-29	Edo	H	2	1,600
2- 7-29	Brewster	B-5500	2	5,000
5-21-29	Edo	J	2	5,570
5-21-29	Edo	K	2	4,880
7- 1-29	Edo	I	2	1,930
8-13-29	Edo	P (Model 3300)	2	3,450
8-13-29	Edo	Q (Model 3850)	2	4,020
8-29-29	Fairchild	P-4	2	4,680
9-27-29	Fairchild	P-2-B	2	3,730
10-15-29	Edo	L (Model 2262)	2	2,380
10-15-29	Edo	M (Model 2665)	2	2,810

FLYING SCHOOLS GRANTED APPROVED CERTIFICATES BY DEPARTMENT OF COMMERCE

		Ratings for which Approved	Approved Certificate Issued
Airtech Training School Airtech Field San Diego, Calif.	Ground and Flying	Transport Lim. Commercial Private	7-15-29
Standard Flying School 9401 S. Western Ave. Los Angeles, Calif.	Ground and Flying	Transport Lim. Commercial Private	10-26-29 7-15-29

		Ratings for which Approved	*Approved Certificate Issued*
Embry-Riddle Flying School Lunken Airport Cincinnati, Ohio	Ground and Flying	Transport Lim. Commercial Private	7-15-29
Parks Air College, Inc. Parks Airport E. St. Louis, Ill.	Ground and Flying	Transport Lim. Commercial Private	7-15-29
D. W. Flying Service, Inc. Le Roy Airport Le Roy, N. Y.	Ground and Flying	Lim. Commercial	7-15-29
T. C. Ryan Flying Service Ryan Airport 3300 Barnet Ave. San Diego, Calif. In combination with Pacific Technical University 2119 Kettner Blvd. San Diego, Calif.	Ground and Flying	Transport Lim. Commercial Private	7-19-29
Universal Flying School Wold-Chamberlain Field Minneapolis, Minn.	Ground and Flying	Transport Lim. Commercial Private	8-9-29
Curtiss Flying Service Valley Stream Airport Valley Stream, L. I., N. Y. In combination with New York University New York, N. Y.	Ground and Flying	Lim. Commercial Private	8-14-29
Universal Flying School Lambert Field St. Louis, Mo.	Ground and Flying	Transport Lim. Commercial Private	8-19-29
Curtiss Flying Service Grosse Ile Airport Grosse Ile, Mich.	Ground and Flying	Transport Lim. Commercial Private	10-9-29 8-20-29
California Aerial Transport Flying School Municipal Airport Los Angeles, Calif. In combination with Western College of Aeronautics Municipal Airport Los Angeles, Calif.	Ground and Flying	Transport Lim. Commercial Private	8-29-29
Curtiss Flying Service of the Middle West Fairfax Airport Kansas City, Kan.	Ground and Flying	Transport Lim. Commercial Private	9-24-29
Porterfield Flying School Fairfax Airport Kansas City, Mo.	Ground and Flying	Transport Lim. Commercial Private	10-3-29
Von Hoffman Aircraft School Lambert Field Anglum, Mo.	Ground and Flying	Transport Lim. Commercial Private	10-3-29
Curtiss Flying Service Oakland Airport (Flying) Oakland, Calif. 1258 Russ Building San Francisco, Calif. (Ground)	Ground and Flying	Transport Lim. Commercial Private	10-4-29
Curtiss Flying Service of the Middle West, Inc. Curtiss Reynolds Airport Glenview, Ill.	Ground and Flying	Transport Lim. Commercial Private	10-9-29

		Ratings for which Approved	*Approved Certificate Issued*
Boeing School of Aeronautics Oakland Municipal Airport Oakland, Calif.	Ground and Flying	Transport Lim. Commercial Private	10-17-29
Spartan School of Aeronautics Apache Blvd. and Chamberlain Drive Tulsa, Okla.	Ground and Flying	Transport Lim. Commercial Private	10-18-29
Curtiss Flying Service Los Angeles Municipal Airport Inglewood, Calif.	Ground and Flying	Transport Lim. Commercial Private	10-21-29
Roosevelt Aviation School, Inc. Roosevelt Field No. 1 Mineola, L. I., N. Y.	Ground and Flying	Transport Lim. Commercial Private	10-23-29
Universal Aviation School 344 North Exchange St. St. Paul, Minn. In combination with Universal Flying School Wold-Chamberlain Field Minneapolis, Minn.	Ground and Flying	Lim. Commercial Private	10-30-29
Curtiss Flying Service of Indiana Stout Field, Mars Hill Indianapolis, Ind.	Ground and Flying	Lim. Commercial Private	11-7-29
Universal Aviation School Memphis Municipal Airport Memphis, Tenn.	Ground and Flying	Lim. Commercial Private	11-16-29
Curtiss Flying Service of South Memphis Municipal Airport Memphis, Tenn.	Ground and Flying	Lim. Commercial Private	11-16-29
Garland School of Aeronautics 51st and Sheridan Road Tulsa, Okla.	Ground and Flying	Transport Lim. Commercial Private	11-27-29
Wolf Flying Service Williamsport Airport Williamsport, Pa.	Ground and Flying	Private	11-30-29
Penn School of Aviation Pittsburgh-Butler Airport Butler, Pa.	Ground and Flying	Transport Lim. Commercial Private	12-12-29
Art Goebel Aviation Co., Inc. 101 West 12th St. Kansas City, Mo. Liberty Field (Flying) Liberty, Mo.	Ground and Flying	Transport Lim. Commercial	12-27-29
Curtiss Flying Service of Kentucky Bowman Field Louisville, Ky.	Ground and Flying	Lim. Commercial Private	12-27-29
Curtiss Flying Service 208 Richardson Bldg. St. Clair St. Toledo, Ohio. Transcontinental Airport Walbridge, Ohio. (Flying)	Ground and Flying	Lim. Commercial Private	12-27-29
Mamer Flying Service, Inc. 320 Paulsen Bldg. Spokane, Wash. Felts Field (Flying) Spokane, Wash.	Ground and Flying	Transport Lim. Commercial Private	12-27-29

AIRWAY STRIP MAPS

Dec. 31, 1929

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 airway "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, 119 D Street, N. E., 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.
115. Louisville-Cincinnati-Cleveland.
119. Buffalo-Albany.
127. Birmingham-Atlanta.
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.
116. Cleveland-Buffalo.
117. Detroit-Grand Rapids-Milwaukee.
118. Detroit-Buffalo.
120. Albany-Boston.
122. Albany-Montreal.
123. Miami-West Palm Beach-Titusville.
124. Tampa-Titusville.
125. Titusville-Jacksonville.
126. Jacksonville-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. Beaumont-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. 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.
59. 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-418. San Francisco-Humboldt Bay.
V-419. Humboldt Bay-Coos Bay.
V-420. Coos Bay-Astoria.
V-422. Astoria-Vancouver Island.
V-423. Seattle-Alert Bay.
V-424. Alert Bay-Ketchikan.
V-425. Ketchikan-Juneau.

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-421. Columbia River.

AIRPORTS AND LANDING FIELDS IN THE UNITED STATES

Dec. 31, 1929

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, Camp McClellan, Air Corps, auxiliary.
Atmore, Perdido Hills Airport, commercial.
Birmingham, Roberts Field, municipal.
Birmingham, commercial.
Citronelle, commercial.
*Cropwell, intermediate.
Gulfcrest, commercial.
Mobile, Mobile Airport, municipal.
*Monteralla, intermediate.
Montgomery, Maxwell Field, Air Corps.
*Plantersville, intermediate.

Arizona

Ajo, auxiliary.
Ajo, Ajo Airport, municipal.
Apache Pass, auxiliary.
Bellemont, auxiliary.
Benson, municipal.
Casa Grande, municipal.
Chandler, Chandler Airport, municipal.
Cochise, municipal.
Douglas, Douglas International Airport, municipal.
Eloy, municipal.
Flagstaff, municipal.
Fort Huachuca, Army.
Gila Bend, municipal.

Grand Canyon, commercial.
Holbrook, municipal.
Kingman, municipal.
Marana, municipal.
Maricopa, municipal.
Mobile, auxiliary.
Nogales, municipal.
Phoenix, municipal.
†Phoenix, Sky Harbor Airport, commercial.
Phoenix, State Fairgrounds, auxiliary.
Prescott, municipal.
Quartzite, Conner Field, commercial.
Salome, auxiliary.
San Simon, municipal.
Seligman, auxiliary.
Stoval, municipal.
†Tucson, Davis-Monthan Field, municipal.
Tucson, Mayse Field, commercial.
Vail, municipal.
Wellton, auxiliary.
Williams, Webber Field, municipal.
Winslow, Berrigen Field, municipal.
Winslow, race track, auxiliary.
Yuma, fly field, municipal.

Arkansas

Bentonville, municipal.
Conway, commercial.
El Dorado, auxiliary.
Fort Smith, Alexander Airport, 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, Banning Airport, municipal.
Barstow, commercial.
Beresford, commercial.
Big Bear City (see San Bernardino).
Brawley, Brawley Airport, municipal.
Brea, municipal.
Bridgeport, municipal.
Burbank, commercial.
Calexico, Calexico Airport, municipal.
Calipatria, Calipatria Airport, municipal.
Camp Kearney, Army.
Campo, municipal.
Chico, municipal.
Chowchilla, municipal.
*Chowchilla, intermediate.
Chula Vista, Chula Vista Airport, municipal.
Coalinga, municipal.
Concord, municipal.
†Corning, Woodson Airport, commercial.
Corona, auxiliary.
Culver City, commercial.
Delano, auxiliary.
*Earlimart, intermediate.
El Centro, Imperial County Airport, municipal.
El Monte, commercial.
Elsinore, municipal.
Encinitas, auxiliary.
Escondido, Howell Airport, municipal.
Fresno, auxiliary.
Fresno, municipal.
Fullerton, Fullerton Airport, municipal.
†Galt, MacCracken Field, commercial.
Glendale, Grand Central Air Terminal, commercial.
Grass Valley, auxiliary.
Grays Well, municipal.
Hanford, municipal.
*Harvard, intermediate.
†Hawthorne, Kelly Airport, commercial.
Hayward, auxiliary.
*Hesperia, intermediate.
Hollister, commercial.
Imperial (see El Centro).
Indio, commercial.
Jacumba Hot Springs, auxiliary.
Laguna Beach, commercial.
Lancaster, municipal.
Lakeport, municipal.
*Lenwood, intermediate.
*Livermore, intermediate.
*Livingston, intermediate.
†LongBeach, municipal.
Los Angeles, Aero Corporation Field, commercial.
Los Angeles, American Airport, commercial.
Los Angeles, Daugherty Field, commercial.
Los Angeles, Dycer Field, commercial.
Los Angeles, Griffith Park Airport, municipal.
Los Angeles, Kinner Airport, commercial.
†Los Angeles, Los Angeles Airport, municipal.
†Los Angeles, Metropolitan Airport, commercial.
Los Angeles, Rogers Airport, commercial.
Los Angeles, seaplane anchorage, Navy.
Los Angeles, Sperl Aerodrome, commercial.
Los Angeles, Vail Field, commercial.
McKittrick, auxiliary.
Maricopa, municipal.
Marysville, municipal.
Maxwell, auxiliary.
Merced, commercial.
Mineral, commercial.
Modesto, municipal.
*Mohawk, intermediate.
Mojave, commercial.
Montague, Montague Airport, municipal.
Montebello, auxiliary.
Monterey, polo field, auxiliary.
*Mount Shasta, intermediate.
Natoma, auxiliary.
†Oakland, Oakland Airport, municipal.
Ontario, municipal.
Palmdale, municipal.
Palo Alto, commercial.
Parris, auxiliary.
Petaluma, commercial.
Pomona, Burnley Airport, commercial.
Porterville, commercial.
Ramona, auxiliary.
Redding, Benton Field, municipal.
Redwood, commercial.
†Riverside, March Field, Air Corps.
Riverside, Riverside Airport, commercial.
†Sacramento, Mather Field, Air Corps.
Sacramento, municipal.

San Bernardino (Big Bear), Big Bear Airport, commercial.
San Diego, Lindbergh Field, municipal.
San Diego, North Island, Navy.
San Diego, Rockwell Field, Army.
†San Diego, T. C. Ryan Airport, commercial.
San Diego, U. S. Naval Air Station.
San Francisco, Crissy Field, Army.
†San Francisco, Mills Field, municipal.
†San Jose, Alum Rock Airport, municipal.
San Juan, auxiliary.
†San Leandro, San Leandro Airport, commercial.
San Mateo, Johnson Field, commercial.
San Pedro, Allen Field, municipal.
San Simeon, Hearst Ranch Airport, auxiliary.
Santa Ana, Eddie Martins Airport, commercial.
Santa Barbara, Ovington Airport, commercial.
Santa Clara, commercial.
Santa Maria, municipal.
†Santa Monica, Clover Field, municipal.
Santa Rosa, Santa Rosa Airport, municipal.
*Saugus, intermediate.
Seal Beach, commercial.
Sebastapol, municipal.
†Selma, municipal.
Sonora, auxiliary.
†Spadra, W. K. Kellogg Airport, municipal.
†Stockton, municipal.
Stockton, Farris Field, commercial.
Strathmore, Strathmore Airport, municipal.
Taft, Taft Airport, municipal.
Tallac, auxiliary.
Trona, auxiliary.
Truckee, auxiliary.
†Tulare, municipal.
*Turlock, intermediate.
Universal City, commercial.
Venice, municipal.
Ventura, auxiliary.
*Verdemonte, intermediate.
†Visalia, municipal.
Weed, Weed Airport, commercial.
*Westley, intermediate.
Woodland, municipal.
Yreka, Yreka Airport, municipal.
Yuba City, commercial.

Colorado

Canyon City, auxiliary.
*Castle Rock, intermediate.
†Cheyenne, municipal.
†Colorado Springs, Colorado Springs Airport, municipal.
Colorado Springs, Alexander Airport, commercial.
Cortex, auxiliary.
Creede, auxiliary.
DeBeque, Big Four Airport, commercial.
†Denver, Colorado Airways Field, Commercial.
Denver, Lowry Field, National Guard, Air Corps.
Denver, Curtiss Field, commercial.
*Dover, intermediate.
Estes Park, commercial.
Fort Collins, Fort Collins Airport, municipal.
*Fort Lupton, intermediate.
Grand Junction, municipal.
*Greeley, intermediate.
Lamar, municipal.
Leadville, Bingham Field, municipal.
Monte Vista, Monte Vista Airport, municipal.
*Monument, intermediate.
Otis, Otis Airport, municipal.
†Pueblo, Pueblo Airport, municipal.
Trinidad, commercial.
†Wigwam, intermediate.

Connecticut

*Bethany, intermediate.
†Bridgeport, Bridgeport Airport, commercial.
Danbury, municipal.
†Hartford, Brainard Field, municipal.
Meriden, municipal.
New London, auxiliary.
New Milford, auxiliary.
Niantic, auxiliary.
Torrington, auxiliary.
Wallingford, Wallingford Airport, municipal.

Delaware

Lewes, auxiliary.
Newark, auxiliary.
New Castle, auxiliary.
†New Castle, Bellanca Field, 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.), Washington Airport, commercial.
Rockville (Md.), Congressional Airport, commercial.

Florida

Arcadia, auxiliary.
Arcadia, Carlstrom Field, auxiliary.
Avon Park, auxiliary.
Bartow, auxiliary.
Bradenton, Wallace Field, municipal.
Clearwater, municipal.
De Land, De Land Airport, municipal.
Fort Meyers, municipal.
Hollywood, Hollywood Airport, municipal.
Inverness, commercial.
Jacksonville, Camp Johnson, Army.
†Jacksonville, municipal.
Jacksonville, Paxon Field, commercial.
Key West, commercial.
Key West, Naval Air Station, Navy.
Lakeland, municipal.
Leesburg, Leesburg Airport, commercial.
Melbourne, Melbourne Airport, municipal.
Miami, Fifty-fourth Street Airport, commercial.
†Miami, Miami Airport, municipal.
Miami, Pan American Airport, commercial.
North La Belle, auxiliary.
Ocala, commercial.
Okeechobee, commercial.
Orlando, commercial.
Orlando, municipal.
Palmdale, auxiliary.
Pensacola, Corry Field, Naval.
Pensacola, Naval Air Station, Navy.

St. Augustine, auxiliary.
St. Petersburg, Piper-Fuller Field, municipal.
Sanford, commercial.
Sebring, auxiliary.
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, Army, auxiliary.
*Jefferson, intermediate.
*Lawrenceville, intermediate.
Macon Miller Airport, municipal.
Pelham, commercial.
Rome, Rome Airport, municipal.
*Royston, intermediate.
Savannah, Daffing Park, municipal.
*Tallapoosa, intermediate.
Thomasville, Thomasville Airport, municipal.
Tifton, auxiliary.
Valdosta, municipal.
*Villa Rica, intermediate.

Idaho

*Bliss, intermediate.
†Boise, Boise Airport, municipal.
Cœur d'Alene, Cœur d'Alene Aviation Field, municipal.
Idahome, auxiliary
Lewiston, auxiliary.
*Mountain Home, intermediate.
Pocatello, Pocatello Airport, municipal.

Illinois

*Ashburn, intermediate.
†Aurora, commercial.
Belleville, Scott Field, Air Corps.
Bloomington, municipal.
Carlinville, auxiliary.
Champaign, Chamber of Commerce Airport, commercial.
*Chesterfield, intermediate.
†Chicago, Aero Club Field, commercial.
Chicago, Yackey Airport, commercial.
†Chicago, Chicago Airport, municipal.
Chicago, Fort Sheridan, auxiliary.
Chicago (Oaklawn), Harlem Airport, commercial.
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.
Chicago, Westchester Airport, commercial.
*Cordova, intermediate.
Danville, Chamber of Commerce Airport, commercial.
Decatur, National Airways Field, commercial.
Des Plaines, Heath Flying Field, commercial.
†Des Plaines, Pal-Waukee Airport, commercial.
East St. Louis, (See St. Louis, Mo.).
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.
Joliet, Joliet Airport, commercial.
Kewanee, Machesney Field, commercial.
†Lansing, Ford Airport, commercial.
*La Rose, intermediate.
Litchfield, auxiliary.
Lomax, commercial.
*Lowder, intermediate.
McCook, commercial.
Marion, commercial.
*Mason City, intermediate.
†Moline, Moline Airport, commercial.
Monmouth, commercial.
*Morris, intermediate.
†Northbrook, Sky Harbor, commercial.
†Peoria, municipal.
Peoria, Lufbery Flying Field, commercial.
Pinckneyville, auxiliary.
*Plainfield, intermediate.
Quincy, Monroe Airport, commercial.
Rantoul, Chanute Field, Air Corps.
*Rock Falls, intermediate.
Rockford, Black Hawk Airport, commercial.
Rockford, Rockford Airport, commercial.
St. Elmo, Smith Field, commercial.
*South Pekin, intermediate.
†Springfield, Conkling Field, municipal.
Sterling, auxiliary.
†Sterling, Sterling Airport, municipal.
Stockton, commercial.
Tonica, auxiliary.
Waterman, commercial.
†Waterman, De Kalb Field, municipal.

Indiana

*Ashley, intermediate.
Bedford, commercial.
Cedar Lake, auxiliary.
Elkhart, Elkhart Airport, municipal.
Fort Wayne, Baer Field, municipal (temporary).
Fort Wayne, Guy Means Airport, commercial.
Frankfort, Frankfort Airport, municipal.
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, Knox Airport, commercial.
Kokomo, Shockley Field, commercial.
La Fayette, Shambaugh Airport, commercial.
*Lakeville, intermediate.
*La Porte, intermediate.
*McCool, intermediate.
*Milroy, intermediate.

Muncie, Wall Field, municipal.
Peru, commercial.
Richmond, Berry Field, commercial.
Richmond, Richmond Airport, commercial.
*Rising Sun, intermediate.
Seymour, commercial.
Shelbyville, Nave Field, auxiliary.
*Shelbyville, intermediate.
South Bend, commercial.
†South Bend, municipal.
*Sullivan, intermediate.
Terre Haute, auxiliary.
Terre Haute, Dresser Field, municipal.
Vincennes, commercial.
Vincennies, municipal.
Wabash, Rettig Airport, commercial.
*Wolcottville, intermediate.

Iowa

*Adair, intermediate.
*Adel, intermediate.
Ames, Gerbracht Airport, commercial.
*Atalissa, intermediate.
*Atlantic, intermediate.
Battle Creek, commercial.
Belle Plaine, commercial.
*Bloomfield, intermediate.
Burlington, Burlington Airport, commercial.
Cedar Falls, Cedar Falls Airport, commercial.
†Cedar Rapids, municipal.
Centerville, municipal.
Clarinda, Clarinda Airport, commercial.
Council Bluffs, commercial.
†Davenport, Cram Field, commercial.
Des Moines, Camp Dodge, Army.
Des Moines, Herring Field, commercial.
†Des Moines, municipal.
*Dixon, intermediate.
*Fairfield, intermediate.
Fort Dodge, commercial.
*Grand Mound, intermediate.
†Iowa City, municipal.
*Libertyville, intermediate.
*McCausland, intermediate.
Mason City, municipal.
Milford, Donaldson Field, commercial.
*Montezuma, intermediate.
†Muscatine, Muscatine Airport, municipal.
*Oakland, intermediate.
Ottumwa, commercial.
*Reasnor, intermediate.
Rockwell City, municipal.
Scranton, auxiliary.
Shenandoah, municipal.
Sioux City, Kari-Keen Airport, commercial.
Sioux City, Rickenbacker Airport, commercial.
*Tifton, intermediate.
†Waterloo, municipal.
Wesley, Wesley Airport, commercial.
*Williamsburg, intermediate.

Kansas

Arkansas City, commercial.
Caney, commercial.
*Cassody, intermediate.
Chanute, municipal.
Coffeyville, municipal.
Dodge City, McCoy Airport, commercial.
El Dorado, municipal.
Eureka, Eureka Airport, municipal.
Fort Leavenworth, Army.
†Fort Riley, Marshall Field, Air Corps.
Fort Scott, municipal.
†Garden City, municipal.
Grand Bend, Grand Bend Airport, municipal.
Hutchinson, Albright Field, commercial.
Kansas City, Fairfax Airport, commercial.
Larned, Larned Airport, municipal.
Lawrence, Allison Field, commercial.
Manhattan, Manhattan Airport, municipal.
Newton, municipal.
*Olathe, intermediate.
*Olivet, intermediate.
*Olpe, intermediate.
*Ottawa, intermediate.
*Oxford, intermediate.
Parsons, municipal.
Plainville, Gilbert Field, municipal.
Pratt, commercial.
Sedan, Sedan Airport, municipal.
Topeka, auxiliary.
†Wichita, Wichita Airport, municipal.
Wichita, Swallow Field, commercial.
Wichita, Swift Airport, commercial.
Winfield, municipal.

Kentucky

*Carrollton, intermediate.
Covington, municipal.
Danville, commercial.
Hopkinsville, commercial.
*La Grange, intermediate.
Lexington, Lexington Airport, municipal.
†Louisville, Bowman Field, Municipal.
Louisville, Louisville Airport, commercial.
Owensboro, Sheehan Field, commercial.

Louisiana

Alexandria, Camp Beauregard, auxiliary.
Baton Rouge, Dougherty Field, municipal.
Chalmette, commercial.
Crowley, Crowley Field, 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, Menefee Airport, commercial.
Shreveport, Shreveport Airport, commercial.
Shreveport, Texico Airport, commercial.
†Tallulah, Department of Agriculture.
Wisner, Gilbert Field auxiliary.

Maine

Bangor, auxiliary.
Bangor, Bangor Airport, commercial.
Caribou, Caribou Airport, municipal.
†Portland, Portland Airport, municipal.
Portland, Stroudwater Field, commercial.

Maryland

†Aberdeen, Phillips Field, Air Corps.
†Baltimore, Logan Field, municipal.
Bowie, race track, auxiliary.
Camp Meade, Army, auxiliary.
College Park, Bureau Standard Flying Field, Department of Commerce and commercial.
Cumberland, Army.
Edgewood Arsenal, Army, auxiliary.
Elk Mills, auxiliary.
Frederick, fairgrounds, auxiliary.

Grantsville, auxiliary.
Hagerstown, Kreider-Reisner Airport, commercial.
Havre de Grace, race track, auxiliary.
Hebron, Pride of Del-Mar-Va Airport, commercial.
Laurel, race track, auxiliary.
Pikeville, Park Heights Flying Service Airport, commercial.
Rockville (see District of Columbia).

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 (see Barnes Airport, Westfield, Mass.).
Hyannis, Hyannis Airport, commercial.
Lawrence, commercial.
Lowell, commercial.
Mendon, commercial.
Revere, commercial.
Saugus, Groah Field, auxiliary.
Seekonk, commercial.
South Dartmouth, Round Hill Airport, private.
South Sudbury, commercial.
Taunton, King Field, commercial.
Wareham, commercial.
Westfield, Barnes Airport, municipal.
†Worcester, commercial.

Michigan

Ann Arbor, Ann Arbor Airport, municipal.
Augusta, Camp Custer, Army.
Bad Axe, auxiliary.
Battle Creek, municipal.
Bay City, Clement Airport, municipal.
Benton Harbor, commercial.
Blaney, Blaney Airport, commercial.
Cadillac, auxiliary.
Charlevoix, Charlevoix Airport, municipal.
†Detroit, Ford Airport, commercial.
Detroit, John R. Airport, commercial.
Detroit, fairgrounds, auxiliary.
Detroit, Detroit City Airport, municipal.
Detroit, Grosse Ile Airport, commercial.
East Lansing, East Lansing Airport, commercial.
Gaylord, Clyde Wilks Post, municipal.
Grand Haven, Grand Haven Airport, municipal.
Grand Rapids, commercial.
Grand Rapids, fairgrounds, auxiliary.
Grand Rapids, municipal.
Grayling, auxiliary.
Iron Mountain, commercial.
†Jackson, Reynolds Field, municipal.
Kalamazoo, municipal.
†Lansing, Capitol City Airport, municipal.
Marysville, Marysville Airport, municipal.
Menominee, municipal.
*Monroe, intermediate.
†Mount Clements, Selfridge Field, Air Corps.
Munising, auxiliary.
Muskegon, municipal.
Niles, municipal.
Northville, Stinson-Northville Field, commercial.
Petoskey Harbor Springs Airport, municipal.
†Pontiac, Pontiac Airport, municipal.
Saginaw, municipal.
Standish, fairgrounds, auxiliary.
Ypsilanti, municipal.

Minnesota

Alexandria, Alexandria Airport, municipal.
Brainerd, Rosko's Airport, commercial.
Crookston, auxiliary.
Fergus Falls, Fergus Falls Airport, municipal.
Lake City, State Camp Ground, auxiliary.
Little Falls, auxiliary.
Mankato, auxiliary.
Mankato, commercial.
Maynard, commercial.
Minneapolis, commercial.
†Minneapolis, Minneapolis Airport (Wold-Chamberlain Field), municipal.
*Redwing, intermediate.
St. Cloud, Albert G. Whitney Memorial Airport, municipal.
†St. Paul, municipal.
Sleepy Eye, Berkner Field, commercial.
Virginia, commercial.
*Wabasha, intermediate.
White Bear Lake, commercial.
*Winona, intermediate.

Mississippi

Clarksdale, auxiliary.
Greenville, Greenville Airport, commercial.
Grenada, Borden Field, commercial.
Jackson, commercial.
Meridian, Meridian Airport, commercial.
Natchez, auxiliary.
Pascagoula, Raby Field, municipal.

Missouri

†Anglum, Lambert-St. Louis Field, municipal.
*Boonville, intermediate.
Bucklin, Van Osdee Field, commercial.
Carthage, commercial.
Jefferson City, municipal.
Joplin, municipal.
†Kansas City, municipal.
†Kansas City, Richards Field, commercial.
Kirksville, Dodson Airport, commercial.
†Marshall, Nicholas-Beazley Airport, 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.
*Unionville, intermediate.

Montana

Bigtimber, Budd Field, auxiliary.
*Boulder, intermediate.
Butte, Butte National Airport, commercial.
Butte, Butte Airport, municipal.
Chinook, fairgrounds, auxiliary.
Dillon, commercial.
Froid, Schnitzler Field, commercial.
Fort Missoula, Army, auxiliary.
Glendive, auxiliary.

Great Falls, Vance Airport, commercial.
Harlowton, auxiliary.
Helena, Helena Airport, municipal.
Lewistown, Harrison Green Airport, auxiliary.
Livingston, municipal.
Manhattan, municipal.
†Miles City, Miles City Airport, municipal.
Missoula, Missoula Airport, municipal.
Sidney, Sidney Airport, commercial.
Terry, Martin Airport, municipal.

Nebraska

Alliance, commercial.
*Big Springs, intermediate.
Chadron, fairgrounds, auxiliary.
*Chappell, intermediate.
*Dix, intermediate.
*Gothenburg, intermediate.
†Grand Island, Grand Island Airport, municipal.
Hastings, municipal.
Havelock, Arrow Airport, commercial.
*Kearney, intermediate.
*Lexington, intermediate.
Lincoln, Lincoln Airport, commercial.
†Lincoln, Lincoln Airport, municipal.
*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, Scottsbluff Airways Airport, commercial.
*Shelton, intermediate.
*Sidney, intermediate.
*Sutherland, intermediate.
*Ulysses, intermediate.

Nevada

Battle Mountain, auxiliary.
*Beowawe, intermediate.
Caliente, municipal.
*Dry Lake, intermediate.
†Elko, municipal.
Ely, municipal.
Hazen, auxiliary.
Hawthorne, municipal.
*Jean, intermediate.
†Las Vegas, municipal.
Lovelock, municipal.
Parran, auxiliary.
†Reno, Hubbard Field, commercial.
Reno, Blanch Field, municipal.
Tonopah, auxiliary.
Wells, race track, auxiliary.
Winnemucca, municipal.
Yerington, municipal.

New Hampshire

Claremont, municipal.
Concord, municipal.
Greenfield, auxiliary.
Keene, municipal.
Manchester, municipal.
Whitefield, Whitefield Airport, municipal.

