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NAVY BUILDING

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From: Technical Assistant in Europe,
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To: National Advisory Committee for Aeronautics,
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Subject: Paris Aviation Salon, 1934

The Fourteenth Aviation Salon held in the Grand Palais from November 16, to December 2, 1934, was undoubtedly one of the most interesting exhibitions ever seen in Paris. One reason for its great interest was the strong foreign participation. The exhibits of the French constructors in the central portion of the main floor were surrounded by aircraft from Germany, Great Britain, Poland, Czechoslovakia, and Russia. In one of the ground-floor galleries was a display of Italian aeronautics including the world's fastest aircraft. The gallery opposite was devoted to a display by the French Air Ministry of standard service airplanes. Two galleries were allotted to the large international photogrammetric display in connection with which a congress was held during the Salon.

The engine exhibits were arranged in stands around the edge of the main hall. Aviation accessories were displayed in the second-floor galleries surrounding the hall while the principal rooms on that floor were filled by the Air Ministry with a great display of the scientific, technic[al] and commercial aspects of flight. There were noted res[ults] of the work done by the "external collaborators" of th[e Min]istry at various Institutes, progress in heavy-oil en[gines]

design, results of wind-tunnel tests on high-lift devices (from which slotted flaps appeared to give the best results), wall charts showing the French civil-aviation system with meteorological maps kept up to date during the duration of the Salon, models of the various 20-ton transatlantic seaplanes (Latécoère 300, Blériot 5190, Lioré-Olivier 27), and the high-speed 30-seaters now building for Air France.

In another room were charts which revealed that, thanks to the government paying about 40 percent of the purchase price, the number of touring airplanes sold to private owners in 1933 was 112 as compared with 64 in 1932, while the purchases by Clubs increased to 78 from 44. Potez and Caudron proved the most popular makes, with Farman a poor third.

A depressing series of dioramas showed the progress of air invasion of France with models of the ruins of the Place de l'Opéra and the directions for evacuation and the use of shelters and gas masks following the warning sirens. These scenes merely disturbed the visitors, especially as effective shelters are as yet practically nonexistent.

The total number of aircraft exhibited was 68. Of these, France showed 38, Germany 8, Italy 7, Great Britain 5, Poland 4, Czechoslovakia 3, and Russia 3.

While it is unnecessary to list the names of all the French exhibitors, it may be noted that the German Reichsverband der Luftfahrt Industrie showed products of the Arado, B.F.W., Bücker, Fieseler, Focke-Wulf, Heinkel, and Junkers firms; the Italian Air Ministry displayed Breda, Fiat, Macchi, Magni, and Savoia aircraft; Great Britain was represented by A. V. Roe & Co, Armstrong-Whitworth, Bristol, and Hawker; Polish prestige was upheld by P.Z.L. and R.W.D.; Czechoslovakia sent Avia and Letov; and the U.S.S.R., 3 airplanes including the rescuer of the Chelyuskin expedition.

Previous Salons generally afforded some amusement by the obviously impractical nature of a few of the machines shown. This year, however, with the exception of a couple of small aircraft stowed away in an upper gallery (Fauvel flying wing and Mignet monoplane), none was highly unconventional although many of the French prototypes have yet to prove their qualities in flight.

Although light alloy construction including stressed skin covering dominated the scene as far as war airplanes were concerned, many of the touring and training airplanes

were of wood with either plywood or fabric wing covering.

The Salon gave expression to the recent amalgamation of a number of French firms into a few groups having considerable financial strength in pursuance of the policy of "concentration and decentralization." The former Société Générale Aéronautique has all but completely disintegrated, having had to sell the shares of most of its units in order to meet financial obligations. It now consists merely of the Lorraine engine factory and S.E.C.M.-Latham firm. Of former units in the S.G.A., Nieuport-Astra has been absorbed by the Chantiers de la Loire, C.A.M.S. by Henry Potez (who also has a working agreement with Marcel Bloch), while Hanriot and the Société Aérienne Bordelaise are now independent. Bréguet controls Wibault, Morane-Saulnier, Mauboussin, and Couzinet, and for some time Dewoitine has been associated with Lioré et Olivier. Louis Renault last year took over the Caudron firm with exceedingly happy results as regards sporting and private flying.

Absentees at the 1934 Salon included Loire-Nieuport, Latécoère, S.P.C.A., Bernard and Louis Blériot, who has closed his doors but has made an arrangement with the Farman brothers and Mureaux to share production orders with them.

C.A.M.S., Wibault, and Couzinet were represented merely by models on the stands of their controlling companies, and it may be remarked that despite the ten South Atlantic crossings of the "Arc-en-ciel" Mr. Couzinet has had to close his factory.

While no American airplanes were shown, their influence was strongly felt. The exploits of the Douglas and Boeing in the MacRobertson Race have brought them great European acclaim. During the Salon, two Douglas D C 2 airplanes visited Le Bourget. After piloting one of them, the Air Minister took occasion to laud it highly in his speech at the Salon banquet attended by delegates of 34 nations.

Attached to this report is a chart giving the characteristics and performances of the 68 aircraft shown, converted into English units of measure. It should not be overlooked that the performances given for the untested prototypes are estimates of the makers which are unlikely to err on the conservative side. For instance, Breguet claims a top speed of 239 miles per hour for his 12-passenger monoplane with 2 Gnome-Rhone 800 hp. engines. Likewise there

are many claims of speeds well in excess of 250 miles an hour for pursuit airplanes but very few of such claims have been officially proved. However, in the case of the PZL, the Polish Technical Service vouches for a speed of 258 miles per hour at 15,000 feet, a speed reached only by using a 900 hp. engine.

While the exhibits are arranged alphabetically on the chart, they are grouped according to classes in the text of this report. The various categories of aircraft (with the numbers in each class) are shown in the following list:

Airplanes

12	Pursuit
2	Observation
5	Multiplace fighting-bombing
7	Training
7	Transport
1	Mail
1	Racing
22	Touring and sport
2	Experimental

Seaplanes

1	Pursuit
1	Observation
1	Torpedo-bombing
2	Transport
1	Racing
3	Touring (amphibian)

AIRPLANES

Single-Seat Pursuit

Armstrong-Whitworth "Scimitar" (635 hp. Siddeley Panther).