New Jersey

Arcola, Arcola Airport, commercial.
Asbury Park, municipal.
Atlantic City, commercial.
Atlantic City, Bader Field, municipal.
Auburn, auxiliary.
Avalon, commercial.
Camden, Central Airport, commercial.
Cape May, Coast Guard.
Dover, commercial.
Freehold, Patten Field, commercial.
Greenwich Flying Field, municipal.
†Hasbrouck Heights, Teterboro Airport, commercial.
Kenvil, commercial.
Keyport, commercial.
Lakehurst, Naval Air Station, Navy.
Lakehurst, Lakehurst Airport, commercial.
Lyons, commercial.
Medford, auxiliary.
Moorestown, municipal.
†Newark, Newark Airport, municipal.
†New Brunswick, Hadley Field, commercial.
New Brunswick, municipal.
Oceanport (Fort Monmouth), Army.
Paterson, commercial.
Pine Valley, Ireland Field, commercial.
Princeton, auxiliary.
†Redbank, Airview Flying Field, commercial.
Seagirt, Camp Edwards, auxiliary.
*Stewartsville, intermediate.
†Trenton, Mercer Airport, municipal.
*White House, intermediate.
Wrightstown, Camp Dix, Army.

New Mexico

Albuquerque, Albuquerque Airport, commercial.
Alamogordo, auxiliary.
Cambray, municipal.
Carlsbad, municipal.
Carrizozo, auxiliary.
Clayton, Clayton Field, municipal.
Deming, municipal.
Gage, municipal.
Gallup, auxiliary.
Gallup, Moses Field, municipal.
*Grants, intermediate.
Hachita, auxiliary.
Las Vegas, auxiliary.
Lordsburg, Lordsburg Airport, Army.
Lordsburg, municipal.
Roswell, commercial.
Rutter, auxiliary.
Santa Rosa, municipal.
Silver City, auxiliary.
Steins, municipal.
Taiban, municipal.
Tucumcari, auxiliary.

New York

Albany, Quentin Roosevelt Field, municipal.
†Albany, Albany Airport, municipal.
Angola, Angola Airport, commercial.
Armonk, commercial.
Batavia, fairgrounds, auxiliary.
Beacon, commercial.
Belrose, race track, auxiliary.
Binghamton, commercial.
†Buffalo, Buffalo Airport, municipal.
Buffalo, Becker's Airport, commercial.
Buffalo. (See Tonawanda, Consolidated Aircraft Airport.)
Dansville, municipal.
*Dunkirk, intermediate.
Elmira, municipal.
Endicott, commercial.

Fair Haven, Fair Haven Airport, municipal.
Farmingdale, commercial.
Fort Terry, Plum Island, Army, auxiliary.
†Garden City, Roosevelt Field, commercial.
Geneva, Finger Lakes Airport, commercial.
Glens Falls, municipal.
Gloversville, Gloversville Airport, commercial.
Hammondsport, Mercury Field, commercial.
Hemlock, Hemlock Airport, 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, Mitchel Field, Air Corps.
Montgomery, Central Hudson Landing Field, auxiliary.
New Dorp, Miller Field, Air Corps.
Norwich, commercial.
Pittsford, commercial.
Plattsburg, Army.
†Rochester, Rochester Airport, municipal.
Rochester, Rouse Partridge Airport, commercial.
Rochester, Commercial Airport, commercial.
†Schenectady, commercial.
†Syracuse, Syracuse Airport, municipal.
†Tonawanda, Consolidated Aircraft Airport, commercial.
†Utica, municipal.
Watertown, Watertown Airport, municipal.
Watkins Glen, auxiliary.
Wellsville, Wellsville Aviation Club Field, commercial.
West Point, parade grounds, auxiliary.
Yaphank, Camp Upton, Army, auxiliary.

North Carolina

Asheville, municipal.
Charlotte, Charlotte Airport, commercial.
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, Knollwood Airport, municipal.
Raleigh, municipal.
Raleigh, commercial.
Reidsville, commercial.
*Reidsville, intermediate.
Rockingham, commercial.
Rocky Mount, Eagle Field, commercial.
Shelby, Shelby Airport, 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, Grand Forks Airport, municipal.
Jamestown, Jamestown Airport, municipal.
Linton, Seeman Park, commercial.
Minot, Port O Minot, municipal.
Towner, Jake's Airport, commercial.

Ohio

Ada, auxiliary.
Alliance, commercial.
†Akron, Akron Airport, municipal.
Akron, commercial.
*Ashtabula, intermediate.
Belpre, see Marietta.
Bryan, Bryan Air Park, commercial.
*Bryan, intermediate.
Cambridge, auxiliary.
Camp Perry, State Camp, auxiliary.
Canton, commercial.
†Cincinnati, Lunken Airport, municipal.
†Cincinnati, Watson Airport, commercial.
†Cleveland, Cleveland Airport, municipal.
Cleveland, Great Lakes Airport, commercial.
†Columbus, Norton Field, Air Corps.
†Columbus, Columbus Airport, commercial.
†Columbus, Port of Columbus, municipal.
*Conneaut, intermediate.
†Coshocton, Coshocton Airport, commercial.
†Dayton, Dayton Airport, commercial.
Dayton, Moraine Field, commercial.
†Dayton, Wright Field, Air Corps.
Defiance, Defiance-Simplex Airport, commercial.
*Delta, intermediate.
Elyria, La Porte Field, commercial.
Fairfield, Fairfield Air Depot, Air Corps.
Findlay, Rummell Aviation Park, commercial.
Gallipolis, Twin City Airport, municipal.
*Gerald, intermediate.
Greenville, Lansdowne Airport, commercial.
Hamilton, commercial.
*Hartford, intermediate.
Hebron, Harbor Hills Golf Course, auxiliary.
*Huron, intermediate.
Kent, commercial.
Kenton, auxiliary.
*Lebanon, intermediate.
Lima, Thompson Airport, commercial.
London, auxiliary.
Lorain, Port Mills, commercial.
*Loudonville, intermediate.
Mansfield, municipal.
Marietta, Ohio Valley Airport, municipal.
Martins Ferry, Scott Field, commercial.
Massillon, Massillon Airport, commercial.
*Medina, intermediate.
Middletown, Middletown Airport Park, municipal.
*Mount Vernon, intermediate.
North Madison, auxiliary.
*Painesville, intermediate.
*Parkman, intermediate.
Portsmouth, municipal.
Sandusky, Parker Field, commercial.
St. Paris, auxiliary.
*Solon, intermediate.
†Springfield, Springfield Airport, municipal.
Steubenville, commercial.
Toledo, auxiliary.
†Toledo, Transcontinental Airport, commercial.
Toledo, municipal (temporary).
Troy, commercial.
Van Wert, municipal.
*Vermillion, intermediate.
*Vickery, intermediate.

*Watersville, intermediate.
*West Jefferson, intermediate.
Willoughby, commercial.
*Woodville, intermediate.
*Wooster, intermediate.
Wooster, fairgrounds, auxiliary.
Youngstown, Lansdowne Field, municipal.
Youngstown, Bernard Airport, 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, municipal.
Cleveland, auxiliary.
Clinton, municipal.
Coalgate, commercial.
*Criner, intermediate.
Drumright, Cooks Field, auxiliary.
Duncan, Halliburton Field, municipal.
Elk City, municipal.
El Reno, municipal.
Enid, Enid Air Park, municipal.
*Fairfax, intermediate.
Fort Sill, Air Corps.
Guthrie, Guthrie Airport, commercial.
*Guthrie, intermediate.
*Healdton, intermediate.
Hennessey, auxiliary.
Henryetta, auxiliary.
Holdenville, race track, auxiliary.
*Hominy, intermediate.
Kingfisher, race track, auxiliary.
McAlester, Legion Field, commercial.
McLoud, auxiliary.
Mangum, Powder Field, municipal.
Miami, commercial.
Muskogee, Hatbox Field, municipal.
Newkirk, auxiliary.
Norman, Graham Flying Service Field, commercial.
†Oklahoma City, municipal.
Okmulgee, William A. Burke Airport, commercial.
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.
Weewoka, Weewoka Flying Field, commercial.
Woodward, auxiliary.

Oregon

Albany, municipal.
Arlington, Arlington Airport, commercial.
*Baker, intermediate.
Canyon City, municipal.
Condon, auxiliary.
Corvallis, Corvallis Airport, commercial.
The Dalles, fairgrounds, municipal.
Eugene, municipal.
Grants Pass, municipal.
*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

†Allentown, Allentown Airport, municipal.
Altoona, auxiliary.
†Altoona-Tyrone, 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, American Legion Airport, municipal.
Conway, Conway Airport, commercial.
*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, Matter Airport, commercial.
Johnstown, Johnstown Airport, municipal.
Jones Mills, Pike Run Airport, commercial.
*Kennerdell, intermediate.
*Kylertown, intermediate.
*Lamartine, intermediate.
Lancaster, commercial.
Latrobe, J. D. Hill Airport, commercial.
Lebanon, municipal.
Leetsdale, commercial.
Lehighton, Martin Jensen Airport, municipal.
Lemoyne, Stienhauer Airport, commercial.
Lewistown, race track, auxiliary.
Media, municipal.
*Mercer, intermediate.
Middletown, Olmsted Field, Army.
Moscow, Moscow Airport, commercial.
Mount Pleasant, commercial.
Mount Union, municipal.
New Castle, Jackson Field, commercial.
New Castle, New Castle Airport, commercial.
Norristown, commercial.
*Northampton, intermediate.
*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.
Pottstown, Pottstown Airport, commercial.
Reading, Whander Field, commercial.
*Ring Mountain, intermediate.
Selinsgrove, Zimmerman Airport, municipal.
Sellersville, auxiliary.
†Shamokin, Shamokin Airport, municipal.
Sharon, commercial.
Smithfield, Barton Field, auxiliary.
*Snowshoe, intermediate.
Somerset, Rhoades Field, commercial.
*Stockton, intermediate.
*Stroudsburg, intermediate.
Summerfield, auxiliary.
Sunbury, Westley L. Smith Field, commercial.
*Sunbury, intermediate.
Towanda, municipal.
Uniontown, auxiliary.
Uniontown, Burgess Field, municipal.
Uniontown, race track, auxiliary.
Waynesboro, Lesher Field, commercial.
Waynesburg, commercial.
*Wesley, intermediate.
Westfield, race track, auxiliary.
Williamsport, commercial.
Wilkes-Barre, Wyoming Valley Airport, commercial.
*Woodward, intermediate.
York, auxiliary.

Rhode Island

Apponaugh, auxiliary.
Jamestown, auxiliary.
Pawtucket, commercial.
Portsmouth, Narragansett Field, commercial.
Providence, Potheir Field, commercial.
Quonset Point, State camp grounds, auxiliary.
Slocum, auxiliary.
Westerly, commercial.

South Carolina

*Anderson, intermediate.
*Blacksburg, intermediate.
Cheraw, Excelsior Airport, commercial.
Columbia, auxiliary.
Florence, municipal.
Fort Mills, Spring Field, commercial.
Fort Moultrie, Army.
*Gaffney, intermediate.
Greenville, Donaldson Field, municipal.
Myrtle Beach, commercial.
Parris Island, Marine Corps Field, auxiliary.
*Simpsonville, intermediate.
Seneca, commercial.
†Spartanburg, municipal.
White Hall, Dupont Airport, auxiliary.

South Dakota

Aberdeen, municipal.
Belle Fourche, Belle Fourche Airport commercial.
Brookings, Midway Airport, commercial.
Dell Rapids, municipal.
Edgemont, auxiliary.
Huron, commercial.
Mitchell, municipal.
Mobridge, commercial.
Pierre, Walter J. Smith Airport, municipal.
Rapid City, commercial.
Seneca, auxiliary.
Sioux Falls, auxiliary.
Tyndal, commercial.
Vermilion, Vermilion Airport, municipal.
Volga, commercial.
Watertown, Watertown Airport, municipal.

Tennessee

Bristol, Harkrader-Kilgore Airport, municipal.
Chattanooga, municipal.
Cleveland, auxiliary.
Jackson, fairgrounds, auxiliary.
Johnson City, municipal.
Knoxville, race track, auxiliary.
Memphis, Armstrong Field, commercial.
†Memphis, New Brys Airport, commercial.
Memphis, Memphis Airport, municipal.
Memphis, Parks Field, 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, municipal.
Big Springs, commercial.
Big Springs, municipal.
Bloomington, auxiliary.
Borger, auxiliary.
Brackettville, Fort Clark Field, Army.
Brownsville, Field No. 1, Air Corps.
Brownsville, Field No. 2, auxiliary.
†Brownsville, Brownsville Airport, municipal.
Bryant, auxiliary.
Camp Travis, Army.
Carrizo Springs, auxiliary.
Castroville, municipal.
Catarina, Catarina Airport, municipal.
Childress, auxiliary.
Cline, auxiliary.
Comstock, auxiliary.
Corpus Christi, Corpus Christi Airport, municipal.
Dalberg, auxiliary.
†Dallas, Love Field, municipal.
Del Rio, municipal.
Denison, Gray Field, 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 (see Brackettville).
Fort Hancock, auxiliary.
†Fort Worth, Meacham Field, municipal.
Galveston, Fort Crocket, Air Corps.
Gonzales, auxiliary.
Greenville, municipal.
Harlingen, commercial.

Hondo, auxiliary.
Houston, Edwards Airport, commercial.
Houston, Ellington Field, National Guard.
†Houston, Houston Airport, commercial.
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.
Midland, municipal.
Mineral Wells, auxiliary.
*Muenster, intermediate.
Odessa, auxiliary.
Orange, municipal.
Palestine, auxiliary.
Pavo, auxiliary.
Pecos, municipal.
Port Arthur, Texico Airport, commercial.
Pumpville, auxiliary.
Ranger, Ranger Airport, municipal.
Rio Grande, Fort Ringgold, Air Corps.
Sabinal, municipal.
San Angelo, San Angelo Airport, 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.
Snyder, Yoder Field, commercial.
Spur, municipal.
Sweetwater, Sweetwater airport, municipal.
Temple, Temple Airport, commercial.
Toyah, auxiliary.
Victoria, auxiliary.
Waco, Rich Field, municipal.
Wharton, auxiliary.
Wichita Falls, commercial.
†Wichita Falls, Kell Field, 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.
*Wanship, intermediate.

Vermont

Brattleboro, auxiliary.
Burlington, municipal.
Manchester, Equinox Airport, commercial.
Montpelier, auxiliary.
Newport, commercial.
St. Albans, auxiliary.
St. Johnsbury, auxiliary.
Springfield, municipal.
Windsor, auxiliary.

Virginia

Alexandria, Alexandria Airport, commercial.
*Amelia, intermediate.
Arlington, Hoover Field, commercial.
Arlington, Washington Airport, commercial.
Bristol, Harkrader-Kilgore Airport, commercial.
Clifton Forge, Clifton Forge Airport, commercial.
*Crewe, intermediate.
Dahlgren, naval air station, Navy.
Fort Eustis, Army.
Fredericksburg, Shannon Field, commercial.
†Hampton, Langley Field, Air Corps; N. A. C. A.
†Hampton Roads, naval air station, Navy.
*Keysville, intermediate.
Leehall, Fort Eustis, Army.
Leesburg, auxiliary.
Lynchburg, commercial.
Martinsville, auxiliary.
*Milford, intermediate.
*Milton, intermediate.
Norfolk (Virginia Beach) Rifle Range, auxiliary.
*Ontario, intermediate.
Petersburg, Camp Lee, Army.
Port Richmond, municipal.
Quantico, Brown Field, Marine Corps.
*Quantico, intermediate.
Richmond, Charles Field, commercial.
†Richmond, Richard E. Byrd Field, municipal.
Richmond, Richmond air junction, commercial.
*South Boston, intermediate.
Virginia Beach (see Norfolk).
Waynesboro, Valley Airport, commercial.
Winchester, municipal.

Washington

Aberdeen (see Hoquiam).
Bellingham, Graham Field, commercial.
Bellingham, La Fayette Field, commercial.
Camp Lewis, Army.
Chehalis, Donahue Field, municipal.
Davenport, auxiliary.
Hoquiam, Grays Harbor Airport, municipal.
Kennewick, Kennewick Airport, municipal.
Kent, auxiliary.
Longview, municipal.
Olympia, commercial.
Opportunity, auxiliary.
†Pasco, Franklin County Airport, municipal.
Renton, Renton Airport, commercial.
Republic, fairgrounds, auxiliary.
Ritzville, Ritzville Aviation Field, municipal.
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, Yakima County Airport, municipal.

West Virginia

Bluefield, College Field, commercial.
Charleston, Massey Field, auxiliary.
Green Spring, auxiliary.
Huntington, commercial.
Keyser, auxiliary.
Martinsburg, Sheperd Field, municipal.
Morgantown, auxiliary.
Moundsville, Langin Field, commercial.
Petersburg, auxiliary.
Wheeling, municipal.

Wisconsin

Appleton, commercial.
Athelstane, commercial.
*Columbus, intermediate.
Delavan, Delavan Airport, commercial.
Eagle River, Keystone Airport, commercial.
Eagle River, Otter Rapids, Golf Course Field, commercial.
Fond du Lac, commercial.
Green Bay, commercial.
*Hager, intermediate.
Janesville, Janesville Airport, commercial.
*Kenosha, intermediate.
Kilbourn, commercial.
†Kohler, Kohler-Sheboygan Airport, municipal.
La Crosse, Salzer Field, municipal.
†Madison, Madison Airport, commercial.
Madison Pennco Field, commercial.
Manitowoc, Manitowoc Airport, municipal.
Marshfield, Miners Airport, commercial.
*Mauston, intermediate.
Menasha, municipal.
†Milwaukee, Maitland Airport, municipal.
†Milwaukee, Milwaukee County Airport, municipal.
Mosinee, Mosinee Airport, commercial.
Neenah, municipal.
*Oconomowoc, intermediate.
Oshkosh, commercial.
*Portage, intermediate.
Portage, Miller and Winkler Airport, commercial.
Princeton, municipal.
Racine, municipal.
Reedsburg, auxiliary.
Rhinelander, municipal.
*Somers, intermediate.
*Sparta, intermediate.
Stevens Point, auxiliary.
Stevens Point, Stevens Point Airport, commercial.
Sturgeon Bay, commercial.
Superior, municipal.
Three Lakes, Three Lakes Airport, municipal.
Washington Island, commercial.
†Wausau, Alexander Airport, municipal.
Wisconsin Rapids, Tri-City Airport, commercial.

Wyoming

*Bitter Creek, intermediate.
*Bosler, intermediate.
*Burns, intermediate.
Casper, municipal.
*Cherokee, intermediate.
†Cheyenne, municipal.
*Federal, intermediate.
Fort Bridger, commercial.
Gillette, commercial.
*Granger, intermediate.
*Knight, intermediate.
*Laramie, intermediate.
*Leroy, intermediate.
Lost Cabin, auxiliary.
Lusk, auxiliary.
*Lyman, intermediate.
*Medicine Bow, intermediate.
Newcastle, municipal.
Parco, municipal.
*Pine Bluffs, intermediate.
*Rawlins, intermediate.
*Red Desert, intermediate.
*Rock River, intermediate.
†Rock Springs, municipal.
Sheridan, municipal.
*Walcott, intermediate.

AIRWAY MARKING AND LIGHTING IN 1929

Routes	LIGHTING					WEATHER			RADIO	
	Airway miles	Lghtd. miles	Lghtd. inter. flds.	24 inch lights	Flsh. lights	W. Bur. rglr. stns.	W. Bur. Arwys. stns.	Comrs. Airwys. stns.	Comu-ctns. stns.	Range becn. stns.
In Service										
Key West	.....	.....	.....	.....	.....	.....	.....	.....	1	.....
San Francisco—Salt Lake City	690	690	22	54	74	4	8	1	5	0
Parran Br	150	150	1	1	27	0	0	0	0	0
Salt Lake City—Omaha	898	898	26	37	7	5	4	15	5	0
Omaha—Chicago	430	430	16	32	167	4	2	4	3	0
Chicago—New York	735	735	39	86	35	5	2	12	5	4
New York—Boston	201	201	3	20	4	3	0	1	2	1
Los Angeles—San Francisco	378	378	8	31	4	3	4	1	3	0
San Francisco—Seattle	767	367	5	33	2	9	17	2	4	0
Los Angeles—Salt Lake City	664	664	20	41	82	3	13	3	2	0
Dallas—Kansas City	541	541	14	47	30	5	1	5	4	0
Kansas City—Chicago	454	454	8	28	5	4	1	3	3	0
Kansas City—Omaha	159	159	3	11	0	3	0	0	2	0
Kansas City—St. Louis	228	228	7	21	0	2	0	0	2	0
St. Louis—Chicago	275	275	9	24	1	4	0	0	2	0
Chicago—Twin Cities	407	407	9	41	5	4	0	0	2	0
Madison Br	74	74	0	0	0	1	0	0	0	0
Louisville—Cleveland	345	345	9	30	1	3	0	4	1	0
Pueblo—Cheyenne	200	200	6	16	9	3	2	0	1	0
New Orleans—Atlanta	491	226	7	21	5	5	1	0	1	0
Atlanta—New York	788	788	20	78	3	8	4	6	6	1
Cincinnati—Chicago	272	272	6	25	0	2	3	0	0	0
South Bend—Kalamazoo	46	46	1	4	0	0	1	0	0	0
Cleveland—Detroit	134	134	1	8	0	2	0	0	1	0
Tulsa—Ponca City	76	76	2	2	20	0	1	0	0	0
Salt Lake City—Pasco	570	570	15	50	30	2	6	3	3	0
Cleveland—Albany	459	198	5	18	0	6	3	0	0	0
Miami—Atlanta	622	281	7	28	1	4	5	0	0	0
Albuquerque—Clovis	194	194	2	13	15	0	0	0	0	0
Waynoka—Wichita	111	111	1	10	0	1	0	0	1	0
Atlanta—Chicago	631	266	5	15	0	3	3	0	1	0
Total	11,990	10,358	277	825	527	.....	.....	.....	.....	.....
Contracted										
Atlanta—Chicago	.....	365	5	16	1	3	5	0	0	1
Indianapolis—Dayton	135	135	0	10	0	2	0	0	0	0
Gallup—Albuquerque	136	136	1	11	4	0	0	0	0	0
St. Louis—Evansville	162	162	4	15	0	2	1	0	0	0
Milwaukee—Green Bay	122	63	1	5	0	2	0	0	0	0
Cleveland—Albany	.....	261	5	22	2	6	1	0	0	0
Waco—Ft. Worth	90	90	2	8	0	1	1	0	0	0
Kalamazoo—Detroit	120	120	0	7	0	1	0	0	0	0
Detroit—Bay City	93	93	0	6	0	1	1	0	0	0
New York—Montreal	270	142	3	13	1	2	3	1	1	1
San Francisco—Seattle	.....	400	12	55	16	8	12	2	0	0
Total	1,128	1,967	33	168	24	.....	.....	.....	.....	.....
Other routes	18,452	0	0	0	0	.....	.....	.....	.....	.....
Grand Total	31,570	12,325	310	993	551	60	115	63	29	4

MEDICAL EXAMINERS FOR PILOTS

Dec. 31, 1929

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 December 31, 1929. Additions will be made from time to time. Applicants are cautioned that when the examination is made by two collaborating physicians it is necessary to see both physicians for the completion of the examination. For example, one man may give the eye, ear, nose and throat part of the examination and the other the general physical 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.

Medical Director.....Dr. L. H. Bauer, Washington, D. C.
Assistant Medical Director.....Dr. Harold J. Cooper, Washington, D. C.
Advisory Medical Examiner.....Dr. Robert A. Strong, Pass Christian, Miss.

ALABAMA

Anniston—Dr. C. Hal Cleveland; Dr. Wade H. Brannon, 1211 Noble St.

Birmingham—Dr. E. P. Green, 423 First Nat'l 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 F. Holding, 1112 Bell Bldg.; Dr. Clarence K. Weil, 512 Bell Bldg.

ALASKA

Anchorage—Dr. Arthur D. Haverstock
Fairbanks—Dr. Frank de la Vergne.

ARIZONA

Douglas—Dr. John Cook, 505 Tenth St.; Dr. Albert W. Vanneman, Meguire Bldg.

Flagstaff—Dr. Martin G. Fronske, 10 N. Lennox St.

Phoenix—Dr. William A. Schwartz, 605 Goodrich Bldg.; Dr. Thomas W. Woodman, 404 Heard Bldg.

Tucson—Dr. Edward J. Gotthelf, 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. Neihuss, 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, 612 First Nat'l Bank Bldg.

Helena—Dr. William R. Orr, Solomon Bldg.; Dr. Henry H. Rightor, 402 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. Lutterloh, 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, 311 Nat'l Bldg.; Dr. B. D. Luck, 102½ W. Fifth St.

Texarkana—Dr. H. H. Smiley; Dr. T. E. Fuller.

CALIFORNIA

Bakersfield—Dr. Robert M. Jones, 208 Hopkins Bldg.

Barstow—Dr. James A. Graham.

Berkeley—Dr. Werner F. Hoyt, 2490 Channing Way.

El Centro—Dr. Harry P. Findley, Davis Bldg.; Dr. C. S. Brooks, 14 Davis Bldg.

Fillmore—Dr. J. E. Whitlow, 454 Santa Clara St.

Fresno—Dr. D. H. Trowbridge, 719 T. W. Patterson Bldg.

Hollister—Dr. L. E. Smith, 317 Fifth St.

Long Beach—Dr. Francis C. Hertzog, 1006 Pacific-Southwest Bldg.

Los Angeles—Dr. Theodore C. Lyster, 1930 Wilshire Blvd.; Dr. Isaac H. Jones, 1930 Wilshire Road.

Mayfield—Dr. Granville Wood, 2265 El Camino Real; Dr. Ward Cooper, Frazer Bldg.

Modesto—Dr. L. D. Mottram, 1007 Tenth St.

Needles—Dr. H. W. Seiger, 755 Front St.

Oakland—Dr. Arthur Perkins, Medical Bldg., 1904 Franklin St.; Dr. Francis M. Shook, Medical Bldg., 1904 Franklin St.

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 Bruno—Dr. Clarence G. Potter, Mills Field.

San Francisco—Dr. B. J. Edger, Jr., 240 Stockton St.; Dr. C. Latimer Callander, 240 Stockton St.; Dr. Cyrus N. Callander, 240 Stockton St.

San Luis Obispo—Dr. Howard A. Gallup, 774 Marsh St.

Santa Ana—Dr. M. W. Hollingsworth, 409 First Nat'l Bank Bldg.

Santa Barbara—Dr. Philip C. Means, 103 East Micheltorena St.

Santa Cruz—Dr. W. Grant Hatch; Dr. S. B. Randall, Farmers and Merchants' Bank Bldg.

Santa Maria—Dr. Charles G. Baird, 301 East Chapel St.; Dr. Z. B. Coblentz, 301 E. Chapel St.; Dr. W. D. Sink, 301 E. Chapel St.

Stockton—Dr. Hunter L. Gregory, 805 Medico-Dental Bldg.; Dr. George H. Sanderson, 809 Medico-Dental Bldg.

Visalia—Dr. C. M. White, 508 Bank of Italy Bldg.; Dr. W. C. Zeller, 206 Bank of Italy Bldg.

Yreka—Dr. V. M. Hart, 707 Oregon St.; Dr. Clyde G. Reynolds, 707 Oregon St.

COLORADO

Colorado Springs—Dr. H. W. Woodward, Ferguson Bldg.

Denver—Dr. John S. Chase, 424 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, 406 Medical Arts Bldg.

DISTRICT OF COLUMBIA

Washington—Dr. Bernard L. Jarman, The Rochambeau, 815 Connecticut Ave., N. W.

FLORIDA

Fort Myers—Dr. B. Whisnant, 1 Leon Bldg.; Dr. W. A. Harrison, 204 Pythian Bldg.

Jacksonville—Dr. Ralph N. Greene, 303 Wade 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.; Dr. J. H. Cooper, First Nat'l Bank Bldg.

Tampa—Dr. S. B. Forbes, 409 Citizens Bank Bldg.

Tarpon Springs—Dr. A. McCallister, Meres Office Bldg.

West Palm Beach—Dr. S. Ward Fleming, Harvey Bldg.; Dr. William Y. Sayad, Harvey Bldg.

GEORGIA

Athens—Dr. Henry W. Birdsong, Southern Mutual Bldg.

Atlanta—Dr. David D. Moncrief, Atlanta National Bank Bldg.

Augusta—Dr. George A. Traylor, 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 Apts.; Dr. E. Carson Demmond, DeRenne Apts.

HAWAII

Honolulu—Dr. Rufus H. Hagood, Jr., 235 S. Beretania St.

IDAHO

Boise—Dr. Urban C. Merrill, 518 Overland Bldg.; Dr. George H. Wahle, 515 Overland Bldg.

Pocatello—Dr. C. W. Pond, Kane Bldg.; Dr. A. M. Newton, 202 Carlson Bldg.

ILLINOIS

Aurora—Dr. Clarence E. Robertson, Aurora Nat'l Bank Bldg.; Dr. E. S. Denney, Graham Office Bldg.

Bloomington—Dr. Watson W. Gailey (working with Dr. Humphries at Towanda).

Champaign—Dr. Hanly L. Ford, Robeson Bldg.; Dr. Earl D. Wise, Illinois Bldg.

Chicago—Dr. August Anderson, 1107 Bryn Mawr Ave. Dr. R. Ralph Ferguson, 4175 Irving Park Blvd.; Dr. William P. MacCracken, 24 N. Wabash Ave.

Danville—Dr. H. E. Baldwin, Temple Bldg.; Dr. Melvin L. Hole, Temple Bldg.

East St. Louis—Dr. William L. Hanson, 316 Murphy Bldg., 234 Collingsville Ave.

Freeport—Dr. W. J. Rideout, State Bank Bldg.; Dr. Karl F. Snyder, State Bank Bldg.

Hoopeston—Dr. C. O. Nelms, 304 Willdon Bldg.; Dr. L. B. Russell.

Kankakee—Dr. E. N. Greenman, 406 Cobb Bldg.; Dr. J. H. Roth, 504 Arcade Bldg.

LaSalle—Dr. Walter W. Greaves, LaSalle State Bank Bldg.

Marion—Dr. Isaac C. Walker, 1204 Public Square.

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. Carson Gabriel, 908 W. C. U. Bldg.; Dr. Walter Stevenson, 904 W. C. U. Bldg.

Rockford—Dr. Harry H. Davis, 902 Rockford Nat'l Bank Bldg.; Dr. Norman L. Sheehe, 904 Rockford Nat'l Bank Bldg.

Springfield—Dr. E. K. Lockwood, 401 S. Seventh St.; Dr. Edward Morris, 717 E. Capitol Ave.

Streator—Dr. Bernard O. Bendixen, 208 East Main St.

Towanda—Dr. Paul A. Humphries (working with Dr. Gailey at Bloomington).

Waukegan—Dr. O. C. Breitenbach, 4 S. Genesee St.