Avia 534 (860 hp. Hispano-Suiza 12 Ybrs).

Breda 27 (490 hp. Alfa Romeo Bristol Mercury IV).

Dewoitine D.500 (690 hp. Hispano-Suiza 12 Xbrs).

Dewoitine D.511 (860 hp. Hispano-Suiza 12 YCrs).

Fiat C.R.32 (550 hp. A.30 R A).

Hawker "Fury II" (600 hp. Rolls-Royce Kestrel VI).

Letov S 231 (900 hp. Gnome-Rhone 14 Kfs).

Morane-Saulnier 275 (500 hp. Gnome-Rhone 9 Krse).

P.Z.L. P.11 C (605 hp. Skoda Bristol Mercury VI).

P.Z.L. P.24 (900 hp. Gnome-Rhone 14 Kfs).

Two-Seat Pursuit

Mureaux 180 (690 hp. Hispano-Suiza 12 XCrs).

Armstrong-Whitworth "Scimitar" (fig. 1).- This airplane, with the exception of the landing gear now of the continuous type, is identical with that seen at the S.B.A.C. display at Hendon last July, and then fully described. It is a staggered biplane, of which the structure is of high-tensile steel strip and the covering of fabric. One of its interesting features is a separate inner and outer ring cowling coincident at the forward edge. The inner cowling which forces the air through the cylinder finning need not be disturbed for adjustment of the valves while the outer cowling can be removed in a few minutes.

With the Panther engine the "Scimitar" is credited by the firm with a speed of 225 miles per hour at 14,000 feet, but this is understood to be below the actual performance.

The standard Panther VII is rated at 570 hp. at 12,000 feet but the special engine in the "Scimitar" develops 635 hp. at that height using 87 octane fuel.

On account of the double-row radial engine, the two Vickers machine guns are canted so as to fire over the cowling.

Avia 534 (figs. 2-3).- This Czech single-seat fighter was seen at Prague in 1933 and then described. It bears pronounced traces of the Hawker "Fury" and Fairey "Firefly" schools of design. The fuselage is a copy of the Hawker system, being built up of tubes assembled by bolted and riveted flitch plates.

Since it was last seen, the airplane has been fitted with a cockpit cover. It was the first single-seater in Europe equipped with the larger of the two Hispano-Suiza supercharged engines now made under license by Avia and is credited with a speed of 252 miles per hour at 14,760 feet.

Breda 27 (fig. 4).- This low-wing monoplane was described following my visit to Milan in the spring of 1933. The claimed performance of 236 miles per hour at 16,400 feet is difficult to admit in view of the resistance of the forest of wires bracing the wing and the moderate power of the engine. The fuselage is of welded chrome-molybdenum steel tubing while the wings are of wood covered with three-ply.

Dewoitine D.500 (fig. 5).- The example at the Salon is a standard production model shown by the Air Ministry. Following the success of the prototype in the competition, 110 examples were ordered and will equip several squadrons early in 1935. A further order of 150 has just been signed but the new one will have the 20 mm (0.787 in.) gun firing through the propeller hub and two Darne machine guns each with 300 rounds placed in the wing outside the propeller disk. The D.500 is entirely of duralumin. The wing has a single spar which traverses the fuselage immediately aft of the engine. The monocoque fuselage has an ovoid section to give maximum visibility.

Dewoitine D.511 (fig. 6).- When equipped with the larger Hispano-Suiza supercharged engine fitted with a 20-millimeter gun with 60 shells firing through the propeller axis, and with two machine guns in the wings, the D.500 becomes the D.510. The more powerful airplane now under test by the Service Technique at Villacoublay has reached the speed of

249.3 miles per hour at 16,400 feet, the time of climb to that height taking exactly 6 minutes. Both the 500 and 510 have a wing area of 178 square feet but at the Salon, Mr. Dewoitine showed the D.511, identical with the D.510 except for a reduced wing area (161 square feet) and a landing gear consisting merely of two struts unbraced against side loads. The estimated speed of the D.511 is 261 miles per hour. At the patrol speed of 155 miles per hour the D.511 has a range of 800 kilometers (497 miles). Detail changes as compared with the D.500 include a Flettner balance on the rudder.

Fiat C.R.32 (fig. 7).- This airplane, a smaller replica of the C.R.30, was described in my Italian reports of 1933 and 1934. Fitted with an unsupercharged high-compression Fiat A.30 engine, the speed at 9,840 feet is stated to be 242 miles per hour. From conversation with the officers at Montecelio last spring, this claim is apparently justified.

The fuselage is of duralumin tubing with steel joints machined from the solid while the fairing strips are duralumin channels. The wing structure comprises spars of duralumin tubes of rectangular section and duralumin lattice ribs. The covering of the wings and of the rear portion of the fuselage is of fabric.

Hawker "Fury II" (fig. 8).- This airplane, which was displayed at Hendon last July, is a modification of the standard "Fury" equipped with the Rolls-Royce Kestrel VI engine having "composite" cooling, there being a condenser in the leading edge of the center section of the upper wing in addition to the radiator under the fuselage. The added power as combined with slightly lower drag, has resulted in a speed of 240 miles per hour at 16,400 feet.

Letov S.231 (figs. 9-10).- A report of this airplane was given after my visit to Prague in 1933. It is a normal biplane with N interplane struts which has been flown with several engines including the Bristol Mercury IV, the Siddeley Tiger III, and the Gnome-Rhone 14 Kfs Mistral Major. It was with the last-mentioned engine that the example at the Salon was fitted as its construction rights have been acquired by the Walter Co. of Prague.

In order to reduce resistance, the Letov has a landing gear with only two struts. The method of hinging these struts to the fuselage cross member and the concealed oleo-pneumatic Pantof shock absorbers are shown in figure 10.

This figure likewise shows the anchorage of the landing-gear bracing wires.

The speed claimed for the S 231 with the 14 Kfs engine is 251 miles per hour at 13,120 feet, an increase of 34 miles per hour over the speed given by the Mercury engine.

The airplane is equipped with four Pantof machine guns which, as they cannot fire between the cylinders, have all been mounted outboard in the lower wing where they traverse the front duralumin box spar. Firing and even jam clearing is accomplished by a pneumatic control, the air being supplied to a bottle by a small engine-driven compressor. The fuselage structure is of steel, the central portion having riveted and bolted joints whereas the engine mount and the rear portion are welded.

Morane-Saulnier 275 (fig. 11).- This airplane is merely a refinement of the type 225 shown at the 1932 Salon, differing mainly in a lower drag landing gear and a higher-powered Mistral Major.

These refinements have enabled the speed at the altitude of utilization to be raised from 205 to 225 miles per hour.

The wing continues to be built of rectangular-tube duralumin spars and wood ribs, the fuselage comprising round-duralumin-tube longerons.

P.Z.L. P.11 C and P 24 (figs. 12-13).- Both of these airplanes are gull-wing all-metal monoplanes of a design familiar to the United States since the appearance of the P.Z.L. at the National Air Races. They have oval-section fuselages and wings with I-section spars. The visibility in the new types has been improved:

1. By lowering the engine 4 inches;

2. By raising the normal position of the pilot's seat by 2 inches and moving it aft about 10 inches;

3. By mounting the wings at $+2^{\circ}$ in relation to the fuselage axis;

4. By enlarging the cut-out sections of the wing roots.

An interesting feature of design is the mounting within the fuselage of the oleo-pneumatic shock absorbers.

The P.11 C is equipped with four machine guns, of which two are located in the wings and the remaining two in the cockpit, firing through the propeller. The fuselage guns each have 500 rounds of ammunition and the wing guns 300.

The P.24 has an even more formidable armament as added to the fuselage machine guns (which fire outside the cowling), are two 20-millimeter (0.787 inch) Oerlikon guns mounted in the wings. It is claimed that the small reaction of these guns does not unduly stress the wing structure.

Mureaux 180 (figs. 14 and 14a).- This was the only two-seat pursuit airplane exhibited and is a direct derivation of the single-seat Mureaux 170 exhibited in 1932. The structure is entirely of duralumin and the wing covering is of the stressed type. The crew is enclosed in a glazed cockpit cover. The pilot has an Hispano-Oerlikon 20-millimeter gun firing forward, and the gunner facing aft, is provided with twin machine guns.

The designer pointed out that as compared with the single-seater, the 180 has 8 percent more weight, 4 percent higher landing speed, and 4 percent lower maximum speed against which must be balanced the greater defensive power. A nose radiator has been fitted as the tunnel type on the 170 proved inadequate.

Observation

Mureaux 113 (860 hp. Hispano-Suiza 12 Ybrs.)

Mureaux 115 (860 hp. Hispano-Suiza 12 YCrs((fig. 15)

Whereas the Mureaux 113, now the standard long-range observation airplane in the French Air Force, has a 12 Ybrs Hispano-Suiza, the 115 has the 12 YCrs incorporating an Oerlikon 20-millimeter gun. Otherwise the two types are almost identical except for the position of the frontal radiator in the 115. This change, it is hoped, will raise the speed at 16,400 feet from 203 to 211 miles per hour.

The structure is entirely of duralumin, including wing and fuselage covering.

Multiplace Fighting - Bombing

Bloch 200 (two 800 hp. Gnome-Rhone 14 Krsd)

Bloch 211 (two 860 hp. Hispano-Suiza 12 Ydrs)

Bréguet 413 (two 860 hp. Hispano-Suiza 12 Ydrs)

Potez 54 (two 690 hp. Hispano-Suiza Xbrs)

S.E.C.M.-Amiot 142 (two 860 hp. Hispano-Suiza 12 Ybrs)

The French Government has spent an immense amount of money for a number of years encouraging the development of twin-engine high-speed airplanes carrying a crew of 4 and suitable for a number of different functions including long-distance, day-and-night observation, multiplace fighting and bombing with 500, 1,000, or even 1,800 kg (1,102, 2,206, or 3,968 lb.) of bombs.

The Bréguet, Potez, and S.E.C.M. aircraft are well known, and in fact a prototype of the S.E.C.M. was seen at the Salon four years ago.

With the exception of the Potez 54, all the fighter-bombers may be fitted alternatively with the Gnome-Rhone 14 Krsd or the Hispano-Suiza 12 Ybrs, thus the Bréguet Gnome-Rhone is designated the type 414, the S.E.C.M. Gnome-Rhone the type 143, etc.

The French Government recently put out specifications for new high-speed, three-purpose airplanes (multiplace fighter - bomber - observation). None of these airplanes was shown although one, the Bloch 130 (two Gnome-Rhone 14 Krsd engines) is starting its tests. (See fig. 16.) The requirements include a speed of 211 miles per hour and a range of 860 miles with 1,760 pounds of bombs.

Bloch 200 (fig. 17).- A total of 200 examples of the Bloch 200 high-wing monoplane will be delivered to the Air Force by the Potez and Bloch factories and are already in service in several squadrons. An interesting feature of this airplane is the simplicity of its duralumin structure. The flanges of the two-wing spars are merely duralumin angles about 1/2 inch thick. The flanges are connected by duralumin sheet webs 0.04 inch thick stiffened by omega section strips.

The ribs of thin sheet stiffened vertically by U sections are fixed to the spars by angles. The covering is composed of panels stiffened internally by omega sections and externally by T strips. The covering of the lower surface is riveted to the angle strips along the bases of the ribs. On the upper surface the panels are likewise riveted to the ribs but by angles applied externally.

The fuselage has its longerons of four angles and frames composed of U sections assembled by gussets. The riveted duralumin sheet covering is stiffened internally by vertical omega sections and externally by longitudinal omega sections.