Woodstock—Dr. Clyde F. Baccus.

INDIANA

Bedford—Dr. Frank D. Martin, 200 Home City Bank Bldg.; Dr. W. H. McKnight.

Ft. Wayne—Dr. D. D. Johnston, 624 Calhoun St.

Gary—Dr. A. F. Lenzon, 504 Broadway; Dr. Thomas D. Keckich, 34 W. Fifth Ave.

Indianapolis—Dr. Wilbur F. Smith, 1819½ College Ave.

Lafayette—Dr. George R. Clayton, 610 Lafayette Life Bldg.; Dr. A. C. Arnett, Schultz Bldg., 4th and Main Sts.

Logansport—Dr. James J. Stanton; Dr. W. W. Holmes.

Muncie—Dr. Karl T. Brown, 503 Johnson Bldg.

Seymour—Dr. Guy Martin, 110½ W. Second St.

South Bend—Dr. V. E. Harmon, 316 Sherland Bldg.

Terre Haute—Dr. Albert M. Mitchell, 503 Tribune Bldg.; Dr. Walter E. Stewart, 402 Tribune Bldg.

IOWA

Battle Creek—Dr. George A. Hartley; Dr. G. S. Millice.

Burlington—Dr. D. F. Huston, Iowa State Bank Bldg.; Dr. George L. Dixon, Tama Bldg.

Carroll—Dr. O. C. Morrison.

Cedar Falls—Dr. George E. Hearst.

Cedar Rapids—Dr. John E. Stansbury, Merchants' Nat'l Bank Bldg.; Dr. Roy K. Keech, 502 Mullin 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, Bankers Trust Bldg.

Dubuque—Dr. W. J. Connell, 901 Locust St.; 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. G. 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 Nat'l Bank Bldg.

Waterloo—Dr. E. I. Dunkelberg, 710 James Black Bldg.; Dr. F. Harold Reuling, 719 James Black Bldg.

Woodbine—Dr. Harry N. Anderson, 511 Walker St.

KANSAS

Arkansas City—Dr. L. M. Beatson, Burford Bldg.; Dr. Walter H. Rea, Fitch Bldg.

Coffeyville—Dr. Harold J. Bagby, Condon Bank Bldg.; Dr. C. A. Thomas, 5 Columbia Bldg.

Dodge City—Dr. J. G. Janney, 206 Walnut St.; Dr. C. L. Hooper, Rexall Bldg.

Emporia—Dr. C. S. Trimble; Dr. C. E. Partridge.

Garden City—Dr. Oliver W. Miner.

Hutchinson—Dr. G. R. Walker, 510 R-W Bldg.; Dr. B. L. Greever, 610 Rorabaugh-Wiley Bldg.

Iola—Dr. O. L. Garlinghouse, 1-2 Garlinghouse Bldg.; Dr. Omar L. Cox.

Kingman—Dr. C. W. Longenecker; Dr. Boyd H. Pope, State Bank of Kingman.

Lawrence—Dr. Lyle S. Powell, 813 Massachusetts St.

Lindsborg—Dr. Arvid Pihlblad (working with Dr. Ganoung at Salina).

McPherson—Dr. Andrew Engbert; Dr. W. C. Heaston.

Salina—Dr. E. G. Ganoung, 118 West Iron Ave. (working with Dr. Pihlblad, Lindsborg, Kan.).

Topeka—Dr. Alexander B. Jeffrey, 1001 Nat'l Reserve Bldg.; Dr. George H. Litsinger, 701 Nat'l Reserve Bldg.

Wichita—Dr. C. H. Briggs, 509 Schweiter Bldg.; Dr. G. B. Morrison, 510 Schweiter Bldg.

KENTUCKY

Lexington—Dr. C. W. Trapp, 306 City Nat'l Bldg.; Dr. A. L. Johnson, 457 McClelland Bldg.

Louisville—Dr. Benjamin D. Choate, 2740 Frankfort Ave.; Dr. Gaylord C. Hall, 705 Brown Bldg.

Paducah—Dr. J. Vernon Pace, 711 City Nat'l Bank Bldg.; Dr. Erret Pace, 711 City Nat'l Bank Bldg.

LOUISIANA

Monroe—Dr. George W. Wright, 205 Ouachita Bank Bldg.

New Orleans—Dr. E. E. Allgeyer, 914 Pere Marquette Bldg.; Dr. James C. Cole, 1208 Maison-Blanche Bldg. Medical Officer in Charge, U. S. Marine Hospital No. 14, Tchoupitoulas and Henry Clay Sts.

Shreveport—Dr. D. Bean, 710 Cotton St.; Dr. R. D. McIntyre, 528 Ricou-Brewster Bldg.

MAINE

Bangor—Dr. Alfred H. Schriver, 77 Essex St.

Caribou—Dr. F. L. Gregory, 16 High St.

Fort Fairfield—Dr. A. L. Sawyer, Main St.

Portland—Dr. S. J. Beach, 704 Congress St.

MARYLAND

Baltimore—Dr. Harold R. Bohlman, Medical Arts Bldg.; Medical Officer in Charge, U. S. Marine Hospital No. 1, 31st St. and Remington Ave.

Cumberland—Dr. J. Kile Cowherd, Riverside Bldg., 41 Greene St.; Dr. George O. Sharrett, 119 Bedford St.

Hagerstown—Dr. B. B. Kneisley, 148 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 Attleboro—Dr. Michael E. Vance, 65 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.

Taunton—Dr. Andrew J. McGraw, 93 Washington St.; Dr. 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. Chynoweth, Battle Creek Sanitarium; Dr. B. G. Holtom, 529 Post Bldg.

Bay City—Dr. Charles L. Hess, 916 Washington Avenue; Dr. R. N. Sherman, Ridotto Bldg.

Detroit—Dr. D. S. Brachman, 5821 Dubois St.; Dr. J. L. DeRosier, 14703 Kercheval St.; Dr. Edgar E. Poos, 26 Waverly St.; Henry Ford Hospital.

Escanaba—Dr. John J. Walch, 1007 Ludington; Dr. W. B. Boyce.

Grand Rapids—Dr. F. C. Warnshuis, Michigan State Medical Society, 1508 G. R. Nat'l Bank Bldg.

Iron Mountain—Dr. C. W. Walker; Dr. Garson Fredrickson.

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. Henry B. Weinburgh, 706 American State Bank Bldg.

Saginaw—Dr. J. T. Sample, 409 Second Nat'l Bank Bldg.; Dr. Frederick J. Cady, 506 Wiechman Bldg.

MINNESOTA

Bemidji—Dr. DeWitt H. Garlock; Dr. E. A. Marcum.

Crookston—Dr. C. L. Oppegaard, Northwest Clinic, 220 S. Broadway; Dr. O. E. Lockon, 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, Northern Pacific Hospital, 1515 Charles St.

Winona—Dr. G. H. Walker, 172 Main St.; Dr. E. M. McLaughlin, 172 Main St.

MISSISSIPPI

Greenwood—Dr. L. B. Otken, 308 Fulton St.; Dr. J. C. Adams, 308 Fulton St.

Jackson—Dr. J. F. Armstrong, Merchants Bank Bldg.; Dr. Victor W. Maxwell, Baptist Hospital.

MISSOURI

Carthage—Dr. L. B. Clinton.

Columbia—Dr. C. R. Bruner, Exchange Nat'l Bank Bldg.; Dr. A. W. Kampschmidt.

Florissant—Dr. A. C. Leggat; Dr. R. J. Payne.

Joplin—Dr. Robert M. James, 827 Frisco Bldg.; Dr. Charles T. Reid, 811 Frisco Bldg.

Kansas City—Dr. Wade H. Miller, 712 Argyle Bldg.

Kirksville—Dr. Edward A. Grim, 115 E. Washington St.

Marshall—Dr. W. N. Bickford, Marshall Bldg.; Dr. S. P. Simmons, Bank of Marshall Bldg.

St. Joseph—Dr. W. H. Minton, First State Bank Bldg.; Dr. H. K. Wallace, 301 N. Eighth St.

St. Louis—Dr. Maurice L. Greene, 310 Metropolitan Bldg.; Dr. Joseph F. Mayes, 1800 Olive St.; Dr. John P. Murphy, Lister Bldg.; Dr. Wm. L. Hanson, 316 Murphy Bldg., 234 Collingsville Ave., East St. Louis, Ill.

MONTANA

Billings—Dr. Elmer G. Balsam, 222 Hart Albin Bldg.

Bozeman—Dr. Charles F. Jump; Dr. Clem G. Seerley, 405 Commercial Nat'l Bank Bldg.

Butte—Dr. Edward C. Person, Motor-Clinic Bldg.

Glendive—Dr. J. A. Evert, Northern Pacific Hospital; Dr. A. L. Hammerel, Northern Pacific Hospital.

Great Falls—Dr. Ivan A. Allred, 20 Conrad Bank Bldg.

Havre—Dr. F. W. Briggs, Havre Clinic; Dr. Arthur A. Husser, Havre Clinic.

Helena—Dr. William M. Copenhaver; Dr. Thomas L. Hawkins, Power Block Annex.

Lewistown—Dr. George R. Hageman, Attix Clinic; Dr. Curtis W. Wilder, 403 Montana Bldg.

Miles City—Dr. M. C. Pfunder; Dr. J. H. Garberson.

Missoula—Dr. W. R. Marshall, The Western Montana Clinic; Dr. James D. Hobson, 46 Higgins Block.

NEBRASKA

Edgar—Dr. C. W. Keith.

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313. The Formation of Ice upon Airplanes in Flight. By Thomas Carroll and William H. McAvoy.
314. Spiral Tendency in Blind Flying. By Thomas Carroll and William H. McAvoy.
315. Viscosity of Diesel Engine Fuel Oil Under Pressure. By Mayo D. Hersey.
316. Wind Tunnel Tests on a Model of a Monoplane Wing with Floating Ailerons. By Montgomery Knight and Millard J. Bamber.
317. Tests of Four Racing Type Airfoils in the Twenty-Foot Propeller Research Tunnel. By Fred E. Weick.
318. Full Scale Investigation of the Drag of a Wing Radiator. By Fred E. Weick.
319. Some Experiments on Autorotation of an Airfoil. By Shatswell Ober.
482. Ignition and Combustion Phenomena in Diesel Engines. By F. Sass. Translation from "Zeitschrift des Vereines deutscher Ingenieure," Sept. 10, 1927.
483. Ignition Points and Combustion Reactions in Diesel Engines—Part I. By J. Tausz and F. Schulte. Communication from the Petroleum Research Laboratory of the Institute of Applied Chemistry, Technical High School, Karlsruhe.
484. Ignition Points and Combustion Reactions in Diesel Engines—Part II. By J. Tausz and F. Schulte. Communication from the Petroleum Research Laboratory of the Institute of Applied Chemistry, Technical High School, Karlsruhe.
485. Research on the Control of Airplanes. By Melvill Jones. From "Nature," May 12, 1928. (Lecture delivered at the Royal Institution, Feb. 10, 1928.)
486. Tank Tests of Twin Seaplane Floats. By H. Herrmann, G. Kempf and H. Kloess. Translation from "Luftfahrtforschung," Jan. 3, 1928.
487. The Constructional Design of Metal Flying-Boat Hulls—Part I: Workshop Notes on the Building of Metal Hulls. By M. Langley. From "The Aeroplane," March 28 and July 25, 1928.
488. Determination of the Air Forces and Moments Produced by the Ailerons of an Airplane. By C. Weiselsberger and T. Asano. Translation from "Zeitschrift für Flugtechnik und Motorluftschiffahrt," July 14, 1928.
489. On the Take-Off of Heavily Loaded Airplanes. By Louis Breguet. Translation from "La Revue Scientifique," 1927, No. 12.
490. Structures of Thin Sheet Metal; Their Design and Construction. By Herbert Wagner. Translation of preprint of a paper read at 17th meeting of the "Wissenschaftlichen Gesellschaft für Luftfahrt," at Danzig, Germany, June 2-5, 1928.
491. Propeller Problems. By A. Betz. Translation of reprint from "Zeitschrift für angewandte Mathematik und Mechanik," November, 1927.
492. Influence of Fuselage on Propeller Design. By Theodor Troller. Translation from "Zeitschrift für Flugtechnik und Motorluftschiffahrt," July 28, 1928.
493. Aerodynamic Characteristics of Thin Empirical Profiles and Their Application to the Tail Surfaces and Ailerons of Airplanes. By A. Toussaint and E. Carafoli. Translation from "L'Aerophile," June, 1928.
494. "Safety" Fuels for Aircraft Engines. By A. Grebel. Translation from "Memoires et compte rendu des Travaux de la Societe des Ingenieurs Civils de France," July-August, 1927.
495. Device for the Automatic Control of Airplanes. By Alfred Gradenwitz. (Drexler control.) Translation from "Der Motorwagen," March 31, 1928.

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496. Photogrammetric Take-Off and Landing Measurements. By Bruno Spieweck. Translation from Yearbook of the "Wissenschaftlichen Gesellschaft für Luftfahrt," December, 1926.
497. Effect of Oxygen on the Ignition of Liquid Fuels. By H. Pahl. Translation from "Zeitschrift des Vereines deutscher Ingenieure," June 16, 1928.
498. Fluttering of the Tail Surfaces of an Airplane and the Means for Its Prevention. By F. N. Scheubel. Translation from Yearbook of the "Wissenschaftlichen Gesellschaft für Luftfahrt," December, 1926.
499. Danger of Ice Formation on Airplanes. By W. Kopp. Translation from reports of the German Aeronautical Weather Service, Vol. I, No. 25, Lindenberg Aeronautical Observatory, Berlin.
500. Remarks on Airplane Struts and Girders Under Compressive and Bending Stresses. Index Values. By Herbert Wagner. Translation from "Zeitschrift für Flugtechnik und Motorluftschiffahrt," June 14, 1928.
501. Effect of Intake Pipe on the Volumetric Efficiency of an Internal Combustion Engine. By Antonio Capetti. Translation from "Annalli della R. Scuola d'Ingegneria di Padova," Vol. VI, No. 4, December, 1927. (Paper read at the International Motor Congress, Padova, June, 1927.)
502. Analysis of Flight and Wind-Tunnel Tests on Udet Airplanes with Reference to Spinning Characteristics. By H. Herrmann. Translation from "Zeitschrift fur Flugtechnik und Motorluftschiffahrt," Jan. 14, 1929.
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504. Mechanical Control of Airplanes. By H. Boykow. Translation from Yearbook of the "Wissenschaftlichen Gesellschaft für Luftfahrt," 1928.
505. Impact Waves and Detonation—Part I. By R. Becker. Translation from "Zeitschrift für Physik," 1922, Vol. 8.
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507. Landing and Braking of Airplanes. By Louis Breguet. Translation from "La Chronique des Avions Breguet"—supplements to Nos. 8 and 9, 1928.
508. Aeromechanical Experimentation. (Wind tunnel tests.) By R. Katzmayr. Translation from Luftflotten, 1928.
509. The Transformation of Heat in an Engine. By Kurt Neumann. Translation from Geiger and Scheel's "Handbuch der Physik," Chap. 9, Vol. XI, 1926.
510. Theoretical Investigation of the Effect of the Ailerons on the Wing of an Airplane. By C. Wieselsberger. Translation from Report of the Aeronautical Research Institute, Tokyo Imperial University, December, 1927, No. 30, Vol. II, 16.
511. On the Strength of Box Type Fuselages. By J. Mathar. Translation from Yearbook of the "Wissenschaftlichen Gesellschaft für Luftfahrt, 1928.
512. Technical Report of the 1928 Rhön Soaring-Flight Contest. By A. Lippisch. Translation from "Zeitschrift für Flugtechnik und Motorluftschiffahrt," Feb. 14, 1929.
513. Contribution to the Technique of Landing Large Airships. By O. Krell. Part I. Translation from "Zeitschrift für Flugtechnik und Motorluftschiffahrt," Sept. 28, 1928.
514. Contribution to the Technique of Landing Large Airships. By O. Krell. Part II. Translation from "Zeitschrift für Flugtechnik und Motorluftschiffahrt," Sept. 28, 1928.
515. Materials and Methods of Construction in Light Structures. By Adolf Rohrbach. Translation from Yearbook of the "Wissenschaftlichen Gesellschaft für Luftfahrt," December, 1928.
516. Crank Case Scavenging of Two-Stroke-Cycle Engines. By Hans List. Translation from "Zeitschrift des Vereines deutscher Ingenieure," Feb. 16, 1929.
517. Investigation of the Effect of the Fuselage on the Wing of a Low-Wing Monoplane. By H. Muttray. Translation from "Luftfahrtforschung," June 11, 1928.
518. Investigation of Atomization in Carburetors. By J. Sauter. Translation from "Zeitschrift des Vereines deutscher Ingenieure," Nov. 3, 1928.
519. Force Measurements on Airplanes. By F. Seewald. Translation from "Zeitschrift für Flugtechnik und Motorluftschiffahrt," Oct. 7, 1928.
520. Torsional Rigidity of Cantilever Wings with Constant Spar and Rib Sections. By Giuseppe Gabrielli. Translation from "Luftfahrtforschung," June 26, 1928.
521. Wings with Nozzle-Shaped Slots. By Richard Katzmayr. Translation from "Berichte der Aeromechanischen Versuchsanstalt in Wien," Vol. I, No. 1, 1928.
522. The Analysis of Aircraft Structures as Space Frameworks. Method Based on the Forces in the Longitudinal Members. By Herbert Wagner. Translation from "Zeitschrift für Flugtechnik und Motorluftschiffahrt," Aug. 14, 1928.
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524. Lautal as a Material for Airplane Construction. By Paul Brenner. Translation from Yearbook of the "Deutsche Versuchsanstalt für Luftfahrt."
525. Buckling Tests of Light-Metal Tubes. By August Schroeder. Translation from Yearbook of the "Deutsche Versuchsanstalt für Luftfahrt."
526. Metal Construction Development. By H. J. Pollard. Part I: General. Strip Metal Construction—Fuselage. From "Flight," Jan. 26 and Feb. 23, 1928.

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527. Metal Construction Development. By H. J. Pollard. Part II: Strip Metal Construction—Wing Spars. From "Flight," March 29 and May 31, 1928.
528. Metal Construction Development. By H. J. Pollard. Part III: Workshop Practice. Strip Metal Construction—Wing Ribs. From "Flight," June 21, July 19, Oct. 25 and Dec. 27, 1928.
529. Metal Construction Development. By H. J. Pollard. Part IV: Moments of Inertia of Twin Corrugated Sections. From "Flight," April 25, 1929.
530. Travel of the Center of Pressure of Airfoils Transversely to the Air Stream. By Richard Katzmayr. Translation from "Berichte der Aeromechanischen Versuchsanstalt in Wien," Vol. I, No. 1, 1928.
531. Welding Rustproof Steels. By W. Hoffman. Translation from "Autogene Metallbearbeitung," Dec. 15, 1927, Vol. 20.
532. Welding of Stainless Materials. By H. Bull and Lawrence Johnson. From "Industrial Gases," March and June, 1929.

National Advisory Committee for Aeronautics—Aircraft Circulars Issued During 1929

No.

83. The Vickers "Vellore" (British). A Freight Carrier (Airplane) Which Carries a Load Greater Than Its Own Weight. From "Flight," Sept. 6, 1928.
84. The Caproni Monoplanes "Ca 97" (Italian). Translation from "Bollettino Aeronautico," May-June, 1928.
85. The Gloster "Goldfinch" (British)—Single-Seat Fighter. From "Flight," Oct. 4, 1928.
86. Bleriot Combat Monoplane 127 (French). Translation from "Les Ailes," Sept. 20, 1928.
87. "Villiers 24" Slotted-Wing Airplane (French)—Night Pursuit Sesquiplane. Translation from "L'Aeronautique," March and April, 1928.
88. Farman Two-Engine Commercial Biplane F-180 (French). Translation from a circular received from Paris office, N.A.C.A.
89. Albessard "Triavion" Airplane (French)—A Two-Seat Tandem Monoplane. By J. Serryer. Translation from "Les Ailes," Sept. 2, 1926.
90. The Boulton and Paul "Partridge" (British)—All-Metal Single-Seat Fighter. From "Flight," Dec. 6, 1928.
91. The De Havilland D. H. 75 "Hawk Moth" (British)—Cabin Monoplane. From "Flight," Feb. 7, 1929.
92. Nieuport-Delage 640 (French) Commercial High-Wing Monoplane. Translation from Manufacturer's circular received from Paris office, N.A.C.A., Aug. 3, 1928.
93. Morane-Saulnier 180 Light Airplane (French)—A Single-Seat Training Monoplane. By Andre Frachet. Translation from "Les Ailes," Nov. 22, 1928.
94. The Blackburn "Bluebird" Mark IV (British)—All-Metal Biplane. From "Flight," Jan. 17, 1929.
95. The Westland IV Commercial Monoplane (British)—Three "Cirrus III" Engines. From "Flight," Feb. 28, 1929.
96. The "Potez 33" Military Airplane (French). Translation from "Bulletin Technique des Avions H. Potez," January, 1929.
97. The Amiot S.E.C.M. 110 C.1—A Single-Seat Pursuit Monoplane. Translation from "Les Ailes," May 16, 1929.
98. The Bernard 20 C.1 (French)—A Single-Seat Pursuit Monoplane. Translation from "L'Aeronautique," May, 1929.
99. The Parnall "Pipit" (British)—A Single-Seat Ship's Fighter. From "Flight," June 13, 1929.
100. The "K 47" of the A. B. Flygindustri—An Armored Pursuit Monoplane. By R. Schulz. Translation from "Luftwacht," May, 1929.
101. The A.B.C. "Robin" (British)—A Single-Seat Cabin Monoplane. From "Flight," May 30, 1929.
102. The Fairey III.F (British)—A General-Purpose Biplane. From a circular issued by The Fairey Aviation Company, Limited, England.

U. S. AIR CORPS, WAR DEPARTMENT

Chief of the Air Corps.....Maj. Gen. James E. Fechet

Assistant Chiefs of the Air Corps

Brig. Gen. Frank P. Lahm, commanding Training Center, San Antonio, Tex.
Brig. Gen. Benjamin D. Foulois, in charge of Training and Operations Division, Washington, D.C.
Brig. Gen. William E. Gillmore, in charge of Material Division, Dayton, Ohio.

Organization

In the office of the Chief of the Air Corps is the Executive Officer, Maj. L. W. McIntosh, under whom comes the Finance Section, the Buildings and Grounds Section and the following Divisions:

Training and Operations Division in Washington, D. C., under which come 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, D. C.

Personnel Division, which is in Washington, D. C., 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

F. Trubee Davison.....Assistant Secretary of War
Maj. Gen. James E. Fechet.....Chief of the Air Corps
Brig. Gen. William E. Gillmore.....Assistant Chief of the Air Corps

Colonels—Clarence C. Culver, L. M. Hathaway.

Lieutenant Colonels—A. G. Fisher, Roy C. Kirtland, R. H. Young.

Majors—Frank M. Andrews, J. Y. Chisum, J. B. Brooks, H. C. Davidson, M. F. Davis, D. C. Emmons, R. A. Hale, H. W. Harms, H. M. Hickam, A. F. Hobley, D. Johnson, B. Q. Jones, J. W. Jones, F. Kennedy, R. F. Longacre, I. Longanecker, F. L. Martin, J. C. McDonnell, J. T. McNarney, L. W. McIntosh, T. DeW. Milling, E. L. Naiden, D. B. Netherwood, C. W. Russell, L. M. Field.

Captains—E. E. Adler, C. B. B. Bubb, E. Clark, J. J. Devery, H. A. Dinger, I. C. Eaker, W. E. Farthing, W. J. Flood, W. H. Hale, T. W. Hastey, D. B. Howard, F. O'D. Hunter, L. B. Jacobs, W. E. Lynd, P. J. Mathis, H. M. McClelland, W. J. Reed.

Lieutenants—C. R. Archer, E. B. Bayley, R. Birnn, Harold Brand, H. L. Clark, J. C. Cluck, H. A. Craig, F. Elbe, A. I. Ennis, D. W. Goodrich, J. S. Gullet, R. A. Hicks, B. Hoppin, D. L. Hutchins, J. B. Jordan, F. Von H. Kimble, Guy Kirksey, M. S. Lawton, N. Longfellow, F. M. McKee, L. J. Maitland, Vincent J. Meloy, Louis M. Merrick, B. E. Meyers, D. M. Myers, L. W. Miller, C. P. Prime, E. R. Quesada, W. A. R. Robertson, M. Stenseth, L. S. Stranathan, C. W. Sullivan, J. E. Upston, L. P. Whitten, M. R. Wood.

Air Corps Posts

Akron, Ohio—Balloon Production and Inspection. Procurement Section, District Office (Chief of the Air Corps). P. O. % Goodyear Tire & Rubber Co., Akron, Ohio.

Armstrong, Ft.—(H. Dept.). P. O. Honolulu, T. H. Air Depot.

Biggs Field—(Eighth Corps Area). P. O. Ft. Bliss, Tex. 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 Hq. Flight. Intermediate Landing Field. Reserve Flying. Reserve Airdrome.

Bowman Field—(Fifth Corps Area). P. O. Jeffersontown, 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, Tex. 11th School Group Hq. 46th School Sq. 62d Service Sq. 51st, 52d School Sqs. 20th Photo Sec. 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 Representative. Curtis 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.). P. O. Camp Stotsenburg, P. I. 3rd Pursuit Sq.

Clark, Ft.—(Eighth Corps Area). P. O. Brackettville, Tex. 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 Sec.

Crockett, Ft.—(Eighth Corps Area). P. O. Galveston, Tex. Hq. 3rd Attack Group, 8th, 90th Attack Sqs. 60th Service Sq.

Crook, Ft.—(Seventh Corps Area). P. O. Ft. Crook, Neb. Corps Area Hq. 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 Building. Detroit, Mich. Procurement Planning Representative.

DODD FIELD—(Eighth Corps Area). P. O. Ft. Sam Houston, Tex. Airdrome. 12th Obs. Sq. 1st Photo Section.
DOUGLAS, ARIZ.—(Eighth Corps Area). P. O. Douglas, Ariz. Airdrome. Intermediate Landing Field.
DRYDEN, TEX.—(Eighth Corps Area). P. O. Dryden, Tex. Border Patrol Station. Airdrome. Intermediate Landing Field.
DUNCAN FIELD—(Chief of the Air Corps). P. O. San Antonio, Tex. 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.
FRANCE FIELD—(P. C. Dept.). P. O. France Field, Canal Zone. 6th Composite Group Hq. 7th Obs. Sq. 12th Photo Sec. 63d Service Sq. 24th Pursuit Sq. 25th Bomb Sq. Aerial Coast Defense. Air Corps Band. Panama Air Depot.
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, Okla. Intermediate Landing Field.
HOUSTON, FT. SAM—(Eighth Corps Area). P. O. Ft. Sam Houston, Tex. Airway Control Officer. (See Dodd Field).
KELLY FIELD—(Chief of the Air Corps). P. O. Kelly Field, Tex. 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.
LANGLEY FIELD—(Chief of the Air Corps). P. O. Hampton, Va. Hq. 2d Wing, 19th Airship Co. Hq. 2d Group. 20th, 49th, 96th Bomb. Sqs. 58th, 59th Service Sqs. 2d Photo Sec. Tactical School. Flying Field.
LEAVENWORTH, FT.—P. O. Ft. Leavenworth, Kan. Air Corps Detachment. Intermediate Landing Field.
LITTLE ROCK AIR DEPOT—(Chief of the 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, Tex. Intermediate Landing Field.
LUKE FIELD—(H. Dept.). P. O. Honolulu, T. H. 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, Tex. 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 Sec. 47th School Sq. 53d, 54th School Sqs. Flying Cadet Detachment.
MARFA, CAMP—(Eighth Corps Area). P. O. Marfa, Tex. Airdrome. Intermediate Landing Field.
MARSHALL FIELD—(Seventh Corps Area). P. O. Ft. Riley, Kan. 16th Obs. Sq. 9th Photo Sec.
MAXWELL FIELD—(Fourth Corps Area). P. O. Montgomery, Ala. 22d Obs. Sq. (less detachment at Ft. Bragg). 4th Photo Sec.
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 Sec. 1st, 5th, 99th Obs. Sqs. 61st Service Sq.
NEW YORK—(Chief of the Air Corps). P. O. 39 Whitehall St., New York, 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 Sec. 28th Bomb. Sq. Philippine Air Depot. 2d Obs. Sq.
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, Neb. 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. 1st Balloon Co. 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.

SALT LAKE CITY—Municipal Airport. P. O. Salt Lake City, Utah. (Formerly Woodward Field.) Reserve Airdrome.

SAN ANTONIO AIR DEPOT—(Chief of the Air Corps). P. O. Duncan Field, San Antonio, Tex. 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 St., 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 Airship Cos. 21st Airship Group Hq. 21st Photo Sec. 24th Airship Service Co. Balloon and Airship School. Air Depot. Flying Field.

SEATTLE—(Chief of the Air Corps). P. O., % Boeing Airplane Co., Georgetown Station, Seattle, Wash. District Procurement Office. Air Corps Representative 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 Sec. 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, T. H. 18th Pursuit Group. 6th, 19th Pursuit Sqs. Flying Field.

WRIGHT FIELD—(Chief of the Air Corps). P. O. Dayton, Ohio. Matériel Division.

ENGINEERING SCHOOL—Experimental Engineering Section. Procurement Planning Representative—Repair and Maintenance Section. Industrial War Plans. Field Service Section Procurement Section.

Special Service Schools—Advanced Flying School, Kelly Field, Tex.; Primary Flying School, Brooks Field, Tex.; 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, Tex.; Balloon and Airship School, Scott Field, Belleville, Ill.