The fuselage is divided into three parts bolted together. The nose portion includes the quarters for the navigator and gunner, the center section, the enclosed pilot's cockpit and bomb racks, and the rear section, the two gunners' stations firing above and below the fuselage and bearing the tail surfaces. The fuel tanks are contained in the inboard portion of the wing between the engines and the fuselage. The landing gear is oleo-pneumatic and while not retractable, is well faired.

The airplane can be used for a number of missions but a typical one is a range of 620 miles with a ton of bombs. With four bombs of 225 kg (496 lb.) mounted in racks below the fuselage, the maximum speed is 178 m.p.h., but 186 m.p.h. can be reached if twenty 50 kg (110.2 lb.) bombs are installed vertically within the fuselage.

Bloch 211 (figs. 18-19).- The Bloch 210 (two Gnome-Rhone K.14 engines) and 211 are new productions of Mr. Marcel Bloch, having somewhat greater capacity than the type 200. They have low instead of high wings and retractable landing gears. The 211 may be mounted on floats for naval use and in the Salon a float was shown alongside the airplane. In view of its probable service with the Navy, much use has been made of Vedal (the French Alclad), although stainless steel tubes are likewise used.

The wing surface offers less resistance than that of the 200 as the only projections are the top edges of the ribs riveted to angles.

The fuselage construction remains straight-sided so that the covering requires no beating. The useful load of the Bloch 211 is over 7,000 pounds, which should enable it to have a range of 1,240 miles with a ton of bombs. It is estimated that the maximum speed is 205 miles per hour and the cruising speed 186 miles an hour.

Bréguet 413 (fig. 20).- The Bréguet 413 multiplace biplane may be used for fighting, observation, day bombing with 10 bombs of 50 kg (110.2 lb.) and a range of 400 miles, long-range (740 miles) night bombing, in which four 225 kg (496 lb.) bombs are carried below the lower wing, and heavy night bombing, in which six 225 kg bombs may be carried 650 miles.

Under day-bombing conditions with a total weight of 12,170 pounds, the maximum speed at 13,120 feet is 192 miles per hour for the type 414 with two Gnome-Rhone K.14 engines and 5 miles less for the type 413 shown at the Salon. For both types the time of climb under day-bombing conditions to 13,120 feet, is about 9 minutes.

The upper wing has two steel spars and duralumin ribs; a single steel box spar forms the leading edge of the small lower wing and to it are fixed the engines and landing gear with its independent wheels. The fuselage is built up of duralumin sections and is metal covered. The tail is carried by a duralumin box girder instead of the steel structure used on the type 27. The small section of the stern portion of the fuselage greatly increases the field of fire rearward.

Potez 54 (fig. 21).- Henry Potez displayed his type 54 multiplace-fighter high-wing monoplane with two Hispano-Suiza 12 Xbrs engines slung below the wing. The airplane is an attempt to realize a formidable weapon economically and so appeal to small powers with limited budgets.

While the two-spar wing structure is of duralumin covered with cloth, the fuselage and tail unit are of wood covered with three-ply. The normal total weight is 12,257 pounds but a weight of 15,650 pounds is admitted for long-range bombing (1 ton of bombs carried 740 miles). At the normal weight the maximum speed is stated to be 198 miles per hour, a figure which appears astonishingly high in view of the apparent drag due to the engine position.

S.E.C.M.-Amiot 142 (figs. 22-23).- It may be remembered that at the 1930 Salon the S.E.C.M. showed a two-engine multiplace fighter called the 140. From that airplane was derived the bomber-fighter 142 exhibited at the 1934 Salon, 40 examples of which are building for the Air Ministry. The actual airplane shown is type 142 with two Hispano-Suiza 12 Ybrs engines, but the airplane is likewise supplied with two Gnome-Rhone K.14 engines when it is known as type 143.

The production type exhibits many improvements over the prototype. The visibility of the various occupants of the lower deck is really excellent, due to the series of large windows. Moreover, the floor is composed of a series of slats which, by being turned through 90°, allow good visibility directly downward for the occupants (fig. 23). Whereas in the type 140 the assistant pilot was placed behind the senior pilot and had a poor view, in the types 142/43, the assistant pilot is directly below his chief on the lower deck and has an excellent view.

The internal bomb racks are now placed on the left of the fuselage and are loaded from without. There is therefore room for a passage on the starboard side of the fuselage running aft to the rear gun locations.

The rear gunner firing below the fuselage is also the radio operator and sends his messages to the commanding officer by a pneumatic-tube system.

The structure of the 142 is entirely of duralumin. The fuselage is divided vertically into halves, the elements being channel and T sections with covering suitably stiffened internally by vertical and horizontal stringers.

There are three main wing spars of duralumin tubes suitably interbraced by further tubes forming a girder so that if one spar is broken by a 20-millimeter (0.787 in.) shell, the wing will still have a load factor of 3.5 with full load.

The wing covering is composed of a series of detachable panels to facilitate repair in the field and inspection of the interior of the wing after an action. The leading and trailing-edge sections of the wing are bolted to the girder.

The armament of the type 142 consists of seven machine guns with 3,400 rounds. At a distance of 100 feet from the airplane there is no blind zone. The protection of the gunners from the relative wind is quite satisfactory.

The maximum bomb load taking advantage of both the internal and external racks, consists either of eight 200 kg (441 lb.), or four 200 kg, and sixteen 50 kg (110.2 lb.) bombs.

With the above loads and with 4,188 pounds of fuel the range is 1,240 miles with a load factor of 5.6 (instead of the normal 7). In this overloaded condition the total weight is 22,487 pounds instead of 16,534 pounds when used

as a multiplace fighter and 19,533 pounds as a bomber carrying a ton of bombs for 740 miles at a cruising speed of 155 miles per hour.

Training

Arado A.R. 69 B (125 hp. Siemens-Halske 14 A)

Avro 626 (270 hp. Siddeley Cheetah V)

Bücker Jungmann (72 hp. Hirth H M 60 R)

Focke-Wulf "Steiglitz" (125 hp. Argus As 8B)

Hanriot 182 (140 hp. Renault Bengali)

Hanriot 190 (180 hp. Régnier R6)

Morane-Saulnier 315 (135 hp. Salmson 9 NC)

Several of the seven airplanes exhibited are fairly well known and do not present points of special interest.

The Hanriots, however, are of new design and due to their construction are readily adaptable to a variety of purposes including ordinary training, gunnery, and wireless instruction, touring and ambulance work. The fuselage is built of square duralumin tubes but only the lower half forms the real structure, the upper portion being nothing more than a detachable fairing which can be raised for the insertion of a stretcher (fig. 24). The tiny lower wings form the steps for the cabin doors. The upper wing is braced to the lower by V struts, the wide-track landing gear being fixed to the lower wings at their tips. The wing structure comprises duralumin spars and wood ribs, the covering being of cloth.

Transport

Avia 51 (three 300 hp. Avia R.12)

Bréguet 46 T (two 815 hp. Gnome-Rhone 14 Krsd)

Bristol 143 F (two Bristol 505 hp. Aquila)

Farman F.431 (two 180 hp. Renault Pdi)

Heinkel He 70 (630 hp. BMW VI)

Transport (Cont.)

Potez 56 (two 185 hp. Potez 9 Ab)

U.S.S.R. Stal 2 (U.S.S.R. 300 hp. M 36)

Avia 51 (fig. 25).- This high-wing monoplane was reported following my visit to Prague in 1933. The designer evidently received his schooling in the Lockheed factory although the construction is of duralumin. The conception of employing three 200 hp. engines for the transport of six passengers seems a rather extravagant one. The fuselage is a monocoque structure, having six main stringers of V section with a number of minor longitudinal members of channel section. The stiffening is by seven principal formers to which the covering is riveted.

The wing has two built-up duralumin spars having tubular flanges and channel lattice webs. The forward portions of the wing and tail surfaces are of duralumin sheet, the rear portion being of cloth.

It may be mentioned that the Avia Company has built a transport monoplane christened type 56 similar to type 51 and likewise accommodating six passengers, but with a single engine, an Avia Hispano-Suiza 12 Ybrs supercharged to 13,120 feet. With this power plant the maximum speed has been raised from 170 miles per hour at ground level for type 51 to 223 miles per hour at 13,120 feet.

The Avia Company is also completing type 57, a low-wing monoplane seating 14 passengers and having three Hispano-Suiza 575 hp. Cyclone engines. With a total weight of 18,000 pounds the maximum speed is estimated as 205 miles per hour. The airplane has very deep wing fillets and split flaps of a span equal to the distance between the wing engines. The structure is similar to the types 51 and 56.

Breguet 46 T (figs. 26-27 and also fig. 6).- On the Breguet stand was a mock-up of the 46 T low-wing transport monoplane for 12 passengers. As is the case with practically all the new high-speed continental transport airplanes, Douglas-Boeing influence is patent. In order that the cabin floor shall be above the wing spars the height of the oval-section monocoque fuselage is somewhat exaggerated and in fact, the lines in general leave a good deal to be desired.

The two I-beam wing spars are of high-tensile steel. The ribs are of light alloy and the same material is used for the upper wing covering. The covering of the under surface of the wing between the spars is of fabric.

Slotted instead of split flaps are used for increasing lift, the outer flaps likewise forming the ailerons.

The landing wheels retract into the wing directly aft of the two Mistral Major engines which are housed in N.A.C.A. cowlings. The fuel tanks placed outboard of the engines can be dropped. The 46 T is also adapted for long-distance mail service, in which case the range is increased from 650 to 1,000 miles by extra fuel tanks in the fuselage. Mr. Bréguet's estimate of a maximum speed of 239 miles per hour at 7,000 feet would appear optimistic, to say the least.

Although shown only in model form on the Bréguet stand, mention should be made of the 18-passenger Wibault 670 low-wing transport monoplane with two Gnome-Rhone 14 Krsd engines now building for Air France. (See fig. 28.) This, again, is strongly reminiscent of modern American practice, having split trailing-edge flaps, deep fillets, flush riveting, Hamilton controllable pitch propellers, retractable landing gear, etc. It is expected to have a maximum speed of 224 miles per hour and a cruising speed of 190 miles per hour, using 60 percent of the total 1,630 horsepower available.

In view of its greater passenger capacity, the Wibault 670 is somewhat heavier than the Bréguet 46, weighing 20,000 pounds as against 15,000 pounds.

Bristol 143 F (fig. 29).- The Bristol Company showed part of the fuselage of a low-wing cantilever monoplane for 8 passengers, designated the 143 F. This is to be the commercial version of an airplane which the Bristol Company is completing for Lord Rothermere, the British newspaper owner.

Lord Rothermere's airplane has two special low-altitude Mercury 600 hp. engines, but it is proposed to fit in each of the commercial examples (of which 5 are being laid down) two 500 hp. Aquila radial-sleeve-valve engines which made their first public appearance on the Bristol engine stand and which are reduced versions of the Perseus.

The fuselage construction is similar to that of the new

Bristol low-wing single-seat fighter (fig. 30), being an Alclad monocoque structure with ⌊ section formers and ⎍ section stringers, to which the sheet covering is riveted. The stringers are spaced fairly close together along the comparatively flat body sides but are omitted at top and bottom where the curved section itself requires no bracing beyond that of the formers.

Attached to the cabin were the roots of the wing which has two I-beam spars with high-tensile steel flanges connected by solid Alclad webs. The spars are strengthened by quadrant-shaped Alclad strips riveted to the flanges and webs at top and bottom. These strips are in several thicknesses, depending upon the stresses at the various points of the wing. The spars are continuous, passing through the cabin and forming a considerable obstruction. Inboard of the ailerons are split flaps hydraulically operated. The fuel tanks are contained between the spars in the wing roots. The landing wheels will retract backward into the wing.

The outboard portions of the wings beyond the engines are quickly detachable, being bolted to the center section. The coverings of wings, stabilizer, and fin are of Alclad sheet while the rudder and elevators are fabric covered.

Criticisms which may be made of the airplane from the passengers' standpoint, in addition to the deep floor obstructions are the small size of the windows and emergency exits in the roof.