Matériel Division

Wright Field, Dayton, Ohio

Brig. Gen. Benjamin D. Foulois, Chief of Division

Executive	Maj. Jacob E. Fickel
Assistant Executive	Maj. L. A. Lawson
Commanding Officer and Chief of Administration	Maj. Leslie MacDill
Chief Engineering	Maj. C. W. Howard
Chief Procurement	Maj. Leslie MacDill
Chief Field Service	Maj. Harold S. Martin
Chief Maintenance	Lieut. C. S. Johnson
Chief Industrial War Plans	Maj. W. H. Crom
Chief Finance Budget	Mr. C. E. Orton
Assistant Commandant Air Corps Engineering School	Capt. E. P. Sorenson
Adjutant	Lieut. L. A. Lawson
Finance Officer	Capt. G. W. Cooke
Flight Surgeon	Capt. E. G. Reinartz
Quartermaster	Lieut. E. Hostetter
Constructing Quartermaster	Capt. L. Doten
Signal Officer	Capt. A. H. Thiessen
Station Supply Officer	Capt. A. M. Drake
Engineer Corps Representative	Lieut. G. C. Hill
Ordnance Corps Representative	Capt. C. F. Hofstetter
Signal Corps Representative	Capt. P. S. Edwards
Navy Corps Representative	Lt. Comdr. G. R. Fairlamb

Air Corps National Guard Units

101st Obs. Sq. & Photo Sec., Mass. Nat'l Gd.	Boston Airport, Boston, Mass.
102d Obs. Sq. & Photo Sec., N. Y. Nat'l Gd.	Miller Field, Staten Island, N. Y.
103d Obs. Sq., Penna. Nat'l Gd.	Philadelphia, Pa.
104th Obs. Sq. & Photo Sec., Md. Nat'l Gd.	Logan Field, Baltimore, Md.
105th Obs. Sq. & Photo Sec., Tenn. Nat'l Gd.	McConnell Field, Nashville, Tenn.
106th Obs. Sq. & Photo Sec., Ala. Nat'l Gd.	Roberts Field, Birmingham, Ala.

107th Obs. Sq. & Photo Sec., Mich. Nat'l Gd..Route 9, Box 453, Detroit, Mich.
108th Obs. Sq., Illinois Nat'l Gd.....Chicago. Ill.
109th Obs. Sq. & Photo Sec., Minn. Nat'l Gd.Chamberlain-Wold Field, St. Paul, Minn.
110th Obs. Sq. & Photo Sec., Mo. Nat'l Gd...Anglum Field, St. Louis, Mo.
111th Obs. Sq. & Photo Sec., Tex. Nat'l Gd...Ellington Field, Houston, Tex.
112th Obs. Sq., Ohio Nat'l Gd.....Cleveland, Ohio
113th Obs. Sq. & Photo Sec., Ind. Nat'l Gd...Indianapolis, Ind.
115th Obs. Sq. & Photo Sec., Cal. Nat'l Gd...Los Angeles Airport, Griffith Park, Cal.
116th Obs. Sq. & Photo Sec., Wash. Nat'l Gd.Parkwater Aviation Field, Spokane, Wash.
118th Obs. Sq. & Photo Sec., Conn. Nat'l Gd..Municipal Airdrome, Hartford, Conn.
120th Obs. Sq. & Photo Sec.. Colo. Nat'l Gd..Lowry Field, Denver, Colo.
154th Obs. Sq., Arkansas Nat'l Gd.....Little Rock, Ark.

Corps Area and Department Air Offices

First Corps Area.....Army Base, South Boston, Mass.
Second Corps Area.....Governors Island, N. Y.
Third Corps Area.....Standard Oil Bldg., Baltimore, Md.
Fourth Corps Area.....Oakland City Station, Atlanta, Ga.
Fifth Corps Area.....Ft. Hayes, Columbus, Ohio
Sixth Corps Area.....1819 W. Pershing Road, Chicago, Ill.
Seventh Corps Area.....Army Bldg., Omaha, Neb.
Eighth Corps Area.....Ft. Sam Houston, Tex.
Ninth Corps Area.....Presidio of San Francisco, Cal.
The Philippine Department .....Manila, P. I.
The Hawaiian Department .....Ft. Shafter, T. H.
The Panama Department .....Quarry Heights, Balboa Heights, C. Z.

Strength of the Army Air Corps

Dec. 31, 1929

Commissioned Officers		1,143
Student Officers	72	
Pilots	958	
Enlisted men		10,842
Civilians	2,971	

Air Equipment

Attack Airplanes	68
Bombardment Airplanes	45
Observation Airplanes	457
Pursuit Airplanes	213
Training Airplanes	335
Cargo Airplanes	33

Strength of Air Corps Organized Reserves

Officers	5,954
Pilots and Observers	2,045
Number of Civilian Employees, Dec. 31, 1929	2,971

Army Flying Time and Distances

1929

Heavier-than-air	263,381 hours
Lighter-than-air	2,410 hours
Total flying time	265,791 hours
Miles flown	25,250,145 miles

ARMY PURCHASES OF AERONAUTICAL EQUIPMENT

Fiscal Year 1929

Aircraft

No.	*Types*	*Cost*
	Lighter than air equipment:	
4	Observation Balloons	$ 13,000.00
	Heavier than air equipment:	
	1. Airplanes and Spares:	
120	Primary Training Airplanes and Spares (Wright R-790 Engines)	1,363,491.71
30	Pursuit Airplanes converted from Advanced Training Type (Curtiss D-12 Engines)	479,047.62
41	Pursuit Airplanes and Spares (P&W R-1340 Engines)	1,167,330.56
33	Pursuit Airplanes and Spares (Curtiss D-12 Engines)	894,329.92
18	Pursuit Airplanes and Spares (Curtiss V-1570 Engines)	628,310.31
38	Observation Airplanes and Spares (Curtiss D-12 Engines)	862,421.96
61	Observation Airplanes and Spares (Liberty Engines)	849,402.96
8	Amphibian Airplanes and Spares (Wright V-1460 Engines)	425,927.90

No.		
10	Bombardment Airplanes and Spares—Model B-2 (Curtiss GV-1570 Engines)	1,370,054.09
10	Bombardment Airplanes and Spares—Model LB-7 (P&W R-1690 Engines)	657,789.20
17	Bombardment Airplanes and Spares—Model LB-6 (Wright R-1750 Engines)	1,016,373.93
8	Cargo Airplanes and Spares—Model C-3A (1 P&W Wasp Engine; 7 Wright R-975 Engines)	580,190.01
7	Cargo Airplanes and Spares—Model C-7A (1 P&W R-1340 Engine; 6 Wright R-975 Engines)	517,083.30
1	Observation Airplane—Model O-23	28,300.00
1	Morane-Saulnier Airplane	7,500.00
3	Pursuit Airplanes (Curtiss H-1640 Engines)	83,011.07
3	Observation Airplanes (Curtiss V-1570 Engines)	35,500.00
5	Observation Airplanes (P&W R-1340 Engines)	133,498.10
1	Sikorsky Amphibion	43,616.00
1	DeHavilland Moth	3,908.42
1	Vought Corsair	13,100.00

2. Engines:

157	Curtiss D-12 Engines	(See Airplanes)		1,165,199.68
36	Curtiss V-1570 Engines	"	"	380,905.37
40	Curtiss GV-1570 Engines	"	"	493,722.15
4	Curtiss H-1640 Engines	"	"	40,000.00
164	Wright R-790A Engines	"	"	566,001.57
78	Wright R-975 Engines	"	"	327,446.33
12	Wright V-1460 Engines	"	"	241,580.08
68	Wright R-1750 Engines	"	"	531,104.30
106	Pratt & Whitney R-1340 Engines	"	"	710,667.46
40	Pratt & Whitney R-1690 Engines	"	"	369,839.96
105	Liberty Engines Reconditioned	"	"	55,905.00
	(These engines are initial equipment for above airplanes)			
8	Curtiss V-1570 Engines			75,647.94
2	Curtiss R-600 Engines			3,500.00
4	Pratt & Whitney R-1340 Engines			24,727.88
48	Wright R-975 Engines			204,072.56
2	Warner 110 H.P. Air-cooled Engines			4,530.00
1240	Liberty Engines Remodeled			737,042.80

3. Miscellaneous:

1106	Parachutes	201,539.85
250	Winter Flying Suits	26,950.00
700	Summer Flying Suits	3,213.00
3491	Pairs Goggles	44,177.13
2200	Summer Helmets	6,249.00
500	Aviators Jackets	4,287.47
15	Cameras, Type K-3A	52,762.65
6	Photographic Outfits	13,061.00
6	Gun Cameras	17,304.00
25	Bomb Sights, Type C-3	296,900.00
5	Bomb Sights, Type L-1	40,000.00
1300	Sets Steel Backed Bearings for Liberty Engines	85,800.00
	Government-furnished equipment for future airplanes	114,844.42
	Airplane Equipment and Accessories	188,897.75
	Power Plant Equipment and Accessories	167,208.70
	Photographic Equipment	5,202.62
	Armament Equipment	63,639.89
	Miscellaneous	5,597.13
	Transportation and Crating for Overseas Shipment	135,874.29

AIRPLANES DELIVERED TO U. S. ARMY IN 1929

Fiscal Year

No.	*Type and Model*	*Contractor*
1	Bombardment, Model B-2	Curtiss Aeroplane & Motor Co., Inc.
8	Bombardment, Model LB-7	Keystone Aircraft Corporation
90	Training, Model PT-3A	Consolidated Aircraft Corporation
21	Observation, Model O-2H	The Douglas Company
40	Observation, Model O-2K	The Douglas Company
2	Cargo, Model C-3A	Stout Metal Airplane Company
33	Pursuit, Model P-1C	Curtiss Aeroplane & Motor Co., Inc.
10	Observation, Model O-2H (for National Guard)	The Douglas Company
9	Pursuit, Model P-12	Boeing Airplane Company
1	Pursuit, Model XP-12-A	Boeing Airplane Company
1	Observation, Model O-19	Thomas Morse Aircraft Company

No.	Type and Model	Contractor
4	Observation, Model O-2H (for National Guard)	The Douglas Company
1	Cargo, Model F-10-A (C-5)	Fokker Aircraft Corporation
1	Observation, Model O-2S	Chance Vought Corporation
1	FC-2 Airplane	Fairchild Airplane Mfg. Co.
1	Pursuit Viper	Thomas Morse Aircraft Company

BUREAU OF AERONAUTICS, NAVY DEPARTMENT

Chief of Bureau.....Rear Admiral William A. Moffett
Assistant Chief of Bureau.....Comdr. J. H. Towers

Organization

The following divisions assist in carrying on the duties of the Bureau of Aeronautics:
Administration.....Comdr. A. H. Gray
Financial.....Comdr. E. A. Cobey
Plans.....Comdr. R. K. Turner
Flight.....Lt. Comdr. H. B. Cecil
Material.....Comdr. S. M. Kraus

Naval Air Stations

Pensacola, Fla., Training—Commandant, Rear Admiral A. W. Marshall; Captain of the Yard, Comdr. E. D. McWhorter.

San Diego, Cal., Fleet Base—Commanding Officer, Capt. F. R. McCrary; Executive Officer, Lt. Comdr. E. W. Spencer.

Hampton Roads, Va., Fleet Base—Commanding Officer, Capt. E. J. King; Executive Officer, Lt. Comdr. H. T. Bartlett.

Lakehurst, N. J., Lighter-than-Air—Commanding Officer, Comdr. M. R. Pierce; Executive Officer, Lt. Comdr. F. C. McCord.

Pearl Harbor, T. H., Fleet Base—Commanding Officer, Comdr. V. D. Herbster; Executive Officer, Lieut. S. B. Stadtler.

Coco Solo, C. Z., Fleet Base—Commanding Officer, Comdr. A. D. Bernhard; Executive Officer, Lieut. J. D. Alvis.

Anacostia, D. C., Experimental—Commanding Officer, Comdr. A. H. Douglas; Executive Officer, Lieut. J. J. Clark.

Rockaway, L. I., N. Y., Naval Aviation Reserve Unit—Commanding Officer, Lieut. L. A. Moebus.

Seattle, Wash., Naval Air Station—Commanding Officer, Lt. Comdr. J. D. Price.

Great Lakes, Ill., N.A.R.U.—Commanding Officer, Lieut. John M. Hoskins.

Squantum, Mass., N.A.R.U.—Commanding Officer, Lieut. G. C. Haeberle.

Aircraft Squadrons

Aircraft Squadrons, Scouting Fleet—Commander, Capt. J. J. Halligan; Senior Aide, Lt. Comdr. H. C. Wick.

Observation Squadron Two—Squadron Commander, Lt. Comdr. H. C. Frazer.
Scouting Plane Squadron Five—Squadron Commander, Lieut. M. R. Browning.
Scouting Plane Squadron Six—Squadron Commander, Lt. Comdr. C. G. Halpine.
Scouting Plane Squadron Seven—Squadron Commander, Lieut. J. D. Lowry.
Torpedo and Bombing Squadron Nine—Squadron Commander, Comdr. E. W. Todd.
Patrol Squadron Eight—Squadron Commander, Lt. Comdr. A. I. Price.
Utility Squadron Two—Squadron Commander, Lt. Comdr. J. F. Moloney.
U. S. S. *Wright* (Tender) (Flagship)—Commanding Officer, Capt. R. F. Zogbaum; Executive Officer, Lt. Comdr. G. D. Murray.
U. S. S. *Patoka*—Commanding Officer, Capt. A. Claude.
U. S. S. *Sandpiper* (Tender)—Commanding Officer, Lieut. A. B. Dorsey.
U. S. S. *Teal* (Tender)—Commanding Officer, Lieut. J. F. McCarthy.

Aircraft Squadrons, Battle Fleet—Commander, Rear Admiral H. V. Butler; Senior Aide, Capt. K. Whiting.

*Observation Squadron Three—Squadron Commander, Lieut. J. G. Farrell.
Observation Squadron Four—Squadron Commander, Lt. Comdr. Gail Morgan.
Observation Squadron Five—Squadron Commander, Lt. Comdr. A. R. Simpson.
Fighting Plane Squadron One—Squadron Commander, Lt. Comdr. J. B. Kneip.
Fighting Plane Squadron Two—Squadron Commander, Lt. Comdr. F. W. Neilson.
Fighting Plane Squadron Three—Squadron Commander, Lt. Comdr. S. P. Ginder.
Light Bombing Squadron One—Squadron Commander, Lt. Comdr. J. H. Campman.
Light Bombing Squadron Two—Squadron Commander, Lt. Comdr. H. M. Mullinnix.
Torpedo and Bombing Squadron One—Squadron Commander, Lt. Comdr. A. C. McFall.
Torpedo and Bombing Squadron Two—Squadron Commander, Lt. Comdr. A. E. Montgomery.
Scouting Plane Squadron One—Squadron Commander, Lt. Comdr. H. B. Sallada.
Scouting Plane Squadron Two—Squadron Commander, Lt. Comdr. D. C. Watson.
Scouting Plane Squadron Three—Squadron Commander, Lt. Comdr. G. S. Gillespie.
Scouting Plane Squadron Four—Squadron Commander, Lieut. W. C. Allison.
Patrol Squadron Seven—Squadron Commander, Lt. Comdr. G. R. Fairlamb.

*Temporarily attached to Aircraft Squadrons, Scouting Fleet.

Utility Squadron One—Squadron Commander, Lt. Comdr. J. H. Strong.

U. S. S. *Saratoga* (Aircraft Carrier) (Flagship)—Commanding Officer, Capt. F. J. Horne; Executive Officer, Comdr. A. C. Read.

U. S. S. *Lexington* (Aircraft Carrier)—Commanding Officer, Capt. F. D. Berrien; Executive Officer, Comdr. J. H. Hoover.

U. S. S. *Langley* (Aircraft Carrier)—Commanding Officer, Capt. A. B. Cook; Executive Officer, Lt. Comdr. M. A. Mitscher.

U. S. S. *Aroostook* (Tender)—Commanding Officer, Comdr. W. G. Child; Executive Officer, Lt. Comdr. Roy Pfaff.

U. S. S. *Gannet* (Tender)—Commanding Officer, Lieut. W. E. Tarbutton.

Aircraft Squadrons, Asiatic Fleet—Commander, Comdr. A. L. Bristol.

Torpedo and Bombing Plane Squadron Five—Squadron Commander, Lt. Comdr. R. S. Parr.

Scouting Squadron Eight—Squadron Commander, Lt. Comdr. Ralph Wyman.

Airship

U. S. S. *Los Angeles*—Commanding Officer, Lt. Comdr. H. V. Wiley; Executive Officer, Lt. Comdr. B. J. Rodgers.

Rigid Airship Training and Experimental Squadron—Commanding Officer, Lt. Comdr. C. E. Rosendahl.

Aviation Duty Other Than Department Stations and Squadrons

Naval Torpedo Station, Newport, R. I.—Lieut. P. E. Roswall.

Naval Aircraft Factory, U. S. Navy Yard, Philadelphia, Pa.—Manager, Comdr. R. D. Weyerbacher; Chief Engineer, Lt. Comdr. Donald Royce (CC).

Naval Air Detail, Dahlgren, Va.—Officer-in-Charge, Lieut. J. J. Ballentine.

Aviation Mechanics' School, Naval Training Station, Great Lakes, Ill.—Lieut. A. B. Anderson.

Aide to Assistant Secretary of the Navy (Air), Navy Department, Washington, D. C.—Lt. Comdr. R. P. Molten.

Bureau of Navigation, Navy Department, Washington, D. C.—Lt. Comdr. W. Capehart.

Hydrographic Office, Navy Department, Washington, D. C.—Lieut. (jg) J. P. W. Vest.

Bureau of Ordnance, Navy Department, Washington, D. C.—Lieut. F. I. Entwistle.

Bureau of Engineering, Navy Department, Washington, D. C.—Lieut. H. C. Rood.

Aide to C-in-C, U. S. Fleet, Staff—Lt. Comdr. C. T. Durgin.

Aide to C-in-C, Battle Fleet, Staff—Comdr. E. E. Wilson.

Office of Naval Operations, Navy Department, Washington, D. C.—Lt. Comdr. W. K. Harrill (Board of Inspection and Survey); Lt. Comdr. R. E. Davison (Operations); Lieut. R. P. McConnell (Fleet Training).

Strength of Naval Aviation in 1929

PILOTS

Navy:		
Commissioned Officers	498	
Warrant Officers	22	
Enlisted Men	173	
		693
Marine Corps:		
Commissioned Officers	60	
Warrant Officers	2	
Enlisted Men	23	
		85

NON-PILOTS—Includes students, observers, ground personnel, etc.

Navy:		
Officers	323	
Enlisted Men	11,469	
		11,792
Marine Corps:		
Officers	49	
Enlisted Men	983	
		1,032

TOTALS

Navy Pilots	693	
Marine Corps Pilots	85	
		778
Navy non-pilot personnel	11,792	
Marine Corps non-pilot personnel	1,032	
		12,824
GRAND TOTAL, Navy and Marine Corps		13,602

Number of Naval Airplanes in Service

1929

Fighting Planes	164
Observation Planes	195
Torpedo and Bombing Planes	210
Patrol and Scouting	7
Training	160
Total	736

Types and Number of Planes, U. S. Marine Corps

1929

Fighting Planes	28
Observation	57
Patrol and Scouting	6
Training	2
Total	93

NAVY PURCHASES OF AERONAUTICAL EQUIPMENT

1929

Aircraft

No.		*Cost*
68	Fighting Planes	$1,103,968.00
181	Observation Planes	2,494,228.00
46	Patrol and Scouting Planes	2,228,608.00
23	Torpedo and Bombing Planes	618,118.00
2	Ambulance Planes	36,000.00
103	Training Planes	904,111.00
	Spares	1,846,188.00
	Total	$9,231,421.00

Engines

161	Wright "Whirlwind"	$ 666,666.00
135	Wright "Cyclone"	843,491.00
526	Pratt & Whitney "Wasps"	3,462,926.00
42	Pratt & Whitney "Hornet"	285,719.00
2	Curtiss "Challenger"	6,800.00
2	"Jupiter" (E. W. Bliss Co.)	18,000.00
1	"Jupiter VII" (Bristol A. C. Co.)	9,000.00
	Spares	1,324,150.00
	Total	$6,616,752.00

Airplanes Delivered to U. S. Navy in 1929

Model	*Number Delivered*	*Contractor*
F4B-1	29	Boeing Airplane Co.
F8C-4	37	Curtiss Aeroplane and Motor Co.
XFJ-1	1	Berliner-Joyce Aircraft Co.
Bristol Bulldog	1	Bristol Airplane Co.
OL-8	20	Loening Aeronautical Eng. Corp.
O2U-2	37	Chance Vought Corp.
O2U-3	80	Chance Vought Corp.
O2U-4	42	Chance Vought Corp.
XOK-1	1	Keystone Aircraft Corp.
XOJ-1	1	Berliner-Joyce Aircraft Co.
PS-2	2	Sikorsky Aircraft Mfg. Co.
PS-3	4	Sikorsky Aircraft Mfg. Co.
PM-1	30	Glenn L. Martin Co.
P3M-1	9	Glenn L. Martin Co.
XP2M-1	1	Glenn L. Martin Co.
TA-2	1	Atlantic Aircraft Corp.
JR-2	2	Ford Airplane Co.
JR-3	1	Ford Airplane Co.
TG-1	18	Great Lakes Aircraft Corp.
XT6M-1	1	Glenn L. Martin Co.
XHL	2	Loening Aeronautical Eng. Corp.
NK-1	16	Keystone Aircraft Corp.
NY-2	25	Consolidated Aircraft Corp.
NY-1	61	Consolidated Aircraft Corp.
XN3Y-1	1	Consolidated Aircraft Corp.
Total	423	

Aircraft Engines Delivered to U. S. Navy in 1929

Model	*Number Delivered*	*Contractor*
R-760	3	Wright Aeronautical Corp.
R-790	161	Wright Aeronautical Corp.
R-540	3	Wright Aeronautical Corp.
R-975	24	Wright Aeronautical Corp.
R-1750	132	Wright Aeronautical Corp.
R-1920	3	Wright Aeronautical Corp.
R-1340	526	Pratt & Whitney Aircraft Co.
R-1690	36	Pratt & Whitney Aircraft Co.
R-1860	7	Pratt & Whitney Aircraft Co.
R-600	2	Curtiss Aeroplane and Motor Co.
Jupiter	2	E. W. Bliss Co.
Jupiter VII	1	Bristol Airplane Co.
Total	900	

AIRCRAFT APPROPRIATIONS, UNITED STATES

1922-1930

			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	–$4,347,841
1923–24	Army	12,426,000		–469,000	
	Navy	14,647,174		–36,416	
	Air Mail	1,500,000		–400,000	
	N.A.C.A.	283,000	28,856,174	+73,000	–832,416
1924–25	Army	14,113,043.80		+1,687,043.80	
	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	+3,626,869.80
1925–26	Army	14,709,000*		+586,956.20	
	Navy	14,790,000‡		–360,000	
	Air Mail	2,810,000††		–150,000	
	N.A.C.A.	534,000	32,624,000	+64,000	+350,956.20
1926–27	Army	15,050,000		+350,000	
	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	+3,884,288
1927–28	Army	20,396,300		+5,346,300	
	Navy	20,100,000		+1,594,712	
	N.A.C.A.	513,000			
	Commerce	3,791,500	44,787,800		+10,219,512
1928–29	Army	24,848,562(1)		+4,452,262	
	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
1929–30	Army	34,690,785		+9,842,223	
	Navy	31,430,000(2)		–759,560	
	N.A.C.A.	1,292,200		+692,200	
	Commerce	6,416,620	73,829,605	+2,054,770	+11,829,633

(1) And contract authorization of $5,000,000.

(2) And contract authorization of $10,000,000.

*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.

+Shows amount of increase.

–Shows amount of decrease.

Note—Budget estimates for the fiscal year 1930-31 recommended for the Army, $35,823,473; Navy, $32,230,000 (and contract authorization for $10,000,000); National Advisory Committee for Aeronautics, $1,321,000; and Department of Commerce, $8,925,830. Total estimated amount, $78,300,303.

ORDERS OF FEDERAL RADIO COMMISSION AFFECTING AIR TRANSPORT

FEDERAL RADIO COMMISSION

Washington, D. C.

Sept. 9, 1929.

Upon motion duly made, seconded and carried the following order was adopted:

It appearing that representatives of the aviation transport companies and agencies have conferred with members of the Commission and responsible officials of the Army, Navy, Department of Commerce and Bureau of Standards, to the end that a suitable, economical and comprehensive plan for the radio requirements of aviation be adopted, and

It appearing that all of the representatives of said companies and agencies and officials of the Government have carefully considered and approved such a plan, and

It further appearing that said plan provides for an economical and scientific use of the frequencies involved, in the public interest, convenience and necessity, now, therefore, acting under Section 4 (c) of the Radio Act of 1927 as amended,

It is ordered that said plan be adopted by the Commission to be followed in the designation of frequencies for aviation purposes, as follows:

1. To co-ordinate the use of radio facilities for the purpose of aviation and to secure a maximum of flexibility in the use of the same, the Commission will and it hereby does, reserve the frequencies now set aside for use in aviation service and, in addition, reserves the frequencies 3136, 3142, and 3148 solely for this use. Upon proper application of any companies or agencies maintaining, or proposing to maintain, aeronautical stations, if the Commission is satisfied that the particular applicant is qualified and that the issuance of the license or licenses in question would serve public interest, convenience or necessity, the frequencies will be designated solely for use by all of said stations comprising a continuous series, or chain, along a particular airway. The Commission will recognize new or different chains from time to time and frequencies will be designated to them in accordance with this plan.

2. Aeronautical stations licensed pursuant to this plan will provide adequate service, without discrimination, for all and any aircraft of whatever nature. Where the service provided by a chain is regularly used, as distinguished from casual, incidental, or emergency use, the owners of the aircraft which use such chain or chains, shall co-operate among themselves as to the operation, maintenance, operation and liability of the stations: Provided, however, that nothing herein will impose upon the Commission any authority or responsibility whatever with reference to the private business or transactions of any license.

3. All frequencies reserved for aviation purposes shall be designated in three classes as follows:

(a) frequencies used by aeronautical or aircraft stations on a chain or chains for communication purposes.

(b) frequencies used for distress, calling, and navigational service.

(c) experimental frequencies which will include all communication frequencies other than those in use on a chain or chains, all such experimental frequencies shall be subject to change by the Commission during the term of the license without advance notice or hearing.

4. Frequencies designated for use by aeronautical stations shall not be used for point-to-point service: Provided, however, that point-to-point service may be carried on only where wire lines are not available or where the delay in the transmission of wire messages is such as to create a hazard to life or property and then solely for emergency messages and for meteorological service. Any licensee of point-to-point service shall be required to transmit emergency messages for the general public relating to the safety of life or property.

5. The Airways Division of the Department of Commerce has established a master map showing (1) the location of all aeronautical stations, (2) all navigational aids, and (3) the frequencies which have been designated by the Commission for use on particular chains; and all proposed chains (following, connecting with or independent of existing chains) will be referred to this map, of which the Commission will maintain an exact copy.

6. The initial chains will be established as indicated upon this map in colored lines, the colors having the following designations and frequency designations.

Brown	Universal Air Lines Aviation Corporation Braniff Air Lines Central Air Lines Continental Air Lines Northern Air Lines Southern Air Transport Texas Air Transport Gulf Air Lines Interstate Air Lines Clifford Ball Colonial Air Transport	5,600 3,484	Day aircraft and aeronautical station Night aircraft and aeronautical station

Blue	Western Air Express	3,070	Point-to-point, aeronautical
	Standard Air Lines	5,690	Point-to-point, aeronautical and aircraft and aeronautical
	Mid-Continent	3,460	Aircraft and aeronautical station
	West Coast Air Transport	8,015	Point-to-point aeronautical, day only
Green	Transcontinental Air Transport	2,344	Day, aircraft and aeronautical station
	National Air Transport	1,624	Night, aircraft and aeronautical station
	Northwest Airways		
	Pitcairn Aviation		
	Maddux Air Lines		
Red	Boeing Air Transport	5,660	Day, aircraft and aeronautical station
	Pacific Air Transport	3,142	Night, aircraft and aeronautical station
	Stout Air Services		
	Varney Air Lines		
	National Parks Airways		
	Pan American-Grace Airways	8,015	Point-to-point aeronautical, day only
	Pan American Airways	5,690	Aircraft and aeronautical station, day only—also point-to-point aeronautical, night only
		2,662	Navigation
		3,070	Night, aircraft and aeronautical station

The distress, calling and navigational frequencies shall be assigned as follows:

278 kc. Calling and working frequency from all ground stations to itinerant airplanes. Power not to exceed 10 watts.

333 kc. International air calling frequency.

375 kc. Radio compass.

500 kc. International calling and distress frequency for ships and aircraft over the seas.

3,106 kc. National calling frequency for all transport and itinerant airplanes.

5,525, 11,050, 16,580 kc. Primarily for coastal stations and ships. May also be assigned to aircraft only for purpose of calling A.V.S. Coastal station from aircraft in flight over the sea.

393, 400, 414, 420, 457 kc. For stations on chains, providing no interference is caused with other services.

333 kc., 500 kc.—calling
414 kc., 457 kc.—working
375 kc.—compass

For airplanes on sea flights desiring intermediate frequencies. Those desiring high frequencies will use those for maritime calling and working.

7. No aeronautical station will be licensed to use more than 1 KW power on frequencies of 1,000 kc. and above.

8. All aeronautical stations will maintain a watch on such frequencies and for such periods as the Airways Division of the Department of Commerce may designate.

9. For the purpose of the foregoing, two types of aircraft are defined: (a) transport airplanes—those commercially transporting persons and/or property and operating regularly on fixed routes, and (b) itinerant airplanes—all those other than transport or government airplanes. An aeronautical station shall be understood as being capable of giving:

(1) ground-to-plane communication
(2) point-to-point communication
(3) distress, calling and navigational service

10. From time to time after the adoption of this order representatives of the aviation companies and agencies mentioned herein, together with representatives of all aviation companies or agencies which wish to participate herein, shall confer with members of the Commission and responsible officials of the Army, Navy, and Department of Commerce, to the end that this plan may be modified so as to conform with experience in the operation thereof and developments in the arts of radio and aeronautics.

11. This order is and shall be construed as a regulation of the Commission, violation of which will be cause for revocation as provided by the Radio Act of 1927, as amended.

* * *

FEDERAL RADIO COMMISSION

Washington, D. C.

Oct. 1, 1929

The Commission adopted the following amendments to be incorporated with the Aviation Plan of Sept. 9, 1929.

1. That the frequencies 12,180 and 12,210 kilocycles, designated by the President as reserved for Government experimental stations, but available for assignment to commercial companies subject to recall by the Government upon six months' notice, be made available on such temporary basis for emergency aeronautical point-to-point communica-

tions on chains during daylight hours only, provided, however, applicants desiring the use of such frequencies can show by reason of distance to be worked that such frequencies are required.

2. That the channels, 6,155 to 6,410 kilocycles inclusive, heretofore designated for aviation be made available to all chains for primary assignment to plane-to-ground and ground-to-plane communication, and secondarily for emergency aeronautical point-to-point service.