Every effort is made to reduce resistance by such refinements as the employment of flush rivets, skin-type oil radiators on the leading edge of the wing roots, etc.

The normal total weight of the 143 F is estimated at 8,600 pounds, of which 5,720 pounds is the weight of the airplane empty, equipped for passenger transport. As a passenger airplane, 112 Imperial gallons (134 U.S. gallons) of fuel are carried, but the total capacity of the tanks is 200 Imperial gallons (240 U.S. gallons), in view of its possible use as a long-range mail airplane. For a cruising speed of 180 miles per hour, the range as a passenger carrier should be 540 miles, for mail carrying, 970 miles. It is expected that the top speed will be 224 miles per hour.

The Bristol Company have designed a bomber based on the type 143 but with a different nose and rear fuselage portion.

The position of the bomber would either be in the nose prone under the pilot's cockpit or alternatively behind the rear spar near the after cockpit. Up to 1,200 pounds of bombs could be placed within the body or wings. As a multiplace fighter, the nose would be arranged to take a 20-millimeter (0.787-inch) gun. The cone of fire would be about 30° in all directions, the gunner being mounted on a counterbalanced seat moving with the gun.

Farman F.431.- This all-wood low-wing cantilever monoplane carrying 5 passengers, was introduced last summer and, like the Potez 56 and the Caudron "Goëland", is a French reply to the De Havilland "Dragon" in monoplane terms. Fitted with two 6-cylinder Renault engines, the price is 255,000 francs. The F.431 is likewise suitable for long-distance touring, but does not benefit from any premium from the Air Ministry as the total horsepower is over 200.

Heinkel He 70.- The Heinkel He 70 made its appearance two years ago. Six are in service in the Luft Hansa for high-speed mail and passenger transport. As the top speed as measured by the D.V.L. is 234 miles per hour, the He 70 takes front rank among high-speed civil airplanes, but the cabin affords cramped accommodations for only 4 passengers. The radiator is of small dimensions as ethylene-glycol cooling is employed. The structure comprises a duralumin monocoque fuselage and two-spar wood wings with plywood covering.

Potez 56 (fig. 31).- This is a small low-wing cantilever transport monoplane of wood construction, carrying six passengers in the cabin. It has a retractable landing gear, split flaps and other modern-design features.

U.S.S.R. Stal.2 (fig. 32).- On the Russian stand was seen the skeleton of a small high-wing monoplane to carry 4 passengers. The airplane is built of stainless steel shot welded by a system strangely resembling the Budd process but unlicensed.

The engine usually fitted in this type is a 9-cylinder radial, resembling a Wright Whirlwind.

Before leaving the transport category, mention may be made of the Dewoitine 620 high-speed 30-passenger low-wing monoplane (3 Gnome-Rhone 880 hp. 14 Krsd engines), of which a model was shown on the Dewoitine stand. Figure 33 gives the general arrangement plans of this airplane, two examples of which are being started for Air France. With a total

weight of 26,150 pounds, of which 10,930 will be useful load, the D.620 should have a speed of 217 miles per hour at 6,560 feet. The wing area is to be 1,046 square feet.

Postal

U.S.S.R. P.5 (500 hp. U.S.S.R.) (fig. 34).- This was the ancient biplane fitted with skis, used for the Chelyuskin expedition rescue. Its engine appeared to be a copy of an American Liberty.

In front of the P.5 on the Russian stand were a gondola used for stratospheric balloon ascension and a couple of wheels of the type used on the 46-ton "Maxim Gorki" monoplane, having eight M 34 900 hp. 12-cylinder V engines.

Racing

Caudron C.450 (300 hp. Renault).- This low-wing all-wood monoplane was the actual winner of the 1934 Deutsch Cup, covering the 2,000 km (1,243 miles) at the average rate of 389 k.p.h. (241.7 m.p.h.), piloted by Arnoux. Due to the split flaps, it was possible to land the airplane at 62 miles per hour. Taking off was greatly facilitated by the Ratier automatically variable two-pitch propeller.

Touring

Avro-La Cierva C.30 P Autogiro (140 hp. Siddeley Genet Major)

B.F.W. M.35 (125 hp. Siemens-Halske 14 A)

B.F.W. Me 108 (225 hp. Hirth H M 8 u)

Caudron 480 (140 hp. Renault Bengali)

Caudron 510 (140 hp. Renault Bengali)

Caudron 520 (170 hp. Renault 6 P f i)

Caudron 530 (140 hp. Renault Bengali)

Caudron 600 (100 hp. Renault Bengali, Jr.)

Farman 393 (190 hp. Farman 9 EB)

Farman 403 (170 hp. Farman 7 ED)

Fiat G.8 (125 hp. Fiat A.54)

Fieseler Fi 97 (200 hp. Argus As 17a)

Hanriot 170 (170 hp. Salmson 6 TE)

Magni Vale (130 hp. Farina T 58)

Maboussin 112 (45 hp. Salmson 9 AD)

Mauboussin 120 C (60 hp. Salmson 9 Adr)

Morane-Saulnier 341 (140 hp. Renault Bengali)

PZL 26 (210 hp. Menasco Buccaneer)

Potez 58 (120 hp. Potez 6 B)

Potez 60 (60 hp. Potez 3 B)

RWD 9 (260 hp. Skoda)

U.S.S.R. Air 9 (100 hp. U.S.S.R. M 11)

The touring category was by far the largest in the exhibition and contained a number of interesting, if well known, airplanes. Several of them (B.F.W. Me 108, Fieseler Fi 97, PZL 26, RWD 9) participated in the 1934 International Touring Challenge, the last-named airplane capturing first and second places. All of these airplanes were fitted with various devices to increase lift and maintain control beyond the stall and have been thoroughly described in the German technical press, the November 1934 L'Aéronautique, October 1934 l'Aérophile, etc.

Avro-La Cierva Autogiro.- Two examples of the British-built direct-control C.30 Autogiro were shown at the Salon: one by A. V. Roe, the makers, and the other by Lioré and Olivier, the French selling agents.