3. That paragraph six of the September 9 plan be modified with respect to the BLUE chain to read as follows:

BLUE	Western Air Express	3,070	Aeronautical and Aircraft
	Standard Air Lines	3,460	Point-to-point aeronautical
	Mid-Continent	6,350	Primarily for Aircraft and Aeronautical. Secondarily for point-to-point aeronautical
	West Coast Air Transport	8,015 12,180	Point-to-point aeronautical, day only

4. That such existing licenses for aeronautical and aircraft stations as do not conform to the Plan of September 9, and amendments thereto, be so modified as to conform to said plan."

DIPLOMATIC SERVICE OF THE UNITED STATES

Army

Berlin, Germany.....Maj. George E. A. Reinberg, U. S. A., Assistant Military Attaché for Air; Germany, Austria, Czechoslovakia, Denmark, Netherlands, Sweden, Switzerland.
Paris, France.....Maj. Barton K. Yount, U. S. A., Assistant Military Attaché for Air; France and Spain.
London, England.....Maj. Hubert R. Harmon, U. S. A., Assistant Military Attaché for Air; Great Britain.
Rome, Italy.....Maj. George E. Lovell, U. S. A., Assistant Military Attaché for Air; Italy.

Navy

London .....Lt. Comdr. Wm. D. Thomas, Assistant Naval Attaché for Aviation. (Also accredited to Paris, The Hague, Berlin, Madrid and Lisbon.)
Rome .....Comdr. P. N. L. Bellinger, Assistant Naval Attaché for Aviation.
Naval Representative (Aviation), U. S. Naval Mission to Brazil, Lt. Comdr. Paul Cassard.
Naval Representative (Aviation), U. S. Naval Mission to Peru, Lt. Comdr. B. H. Wyatt.

DIPLOMATIC SERVICE TO THE UNITED STATES

Great Britain.....Wing Comdr. T. G. Hetherington, C.B.E., Air Attaché.
Peru .....Col. Jose Urdanivia Ginés, Military Attaché.
Mexico .....Señor Coronel Don Samuel Rojas, Military Attaché.
Italy .....Comdr. Silvio Scaroni, Air Attaché.
Spain .....Maj. Victoriano Casajus, Royal Spanish Army, Military Attaché.
Cuba .....Capt. Enrique A. Prieto, Military Attaché.
France .....Maj. Georges Thenault, Assistant Military Attaché for Aeronautics.
Chile .....Maj. Zorobabel Galeno, Military Attaché.
Japan .....Col. Hisao Watari, I.J.A., Military Attaché.
Argentina .....Lt. Col. 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

Lt. 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, Sec. 49, Aviation Department, 1, Stubenring 1, 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 Oliveiria 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. Popkriesteff, Bureau of Aeronautics, Sofia.

CANADA

Col. the Hon. J. L. Rolston, Minister of National Defense, Department of Defense, Ottawa, Ontario.

Mr. G. J. Desbarots, Deputy Minister of National Defense, Department of National Defense, Ottawa, Ontario.

Wing Comdr. L. S. Breadner, Acting Director Royal Canadian Air Force, Department of National Defense, Ottawa, Ontario.

Wing Comdr. J. L. Gordon, Director of Civil Government Operations.

Mr. J. A. Wilson, Director of Civil Aviation, Department of National Defense, Ottawa, Ontario.

Wing Comdr. E. W. Stedman, Chief Aeronautical Engines, Department of National Defense, Ottawa, Ontario.

CHILE

Col. M. Merino, Director de Aviacion, Ministerio de Guerra, 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, Bogotá.

Maj. Henri Pilichody, Jefe de Escuela Militar, Madrid, Bogotá.

Sr. Josede Jesus Garcia, Minister de Correos y Telegraphos, Bogotá.

CUBA

Dr. Jose Antonio Montalvo, Chief of Communications, Havana.

Military Aviation: Capt. 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 Sec. Administrative.

Maj. Eng. Julius Philip, Chief Technical Sec.

Maj. Karel Kulin, Chief Supervisory Sec.

Ministry of National Defense, ul Narodni Obrany, Prague-Bubenec.

Dr. Frantissele Spina, Minister of Public Works.

Chief Ing. V. Roubic, Chief of Transportation Division.

Ing. Zdzenko Janak, Chief of Aviation Sec.

Ing. J. Najbrt, Administrative Sec.

Ing. H. Berounsky, Administrative Sec.

Dr. Ing. Gustav Sticha, Technical Sec.

Ing. F. Stoces, Technical Sec.

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

Lt. Col. A. Steinberg is in command of the Air Force Tallinn.

FINLAND

Pouhustusministerion Insinooriosasto, Teknillisen Toimiston Paalikko, Korkeavnorenkatu 21, Helsinski, Finland.

Lt. 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

General 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

Capt. Gustaitis, Assistant Chief of Aviation, Ministry of Defense, Kovno.

MEXICO

Brig. Gen. Jose Luis Amezcua, Chief of Aviation, Mexican Army, Valbuena, D. F., Mexico.

Engineer Juan Guillermo Villasana, Chief, Aviation Bureau, Department 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

Lt. Col. Hoeksemade Groot, Chief, Army Aviation Department, Batavia, Java.

Lt. 1st Cl. J. Olivier, Department der Marine, Weltevreden, Batavia, Java.

Group-Comdr. E. A. Brunner, Naval Flying Station, Batavia, Java.

Capt. W. Leenderts, Department Van Oorlog, Bandoeng, Java.

NEW ZEALAND

Maj. Gen. R. Young, General Officer Commanding New Zealand Air Force, Wellington, New Zealand.

NORWAY

Col. G. Gruner, Chairman, Eprsvarsdepartementels Luftartsrad, P. O. Box 313, Oslo.

PERSIA

Col. Ahmed Khan Nakhitchevan, Chief of Aviation Bureau, Ministry of War, Teheran.

PERU

Capitan H. B. Grow, Director Aviation, Ancon.

Lt. Col. K. B. Von Doering, Director of Military Aviation.

POLAND

Mr. Witold Czapski, Department Director, Ministerstwo Kolei, Warsaw (Commercial).

Col. Ludomil Rayslei, Chief, Aviation Department, Ministry of War, Warsaw.

PORTUGAL

Gen. 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.

Gen. of Engrs. Carlos Carmona, First Chief of Aviation, Salvador.

SIAM

Purchases U. S. Materials through The International Engineering Co., 250 Park Ave., 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, Gen. 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), Maj. al'E. M. G. A. Isler, Department des Chemins de Fer, Batiment 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

Gen. Jose Vincente Gomez, El Ministerio de Guerra y Marina, Caracas.
Col. Daniel Lopez Henrique, Director School of Military Aviation, Caracas.

AERONAUTICAL MAGAZINES OF THE UNITED STATES

Aero Digest, 220 W. 42nd St., New York, N. Y.
Aero Mechanics, Experimenter Publishing Company, 381 Fourth Ave., New York, N. Y.
Aeronautic Review, National Aeronautic Association, 910 Seventeenth St., N. W., Washington, D. C.
Aeronautical Journal of Commerce, Simmons Aeronautical Interests, Chamber of Commerce Bldg., Los Angeles, Cal.
Aeronautical World, 1709 W. 8th St., Los Angeles, Cal.
Aeronautics, 608 S. Dearborn St., Chicago, Ill.
Aircraft Age, 1016 Baltimore Ave., Kansas City, Mo.
Airport Construction and Management, 145 S. Spring St., Los Angeles, Cal.
Airports, Bank of Manhattan Bldg., Flushing, Long Island, N. Y.
Air Transportation, 1265 Broadway, New York, N. Y. (Weekly).
Air Travel News, 1500 Buhl Bldg., Detroit, Mich.
Airway Age, Simmons-Boardman Publishing Company, 30 Church St., New York, N. Y.
American Aviator, 101 W. 31st St., New York, N. Y.
Aviation, McGraw-Hill Publishing Company, 10th Ave. and 36th St., New York, N. Y. (Weekly).
Aviation and Mechanics, 1841 Broadway, New York, N. Y.
Aviation Engineering, 52 Vanderbilt Ave., New York, N. Y.
Daily News Record, Fairchild News Service, 8 E. 13th St., New York, N. Y. (Daily).
Illustrated Air News, 6040 Hollywood Blvd., Hollywood, Cal. (Weekly).
Model Airplane News, Macfadden Building, 1926 Broadway, New York, N. Y.
Pacific Airport News, 212 Park St., Portland, Ore.
Pacific Flyer, Air World Publishing Company, 308 Balboa Bldg., San Francisco, Cal.
Pilot, 524 S. Spring St., Los Angeles, Cal.
Southern Aviation, W. R. C. Smith Publishing Company, Grant Bldg., Atlanta, Ga.
Sportsman Pilot, 551 Fifth Ave., New York, N. Y.
U. S. Air Services, Star Building, Washington, D. C.
Western Flying, 145 S. Spring St., Los Angeles, Cal.

FOREIGN AERONAUTICAL MAGAZINES

Argentine

Annario-Guia de la Aeronautica—Buenos Aires. *Aviacion*—Uruguay, 1093, Buenos Aires. *Boletin de Aeronautico*—Buenos Aires. *Boletin del Aero-Club Argentine*—Avenida de Mayo, 0646, Buenos Aires.

Australia

Aircraft—Peacock House, 486-490 Bourke St., Melbourne.

Austria

Flug—Traungasse, 11, Vienna III. *Flugzeug und Jacht*—Freidrichstrasse, 3, Vienna I. *Oesterreichischer Motor der Flug*—Josefstaderstrasse, 87, Vienna VII.

Belgium

Bulletin d'Informations du Secretariat de Propagande Aeronautique—90 rue de la Loi, Brussels. *Bulletin du Laboratoire Aerotechnique*—Rhode Saint-Genèse-les-Bruxelles. *Conquête de l'Air*—16 Rue de Namur, Brussels.

Brazil

Aeronautica—151 Avenida Rio Branca, Rio de Janiero. *Aviacao*—Escola de Aviacao Militar, Rio de Janiero. *Aviacao Nacional*—110 Avenida Rio Branca, Rio de Janiero.

Canada

Aircraft and Airways—Toronto. *Canadian Air Review*—Grosvenor at Bay St., Toronto. *Canadian Aviation*—210 Dundas St., W., Toronto 2.

Chile

Auto y Turismo—Delicias, 1171, Santiago.

China

Aeronautics—Pekin. *Yu Phong*—Pekin.

Cuba

El Automovil et Aeronautica—Tenien e rey, 92, Havana. *Revista del Transporte*—Ave de la Republica, 85, Havana.

Czechoslovakia

Flugwesen—Konviktgasse, 22, Prague. *Letec*—8 Lucemburska, Prague XII. *Letectvi*—Tr. M Foche, 8, Prague XII. *Le Mois Aéronautique Tchecoslovaque*—Tr. M Foche, 8, Prague XII. *Zpravyo-Letectvi*—Letnaney, Prague. *Zpravy Vojenskeho*—Letnaney, Prague.

Denmark

Motor Mandens Magasin—Set. Pederstraede, 34-36, 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 François, Paris. *Les Ailes*—40 Quai des Celestins, 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 Ligue Aéronautique de France*—9 Rue Montaigne, Paris. *Bulletin de la Navigation Aérienne*—7 Rue St. Lazare, Paris 9e. *Bulletin Technique du Bureau Veritas*—31 Rue d'Offemont, Paris. *Le Document Aéronautique*—65 Faubourg Poissonnière, Paris 9e. *Droit Aérien*—4 Rue Tronchet, Paris. *Etudes Aéronautiques*—282 Blvd. St. Germain, Paris. *L'Indicateur Aérien*—5 Rue de l'Isly, Paris. *Revue des Forces Aériennes*—55 Quai des Grands Augustins, Paris 6e. *La Technique Aéronautique*—5 Rue de l'Isly, Paris. *La Vie Aérienne*—7 Rue de Metz, Paris. *La Vie Maritime et Aérienne*—24 Rue des Ardennes, Paris.

Germany

Der Adler—Seyfferstrasse, 66c, Stuttgart. *Automobil und Flugverkehr*—Uhlandstr., 184, Charlottenburg. *Automobilwelt-Flugwelt*—Breitestr., 8-9, Berlin, C. 2. *Der Deutsche Sportflieger*—Krausenstr., 35, Berlin, S. W. 19. *Flugsport*—Bahnhofsplatz, 8, Berlin, W. 62. *Ikarus*—Luftfahrt-Verlag G.m.b.H., Krausenstr., 35, Berlin, S. W. 19. *Illustrierte Flug-Woche*—Budepesterstrasse 35, Berlin, W. 62. *Luft-Und Kraftfahrt*—Michaelkirchplatz, 1, Berlin, S.O. 16. *Luftfahrt*—Linkstrasse, 38, Berlin, W. 9. *Luftschau*—Blumenshof, 17, Berlin, W. 35. *Luftwacht*—Blumenshof, 17, Berlin, W. 35. *Luftweg*—Blumenshof, 17, Berlin, W. 35. *Nachrichten für Luftfahrer*—Radetzkim, Berlin, S. W. 48. *Zeitschrift für dasgesamte Luftrecht*—Genthinerstrasse, 38, Berlin, W. 10. *Zeitschrift für Flugtechnik und Motorluftschiffahrt*—Oldenburg, Munich.

Great Britain

Aerial A. B. C.—4 Dike St., Adelphi, London, W. C. 2. *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. *Aircraft Engineering*—110 Fenchurch St., London, E. C. 2. *Airways*—110-111 Strand, London, W. C. 2. *Flight*—36 Great Queens St., Kingsway, London, W. C. 2. *Journal of the Royal Aeronautical Society*—7 Albermarle St., London, W. 1. *Wings*—12-13 Henrietta St., London, W. C. 2.

Hungary

Aviatikai Ertesito—Lonyay utca, 36, Budapest IX. *Magyar Aero Szovetseg*—Longyai utca, 36, Budapest IX.

Italy

Aeronautica—Via Gesu, 6, Milan. *L'Aerotecnica*—Via delle Coppelle, 35, Rome, 120. *L'Ala d'Italia*—Via L. Settala, 22, Milan. *Atti dell'Associazione Italiana di Aerotecnica*—Via delle Coppelle, 85, Rome. *L'Aviazione*—Via del Tritone, 183. Rome. *Bollettino dell'Aviazione Civile e del Traffico Aereo*—Via della Mercede, 9, Rome. *Il Diritto Aeronautico*—Via della Sorofa, 29, Rome. *La Gazetta dell'Aviazione*—Via Petrarca, 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. *Le Vie dell'Aria*—Via Piacenza, 6, Rome.

Japan

Hiko Shonen—Nippon Hiko Kenkyukai, No. 1 Hatchobori 2, chome Nihonbashi-ku, Tokyo. *Hikokai*—Nippon Hiko Kenkyukai, No. 1 Hatchobori 2, chome Nihonbashi-ku, Tokyo. *Journal of the Aeronautical Research Institute*—Tokyo Imperial University, Tokyo. *Kagakuchishiki*—% Sankyo Bldg., Muromachi, Nihonbashi-ku, Tokyo. *Kaiho*—Teikoku Hiko Kyokai, No. 1 Yuraku-cho, Marunouchi, Tokyo. *Kodomo No Kagaku*—Kodomo no Kagakusha, 1-19 Nishiki-cho, Kandaku, Tokyo. *Koku Jiho*—Rikugun Koku Hombu, Hayabusa-cho, Kojimachi-ku, Tokyo. *Koku Kiji*—Rikugun Koku Hombu, Hayabusa-cho, Kojimachi-ku, Tokyo. *Motor*—Kyokuto Shoin, No. 32, Taneike machi, Akasaka-ku, Tokyo. *Report of the Aeronautical Research Institute*—Tokyo Imperial University, Tokyo. *Speed*—Nipon Jidosha Gakko, Kamata machi, Tokyo Fuka.

Jugoslavia

Nasa Krila—Belgrade.

Mexico

Aviacion—San Juan de Letran, 6, Mexico City. *El Piloto*—Tiajuana B. C. *Revista Aerea*—Departmento Aeronautico, Mexico City. *Tohtli*—Avenida Francisco Madero, 1, Mexico City.

Netherlands

Aëronautica—Keizersgracht, 215, Amsterdam C. *Het Vliegveld*—Singel, 464, Amsterdam.

New Zealand

Wings—160 Queen Victoria St., London, E. C. 4, England.

Norway

Lustseilas—Myntgaten, 2, Oslo.

Peru

El Motor—694 Lampa, Lima

Philippine Islands

Far East Aviation—6 ila de Romero, Manila.

Poland

Lot Polski—Dluga, 50, Warsaw. *Lotnik*—Stary Rynek NR, 95/96, Posen. *Mlody Lotnik*—Krakowski Przedmiescie, 57, Warsaw. *Przeglad Lotniczy*—Warsaw.

Portugal

Revista Aeronautica—Traversa de Gloria, 22, A 2º D, Lisbon.

Roumania

Aeronautica Romana 28 Calea Grivitza, Bucharest. *Aripa* Str. Clemenceau, 9, Bucharest. *Romania Aeriana* Strada Romana, 171, Bucharest.

Russia

Aviation and Chemistry—Iljinka, Khrustalny per, Moscow. *Messenger of the Aero Fleet*—Ilinka, 3, Moscow.

Spain

Aerea—Glorieta de Atocha, 8, Madrid. *Alas*—Plaza de la Lealtad, 4, Madrid. *Boletin Oficial de la Direccion, General de Navegacion y Transportes Aereos*—Madrid. *Boletin Oficial del Real Aero-Club de Espagna* Madrid. *España Automovil y Aeronautica* Plaza de Isabel II, 5, Madrid. *Heralde Deportivo*—Abascal, 364, Madrid. *Icaro*—Alberto Bosch, 3, Madrid.

Sweden

Flygning—Jacobsgaten, 6, Stockholm. *Svensk Motortidning* Nybrogatan, 3, Stockholm.

Switzerland

Aero-Revue Sihlstrasse, 43, Zurich. *En Plein Vol* Case Ville, 13741, Lausanne.

STATE AERONAUTICAL LEGISLATION 1928-29 SESSION

The following is a check list of legislation pertaining to or effecting aviation, enacted in the several states during the sessions of the legislative year 1928-29, showing the original senate or house bill numbers in each state, together with the date each law was approved by the Governor and the official citation of the law in the statutes of the state.

State	*Senate or House Bill No.*	*Date Approved*	*Laws 1929*
Arizona	H. B. 36	March 6	Chap. 38
Arkansas	S. B. 148	March 7	Act 96
	H. B. 243	March 14	Act 135
	H. B. 418	Feb. 28	Act 65
California	S. B. 623	April 30	Chap. 193
	S. B. 870	June 18	Chap. 850
	S. B. 875	May 8	Chap. 247
	H. B. 1167	June 18	Chap. 847
Colorado	H. B. 529	May 1	Chap. 139
Connecticut	S. B. 70	May 1	Special Act 107
	S. B. 75	May 1	Special Act 104
	H. B. 901	May 2	Chap. 135
	H. B. 699 (Sub.)	June 6	Chap. 236
	H. B. 694 (Sub.)	June 6	Chap. 253
	H. B. 185	May 2	Special Act 266
	H. B. 979	May 13	Chap. 281
Delaware	H. B. 135	April 1	Chap. 249
	H. B. 233	April 2	Chap. 248
Florida	S. B. 37	April 23	Chap. 14193
	S. B. 83	June 20	Chap. 14628
	S. J. R. 89	May 15	
	S. B. 92	April 23	Chap. 14313
	S. B. 232	May 4	Chap. 14416
	S. B. 502	June 7	Chap. 14314
	S. B. 561	June 7	Chap. 14405
	S. B. 605	June 7	Chap. 14250
	S. B. 682	June 8	Chap. 13666
	S. B. 704	June 8	Chap. 13992

State	Senate or House Bill No.	Date Approved	Laws 1929
	H. B. 10	June 8	Chap. 13569
	H. B. 246	June 20	Chap. 14637
	H. B. 795	June 8	Chap. 13992
	H. B. 804	May 23	Chap. 14310
	H. B. 808	May 23	Chap. 14207
	H. B. 830	May 20	Chap. 14303
	H. B. 898	May 25	Chap. 14045
	H. B. 1032	June 5	Chap. 14227
	H. B. 1084	June 7	Chap. 13574
	H. B. 1123	June 7	Chap. 14397
	H. B. 1404	June 8	Chap. 14433
	H. B. 1084	June 7	Chap. 13574
Georgia	H. B. 276	July 27	
	H. B. 301	July 29	
Idaho	H. B. 3	March 1	Chap. 106
	H. B. 10	March 4	Chap. 108
	H. B. 31	Feb. 27	Chap. 88
	H. B. 79	March 13	Chap. 158
	H. B. 95	March 7	Chap. 137
	H. B. 117	March 2	Chap. 107
	H. B. 215	March 6	Chap. 133
	H. B. 299	March 9	Chap. 146
	H. B. 324	March 16	Chap. 241
	H. B. 340	March 19	Chap. 283
Illinois	H. J. R. 40	May 28	
	H. B. 396	June 18	
	H. B. 440	June 10	
	H. B. 773	June 26	
Indiana	S. B. 8	March 14	Chap. 171
	S. B. 11	March 6	Chap. 54
	S. B. 88	March 12	Chap. 134
	H. B. 24	March 9	Chap. 57
Iowa	S. B. 284	March 21	Chap. 135
	S. B. 285	April 5	Chap. 138
	S. B. 332	April 6	Chap. 54
	H. B. 194	March 27	Chap. 137
	H. B. 359	March 27	Chap. 133
	H. B. 531	April 16	Chap. 229
	H. B. 535	April 13	Chap. 136
Kansas	S. B. 25	Jan. 29	Chap. 11
	S. B. 150	March 13	Chap. 5
	H. B. 211	Feb. 22	Chap. 287
Maine	S. B. 31	April 9	Chap. 265
	H. B. 1224	April 13	Sec. 3, Chap. 365
Maryland	H. B. 221	April 2	Chap. 318
	H. B. 240	April 2	Chap. 220
	H. B. 322	April 2	Chap. 219
Massachusetts	H. B. 1208	April 18	Chap. 24 R
Michigan	S. B. 244	May 16	No. 154 (Part 4, Purpose 4)
	S. B. 273	May 22	No. 247
	S. B. 350	May 20	No. 157
	S. B. 91	May 23	No. 286
	H. B. 116	April 2	No. 24
	H. B. 321	April 29	No. 103
	H. B. 380	May 20	No. 177
	H. B. 415	May 20	No. 210
	H. B. 447	May 15	No. 148
	H. B. 492	May 20	No. 193
Minnesota	S. B. 5	April 17	Chap. 217
	S. B. 387	April 17	Chap. 219
	S. B. 677	April 23	Chap. 296
	S. B. 705	April 3	Chap. 125
	S. B. 1152	April 25	Chap. 379
	H. B. 767	April 23	Chap. 290

State	Senate or House Bill No.	Date Approved	Laws 1919
Missouri	S. B. 25	June 1	Page 122
	S. B. 29	June 1	Page 345
	S. B. 476	May 24	Page 276
	S. B. 564	May 24	Page 124
	S. B. 703	June 7	Page 442
Montana	S. B. 25	Feb. 18	Chap. 17
	H. B. 196	March 11	Chap. 108
Nebraska	S. B. 190	April 29	Chap. 162
	H. B. 374	April 24	Chap. 34
	H. B. 424	April 24	Chap. 35
New Hampshire	H. B. 185	March 28	Chap. 90
	H. B. 219	April 5	Chap. 112
	H. B. 297	April 19	Chap. 182
New Jersey	S. J. R. 11	April 23	Chap. 21 J. R.
	S. B. 59	April 8	Chap. 60
	S. B. 204	May 6	Chap. 284
	S. B. 214	April 29	Chap. 206
	H. B. 31	April 1	Chap. 26
	H. B. 151	May 6	Chap. 311
	H. B. 317	May 6	Chap. 325
	H. B. 514	May 6	Chap. 350
New Mexico	S. B. 17	March 11	Chap. 71
	S. B. 63	March 11	Chap. 54
	S. B. 106	March 11	Chap. 53
New York	S. B. 1021	April 8	Chap. 364
	S. B. 1062	March 6	Chap. 53
	H. B. 23	Feb. 16	Chap. 16
	H. B. 24	Feb. 25	Chap. 31
	H. B. 432	March 23	Chap. 187
North Carolina	S. B. 81	March 16	Chap. 190
	S. B. 212	March 5	Chap. 87
	S. B. 393	March 5	Chap. 90
	S. B. 394	March 15	Chap. 171
	S. B. 395	March 15	Chap. 170
North Dakota	S. B. 83	Feb. 11	Chap. 86
	H. B. 120	March 11	Chap. 133
	H. B. 153	March 8	Chap. 85
Ohio	H. B. 96	March 25	Chap. 21-A, Gen. Code
	H. B. 250	April 6	Sec. 9556, Gen. Code
Oklahoma	S. B. 141	July 12	Chap. 238
	S. B. 214	April 5	Chap. 83
	H. B. 175	April 6	Chap. 11
Oregon	S. B. 188	Feb. 27	Chap. 195
	S. B. 202	March 7	Chap. 352
	H. J. R. 2	Jan. 28	
Pennsylvania	S. B. 406	May 2	Chap. 446
	S. B. 407	May 7	Chap. 484
	S. B. 597	April 9	Chap. 175
	S. B. 985	April 25	Chap. 318
	H. B. 1118	April 25	Chap. 319
	H. B. 1432	April 25	Chap. 316
	H. B. 1434	April 25	Chap. 317
	H. B. 1861	May 8	Chap. 540
Rhode Island	S. B. 78	April 16	Chap. 1353
	H. B. 739	April 25	Chap. 1411
	H. B. 910	April 23	Chap. 1405
	H. B. 1023	April 27	Chap. 1435

State	Senate or House Bill No.	Date Approved	Laws 1929
South Carolina	S. B. 440	March 14	No. 440
	H. B. 556	March 16	No. 189
	H. B. 778	March 14	No. 562
	H. B. 780	March 16	No. 538
	H. B. 784	March 1	No. 461
South Dakota	H. B. 18	March 5	Chap. 71
	H. B. 19	March 5	Chap. 70
	H. B. 145	March 13	Chap. 168
	H. B. 182	March 8	Chap. 135
Tennessee	S. B. 21	Jan. 22	Chap. 2P
	S. B. 327	Feb. 21	Chap. 204P
	S. B. 950	April 13	Chap. 114
	H. B. 1181	April 13	Chap. 759P
Texas	S. B. 477	March 26	Chap. 285
	S. B. 581	March 26	Chap. 281
	H. B. 160	May 28	Chap. 83
Vermont	S. B. 66	March 14	No. 20
	H. B. 47	March 8	No. 60
	H. B. 203	March 15	No. 79
Washington	S. B. 54	Feb. 14	Chap. 56
	S. B. 77	March 20	Chap. 157
	S. B. 82	March 9	Chap. 93
West Virginia	S. B. 48	Feb. 13	Chap. 61
Wisconsin	S. B. 106	July 19	Chap. 318
	S. B. 237	Sept. 3	Chap. 464
	S. B. 300	June 21	Chap. 201
	H. J. R. 60	April 18	
	H. B. 544	Aug. 1	Chap. 348
	H. B. 612	July 11	Chap. 285
	H. B. 850	Sept. 19	Chap. 520
	H. B. 855	Sept. 19	Chap. 521
Wyoming	H. B. 166	Feb. 15	Chap. 66

STATE LICENSE REQUIREMENTS

The following is a list of license requirements for aircraft and pilots in the several states and territories including legislation enacted during the 1928-29 sessions:

Federal Licenses Required for All Aircraft and Airmen

Alaska (1929)*
Arizona (1929)
California (1929)
Delaware (1929)
Idaho (1929)
Indiana (1929)
Iowa (1929)
Michigan (1929)
Mississippi (1928)
Missouri (1929; except solo pleasure)
Montana (1929)
Nebraska (1929; except solo pleasure)
New Mexico (1929)
Rhode Island (1929)
South Dakota (1929)
Texas (1929)
Vermont (1929)
Washington (1929)
Wisconsin (1929)

Federal Licenses Required for All Aircraft and Airmen Engaged in Commercial Flight

(Private Pleasure Flight Not Included)

District of Columbia (1926)*
Hawaii (1927)*
Illinois (1929)
New Jersey (1928)
New York (1928)
North Carolina (1929)
Ohio (1929)
Philippine Islands (1926)*
Porto Rico (1926)*
West Virginia (1929)
Wyoming (1929; providing state license for private pilots not necessarily navigating aircraft for commercial purposes)

*The Air Commerce Act of 1926 applied to the District of Columbia and all territories; Alaska and Hawaii have supplementary Territorial Acts.

Either State or Federal Licenses Required for All Aircraft and Airmen

Maine (1929)
Maryland (1929)
Minnesota (1929)
North Dakota (1929; but places discretion in administrative board to adopt the Federal Laws in lieu of any and all state regulation)
New Hampshire (1929)
Oregon (1929)
Virginia (1928)

State Licenses Required for All Aircraft and Airmen

Arkansas (1927)
Connecticut (1927)
Florida (1925)
Colorado (1927; requiring the administrative board to promulgate such regulations as are not in conflict with the Air Commerce Act of 1926. The regulations of the Commission of Aeronautics, 1929, require all pilots residing in the state and all pilots flying into the state for a stay of longer than ten days, for any purpose whatsoever, to be registered with and licensed by the Commission)
Kansas (1921)
Massachusetts (1928; a person holding any class of pilot's license issued after proper examination by authority of the United States or of another state thereof or of a foreign country may, without further license, operate aircraft within the commonwealth for purposes of private flying only, or may engage in commercial flying not exceeding 10 days in the calendar year)
Pennsylvania (1929)

No License Requirements

Alabama (not in session 1928-29)
Georgia
Kentucky (not in session 1928-29)
Louisiana (special session only 1928-29)
Nevada
Oklahoma
South Carolina
Tennessee
Utah

STATE AVIATION LEGISLATION

The following is a list of the states which considered aeronautical legislation during the 1928-29 sessions showing the number of bills introduced, laws enacted and bills defeated in each state.

States	*Bills Introduced*	*Bills Enacted*	*Bills Defeated*
Arkansas	4	3	1
Arizona	4	1	3
California	10	5	5
Colorado	4	1	3
Connecticut	15	7	8
Delaware	2	2	..
Florida	33	22	11
Georgia	6	2	4
Idaho	10	10	..
Illinois	11	4	7
Indiana	4	4	..
Iowa	12	7	5
Kansas	7	3	4
Maine	3	2	1
Maryland	4	3	1
Massachusetts	5	1	4
Michigan	13	10	3
Minnesota	19	6	13
Missouri	11	5	6
Montana	2	2	..
Nebraska	3	3	..
New Hampshire	3	3	..
New Jersey	9	8	1
New Mexico	3	3	..
New York	26	5	21
North Carolina	6	5	1
North Dakota	4	3	1
Ohio	3	2	1
Oklahoma	6	3	3
Oregon	4	3	1
Pennsylvania	13	8	5
Rhode Island	5	4	1
South Carolina	5	5	..
South Dakota	4	4	.
Tennessee	9	4	5

States	Bills Introduced	Bills Enacted	Bills Defeated
Texas	4	3	1
Utah	1	..	1
Vermont	3	3	..
Washington	4	3	1
West Virginia	1	1	..
Wisconsin	18	8	10
Wyoming	1	1	..
Total	314	182	132

AERONAUTICAL EDUCATION IN AMERICAN UNIVERSITIES AND COLLEGES

The following table of statistics on aeronautical education in American universities and colleges was compiled from a survey made by the Aeronautical Chamber of Commerce of America, Inc. Sixty-one institutions reported some kind of aeronautical education, while 175 reported no instruction in aeronautics. Those starred (*) offer full courses leading to a degree in aeronautical engineering.

Name of Institution	Number of Instructors	Number Full Time	Number Part Time	Number Students Enrolled
University of Akron	10	1	9	58
University of Alabama*	4	1	3	40
University of Arizona	1	0	1	20
Armour Institute of Technology	6	0	6	50
Birmingham—Southern College	1	0	1	10
Bradley Polytechnic Institute	2	0	2	32
University of Buffalo	6	1	5	80
California Institute of Technology	3	2	1	14
University of California	..	..	..	59
Carnegie Institute of Technology*	4	4	0	136
Catholic University of America	1	1	0	4
University of Cincinnati*	6	1	5	90
Clarkson College of Technology	1	1	0	..
Colorado College	1	0	1	10
University of Delaware	1	0	1	12
College of City of Detroit	1	0	1	40
University of Florida	1	0	1	23
University of Idaho	2	0	2	15
University of Illinois	3	0	3	35
University of Iowa	1	0	1	10
Kansas State Agricultural College	3	0	3	8
University of Kansas	2	0	2	10
Marquette University	1	1	0	20
Massachusetts Institute of Technology*	15	14	1	247
University of Miami	1	1	0	46
University of Michigan*	..	..	..	..
University of Minnesota*	5	2	3	220
Morningside College	1	0	1	8
University of Nebraska	3	0	3	10
University of Nevada	1	0	1	6
New York University*	6	3	3	346
North Carolina State College	3	0	3	50
University of North Carolina	1	0	1	12
North Dakota Agricultural College	1	0	1	10
Ohio State University	..	..	..	20
Oklahoma City University	1	1	0	5
University of Oklahoma	2	0	2	3
Oregon State Agricultural College*	2	1	1	57
University of Oregon	2	0	2	35
Pennsylvania State College	2	0	2	12
University of Pittsburgh*	20	2	18	100
Purdue University	2	1	1	48
Rensselaer Polytechnic Institute	6	0	6	40
University of South Dakota	6	0	6	18
University of Southern California	4	0	4	20
Stanford University*	3	0	3	14
Swarthmore College	1	0	1	3
Syracuse University	3	1	2	20
Temple University	8	0	8	24
Union College	4	0	4	21
University of Utah	2	0	2	18
Vanderbilt University	2	0	2	22

Name of Institution	*Number of Instructors*	*Number Full Time*	*Number Part Time*	*Number Students Enrolled*
University of Vermont	..	..	..	20
Virginia Polytechnic Institute	3	0	3	45
State College of Washington	1	0	1	15
Washington University (St. Louis)	3	0	3	20
University of Washington*	4	1	3	73
University of Wisconsin	3	0	3	80
Worcester Polytechnic Institute*	5	0	5	15
University of Wyoming	1	0	1	10
Yale University	2	0	2	16
Total	190	40	150	2,406

AERONAUTICAL EDUCATION IN ELEMENTARY AND SECONDARY SCHOOLS

The following schools indicated that they were offering some kind of aeronautical education during 1929 through a survey made by the Daniel Guggenheim Fund Committee on Elementary and Secondary Aeronautical Education:

City	*Name of School*	*Level*
Aberdeen, S. D.	Aberdeen Public Schools	Junior High
Alameda, Calif.	Alameda Public Schools	Elementary, Evening, Senior High
Ann Arbor, Mich.	Ann Arbor Public Schools	Junior High
Appleton, Wis.	Appleton High School	Senior High
Ardmore, Okla.	Ardmore Public Schools	Junior and Senior High
Athens, Pa.	Athens Public Schools	Senior High
Batavia, Ill.	Batavia Public Schools	Senior High
Beaver Dam, Wis.	Beaver Dam Public Schools	Junior High
Bellefontaine, Ohio.	Bellefontaine Public Schools	Senior High
Bellingham, Wash.	Bellingham Public Schools	Senior High
Bloomington, Ind.	Bloomington Public Schools	Junior High
Boone, Iowa	Boone Public Schools	Elementary
Boston, Mass.	Boston Public Schools	Junior High, Boys' Trade
Boulder, Colo.	Boulder Public Schools	Junior and Senior High
Brawley, Calif.	Brawley High School	Senior High
Bridgeport, Conn.	Bridgeport Public Schools	Junior and Senior High
	Manuel Training	Junior High
Brooklyn, N. Y.	Brooklyn Public Schools	Elementary
Buffalo, N. Y.	Elm Vocational School	Evening, Senior Vocational High
Burlington, N. J.	Burlington Public Schools	Senior High—Continuation
Campbell, Ohio.	Campbell Public Schools	Junior and Senior High
Canandaigua, N. Y.	Canandaigua Public Schools	Senior High
Canastota, N. Y.	Canastota Public Schools	Senior High
Cape Girardeau, Mo.	Cape Girardeau High School	Senior High
Central Village, Conn.	Central Village Public Schools	Junior and Senior High
Charlotte, N. C.	Central High School	Senior High
Cherryvale, Kan.	Cherryvale Public Schools	Senior High
Chicago, Ill.	Chicago Public High Schools	Evening and Senior High
Claremont, N. H.	Claremont Public Schools	Elementary, Junior High, Evening
Cleveland, Ohio.	Cleveland Public Schools	Evening, Senior High
Cleveland, Okla.	Cleveland Public Schools	Senior High
Cleveland Hgts., Ohio	Cleveland Hgts. Public School	Junior High Extra Course
Coalinga, Calif.	Coalinga High School	Senior High
Coldwater, Mich.	Coldwater Public Schools	Junior and Senior High
Columbus, Ga.	Columbus Public Schools	Senior High
Corona, Calif.	Corona High School	Senior High
Corvallis, Ore.	Corvallis High School	Senior High
Coshocton, Ohio.	Coshocton Public Schools	Senior High
Crown Point, Ind.	Crown Point Public Schools	Junior High School
Dansville, N. Y.	Dansville Public Schools	Senior High
Danville, Va.	Danville Public Schools	Junior High
Darby, Pa.	Darby High School	Junior High
Darien, Conn.	Darien High Schools	Junior and Senior High
Delavan, Wis.	Delavan High School	Senior High
Detroit, Mich.	Cass Technical High School	Evening, Senior High
	Detroit Public Schools	Junior, Senior High, Evening, Technical High
Dover, Del.	Dover Public Schools	Junior High
Duncan, Okla.	Duncan High School	Senior High

City	*Name of School*	*Level*
East Chicago, Ind.	East Chicago High School	Junior High
East Newark, N. J.	East Newark Elementary School	Elementary
East Orange, N. J.	Central School, Caldwell	Elementary
Elizabeth, N. J.	Elizabeth High Schools	Junior and Senior High
Elwood, Ind.	Elwood Public Schools	Senior High
Erie, Pa.	Erie Public Schools	Evening
Escanaba, Mich.	Escanaba Public Schools	Junior and Senior High
Evanston, Ill.	Central School	Elementary
Eveleth, Minn.	Eveleth Public Schools	Senior High
Ferndale, Mich.	Ferndale Public Schools	Elementary, Junior High
Flint, Mich.	Longfellow Jr. High School	Junior and Senior High
Flushing, N. Y.	Flushing High School	Senior High
Fort Dodge, Iowa	Fort Dodge Public Schools	Senior High
Georgetown, Ky.	Georgetown Public Schools	Senior High
Glendive, Mont.	Glendive Public Schools	Senior High
Glen Ridge, N. J.	Glen Ridge Public Schools	Senior High
Gloucester, Mass.	Gloucester High School	Senior High
Goshen, Ind.	Goshen Public Schools	Senior High
Grand Rapids, Mich.	Grand Rapids Public Schools	Elementary and Junior High
Grand Rapids, Minn.	Grand Rapids High School	Junior and Senior High
Great Neck, N. Y.	Great Neck High Schools	Junior and Senior High
Greenville, Mich.	Greenville Public Schools	Elementary and Junior High
Grinnell, Iowa	Grinnell High School	Senior High
Hammond, Ind.	Hammond Public Schools	Senior High
Hampton, Va.	Hampton Public Schools	Senior High
Hamtramck, Mich.	Hamtramck High School	Junior High
Harlan, Iowa	Harlan Public Schools	Evening and Senior High
Hasbrouck Hts., N. J.	Hasbrouck Hts. High School	Junior High
Hastings, Mich.	Hastings Public Schools	Junior and Senior High
Hiawatha, Kan.	Hiawatha Public Schools	Junior and Senior High
Highland Park, Mich.	Highland Park Public Schools	Junior and Senior High, Continuation School
Holland, Mich.	Holland Public Schools	Junior High
Indiana, Pa.	Indiana Public Schools	Junior High
Jackson Heights, L. I.	Jackson Heights Continuation School	Continuation
Jacksonville, Texas	Jacksonville High School	Senior High
Jermyn, Pa.	Jermyn Public Schools	Elementary
Jersey City, N. J.	Jersey City High School	Senior High
Jewett City, Conn.	Jewett City Public Schools	Elementary and Junior High
Johnson City, N. Y.	Johnson City Public Schools	Junior High
Jonesboro, Ark.	Jonesboro Public Schools	Junior High
Kokomo, Ind.	Kokomo Public Schools	Evening
Lake Geneva, Wis.	Lake Geneva High School	Junior and Senior
Leavenworth, Kan.	Leavenworth Public Schools	Junior High
Lebanon, Mo.	Lebanon Public Schools	Senior High
Lindsay, Calif.	Lindsay High School	Evening and Senior High
Longbranch, N. J.	Longbranch Public Schools	Junior High
Los Angeles, Calif.	Los Angeles Public Schools	Junior and Senior High, Evening
Loveland, Colo.	Loveland High School	Senior High
Ludlow, Mass.	Ludlow Public Schools	Junior and Senior High, Continuation
Marion, Ind.	Marion Public Schools	Evening
Mayfield, Ky.	Mayfield Public Schools	Junior and Senior High
Medina, Ohio	Medina Public Schools	Senior High
Miami, Fla.	Miami High School	Senior High
Milton, Pa.	Milton Public Schools	Senior High
Milwaukee, Wis.	Milwaukee High School	Junior and Senior High
Mission, Tex.	Mission Public Schools	Junior and Senior High
Modesto, Calif.	Modesto Public Schools	Senior High
Mohawk, N. Y.	Mohawk High School	Senior High
Monaca, Pa.	Monaca Public Schools	Junior and Senior High
Monett, Mo.	Monett Public Schools	Junior and Senior High
Monrovia, Calif.	Monrovia High School	Evening, Senior High

City	*Name of School*	*Level*
Morgantown, W. Va.	Morgantown Public Schools	Elementary and Junior High
Moultrie, Ga.	Moultrie Public Schools	Elementary
Mt. Clemens, Mich.	Mt. Clemens Public Schools	Senior High
Mt. Union, Pa.	Mt. Union Public Schools	Junior High
Mt. Vernon, N. Y.	Washington Junior High School	Junior High
Mt. Vernon, N. Y.	Mt. Vernon High School	Senior High
Mt. Vernon, Wash.	Mt. Vernon Public Schools	Senior High
Muscatine, Iowa	Muscatine Public Schools	Elementary, Evening, Senior High
Napa, Calif.	Napa Union High School	Senior High
Nashville, Tenn.	Nashville Public Schools	Junior and Senior High
Newark, N. J.	Newark Public Schools	Senior High
Newberg, Ore.	Newberg Public Schools	Junior and Senior High
New Haven, Conn.	New Haven Public Schools	Trade School and Junior High
Newport, Ky.	Newport Public Schools	Junior and Senior High
New Rochelle, N. Y.	Central Junior High School	Junior High
Newton, Iowa	Newton Public Schools	Junior High
Newtonville, Mass.	Newtonville Junior High School	Junior High
New York, N. Y.	Public School 80 Bronx	Elementary
Northampton, Pa.	Northampton Public Schools	Junior High
North Providence, R. I.	North Providence Public Schools	Junior High
Oakland, Calif.	Oakland Public Schools	Elementary and Junior High
Oakmont, Pa.	Oakmont High School	Senior High
Ogden, Utah	Ogden Public Schools	Junior and Senior High, Continuation
Oklahoma City, Okla.	Oklahoma City Public Schools	Elementary, Junior and Senior High, Evening
Olympia, Wash.	Olympia High School	Senior High
Oneida, N. Y.	Oneida Public Schools	Junior and Senior High
Oregon City, Ore.	Oregon City High School	Senior High
Orlando, Fla.	Orlando Senior High School	Senior High
Osceola, Iowa	Osceola Public Schools	Junior and Senior High
Palisades Park, N. J.	Palisades Park School	Junior High
Palmerton, Pa.	Palmerton High School	Senior High
Paragould, Ark.	Paragould Public Schools	Junior and Senior High
Pasadena, Calif.	Pasadena Junior College	Senior High
Patchogue, N. Y.	Patchogue High School	Junior and Senior High
Paterson, N. J.	Paterson Public Schools	Elementary and Senior High
Peoria, Ill.	Peoria Public Schools	Senior High
Peterboro, N. H.	Peterboro Public Schools	Junior High
Piedmont, Calif.	Piedmont High School	Junior and Senior High
Pinckneyville, Ill.	Pinckneyville Schools	Junior High
Pleasantville, N. J.	Pleasantville Senior High School	Senior High
Pleasantville, N. Y.	Pleasantville Elementary School	Elementary
Portage, Pa.	Portage Senior High School	Senior High
Port Jervis, N. Y.	Port Jervis Public Schools	Elementary
Port Washington, Wis.	Port Washington Public Schools	Senior High
Princeton, Ind.	Princeton Public Schools	Junior and Senior High
Pueblo, Colo.	Centennial High School	Evening, Senior High
Rahway, N. J.	Rahway Public Schools	Senior High
Reading, Pa.	Reading Senior High School	Senior High
Redlands, Calif.	Redlands Public Schools	Junior High
Richmond, Va.	Richmond Public Schools	Junior High
Rushville, Ind.	Rushville Public Schools	Junior and Senior High
Rye, N. Y.	Rye High School	Senior High
San Bernardino, Calif.	San Bernardino Public Schools	Junior and Senior High
San Francisco, Calif.	San Francisco Public Schools	Senior High
Santa Ana, Calif.	Santa Ana Junior College	Junior College and Continuation
Santa Barbara, Calif.	Santa Barbara Public Schools	Elementary, Junior and Senior High
Schuylkill Haven, Pa.	Schuylkill Haven Public Schools	Junior and Senior High, Continuation
Shawano, Wis.	Shawano Public Schools	Senior High
Sioux City, Iowa	Central High School	Senior High
Somerville, Mass.	Somerville Public Schools	Junior High

City	*Name of School*	*Level*
Stillwater, Minn.	Stillwater Public Schools	Senior High
Stillwater, Okla.	Stillwater Public Schools	Junior and Senior High
Stoneham, Mass.	Stoneham Public Schools	Junior High
Summit, N. J.	Summit Public Schools	Junior and Senior High
St. Cloud, Minn.	Technical High School	Senior High
St. Louis, Mo.	St. Louis Evening School	Evening
St. Paul, Minn.	St. Paul Public Schools	Elementary and Junior High
Toppenish, Wash.	Toppenish Public Schools	Junior High
Tucumcari, N. M.	Tucumcari Public Schools	Senior High
Tulare, Calif.	Tulare High School	Junior and Senior High
Tuscola, Ill.	Tuscola High School	Senior High
Tyrone, Pa.	Tyrone High School	Senior High
Union City, N. J.	Hebrew Technical Institute	Junior High
Uniontown, Pa.	Uniontown Public Schools	Senior High
Vandergrift, Pa.	Vandergrift Public Schools	Junior and Senior High
Visalia, Calif.	Visalia Public Schools	Evening, Senior High
Waltham, Mass.	Waltham Public Schools	Senior High
Washburn, Wis.	Washburn Public Schools	Senior High
Webster Groves, Mo.	Webster Groves Public Schools	Junior High
Wellesley Hills, Mass.	Wellesley Hills Public Schools	Junior and Senior High
West Allis, Wis.	West Allis Public Schools	Junior and Senior High
West Bend, Wis.	West Bend Public Schools	Senior High
West Bridgewater, Mass.	West Bridgewater Public Schools	Senior High
Westfield, N. J.	Roosevelt Junior High School	Junior High
Westfield, N. Y.	Westfield Senior High School	Senior High
West New York, N. J.	West New York Public Schools	Elementary
Weston, W. Va.	Weston Public Schools	Junior High
Westport, Conn.	Bedford Junior High School	Junior High
Whitman, Mass.	Whitman Public Schools	Senior High
Wilmington, Del.	Wilmington Public Schools	Trade and Evening
Wilmington, Mass.	Wilmington Public Schools	Senior High
Winston-Salem, N. C.	Winston Salem Public Schools	Elementary and Senior High
Winthrop, Mass.	Winthrop High School	Senior High
Woonsocket, R. I.	Woonsocket Public Schools	Junior High
Wyandotte, Mich.	Roosevelt High School	Junior and Senior High
Ypsilanti, Mich.	Ypsilanti Public Schools	Junior and Senior High

NATIONAL BALLOON RACE

Pitt Stadium, Pittsburgh, Pa., May 4, 1929

Official Standing of Contestants

Distances Scaled by Geological Survey, Washington, D. C.

	Pilot and Aide	*Entry*	*Place of Landing*	*Miles*
1.	*Lieut. T. G. W. Settle, U. S. N. Ensign W. Bushnell	U. S. Navy A-8278 No. 1	Canavoy, Savage Harbor, Prince Edward Island, 35 mi. W. Eastpoint	952
2.	*W. T. Van Orman A. L. MacCracken	Goodyear VII	Plattsburg, N. Y.	403.6
3.	A. G. Schlosser E. J. Hill	Detroit Times	1 mi. N. Newcomb Lake, Essex Co., N. Y., 6 mi. N. W. Tahawus, N. Y.	386.4
4.	Dr. Geo. M. LeGalle, Samson Motor Co. Walter Chambers		15 mi. N. Utica, N. Y.	312.8
5.	Lieut. Lawrence A. Lawson Lieut. E. W. Fogelsonger.	U. S. Army No. 3	2½ mi. N. W. Roxbury, N. Y., Delaware Co.	304.8
6.	Capt. E. W. Hill Lieut. Robt. D. Heald	U. S. Army No. 2	5 mi. Big Indian, N. Y.	302.4
7.	Capt. Wm. J. Flood Lieut. U. G. Ent	U. S. Army No. 1	6 mi. N. E. Wawarsing, N. Y.	302.4
8.	S. A. U. Rasmussen T. W. Southworth	Detroit Balloon Club	7 mi. N. N. E. Camden, N. Y.	299.2
9.	H. E. Honeywell Roland J. Gaupel	St. Louis	2 mi. E. Middlesex, N. Y.	208.8
10.	Waldemar A. Kilkoff Thorvald Larsen	Detroit Balloon Club	7 mi. N. W. Slate Run, Pa.	143.2
11.	Lieut. J. C. Richardson Lieut. M. M. Bradley	U. S. Navy No. 2	3 mi. N. Apollo, Pa.	23
12.	C. A. Palmer Walter B. Griffin	American Business Club of Akron	No log received.	

*Place winners on U. S. Team in International Gordon Bennett Race, St. Louis, Mo., Sept. 28, 1929.

GORDON BENNETT BALLOON RACE

Starting From St. Louis, Missouri, Sept. 28, 1929

Place	*Balloon*	*Country*	*Pilot and Aide*	*Landing Place*	*Distance Miles**
1.	Goodyear VIII	United States	W. T. Van Orman Alan MacCracken	3 mi. S. E. Troy, Ohio	341
2.	Army	United States	Capt. W. E. Kepner Capt. J. F. Powell	2 mi. N. Neptune, Ohio	338
3.	Navy	United States	Lieut. T. G. W. Settle Ensign W. Bushnell	10 mi. S. W. Eaton, Ohio	304
4.	"Belgica"	Belgium	Ernest Demuyter Franz Lecharlier	Corydon, Indiana	226
5.	"Danmark"	Denmark	Georg Schenstrom S. A. U. Rasmussen	5 mi. S. E. Bedford, Indiana	200
6.	"Lafayette"	France	Georges Planchet Howard A. Scholle	Stinesville, Indiana	200
7.	"Barmen"	Germany	Hugo Kaulen, Jr. Fritz Ebener	4 mi. S. E. Melvin, Illinois	171
8.	"Essen Stadt"	Germany	Eric Leimkugel George Froebel	Catlin, Illinois	160
9.	"Argentina"	Argentina	D. Eduardo Bradley Francisco J. Cadaval	Fairbanks, Indiana	155

*Distances were scaled by the U. S. Geological Survey, Washington, D. C.

NATIONAL AIR TOUR 1929

Place	*Plane*	*A.T.C. No.*	*Motor Used*	*Pilot*	*Points*
1.	Waco	240	Wright J-6	John Livingston	45,672.64
2.	Waco	240	Wright J-6	Art Davis	41,108.84
3.	Ford	246	{ 1 P. & W. Wasp / 2 Wright J-6 }	M. E. Zeller	38,494.04
4.	Curtiss-Condor	193	Curtiss Conqueror	W. J. Crosswell	33,796.16
5.	Bellanca	245	Wright J-6	Geo. Haldeman	33,277.40
6.	Bellanca	129	Wright J-6	R. A. Nagle	31,090.22
7.	Command-Aire	184	Curtiss Challenger	J. C. Cone	29,711.81
8.	Fairchild KR34	162	Wright J-6	Mrs. Keith Miller	28,504.18
9.	Spartan	195	Wright J-6	J. W. Welborn	28,311.62
10.	Ford	165	P. & W. Wasps	B. S. Warner	28,090.60
11.	Cessna	244	Wright J-6	Stanley Stanton	27,759.84
12.	Curtiss-Thrush	236	Wright J-6	Dale Jackson	27,699.20
13.	Cessna	72	Warner	{ Earl Rowland / J. Meehan }	27,664.36
14.	Cessna	243	Wright J-6	Steve Lacey	26,810.36
15.	Fairchild 71	89	P. & W. Wasp	Richard Pears	22,566.02
16.	Great Lakes	228	Am. Cirrus	Chas. Meyers	21,750.46
17.	Lockheed	227	P. & W Wasp	Wiley Post	21,073.39
18.	Curtiss-Thrush	236	Wright J-6	J. L. McGrady	20,272.95
19.	Ryan	142	Wright J-6	Russell Young	19,929.49
20.	Moth	197	Gipsy	A. P. Krapish	19,916.63
21.	Boeing 95	106	P. & W. Hornet	Reuben Wagner	19,393.27
22.	Curtiss-Robin	143	Curtiss Challenger	Gentry Shelton	18,967.09
23.	American Eagle	124	Kinner	May Haizlip	17,408.80
24.	Travel Air	130	Wright J-6	Newman Wadlow	14,740.77
25.	Great Lakes	228	Am. Cirrus	Wm. Lancaster	13,709.60

NATIONAL AIR RACES

Aug. 24—Sept. 2

Municipal Airport, Cleveland, Ohio

PORTLAND (OREGON) TO CLEVELAND DERBY

Place	*Pilot*	*Plane*	*Engine*	*Time*	*Cash Prize*
1st	T. A. Wells	Travel Air D-4000	Wright J-5AB	14:44:10	$3,000.00
2nd	Tex Rankin	Waco Taper Wing	Wright J-6, 7 Cyl	15:26:24	1,500.00
3rd	Sydnor Hall	Travel Air Speedwing	Wright Whirlwind	17:26:00	750.00
4th	W. H. Emery, Jr.	Travel Air B-11D	Wright J-6	17:42:13	450.00
5th	Gilbert H. Eckerson	Waco 220 Taper Wing	Wright J-5A	18:14:02	300.00
6th	Dick Rankin	Waco 10T Land Biplane	Wright Whirlwind J-5	18:27:26	
7th	W. B. Clark	Travel Air 4000	Wright Whirlwind J-4B	22:24:15	
	Clarence F. Bates	Speedwing Waco	Wright J-5	Out	
	Chas. W. Holman	Laird LC-R Speedwing	Wright Whirlwind J-4	Out (down at Sandusky, Ohio)	

RIM OF OHIO DERBY

Aug. 30, 1929

Place	*Pilot*	*Plane*	*Engine*	*Time*	*Cash Prize*
1st	J. O. Donaldson	Travel Air Biplane	Wright J-6	4:48:11	$1,000.00
2nd	W. J. Barrows	Fairchild "71"	Pratt & Whitney Wasp	4:53:47	600.00
3rd	Loren W. Mendell	Buhl Cabin Mono	Wright J-6	5:03:09	400.00

NON-STOP AIR DERBY—Los Angeles to Cleveland

Aug. 24 to Sept. 1, 1929.

Place	*Pilot*	*Plane*	*Engine*	*Speed*	*Cash Prize*
1st	Henry J. Brown	Lockheed Air Express	Hornet	156.20	$5,000.00
2nd	L. Shoenhair	Lockheed Vega Cabin	P. & W. Wasp, Type C	149.05	2,500.00
	Roscoe Turner	Lockheed Vega	P. & W. Wasp	Arrived 7:27 P.M. Out on rule requiring arrival before 6 P.M.	
	J. P. Wood			Failed to arrive	

WOMEN'S DERBY—Santa Monica to Cleveland

Place	*Pilot*	*Plane*	*Motor*	*Time*	*Speed*	*Cash Prize*
DW-1	Louise Thaden	Travel Air	Wright J-5C	20:02:02	135.97	$3,600.00
DW-2	Gladys O'Donnell	Waco 10	Wright J-5	21:21:43	127.52	1,950.00
DW-3	Amelia Earhart	Lockheed Vega	Wright J-5	22:12:42.5	122.64	875.00
DW-4	Blanche Noyes	Travel Air Speed-wing	Wright J-5	24:33:58		725.00
DW-5	Ruth Elder	Swallow Biplane	Wright J-5	28:15:14	96.41	350.00
CW-1	Phoebe Omlie	Monocoupe	Warner	25:10:36.5	108.19	600.00
CW-2	Edith Foltz	Eaglerock Bullet	Kinner	41:37:41		150.00
CW-3	Keith Miller	Fleet Model 2	Kinner K-5	52:24:24.0	51.98	325.00
CW-4	Thea Rasche	Gypsy Moth	DH. Gypsy	64:35:30	42.17	175.00

MIAMI-MIAMI BEACH TO CLEVELAND AIR DERBY

Place	*Pilot*	*Plane*	*Motor*	*Time*	*Cash Prize*
B-1	Robert E. Dake	American Moth	Warner Scarab	13:06:02.5	$1,550.00
B-2	Chas. W. Meyers	Trainer 2T2	Am. Cirrus Mark III	13:10:58.5	775.00
B-3	C. A. Burrows	Fleet 2	Kinner K-5	13:27:33	387.50
B-4	Frank T. Courtney	Gypsy Moth	DH. Gypsy	14:04:16	232.50
C-1	George E. Halsey	Rearwin Kenroyce	Challenger	12:42:04.5	1,200.00
C-2	J. Carroll Cone	Command-Aire Sport	Challenger	13:26:34.5	720.00
C-3	E. Z. Newseon	Air Boss	Whirlwind J-6, 5 Cyl	14:28:48.5	480.00
D-1	Earl Rowland	Cessna Cabin	Warner	12:30:41	1,500.00
D-2	Leslie H. Bowman	Monosport	Kinner K-5	12:39:32.5	750.00
D-3	C. D. Boyer	Cessna Cabin	Comet	12:54:10¾	550.00

PHILADELPHIA TO CLEVELAND DERBY

Place	*Pilot*	*Plane*	*Motor*	*Time*	*Cash Prize*
D-1	Errett Williams	Alexander Bullet	Wright J-6, 5 Cyl	6:31:31	$1,636.35
D-2	Ike Stewart	Monocoach	Wright J-5	7:29:21	981.81
D-3	Howard Young	Bellanca CH-300	Wright J-5	7:30:09	654.60
F-1	J. Wesley Smith	Bellanca CH-300	Wright J-6, 9 Cyl	6:39:03	1,363.63
F-2	S. A. Riley	Travel Air 6000-B	Wright J-6, 9 Cyl	7:49:52	818.18
F-3	R. P. Hewitt	Travel Air 6000-B	Wright J-6, 9 Cyl	9:00:05	545.45

OAKLAND (CALIFORNIA) TO CLEVELAND DERBY

Place	*Pilot*	*Plane*	*Motor*	*Time*	*Cash Prize*
1st	Loren W. Mendell	Buhl Cabin Monoplane	Wright J-6	17:43:16	$3,000.00
2nd	W. J. Barrows	Fairchild 71	Wasp C	17:46:45	1,500.00
3rd	J. O. Donaldson	Travel Air Biplane	Wright J-6	18:17:18	750.00

ALL OHIO DERBY

Place	*Pilot*	*Plane*	*Engine*	*Time*	*Cash Prize*
1st	Lewis Love	Davis Monoplane V's	Le Blond 5 Cyl	4:43:15.6	$1,000.00
2nd	H. A. Speer	Barling NB-3	Genet	5:00:55	500.00
3rd	Vernon L. Roberts	Monocoupe	Velie M5	5:07:43.5	375.00
4th	D. S. Zimmerley	Barling NB-3	LeBlond 60	5:18:01.8	
5th	Leslie C. Miller	Nicholas Beazley	LeBlond 60	5:27:01.6	

TORONTO TO CLEVELAND FLYING CLUB RACE

Place	*Pilot*	*Plane*	*Engine*	*Time*	*Cash Prize*
1st	K. E. Whyte	DH. Gypsy Moth	Gypsy	3:00:26	$ 300.00
2nd	R. C. Guest	De Haviland Moth		3:02:59	200.00
3rd	G. M. Irwin	DH. Gypsy Moth		3:14:26	100.00
4th	Len J. Tripp	De Haviland Moth	DH. Gypsy	3:19:33	
	Walter N. Deisher	DH. Gypsy Moth	DH. Gypsy	Out	
	Albert Brown	Cirrus Avian	Cirrus MK-II	Out	

TORONTO TO CLEVELAND (Commercial)

Place	*Pilot*	*Plane*	*Engine*	*Time*	*Cash Prize*
1st	Herbert St. Martin	Travel Air Wasp	Wasp Radial	2:10:24	$2,000.00
2nd	W. J. E. Johnston	Buhl Airsedan	Wright J-6	2:13:14	1,200.00
3rd	James G. Crang	Buhl	Wright J-5	2:18:00	800.00
4th	Thomas F. Williams	Eaglerock Model A3	Hispano Suiza "A"	2:35:38	
5th	E. Leigh Capreol	Gypsy Moth		2:50:25	
6th	William N. Millar	DH. Moth No. 800		2:50:39	
	O'Brien Saint	Travel Air Biplane	Curtiss Challenger	Out	

WOMEN'S RACE—Event No. 1

Aug. 27, 1929. 5 Miles, 10 Laps

Place	*Pilot*	*Plane*	*Engine*	*Speed*	*Cash Prize*
1st	Mrs. Keith Miller	Fleet Model 2	Kinner K5	98.73	$ 500.00
2nd	Lady Mary Heath	Great Lakes	Am. Cirrus	96.17	300.00
3rd	Blanche Noyes	Great Lakes	Am. Cirrus	85.12	200.00
*	Phoebe Omlie	Monocoupe	Warner	112.38	500.00
	Amelia Earhart	Great Lakes	Am. Cirrus	91.50	
	Louise Thaden	Travel Air 'R'	Chevrolet	Out	
	Thea Rasche	Gypsy Moth	DH. Gypsy	Out	
	Elinor Smith	Curtiss Robin	Curtiss OX5	Out	
	Edith Foltz	Eaglerock Bullet	Kinner	Out	

*First prize paid to Mrs. Phoebe Omlie, in addition to first prize to Mrs. Keith Miller.—Decision of Referee. Protest pylons not properly marked, sustained.