Senor de La Cierva has somewhat improved the range of this aircraft but it is still insufficient to permit safely a nonstop flight between Paris and London.

B.F.W. Me 108 (figs. 35-36).- The B.F.W. company showed the M.35 described in my report of the Geneva Aviation Salon last spring. More interesting, however, was the low-wing Me 108 which participated in the 1934 International

Touring Challenge and has a retractable landing gear, slots, flaps, and interceptors near the leading edge which work in connection with wing-tip ailerons.

Caudron 520 (figs. 37-38).- The Caudron Company showed five low-wing monoplanes, of which collection the star was the 520 with an inverted 6-cylinder 170 hp. Renault. This is a modification of the type 500 built for the 1934 Challenge but not completed in time to take part. Each of the four passengers has his own door which can be slipped to facilitate exit by parachute. At the back of the cabin is a locker with shelves taking four suitcases. The propeller is a Ratier with automatic change of pitch. As is the case with all Caudron touring airplanes, the structure is entirely of wood and the covering of the fuselage, main wings, and tail surfaces is of plywood. Split flaps are provided and the fuel tanks are in the wing roots.

Farman 393 and 403.- The Farman Company showed a couple of wooden-braced high-wing monoplanes which differ only in detail from the F.390 and F.400 seen at the 1932 Salon. The F.393 (fig. 39) holds five persons in the large cabin and the F.403 is a three-seater.

Despite their rather archaic design, the Farman touring airplanes have a number of splendid flights to their credit, notably those of Vicomte Jacques de Sibour to China and South Africa.

Fiat G.8.- This little open cockpit staggered biplane was seen at Turin last spring. It will be remembered that the fuselage is built of welded-steel tubing and the wings of spruce are connected by steel struts forming a Warren truss. The covering of both fuselage and wings is of fabric.

Fieseler Fi 97.- This was another of the 1934 International Challenge airplanes, and although it did not win, one of the type took third place, and the complete team of five finished the tour. This airplane has flaps tucked under the top surface at the trailing edge and sliding back so as to increase the wing area. This device, in combination with leading-edge slots, allowed 131 miles per hour top speed with a minimum speed of 21 miles per hour, giving a ratio of more than 6 to 1.

Hanriot 170.- This was essentially the same airplane

as the 182 and 190 training types but fitted with the new inverted 6-cylinder in-line Salmson 6 TE 170 hp. engine.

Magni Vale (fig. 40).- This single-seat high-wing monoplane was one of the most graceful exhibits in the show. Among a number of interesting features are combined ailerons and flaps so as to change the wing section for landing, aerodynamic braking obtained by rotating the fairing of the rear wing struts through 90°, and tandem ring cowling with a slot between the forward and after sections.

Mr. Magni said that he will replace the Farina engine by the 180 hp. Fiat A.70 S which, having a smaller diameter, will not necessitate the projection of the valve covers outside the cowling.

The construction of the Vale is entirely of wood and the covering of three-ply.

Mauboussin 112 and 120 C.- These wood low-wing monoplanes are similar except that while the 112 has a direct-drive engine and an open cockpit, the 120 C has the crew enclosed by a detachable cover and has a geared engine. These airplanes have made some remarkable flights to Madagascar and Indo-China.

Morane-Saulnier 341.- This high-wing monoplane having a duralumin-tube fuselage and a wing having duralumin spars and wood ribs, is similar to the type used in the French Air Force for training purposes and presents no points of special interest.

PZL 26 (fig. 41).- This low-wing monoplane with its American engine took part in the 1934 International Touring Challenge. The fuselage is of chrome-molybdenum welded-steel tubing and the duralumin wings have a box spar to which are attached the leading- and trailing-edge sections. Automatic slots cover the entire span. As they are divided, the inboard section may be locked in flight. Flaps controlled by the pilot extend from the fuselage to the ailerons.

Potez 58 and 60.- Henry Potez displayed the type 58 high-wing cabin monoplane with fixed slots derived from the type 43 and also the type 60 (fig. 42), a small high-wing monoplane for light touring fitted with the 3-cylinder 60 hp. Potez radial engine.

The Pętez 60, which is built entirely of wood, is intended to meet the latent demand for a very simple light and cheap touring vehicle.

RWD 9.- The Polish RWD 9 high-wing monoplane took the first and second places in the 1934 Touring Challenge. The wood wing is braced by V struts from the fuselage of welded-steel tubing. Along the entire leading edge of the wing are automatic slots connected to the slotted flaps and ailerons.

U.S.S.R. Air 9 (fig. 43).- The Soviets showed a pleasing little two-seat low-wing wooden monoplane having a 5-cylinder radial air-cooled engine which was a patent copy of an obsolete Siddeley Genet with exposed valve gear.

Experimental

Fauvel A.V.10 (75 hp. Pobjoy R)

"Mignet" monoplane (17 hp. Aubier-Dunne) (fig. 59)

Stowed away in the gallery were a couple of experimental aircraft: the Fauvel "Flying Wing", somewhat reminiscent of the "Pterodactyl", and the little "Mignet" parasol monoplane, reminiscent of the Santos Dumont "Demoiselle" of 1909, and having no ailerons. The latter airplane aroused much interest in the press as an effort to produce a really cheap small airplane. The extension of this type is hampered by the fact that it is unable to meet the requirements of the French Government and the C.I.N.A. with regard to airworthiness.

SEAPLANES

Pursuit

Bernard H.52 (490 hp. Gnome-Rhone 9 Krsd).- This all-metal twin-float midwing monoplane was shown by the Air Ministry as the Bernard Company did not exhibit. It is fitted with Handley Page slots and flaps and is arranged to be catapulted. The wing has two tapered duralumin spars, forming a caisson continuous from tip to tip, swelling at the fuselage so as to conform with its cross section. The fuselage is composed of two semishells divided vertically and riveted together.