LIGHT PLANE—Event No. 2

Aug. 27, 1929. 5 Miles, 10 Laps

Place	*Pilot*	*Plane*	*Engine*	*Speed*	*Cash Prize*
1st	E. B. Heath	Heath Super Parasol	Bristol Cherub	62.01	$ 375.00
*	F. Lund	Low Wing Sport	Henderson		45.00
†	Jack McMillan	Heath Super Parasol	Henderson		135.00

*Dropped out on third lap. †Dropped out on sixth lap.

EXPERIMENTAL SHIP RACE—Event No. 3

Sept. 2, 1929. 5 Miles, 5 Laps

Place	*Pilot*	*Plane*	*Engine*	*Speed*	*Cash Prize*
C-1	Douglas Davis	Travel Air	Chevrolet D-6	113.38	$ 400.00
C-2	E. B. Heath	Heath Baby Bullet	Bristol Cherub	105.40	240.00
C-3	H. A. Speer	Barling NB3	Genet	105.12	160.00
D-1	H. S. Myhres	Simplex Monoplane	Wright J-6	147.01	400.00

CLOSED EVENT FOR PILOTS OF U. S. MARINES—Event No. 4

Place	*Pilot*	*Entrant*	*Time*	*Speed*	*Cash Prize*
1st	Lieut. Boyden	United States Marines	30:46.4	142.88	Trophy
2nd	Lieut. Bryce	United States Marines	30:59.4	141.88	Trophy
3rd	Lieut. Belcher	United States Marines	31:13	140.85	Trophy
4th	Lieut. Heagen	United States Marines	31:28	139.73	Trophy

CIVILIAN PLANES—275 CU. IN. OR LESS—Event No. 5

Aug. 28, 1929. 5 Miles, 10 Laps

Place	*Pilot*	*Plane*	*Engine*	*Speed*	*Cash Prize*
1st	E. B. Heath	Heath Baby Bullet	Bristol Cherub	109.46	$ 400.00
2nd	H. A. Speer	Barling NB-3	Genet	105.93	200.00
3rd	Lewis Love	Davis Monoplane	LeBlond 5 Cyl	105.60	100.00
4th	Verne Roberts			100.32	50.00
5th	Barney Zimmerley	Barling NB-3	60 Le Blond	94.50	*
	Leslie Miller	Barling NB-3	60 Le Blond	Out	
	Wilfred H. Moore	Inland Monoplane	60 Le Blond	Out	
	Ted Lundberg	Driggs Skylark	Rover 4 Cyl., in line converted	Out	

*No prize. Fouled at third pylon on fifth lap.

ARMY ATTACK GROUP—Event No. 6

Aug. 30, 1929

Place	*Pilot*	*Plane*	*Engine*	*Speed*	*Prize*
1st	I. M. Palmer	Curtiss A-3	Curtiss D-12	140.20	Mason M. Patrick Trophy
2nd	G. F. Kinzie	Curtiss A-3	Curtiss D-12	138.84	
3rd	F. M. Ziegler	Curtiss A-3	Curtiss D-12	136.14	
	J. H. Jouett	Curtiss A-3	Curtiss D-12	127.62	
	G. A. McHenry	Curtiss A-3	Curtiss D-12	135.42	
	J. G. Moore	Curtiss A-3	Curtiss D-12	134.60	
	W. S. Lee	Curtiss A-3	Curtiss D-12	135.25	
	J. Flock	Curtiss A-3	Curtiss D-12	130.67	
	S. J. Simonton	Curtiss A-3	Curtiss D-12	126.56	
	O. C. George	Curtiss A-3	Curtiss D-12	134.14	
	E. P. Rose	Curtiss A-3	Curtiss D-12	134.84	
	Wm. L. Lee	Curtiss A-3	Curtiss D-12	130.95	
	R. L. Winn	Curtiss A-3	Curtiss D-12	135.91	
	R. D. Johnston	Curtiss A-3	Curtiss D-12	135.93	
	T. L. Moseley	Curtiss A-3	Curtiss D-12	135.63	

ARMY PURSUIT RACE—Event No. 7

Aug. 31, 1929. 10 Miles, 8 Laps

Place	*Pilot*	*Plane*	*Engine*	*Speed*	*Prize*
1st	P. B. Wurtsmith	Curtiss P-1	Curtiss D-12	152.17	John L. Mitchell Trophy
2nd	A. L. Moore	Curtiss P-1	Curtiss D-12	152.04	
3rd	K. E. Roger	Curtiss P-1	Curtiss D-12	152.01	
4th	E. J. Warburton	Curtiss P-1	Curtiss D-12	151.82	
5th	J. A. Winefordner	Curtiss P-1	Curtiss D-12	150.78	
6th	Wm. M. Morgan	Curtiss P-1	Curtiss D-12	150.51	
7th	Hoyt L. Prindle	Curtiss P-1	Curtiss D-12	149.08	
8th	P. W. Wolf	Curtiss P-1	Curtiss D-12	149.48	
9th	C. E. Henry	Curtiss P-1	Curtiss D-12	148.85	
10th	E. H. Underhill	Curtiss P-1	Curtiss D-12	147.79	
11th	J. C. Crosthwaite	Curtiss P-1	Curtiss D-12	146.35	
12th	R. Royce	Curtiss P-1	Curtiss D-12	142.38	
13th	J. F. Egan	Curtiss P-1	Curtiss D-12	141.86	
14th	R. L. Schoonlein	Curtiss P-1	Curtiss D-12	139.35	
15th	R. E. Cobb	Curtiss P-1	Curtiss D-12	138.25	
	H. A. Johnson	Curtiss P-1	Curtiss D-12		

OX5 RACE (REPEAT OF EVENT NO. 8)—Event No. 8

Aug. 28, 1929. 5 Miles, 8 Laps

Place	*Pilot*	*Plane*	*Engine*	*Speed*	*Cash Prize*
1st	Geo. H. Shealey	Travel Air	Curtiss OX5	104.54	$ 500.00
2nd	William E. Winkle	Three Place	Curtiss OX	100.74	400.00
3rd	P. H. Spencer	Curtiss Robin	Curtiss OX	98.22	200.00
4th	Arthur C. Chester	Travel Air	Curtiss OX	97.41	100.00
5th	Louis Miester	Curtiss Robin	Curtiss OX	95.76	50.00
6th	R. W. Brown	Curtiss Robin	Curtiss OX	90.35	
7th	Ralph C. Wensinger	Eaglerock	Curtiss OX	87.98	
	Clarke L. Smith	Waco 9	Curtiss OX	*	
	Eugene J. Detmer	Travel Air	Curtiss OX		
	S. J. Wittman	Pheasant H10	Curtiss OX5		

*Forced down one-third mile east of pylon No. 3; motor trouble.

CIVILIANS ONLY—510 CU. IN. OR LESS—Event No. 9

Aug. 28, 1929. 5 Miles, 10 Laps

Place	*Pilot*	*Plane*	*Engine*	*Speed*	*Cash Prize*
1st	Verne L. Roberts	Monocoupe	Warner Scarab	129.18	$ 500.00
2nd	R. T. Quinby	Monocoupe	Warner Scarab	128.09	400.00
3rd	C. E. Clark	Travel Air RC	Chevrolet D6, 6 Cyl	126.14	200.00
4th	Charles Meyers	Great Lakes	Am. Cirrus III	122.00	100.00
5th	Wilfred G. Moore	Inland Sport	Warner Scarab	116.73	50.00
6th	Clarence Chamberlin	Chamberlin Mono	Kinner, 5 Cyl	114.80	
7th	Leslie Bowman	Monosport	Kinner K-5	114.08	
8th	A. P. Krapish	DH. Gypsy	60 G. M.	112.22	
9th	R. D. Cramer	Cessna AW	Warner 110	112.09	

10th	Bob Dake	DH. Gypsy	Warner 110	111.05	
11th	Lieut. C. P. Warner	Fleet 2	Kinner K-5	105.29	
	Frank T. Courtney	DH. Gypsy	60 G. M	Out in fifth lap	
	C. A. Burrows	Fleet	Kinner		
	Earl Volter	Curtiss Robin	Curtiss OX5	Out second lap	
	Ralph Lockwood	Fairchild KR21	Kinner		
	Earl Rowland	Cessna A. W	Warner Scarab		
	J. Wesley Smith	Monosport			
	Ennis L. Stewart	Cavalier Cabin Mono	Gypsy		
	Errett Williams	Alexander Bullet	Wright J-6, 5 Cyl		
	Wm. McDonough	Moth			
	H. S. Myhres	Simplex	Warner Scarab		
	Glen Messer	Air Boss	Siemans		
	P. H. Spencer	Curtiss Robin	Curtiss OX		

CLEVELAND TO BUFFALO EFFICIENCY RACE—Event No. 10

Sept. 2, 1929

Place	*Pilot*	*Plane*	*Engine*	*Speed*	*Cash Prize*
1st	Geo. W. Haldeman	Bellanca Cabin	Wright J-6	*a* 131.22	$1,500.00
2nd	J. Wesley Smith	Bellanca CH300	Wright J-6	*b* 125.42	750.00
3rd	Otis Beard	Fairchild 71	Wasp	*c* 138.22	450.00
4th	H. P. Young	Bellanca	Wright J-5	*d* 109.84	300.00
	J. M. Johnson	Buhl	Wright	*e* 131.35	
	Errett Williams	Eaglerock Bullet	Wright J-6, 5 Cyl	*f* 100.63	
	S. Hall	Travel Air	Wright		
	C. W. Holman	Laird	Wright J-4		
	T. Taney	Travel Air	Wright J-6		
	J. C. Angel	Albatross	Axelson		
	C. W. Meyers	Great Lakes	Cirrus		
	R. T. Pruyn	Gypsy Moth	Gypsy		
	W. B. Wheatley	Fleet	Kinner		
	Wm. A. Williams	Eaglerock Bullet	Kinner		
	W. T. Backus	DH. Moth	DH. Gypsy		
	C. D. Chamberlin	Crescent Cabin	Wright J-6		
	L. O. Yost	Fairchild	Wright J-5		
	L. C. Miller	N-B-3	LeBlond		
	D. S. Zimmerley	Barling N-B-3	LeBlond		
	W. T. McDonough	Westland Widgeon	Cirrus		
	L. G. Fritz	Lockheed Vega	Wasp		
	L. F. Shoenhair	Lockheed Vega	Wasp		
	R. T. Quinby	Monocoupe	Warner		
	V. L. Roberts	Monocoupe	Warner		
	C. J. Faulkner	Pitcairn	Wright J-6		
	C. D. Bowyer	Cessna	Comet		
	C. J. Jakway	Gypsy Moth	DH. Gypsy		
	A. P. Krapish	Gypsy Moth	DH. Gypsy		
	F. T. Courtney	Gypsy Moth	DH. Gypsy		
	L. H. Bowman	Monosport	Kinner		
		Lockheed Vega	Wasp		

REMARKS

a Merits, 1141.02; pay load, 1625; gallons gas, 51.9.

b Merits, 1067.71; pay load, 1520; gallons gas, 45.3.

c Merits, 676.05; pay load, 1500; gallons gas, 94.5.

d Merits, 564.30; pay load, 1265; gallons gas, 47.9.

e Merits, 508.80; pay load, 1225; gallons gas, 88.

f Arrived 7:32; out because of landing after 7:00 P. M.

SOLO ENDURANCE—Event No. 11

Aug. 28, 1929

Pilot	*Plane*	*Engine*	*Time*	*Cash Prize*
Thomas George Reid	Emsco Whirlwind	Wright J-6, 300 H.P.	*38:00:00	$1,500.00

*The time is approximate, pending calibration of baragraph.

RELAY RACE—Event No. 12

Aug. 30, 1929

Place	*Pilot*	*Plane*	*Engine*	*Speed*	*Cash Prize*
1st	D. H. Davis J. F. Gill C. E. Clark H. McGouchey	Travel Air	Curtiss OX5	96.75	$ 750.00
2nd	W. E. Winkle W. N. Raymond H. G. Bessinger K. F. Lovejoy	Bird	Curtiss OX5	92.58	375.00
3rd	Arthur Chester S. H. Hopkins, Jr. Clark Smith George Shealey	Travel Air	Curtiss OX5	90.18	250.00
4th	R. H. Spencer R. W. Brown Karl Volter L. McGrady	Curtiss Robin	Curtiss OX5	87.05	125.00
5th	Ted Townz Jack Morris Pickering Alden			82.17	

720 CU. IN.—Event No. 13

Aug. 29, 1929. 5 Miles, 10 Laps

Place	*Pilot*	*Plane*	*Engine*	*Speed*	*Cash Prize*
1st	E. Williams			134.58	$ 750.00
2nd	Vernon L. Roberts	Monocoupe	Warner	128.84	375.00
3rd	R. T. Quinby	Monocoupe	Warner	128.15	187.50
4th	C. D. Bowyer	Cessna	Comet	126.61	112.50
5th	G. Halsey	Rearwin Ken-Royce	Challenger	123.98	75.00
	A. Graf	Brunner Winkle	Kimball	97.78	
	Major C. Cone	Command-Aire	Challenger	112.07	
	Fairchild Airplane	Fairchild KR34	Wright J-6	110.63	
	Verne D. Christen	Eagle Rock	Hisso A	112.53	
	C. E. Clark	Travel Air	Chevrolet D-6	Out	
	H. S. Myhres	Simplex	Warner	Out in ninth lap	
	Clarence Chamberlin	Chamberlin Plane	Kinner		

LIBERTY ENGINE BUILDERS' RACE—Event No. 14

Aug. 26, 1929. 9.16 Miles, 8 Laps

Place	*Pilot*	*Plane*	*Engine*	*Speed*	*Trophy Prize*
1st	John K. Gill	Douglas O-2-H	Liberty	132.72	1st
2nd	Claude A. Owen	Douglas O-2-H	Liberty	132.04	2nd
3rd	J. Sydney Owens	Curtiss O-11	Liberty	143.07	3rd
4th	Karl Bushong	Douglas O-2-H	Liberty	127.85	4th
5th	Clarence Barnhill	Douglas O-2-H	Liberty	126.59	
6th	Charles W. Haas	Douglas O-2-H	Liberty	124.91	
7th	Benjamin J. Nasief	Curtiss O-11	Liberty	133.89	
	Walter E. Nicol	Douglas O-2-H	Liberty	Out	
	Floyd E. Evans	Douglas O-2-H	Liberty	Out	
	Leon M. Lindsey	Douglas O-2-H	Liberty	Out	
	Walter M. Williams	Curtiss O-11	Liberty	Out	

CIVILIANS ONLY (LIGHT AIRPLANE AND EFFICIENCY CONTEST)—Event No. 15

Speed

Place	*Pilot*	*Plane*	*Engine*	*Speed*	*Cash Prize*
1st	H. A. Speer	Barling NB3	Genet	105.02	$ 225.00
2nd	William Burns	Heath Bullet	Bristol Cherub	104.68	125.00
3rd	B. W. Diggle	Inland Sport	Le Blond 60	100.67	75.00
4th	Lewis Love	Davis Highwing	Le Blond 60	91.41	50.00

Efficiency

				Merits	
1st	H. A. Speer	Barling NB3	Genet	809.84	225.00
	*D. F. Zimmerley	Barling NB3	LeBlond	909.53	
2nd	B. W. Diggle	Inland Sport	Le Blond 60	300.35	125.00
3rd	William Burns	Heath Bullet	Bristol Cherub	282.59	75.00
4th	Lewis Love	Davis Highwing	Le Blond 60	153.74	50.00

*Two first prizes awarded in Efficiency Contest by Referee because Pilot Zimmerley was misinformed relative to payload and was also flagged down at end of ninth lap.

PARACHUTE JUMPING CONTEST—Event No. 16

Aug. 25, 1929

Place	*Name*	*Address*	*Cash Prize*	*Remarks*
1st	L. C. Snider	Jackson, Michigan	$50.00	80 ft. from circle
2nd	M. H. Weiss	Hampton Roads, Va.	30.00	105 ft. from circle
3rd	Edw. Anderson	7120 Camden Ave., Cleveland, O.	20.00	156 ft. from circle

Aug. 26, 1929

1st	Joseph Crane	1090 Eastlawn, Detroit, Mich.	$50.00	22 ft. 3 in. from center of circle
2nd	Edward Anderson	7120 Camden Ave., Cleveland, O.	30.00	60 ft. 4 in. from center of circle
3rd	L. C. Snider	Jackson, Michigan	20.00	100 ft. from center of circle

Aug. 27, 1929

1st	Dale Dryer	Cleveland, Ohio	$50.00	102 ft. from circle
2nd	Fred Cole	122 E. 42nd Street, New York City	30.00	173 ft. from circle
3rd	Amos McGuire	57 Courtland St., Cleveland, O.	20.00	178 ft. from circle

Aug. 29, 1929

1st	Joe Dunkel	2100 Halstead Ave., Cleveland, O.	$50.00	17 ft. 11 in. from center of circle
2nd	Johnny Runger	Curtis Field, Long Island	30.00	30 ft. 11 in. from center of circle
3rd	Gene Rock	Fort Wayne, Ind.	20.00	74 ft. from center of circle

Aug. 30, 1929

1st	Joe Dunkel	2100 Halstead Ave., Cleveland, O.	$50.00	82 ft. from center of circle
2nd	Amos McGuire	57 Courtland St., Cleveland, O.	30.00	210 ft. from center of circle
3rd	Johnny Runger	Curtis Field, Long Island	20.00	257 ft. from center of circle

Aug. 31, 1929

1st	Joe Crane	1090 Eastlawn, Detroit, Mich.	$50.00	40 ft. 6 in. from center of circle
2nd	L. C. Snyder	310 W. Wilkins St., Jackson, Mich.	30.00	145 ft. 6 in. from center of circle
3rd	Bonnie Rowe	Candler Field, Atlanta, Ga.	20.00	175 ft. 4 in. from center of circle
4th	Jack Cope	Chicago, Ill.	No inspection slip on this parachute.	

Sept. 2, 1929

1st	Joe Crane	1090 Eastlawn, Detroit, Mich.	$500.00	27 ft. from center of circle
2nd	Dale F. Dryer	3833 Cress Road, Cleveland, O.	300.00	593 ft. from center of circle
3rd	Bonnie Rowe	Candler Field, Atlanta, Ga.	200.00	1026 ft. from center of circle
4th	Joseph Dunkel	2100 Halstead Ave., Cleveland, O.	This parachute did not have inspection ticket.	1156 ft. from center of circle

September 2, 1929 (Postponed From Sept. 1 and Aug. 28)

1st	Joe Crane	1090 Eastlawn, Detroit, Michigan	$100.00	30 ft. from center of circle
2nd	Bonnie Rowe	Candler Field, Atlanta, Ga.	60.00	105 ft. from center of circle
3rd	Jack Cope	Chicago, Ill.	This parachute had no 30-day inspection ticket.	
4th	L. C. Snider	310 Wilkins St., Jackson, Mich.	40.00	199 ft. from center of circle

NOTE:—Due to the fact no jump was held on Wednesday, August 28, nor on Sunday, September 1, double money was paid for this jump.

OPEN SHIPS—800 CU. IN.—Event No. 17

Sept. 1, 1929. 5 Miles, 15 Laps

Place	*Pilot*	*Plane*	*Engine*	*Speed*	*Cash Prize*
1st	C. W. Holman	Laird	Wright J-4	150.01	$600.00
2nd	T. A. Wells	Travel Air	Wright J-5	147.33	300.00
3rd	H. S. Myhres	Simplex Mono	Wright J-6	145.56	150.00
4th	I. M. McConaughey	Travel Air	Wright J-6	142.60	100.00
5th	F. Lund	Waco 10	Wright J-6	140.74	50.00
	S. Hall	Travel Air	Wright J-5	140.13	
	D. C. Warren	Travel Air	Whirlwind J-5	137.33	
	A. J. Davis	Waco 10	Wright J-5	136.92	
	L. D. Ruch	American Eagle	Wright J-5	Out	
	G. E. Halsey	Rearwin	Challenger	121.24	
	C. Cone	Command-Aire	Challenger	113.50	
	L. O'Donnell	Waco 10	Wright J-4	133.27	
	C. E. Clark	Travel Air	Chevrolet D-6		
	C. J. Faulkner	Pitcairn	Wright J-6		
	W. B. King	Travel Air	Travel Air		
	G. Graf	Bird	Kimball		

CIVILIANS ONLY (AIR TRANSPORT AND EFFICIENCY CONTEST)—Event No. 18

(For Detroit News Air Transport Trophy)

Speed

Place	*Pilot*	*Plane*	*Engine*	*Time*	*Speed*	*Cash Prize*
1st	Geo. Haldeman	Bellanca Ch-300	Wright J-5	0:36:39.0	119.97	$450.00
2nd	J. W. Smith	Bellanca Ch-300	Wright J-6	0:38:39.3	113.74	270.00
3rd	C. D. Chamberlin	Crescent Cabin	Wright J-6	0:39:54.2	110.19	180.00

Efficiency

1st	Geo. Haldeman	Bellanca Ch-300	Wright J-5	Merits	316.02	$450.00
2nd	C. D. Chamberlin	Crescent Cabin	Wright J-6	Merits	202.49	270.00
3rd	J. V. Smith	Bellanca Ch-300	Wright J-6	Merits	194.17	180.00

CABIN SHIP RACE—800 CU. IN.—Event No. 19

Aug. 31, 1929. 5 Miles, 12 Laps

Place	*Pilot*	*Plane*	*Engine*	*Speed*	*Cash Prize*
1st	R. W. Cantwell	Lockheed Vega	Wasp	152.27	$675.00
2nd	R. Turner	Lockheed Vega	Wasp	150.15	375.00
3rd	J. W. Smith	Bellanca	Wright J-6	135.81	225.00
4th	H. D. Young	Bellanca	Wright J-6	125.03	150.00
5th	Fairchild	Fairchild	Wasp	123.83	75.00
	Theodore Taney	Travel Air Cabin	Wright J-6	105.56	
	C. D. Chamberlin	Crescent Cabin	Wright J-6		

MULTI-MOTORED SHIPS—Event No. 20

Sept. 2, 1929. 10 Miles, 5 Laps

Place	Pilot	Plane	Engine	Speed	Cash Prize
1st	W. D. Waterman	Bach	Hornet & Wright J-5	136.41	$500.00
2nd	William Brock	Bach Aircraft Co.	Hornet & Wright J-6	134.46	300.00
3rd	M. Girton	Fokker F-10	P. & W. Wasp 3	123.00	150.00

NAVY PURSUIT RACE—Event No. 21

Aug. 30, 1929. 10 Miles, 10 Laps

Place	Pilot	Plane	Engine	Speed
1st	W. E. Arnold	Boeing F-2-B	P. & W. Wasp	127.58
2nd	C. Ironmonger	Boeing F-2-B	P. & W. Wasp	126.97
3rd	T. C. Sutton	Boeing F-2-B	P. & W. Wasp	126.50
4th	A. Langford	Boeing F-2-B	P. & W. Wasp	126.08
5th	L. E. Gebres	Boeing F-2-B	P. & W. Wasp	125.71
6th	McMullen	Boeing F-2-B	P. & W. Wasp	125.07
7th	W. Harvey	Boeing F-2-B	P. & W. Wasp	121.85
8th	G. T. Nimdorf	Boeing F-2-B	P. & W. Wasp	120.40
	H. C. Wick	Boeing F-2-B	P. & W. Wasp	*127.43
	D. S. MacMahan	Boeing F-2-B	P. & W. Wasp	*126.19
	C. Briggs	Boeing F-2-B	P. & W. Wasp	*123.42
	C. W. McClusky	Boeing F-2-B	P. & W. Wasp	*126.72
	H. Brow	Boeing F-2-B	P. & W. Wasp	*125.34
	E. R. McLean	Boeing F-2-B	P. & W. Wasp	*129.55
	J. R. Tate (Out)			
	McClure (Out)			

*Disqualified—fouled pylons.

AUSTRALIAN PURSUIT RACE FOR MEN—Event No. 22—Final

Aug. 31, 1929. 5 Miles, 15 Laps

Place	Pilot	Plane	Time	Speed	Cash Prize	Handicap	Net Time
1st	C. C. Jakway	Gypsy Moth	0:44:42.6	100.65	$750.00	4:56.0	49:39.5
2nd	Arthur J. Davis	Waco 10-T	0:32:53.4	136.82	375.00	17:38.5	50:31.9
3rd	H. S. Myhres	Simplex Monoplane	0:30:03.4	149.72	185.00	20:40.6	50:44.0
4th	E. J. Detmer	Travel Air	0:43:25.4	103.63	110.00	7:23.6	50:49.0
5th	A. P. Krapish	Gypsy Moth 60-GM	0:39:25.9	114.12	80.00	11:34.9	51:00.8
6th	I. M. McConaughey	Travel Air	0:32:01.4	140.52		19:05.8	51:07.2
7th	T. Taney	Moth	0:39:43.8	113.26		11:26.2	51:10.0
8th		Fairchild	0:44:16.2	101.65		6:50.4	51:16.6
9th	P. H. Spencer	Command-Aire	0:39:53.6	112.80		11:37.5	51:31.1
10th	R. C. Wensinger	Comb. Eaglerock	0:51:32.2	87.32			51:32.2
11th	S. J. Wittman		0:49:27.1	90.097		2:05.8	51:32.9
12th	Glen E. Messer	Air Boss	0:42:47.6	105.10		9:10.0	51:57.6
13th	Errett Williams	Eaglerock Bullet	0:33:59.5	132.30		18:17.3	52:16.8
14th	E. Z. Newsome	Air Boss 3 Pl	0:48:47.6	92.23		4:04.4	52:51.6
15th	G. W. Haldeman	Bellanca	0:35:09.7	127.98		18:22.9	53:32.6

16th	J. Wesley Smith	Bellanca Cabin	0:35:37.5	125.38		18:22.9	$4:00.4
17th		Fairchild Airplane	0:40:01.6	112.43		14:09.7	$4:11.3
Fouled	F. T. Courtney	Gypsy Moth	0:42:07.5	106.82*		8:24.5	$0:32.0
Fouled	T. A. Wells	Travel Air	0:31:06.4	144.66†		20:59.2	$1:55.6

*Fouled No. 3 pylon fifth lap. †Fouled No. 3 pylon in second and sixth laps.

NATIONAL GUARD RACE—Event No. 23

Aug. 25, 1929. 70 Miles, 7 Laps

Place	*Pilot*	*Plane*	*Speed*	*Cash Prize*	*Remarks*
	Lieut. Philip R. Love	Douglas O-2-H	132.43		Streamline disqualified
1st	John K. Gill	Douglas O-2-H	132.10	$500.00	
2nd	Claude A. Owens	Douglas O-2-H	130.91	300.00	
3rd	Lieut. Wilson V. Newhall	Douglas O-2-H	129.97	200.00	
5th	Leon M. Lindsey	Douglas O-2-H	127.43		
6th	Clarence D. Barnhill	Douglas O-2-H	126.43		
7th	John Sydney Owens	Curtiss O-11	137.32		Handicap speed 10.9.100 126.41
8th	Theo. E. Baker	Curtiss O-11	135.94		Handicap speed 10.8.000 125.03
9th	Fred L. Smith	Douglas O-2-H	124.04		
10th	George J. Bortle	Curtiss O-11	133.35		Handicap speed 10.5.940 122.80
11th	Floyd E. Evans	Douglas O-2-H	122.83		
12th	W. S. Johnston	Curtiss O-11	115.05		Handicap speed 9.1.884 106.46

NOTE:—All planes equipped with Liberty engine.

AIR LINE DISTANCE NON-STOP, NON-REFUEL CONTEST TO ESTABLISH A NEW WORLD'S RECORD FOR LONG DISTANCE FLIGHT—Event No. 24

(Cancelled account no entries)

CONTEST TO ESTABLISH A NEW WORLD'S AIRPLANE ENDURANCE FLIGHT RECORD BY REFUELING—Event No. 25

(Cancelled account no entries)

FREE FOR ALL—Event No. 26

Sept. 2, 1929. 10 Miles, 5 Laps

Place	*Pilot*	*Plane*	*Engine*	*Speed*	*Cash Prize*
1st	D. Davis	Travel Air	Wright J-6	194.90	$750.00
2nd	R. G. Breene	Curtiss P-3-A	Wasp	186.84	450.00
3rd	Roscoe Turner	Lockheed Vega	Wasp	163.44	300.00
	J. J. Clark	Curtiss F6C-6	Curtiss D-12	153.38	
	H. S. Myhres	Simplex	Wright J-6	152.15	
	I. M. McConaughey	Travel Air	Wright J-6	145.20	
	C. E. Clark	Travel Air	Chevrolet D-6		
	C. J. Faulkner	Pitcairn	Wright J-6		
	C. D. Bowyer	Cessna	Comet	Out in second lap	
	E. W. Wood	Laird Racer	Wright J-6		
	H. L. Atkinson	Curtiss Falcon	Conqueror		

DEAD STICK LANDING CONTESTS—Event No. 27

Aug. 25, 1929

Place	*Pilot*	*Plane*	*Engine*	*Cash Prize*	*Remarks*
1st	Orin Welsh	Swallow Training	Kinner	$100.00	2 ft. 6 in. from line
2nd	Ralph Wensinger	Eaglerock	OX5	50.00	9 ft. 7 in. from line
3rd	Larry Ruch			25.00	18 ft. 3 in. from line
4th	Verne D. Christen	Eaglerock	Hisso		58 ft. 2 in. from line
5th	Douglas H. Davis				87 ft. 0 in. from line

Aug. 26, 1929

1st	Verne D. Christen	Eaglerock	Hisso	$100.00	8 ft. 6 in. from line
2nd	Orin Welsh	Swallow Training	Kinner	50.00	79 ft. 0 in. from line
3rd	S. P. Hopkins	Waco 10 Biplane		25.00	110 ft. 8 in. from line

Aug. 27, 1929

1st	Cramer	Curtis Robin		$100.00	on line
2nd	Arthur C. Chester			50.00	16 ft. from line
3rd	Verne D. Christen	Eaglerock	Hisso	25.00	27 ft. from line

Aug. 28, 1929

1st	Arthur C. Chester	Travel Air	OX5	$100.00	1 ft. 6 in. from line
2nd	Verne D. Christen	Eaglerock	Hisso	50.00	7 ft. 8 in. from line
3rd	Orin Welsh	Swallow Training	Kinner	25.00	22 ft. 6 in. from line

Aug. 29, 1929

1st	Arthur C. Chester			$100.00	12 ft. 3 in. from line
2nd	Pat Twohey			50.00	28 ft. from line
3rd	Orin Welsh			25.00	43 ft. from line

Sept. 1, 1929

1st	Al. Krapish	Moth		$300.00	9 ft. from line
2nd	Glen Messer	Air Boss		200.00	12 ft. from line
3rd	Wesley N. Raymond	Moth		150.00	10 ft. 2 in. from line
4th	Verne D. Christen	Eaglerock		75.00	20 ft. 5 in. from line

Sept. 2, 1929

1st	Wesley N. Raymond			$100.00	18 ft. 6 in. from line
2nd	Glen L. Messer			50.00	35 ft. from line
3rd	Clarke L. Smith			25.00	525 ft. from line

WOMEN'S RACE—510-800 CU. IN.—Event No. 28

Aug. 29, 1929. 5 Miles, 12 Laps

Place	Pilot	Plane	Engine	Speed	Cash Prize
1st	Gladys O'Donnell	Waco Taper Wing	Wright J-6, 7 Cyl	137.00	$625.00
2nd	Louise Thaden	Travel Air	Wright J-5	131.43	375.00
3rd	Blanche Noyes	Travel Air	Wright J-5	127.77	250.00
	Florence Barnes	Travel Air	Wright J-5		
	Ruth Nichols	Rearwin Ken Royce	Curtiss Challenger		

DEAD STICK LANDING CONTEST FOR WOMEN PILOTS—Event No. 29

(Cancelled)

WOMEN'S AUSTRALIAN PURSUIT RACE—Event No. 30

Aug. 31, 1929. 5 Miles, 12 Laps

Place	Pilot	Plane	Engine	Speed	Cash Prize
1st	Grace O'Donnell	Waco 10	Wright J-6	138.21	$625.00
*2nd	Thea Rasche	Gypsy Moth	Gypsy	97.31	375.00
*3rd	F. Harrell	Gypsy Moth	Gypsy	112.24	250.00
*4th	Keith Miller	Fleet	Kinner K-5	104.39	
	Lady Heath	Great Lakes	Cirrus		
	Louise Thaden	Travel Air	Wright J-5		
	E. Smith	Cessna	Wright J-6		
	Ruth Nichols	Command-Aire	Challenger	Out	

*Handicapped.

WOMEN'S AUSTRALIAN PURSUIT*—Event No. 31

Sept. 1, 1929. 5 Miles, 12 Laps

Place	Pilot	Plane	Engine	Speed	Cash Prize
1st	Thea Rasche	Gypsy Moth	Gypsy	99.72	$625.00
2nd	Louise Thaden	Travel Air	Wright J-5	136.83	375.00
3rd	Gladys O'Donnell	Waco	Wright J-6	137.63	250.00
4th	Keith Miller	Fleet Model 2	Kinner K-5	104.93	

*Handicapped.

AUSTRALIAN PURSUIT RACE, MEN—Event No. 32

Sept. 3, 1929. 5 Miles, 15 Laps

Place	Pilot	Plane	Engine	Speed	Cash Prize
1st	Clyde C. Jakway	Gypsy Moth	DH. Gypsy	98.78	$750.00
2nd	P. D. Cramer	Curtiss Robin	OX-5	93.71	375.00
3rd	H. S. Myrhes	Simplex Mono	Wright J-6	149.72	185.00
4th	I. M. McConaughey	Travel Air B-11-D	Wright J-6	145.22	110.00
5th	A. B. Johnson	Gypsy Moth	Gypsy	113.91	80.00
6th	E. Williams	Eaglerock Bullet	Wright J-6	134.01	
7th	Theo Taney	Am. Moth Mono	Warner Scarab	112.67	
8th	A. J. Davis	Waco 10	Wright J-5	137.99	
9th	Glen E. Messer	Air Boss	Wright J-6	105.16	
10th	R. T. Quinby	Mono Coupe	Warner	126.18	
11th	E. Z. Newsome	Air Boss 3 Pl. Bi	Simons Y-7 Robin	92.23	
	V. L. Roberts	Mono Coupe	Warner	130.80	
	Frank Courtney	Gypsy Moth	DH. Gypsy	108.26	Fouled

BALLOON BURSTING CONTEST—Event No. 33

Aug. 26, 1929

Place	*Pilot*	*Plane*	*Engine*	*Cash Prize*	*Remarks*
1st	Orin Welsh	Swallow		$20.00	Broke 4 Balloons
2nd	Larry D. Ruch	American Eagle			Broke 3 Balloons
3rd	Verne D. Christen	Eaglerock			Broke 2 Balloons

Aug. 27, 1929

1st	Orin Welsh	Swallow	Kinner K-5	$20.00	Broke 8 Balloons
2nd	Ralph Wensinger	Eaglerock	OX5		Broke 3 Balloons
3rd	Verne Christen	Eaglerock	Hisso Motor		Broke 1 Balloons
1st	Larry Bush	Swallow	Kinner K-5	$20.00	Broke 4 Balloons
2nd	Verne D. Christen	Eaglerock	Hisso Motor		Broke 2 Balloons

Aug. 28, 1929

1st	Verne D. Christen	Eaglerock	Hisso Motor	$20.00	Broke 5 Balloons
2nd	Arthur Chester	Travel Air	OX5		Broke 2 Balloons

CIVILIAN ACROBATIC EXHIBITION—Event No. 34

Aug. 24 to Sept. 2, 1929

Name of Pilot	*Plane*	*Engine*	*Cash Prize*
Waco Aircraft Co. Team of 3 Planes, Fred Lund, Chief Pilot, Troy, Ohio	Waco 10's with tapered Wings	Wright J-5	$900.00*
Travel Air Co. Team of 3 Planes, Douglas Davis, Chief Pilot, Wichita, Kan.	Travel Air Monoplane	Wright J-6	300.00
	2 Travel Air Biplanes with Speed Wings	Wright J-5	600.00*

*Prize money divided between team.

RACE FOR AVIATION TOWN AND COUNTRY CLUB TROPHY—Event No. 35

(Speed and Efficiency Contest)

Speed

Place	*Pilot*	*Plane*	*Engine*	*Time*	*Speed*	*Cash Prize*
1st	E. Williams	Eaglerock Bullet	Wright J-6	0:20:55	153.75	$500.00
2nd	V. L. Roberts	Monocoupe	Warner	0:27:48.8	129.43	300.00
3rd	R. T. Quinby	Monocoupe	Warner Scarab	0:28:40.2	125.57	200.00

Efficiency

				Merits	
1st	G. W. Haldeman	Bellanca	Wright J-6	253.19	$500.00
2nd	C. D. Bowyer	Cessna	Comet	141.31	300.00
3rd	R. T. Quinby	Monocoupe	Warner	118.49	200.00

OFFICIAL WORLD AND AMERICAN AIR RECORDS

Established under Rules and Regulations of the

FEDERATION AERONAUTIQUE INTERNATIONALE

Translated and Compiled by the Contest Committee, National Aeronautic Association, Washington, D. C.

DEC. 31, 1929

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, 1929. 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)—Lieut. T. G. W. Settle and Ensign W. Bushnell, Pitt Stadium, Pittsburgh, Pa., to Savage Harbor, Prince Edward Island, Canada, May 4-5-6, 1929. 43h. 20m.

Distance (United States)—Lieut. T. G. W. Settle and Ensign W. Bushnell, Pitt Stadium, Pittsburgh, Pa., to Savage Harbor, Prince Edward Island, Can., May 4-5-6, 1929. 952 miles.

Altitude—(No Record).

Duration—Lieut. T. G. W. Settle and Ensign W. Bushnell, Pitt Stadium, Pittsburg, Pa., to Savage Harbor, Prince Edward Island, Can., May 4-5-6, 1929. 43h. 20m.

Distance—Lieut. T. G. W. Settle and Ensign W. Bushnell, Pitt Stadium, Pittsburgh, Pa., to Savage Harbor, Prince Edward Island, Can., May 4-5-6, 1929. 952 miles.

Altitude—(No Record).

FIFTH CATEGORY (1,001-2,200 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. 1,108.9 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 (Germany)—Dr. Eckener, Graf Zeppelin, Maybach, 5 motors, from Lakehurst, U.S.A., to Frederickshaven, Germany, Nov. 29-30-31, 1928. 71h. 7m.

Distance (Germany)—Dr. Eckener, Graf Zeppelin, Maybach, 5 motors, Lakehurst, U.S.A., to Frederickshaven, 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—Ensign 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 Wilhelm 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, Cal., Sept. 29-30-Oct. 1, 1928. 59h. 19m. 15s.

REFUELING-IN-FLIGHT

Duration (United States)—Dale Jackson and Forrest O'Brien, St. Louis Robin No. 1, Curtiss-Robertson Challenger 6 cyl. radial engine, 170 h.p., at Lambert Field, St. Louis, Mo., July 13-30, 1929. 420h. 17m.

Duration—Dale Jackson and Forrest O'Brien, St. Louis Robin No. 1, Curtiss-Robertson Challenger 6 cyl. radial engine, 170 h.p., at Lambert Field, St. Louis, Mo., July 13-30, 1929. 420h. 17m.

RETURNING TO POINT OF DEPARTURE WITHOUT REFUELING

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—Lieuts. Kelly and Macready, U. S. A. T-2, Liberty 375 h.p., at Wilbur Field, Dayton, Ohio, April 16-17, 1923. 4,050 kms.—2,516.55 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. 7,188 kms.—4,466 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 (Germany)—Willi Neuenhofen, Junkers W34, monoplane, Bristol-Jupiter 420 h.p., at Dessau, May 25, 1929. 12,739 meters—41,794 feet.

Altitude—Lieut. Apollo Soucek, U.S.N., Wright Apache, Pratt & Whitney 425 h.p., supercharged, at Anacostia, D. C., May 8, 1929. 11,930 meters—39,140 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.

Maximum Speed—Lieut. A. J. Williams, U.S.N., Curtiss Racer, R-2-C-1, Curtiss D-12a 500 h.p., at Mitchell Field, L. I., N. Y., Nov. 4, 1923. 429.025 k.p.h.—266.59 m.p.h.

SPEEDS FOR SPECIFIED DISTANCES WITHOUT PAY LOAD

Speed for 100 Kilometers (United States)—Lieut. 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 100 Kilometers—Lieut. 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 500 Kilometers—Lieut. 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 (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 1,000 Kilometers—Lieut. 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 (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 2,000 Kilometers—Lieut. 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 (France)—Commandants Girler and Weiss, Bregue, Hispano Suiza 600 h.p., Etampes, May 24-25, 1929. 188.097 k.p.h.—116.822 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.

Duration—Lieut. H. R. Harris, U.S.A.S., Douglas DT-2, Liberty 400 h.p., at Wright Field, Dayton, Ohio, June 28, 1924. 9h. 11m. 53.4s.

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.

Distance—Lieut. 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 (Germany)—Reginald Schinzinger, Junkers W-34, Bristol Jupiter VII 420 h.p., at Dessau, Sept. 14, 1928. 9,190 meters—30,150 feet.

Altitude—Lieut. 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 (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.

Speed for 500 Kilometers (Great Britain)—Capt. H. S. Broad, de Haviland "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 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 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 5,000 Kilometers—(No Record).

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 Louis C. Meister, Martin Bomber, MB-2, 2 Liberty, 400 h.p. ea., at Wright Field, June 28, 1924. 120.55 k.p.h. 74.90 m.p.h.

Speed for 1,000 Kilometers—(No Record).

Speed for 2,000 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.

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.

Altitude (Germany)—Reginald Schinzinger, Junkers W-34, Bristol Jupiter VII 420 h.p., at Dessau, Sept. 14, 1928. 7,907 meters—25,941 feet.

Speed for 100 Kilometers (Great Britain)—Capt. H. S. Broad, de Haviland "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 500 Kilometers (Great Britain)—Capt. H. S. Broad, de Haviland "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 1,000 Kilometers (France)—Paillard and Camplan, Bernard monoplane, Hispano-Suiza 600 h.p., Istres, Dec. 23, 1928. 220.791 k.p.h.—137.198 m.p.h.

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 5,000 Kilometers—(No Record).

Duration—Lieut. J. S. Macready, U.S.A.S., Curtiss (Martin) Bomber, NBS-1, 2 Liberty, 400 h.p. ea., at Wright Field, Oct. 2, 1924. 2h. 13m. 49.6s.

Distance—(No Record).

Altitude—Waldo Waterman, Bach landplane, tri-motored cabin monoplane, Pratt & Whitney Hornet, at Los Angeles, Cal., July 26, 1929. 6,346 meters—20,820 feet.

Speed for 100 Kilometers—(No Record).

Speed for 500 Kilometers—(No Record).

Speed for 1,000 Kilometers—(No Record).

Speed for 2,000 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.

Distance (Germany)—Herman Steindorff, Rohrbach-Roland, 3 BMW, 230 h.p., at Staaken, July 31, 1927. 1,750.469 kms.—1,087.68 miles.

Duration—Lieut. H. R. Harris, U.S.A.S., and Mechanician Doug. Culver, Barling Bomber, 6 Liberty, 400 h.p. ea., at Wright Field, Oct. 3, 1924. 1h. 47m. 10.5s.

Distance—(No. Record).

Altitude (Italy)—Demonico Antonini, Captoni CA-73, 2 Isotta Fraschina, 500 h.p. ea., at Cascina Malpensa, May 26, 1927. 6,262 meters—20,544 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 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 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.

Altitude—Lieut. H. R. Harris, U.S.A.S., Barling Bomber, 6 Liberty, 400 h.p. ea., at Wright Field, Oct. 25, 1923. 2,049 meters—6,722 feet.

Speed for 100 Kilometers—(No Record).

Speed for 500 Kilometers—(No Record).

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 ALTITUTE OF 2,000 METERS
(6,671.7 ft.)

L. Bossoutrot, Super Farman-Goliath, 4 Farman, 500 h.p. ea., at LeBourget, Nov. 16, 1925. 6,000 kgs.—13,228 lbs.

Lieut. 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 (United States)*—Maj. Carl Spatz, Capt. Ira C. Eaker, 1st Lieut. Harry A. Halverson, 2nd Lieut. Elwood R. Quesada and Sergt. Roy W. Hooe, U. S. Army Fokker C-2-A, 3 Wright Whirlwind, 220 h.p. ea., at Los Angeles, Cal., Jan. 1-7, 1929. 150h. 40m. 14s.

Duration—Maj. Carl Spatz, Capt. Ira C. Eaker, 1st Lieut. Harry A. Halverson, 2nd Lieut. Elwood R. Quesada and Sergt. Roy W. Hooe, U. S. Army Fokker C-2-A, 3 Wright Whirlwind, 220 h.p. ea., at Los Angeles, Cal., Jan. 1-7, 1929. 150h. 40m. 14s.

*Pending Homologation by F.A.I. of Paris.

Distance (United States)—Lieuts. Smith and Richter, U.S.A., DH-4B, Liberty 400 h.p., at Rockwell Field, San Diego, Cal., Aug. 27-28, 1923. 5,300 kms.—3,293.26 miles.

Distance—Lieuts. Smith and Richter, U.S.A., DH-4B, Liberty 400 h.p., at Rockwell Field, San Diego, Cal., 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. de Haviland and Mrs. de Haviland, DH Moth 60G, DH Gipsy 85 h.p., at Stag Lane, July 27, 1928. 6,054 meters—19,862 feet.

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.

Altitude—Kenneth Gale, Campbell Supersport Landplane, 90 h.p. Kinner motor, Los Angeles, Cal., Aug. 28, 1929. 5,155 meters—16,912 feet.

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. Kaszala, Lampich Monoplane, Thorutzkai engine, 18 h.p., at Budapest, Sept. 14, 1927. 650 kms.—403.9 miles.

Distance (Airline) (Hungary)—Chas. Kaszala, Lampich H-MAFD, Thorutzkai 18 h.p., Budapest to Pola, June 14, 1928. 517.04 kms.—321.3 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 Vichereck, "Avia" BH-11B, Walter 60 h.p., at Prague, June 6-7, 1928. 2,500 kms.—1,553 miles.

Distance (Airline) (United States)—D. S. Zimmerly, Barling NB-3 Landplane, 80 h.p. Genet engine, Brownsville, Tex., to Winnipeg, Can., July 17, 1929. 1,650 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—D. S. Zimmerly, Barling NB-3 Landplane, 80 h.p. Genet engine, Brownsville, Tex., to Winnipeg, Can., July 17, 1929. 1,650 miles.

Altitude—D. S. Zimmerly, Barling NB-3 Landplane, 80 h.p. Genet engine, at Parks Airport, East St. Louis, Ill., May 28, 1929. 6,346 meters—20,820 feet.

Speed for 100 Kilometers—(No. Record).

CLASS C2—SEAPLANES

RETURNING TO POINT OF DEPARTURE WITHOUT REFUELING

Duration (United States)—Lieuts. 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)—Lieuts. B. J. Connell and H. C. Rodd, PN-10, 2 Packard, 600 h.p. ea., at San Diego, Cal., Aug. 15-16, 1927. 2,525 kms.—1,569 miles.

Distance (Airline) (United States)—Comdr. John Rodgers, U.S.N., and Lieut. B. J. Connell, PN-9, 2 Packard 1-A-1500, 500 h.p. ea., San Pablo Bay, Cal., to near Hawaii, Aug. 31-Sept. 1, 1925. 2,963 kms.—1,841 statute miles.

Altitude (United States)—Lieut. Apollo Soucek, U.S.N., Wright Apache, Pratt & Whitney 425 h.p. supercharged, at Washington, D. C., June 4, 1929. 11,753 meters—38,560 feet.

Maximum Speed (Italy)—Maj. 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.

Duration—Lieuts. 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—Lieuts. B. J. Connell and H. C. Rodd, PN-10, 2 Packard 600 h.p. ea., at San Diego, Cal., Aug. 15-16, 1927. 2,525 kms.—1,569 miles.

Distance (Airline)—Comdr. John Rodgers, U.S.N., and Lieut. B. J. Connell, PN-9, 2 Packard 1-A-1500, 500 h.p. ea., San Pablo Bay, Cal., to near Hawaii, Aug. 31-Sept. 1, 1925. 2,963 kms.—1,841 statute miles.

Altitude—Lieut. Apollo Soucek, U.S.N., Wright Apache, Pratt & Whitney 425 supercharged, at Washington, D. C., June 4, 1929. 11,753 meters—38,560 feet.

Maximum Speed (Straightaway)—Lieut. 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 (Great Britain)—Lieut. 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)—Lieut. R. A. Ofstie, Curtiss Navy C-3 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)—Lieut. 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, 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).

Speed for 100 Kilometers—Lieut. 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—Lieut. R. A. Ofstie, Curtiss Navy C-3 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—Lieut. 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—Lieuts. B. J. Connell and H. C. Rodd, U.S.N., PN-10, 2 Packard, 600 h.p. ea., at San Diego, Cal., 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)—Lieuts. B. J. Connell and H. C. Rodd, PN-10, 2 Packard, 600 h.p. ea., at San Diego, Cal., Aug. 15-16, 1927. 20h. 45m. 40s.

Distance (United States)—Lieuts. B. J. Connell and H. C. Rodd, PN-10, 2 Packard, 600 h.p. ea., at San Diego, Cal., 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 (Germany)—Rolf Starke, Heinkel HD 38, BMW-6 600 h.p., at Warnemunde, May 7, 1929. 259.927 k.p.h.—161.510 m.p.h.

Speed for 500 Kilometers (Germany)—Rolf Starke, Heinkel HE 9a, BMW-6 600 h.p., at Warnemunde, May 21, 1929. 235.941 k.p.h.—146.606 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—Lieuts. B. J. Connell and H. C. Rodd, PN-10, 2 Packard, 600 h.p. ea., at San Diego, Cal., Aug. 15-16, 1927. 20h. 45m. 40s.

Distance—Lieuts. B. J. Connell and H. C. Rodd, PN-10, 2 Packard, 600 h.p. ea., at San Diego, Cal., Aug. 15-16, 1927. 2,525 kms.—1,569 miles.

Altitude—Lieut. 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—Lieut. S. W. Callaway, U.S.N., Vought "Corsair," Pratt & Whitney "Wasp" 425 h.p., at Hampton Roads, Va., April 23, 1927. 236.998 k.p.h.—147.263 m.p.h.

Speed for 500 Kilometers—Lieut. J. D. Barner, U.S.N., Vought "Corsair," Pratt & Whitney "Wasp" 425 h.p., at Hampton Roads, Va., April 30, 1927. 218.90 k.p.h.—136.023 m.p.h.

Speed for 1,000 Kilometers—Lieut. N. J. Connell and S. R. Pope, PN-10, 2 Packard, 600 h.p. ea., at San Diego, Cal., July 8, 1927. 142.74 k.p.h.—88.69 m.p.h.

Speed for 2,000 Kilometers—Lieut. B. J. Connell and H. C. Rodd, U.S.N., PN-10, 2 Packard, 600 h.p. ea., at San Diego, Cal., 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)—Lieuts. Zeus Soucek and Lisle J. Maxson, Navy PN-12, 2 Wright R-1750, 525 h.p. ea., at Philadelphia, Pa., May 25-26, 1928. 17h. 55m. 13.6s.

Duration—Lieuts. Zeus Soucek and Lisle J. Maxson, Navy PN-12, 2 Wright R-1750, 525 h.p. ea., at Philadelphia, Pa., May 25-26, 1928. 17h. 55m. 13.6s.

Distance (United States)—Lieut. A. W. Gorton and Chief Boatswain E. E. Reber, U.S.N., PN-12, 2 Pratt & Whitney, 525 h.p. ea., at Philadelphia, Pa., 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)—Rolf Starke, Heinkel BMW-6 600 h.p., at Warnemunde, May 21, 1929. 235.294 k.p.h.—146.204 m.p.h.

Speed for 500 Kilometers (Germany)—Rolf Starke, Heinkel HE 9a, BMW-6 600 h.p., at Warnemunde, May 7, 1929. 259.927 k.p.h.—161.519 m.p.h.

Speed for 1,000 Kilometers (Germany)—Richard Wagner, Dornier Superwal DR-142, 4 Gnome-Rhone-Jupiter, 480 h.p. ea., at Frederickshaven-Lindau, Feb. 2, 1928. 177.279 k.p.h.—110.155 m.p.h.

Speed for 2,000 Kilometers (United States)—Lieut. A. W. Gorton and Chief Boatswain E. E. Reber, U.S.N., PN-12, 2 Pratt & Whitney, 525 h.p. ea., at Philadelphia, Pa., July 11-12, 1928. 130.427 k.p.h.—81.043 m.p.h.

Speed for 5,000 Kilometers—(No Record).

Distance—Lieut. A. W. Gorton and Chief Boatswain E. E. Reber, U.S.N., PN-12, 2 Pratt & Whitney, 525 h.p. ea., at Philadelphia, Pa., July 11-12, 1928. 2,150 kms. 1,336 miles.

Altitude Lieut. Arthur Gavin, U.S.N., PN-12, 2 Pratt & Whitney R-1600, 525 h.p. ea., at Philadelphia, Pa., 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, Cal., July 8, 1927. 148.92 k.p.h.—92.53 m.p.h.

Speed for 500 Kilometers Lieuts. B. J. Connell and S. R. Pope, PN-10, 2 Packard, 600 h.p. ea., at San Diego, Cal., July 8, 1927. 145.68 k.p.h. 90.52 m.p.h.

Speed for 1,000 Kilometers Lieuts. B. J. Connell and S. R. Pope, PN-10, 2 Packard, 600 h.p. ea., at San Diego, Cal., July 8, 1927. 142.74 k.p.h. 88.69 m.p.h.

Speed for 2,000 Kilometers Lieut. A. W. Gorton and Chief Boatswain E. E. Reber, U.S.N., PN-12, 2 Pratt & Whitney, 525 h.p. ea., at Philadelphia, Pa., 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)—Lieut. A. W. Gorton and Chief Boatswain E. E. Reber, U.S.N., PN-12, 2 Pratt & Whitney, 525 h.p. ea., at Philadelphia, Pa., July 11-12, 1928. 16h. 39m.

Distance (United States)—Lieut. A. W. Gorton and Chief Boatswain E. E. Reber, U.S.N., PN-12, 2 Pratt & Whitney, 525 h.p. ea., at Philadelphia, Pa., July 11-12, 1928. 2,150 kms.—1,336 miles.

Altitude (France)—Lieut. deVaisseau, Paris, C.A.M.S., Hispano Suiza 600 h.p., St. Raphael, May 15, 1929. 4,827 meters—15,837 feet.

Speed for 100 Kilometers (Germany)—Richard Wagner, Dornier Superwal DR-142, 4 Gnome-Rhone-Jupiter, 480 h.p. ea., Frederickshaven-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 Frederickshaven-Lindau, Feb. 2, 1928. 179.416 k.p.h.—111.483 m.p.h.

Speed for 1,000 Kilometers (Germany)—Richard Wagner, Dornier Superwal DR-142, 4 Gnome-Rhone-Jupiter, 480 h.p. ea., at Frederickshaven-Lindau, Feb. 2, 1928. 177.279 k.p.h.—110.155 m.p.h.

Speed for 2,000 Kilometers (United States)—Lieut. A. W. Gorton and Chief Boatswain E. E. Reber, U.S.N., PN-12, 2 Pratt & Whitney, 525 h.p. ea., at Philadelphia, Pa., July 11-12, 1928. 130.427 k.p.h.—81.043 m.p.h.

Speed for 5,000 Kilometers (No Record).

Duration—Lieut. A. W. Gorton and Chief Boatswain E. E. Reber, U.S.N., PN-12, 2 Pratt & Whitney, 525 h.p. ea., at Philadelphia, July 11-12, 1928. 16h. 39m.

Distance—Lieut. A. W. Gorton and Chief Boatswain E. E. Reber, U.S.N., PN-12, 2 Pratt & Whitney, 525 h.p. ea., at Philadelphia, Pa., July 11-12, 1928. 2,150 kms.—1,336 miles.

Altitude—Lieut. Arthur Gavin, U.S.N., PN-12, 2 Pratt & Whitney, 525 h.p. ea., at Philadelphia, Pa., June 26, 1928. 4,702 meters—15,426 feet.

Speed for 100 Kilometers—Lieuts. B. J. Connell and S. R. Pope, PN-10, 2 Packard, 600 h.p. ea., at San Diego, Cal., July 8, 1927. 148.92 k.p.h.—92.53 m.p.h.

Speed for 500 Kilometers—Lieuts. B. J. Connell and S. R. Pope, PN-10, 2 Packard, 600 h.p. ea., at San Diego, Cal., July 8, 1927. 145.68 k.p.h.—90.52 m.p.h.

Speed for 1,000 Kilometers—Lieuts. B. J. Connell and S. R. Pope, PN-10, 2 Packard, 600 h.p. ea., at San Diego, Cal., July 8, 1927. 142.74 k.p.h.—88.69 m.p.h.

Speed for 2,000 Kilometers—Lieut. A. W. Gorton and Chief Boatswain E. E. Reber, U.S.N., PN-12, 2 Pratt & Whitney, 525 h.p. ea., at Philadelphia, Pa., 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 (8,818.48 lbs.)

RETURNING TO POINT OF DEPARTURE

Duration (Germany)—Richard Wagner, Dornier Superwal DR-142, 4 Gnome-Rhone-Jupiter, 480 h.p. ea., at Fredericks-haven-Lindau, Feb. 5, 1928. 6h. 1m. 56s.

Duration—(No Record).

Distance (Germany)—Richard Wagner, Dornier Superwal DR-142, 4 Gnome-Rhone-Jupiter, 480 h.p. ea., at Fredericks-haven-Lindau, Feb. 5, 1928. 1,000.160 kms. 621.468 miles.

Distance—(No Record).

Altitude (Germany)—Richard Wagner, Dornier Superwal, 4 Gnome-Rhone-Jupiter, 480 h.p. ea., at Frederickshaven-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 Frederickshaven-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 Frederickshaven-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 Frederickshaven-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—Steindorf, Rohrbach "Romar," 3 BMW, 500 h.p., at Travenmunde, April 17, 1920. 6,450 kgs.—14,220 lbs.

Lieuts. B. J. Connell and H. C. Rodd, U.S.N., PN-10, 2 Packard, 600 h.p. ea., at San Diego, Cal., Aug. 18, 1927. 3,504 kgs.—7,726 lbs.

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