Observation

Levasseur P.L.200 (750 hp. Hispano-Suiza 9 Vbrs) (figs. 44-44a).- This duralumin seaplane is of highly unorthodox design. In an effort to improve the rearward field of fire, the fuselage is reduced to a nacelle ceasing abruptly at the rear gunner's cockpit. The monoplane tail with twin rudders below the stabilizer is carried by the long twin floats which are swept up toward the stern. The idea is certainly interesting although the rear portions of the floats obstruct the rear gunner's field to some extent and add weight. The N.A.C.A. cowling is poorly adapted to the straight-sided body, there being considerable projection at the sides and none at top and bottom.

Torpedo-Bombing

Levasseur P.L.15 (650 hp. Hispano-Suiza 12 Nbr).- The Air Ministry showed one of the well-known P.L.15 torpedo-bomber biplane twin-float seaplane used by the Fleet Air Arm. Despite its total weight of 9,500 pounds, it is used on board ship. With the standard 1,500-pound torpedo, the range of the P.L.15 is 400 miles.

Transport

Junkers Ju 52 (three 500 hp. Junkers Jumo 5)

Lioré et Olivier H.242 (four 350 hp. Gnome-Rhone 7 Kd)

Junkers Ju 52 (fig. 45).- For several years the Luft Hansa has been operating single-engine Junkers G.24 and Focke-Wulf "Möwe" monoplanes with the large Junkers Jumo 4 heavy-oil engines. Exhaustive tests have been made during the past year with three of the smaller engines developing 550 hp. fitted to the Junkers 52. The heavy-oil engines increase the empty weight of the land type Ju 52 by 1,739 pounds as compared with three Pratt and Whitney Hornet S 4-D 2 engines. As the total weight is increased from 20,300 to 20,944 pounds, the weight loaded is still respectable - amounting to 4,700 pounds for a range of 620 miles.

The Junkers Company pointed out that while the air-cooled engines consume about 700 pounds per hour, the Jumo 5 engines consume at cruising speed, 440 pounds of fuel per hour. However, by fitting heavy-oil engines the max-

imum speed is reduced from 180 to 166 miles per hour, although the ceiling is slightly improved (23,900 as against 21,300 feet).

At the Salon Junkers exhibited a Ju 52 with three Jumo 5 engines to which floats were fitted, which add another 1,200 pounds. As the total flying weight should not exceed 20,944 pounds, the pay load for 620 miles range is reduced to 3,500 pounds.

Lioré et Olivier H 242 (fig. 46).- This monoplane flying boat with wing floats is used by Air France on its Mediterranean services. The only perceptible changes between the model at the Salon and the standard type, were cowlings around the four engines which are placed in two tandem groups above the wing. For a total weight of 20,000 pounds, the H 242 carries 11 passengers and a crew of 3, and has a maximum range with no wind of 620 miles. The hull floats are of duralumin while the one-piece wing is of wood covered with three-ply.

Lioré et Olivier are building a modification called the H 243, having two 860 hp. Hispano-Suiza engines mounted in tandem above the wings. Their 21-ton transatlantic mail flying boat with four 650 hp. Hispano-Suiza engines has likewise been completed and is under test (fig. 47). This monoplane is entirely of metal construction including the wing covering.

Racing

Macchi MC 72 (3,100 hp. Fiat A S 6) (fig. 48).- The world's fastest aircraft was exhibited in a shrine at one end of the Italian exposition. It will be remembered that piloted by Agello, this seaplane broke its own record with a speed of 440 miles per hour over 3 kilometers. This was made possible by the increased power now drawn from the 24-cylinder Fiat engine.

Touring (Amphibians)

Armella Sénémaud Mistral (two 120 hp. De Havilland Gipsy Major)

Savoia S 56 M (240 hp. Alfa Romeo D 1)

Savoia S 80 bis (two 75 hp. Pobjoy R)

Armella Sénémaud Mistral.- Although relegated to the gallery, this amphibian is of considerable technical interest. It is a flying boat with a couple of small stabilizing floats in which the landing wheels are inserted and which can be raised slightly above the flotation line. Well above the hull is the wing, at the rear of which are two pusher engines. The cabin has four comfortable seats with large luggage space, wireless telephone and telegraph. The take-off characteristics are stated to be good by the provision of combined slotted aileron-flaps. In view of the high position of the engine the wing section of the stabilizer is inverted, allowing the airplane to be stable with a center of gravity as far back as 50 percent of the wing chord. It is to be hoped that the tests of this airplane will be sufficiently satisfactory to bring into prominence the many advantages of the amphibian from the point of view of the private owner.

Savoia S.56 M and S.80 bis.- The S 56 M in skeleton form was exhibited by the Budd Company as an example of their shot-welded construction. It was built in Italy but is essentially the same as the Philadelphia-built type. The S.80 bis (fig. 49) seen at Sesto Calende last spring, is a two-engine version of the original S.80, the engines being of the pusher type.

The above notes on the aircraft seen at the Salon will give some idea of the activity in creating new designs, at least as far as the French constructors are concerned. It was, of course, impossible to show more than a selection of new airplanes even of the smaller categories and as a record of the activity in prototype creation by French designers, I list below some of the airplanes and seaplanes now building or under test which were either not shown at all or merely in the form of small models.

In this list are not included aircraft which differ from those shown merely in their power plants.

AIRPLANES

Pursuit

Dewoitine 372 (Gnome-Rhone 14 Kfs)

Loiré 46 (Gnome-Rhone 14 Kfs)

Nieuport 125 (Hispano-Suiza 12 YCrs)

Multiplace Fighter-Bombers

Bloch 130 (two Gnome-Rhone 14 Krsd)

Bréguet 460 M 5 (two Gnome-Rhone 14 Krsd)

Dewoitine 420 (two Gnome-Rhone 14 Krsd)

Farman 420 (two Gnome-Rhone 14 Krsd)

Lioré et Olivier (two Gnome-Rhone 14 Krsd)

S.A.B. 80 (two Hispano-Suiza 12 Ybrs)

Day Bomber

Dewoitine D.339 (two Gnome-Rhone 14 Krsd)

Night Bombers

Bernard 82 (Hispano-Suiza 12 Ybrs)

Lioré et Olivier 208 (two Gnome-Rhone 14 Krsd)

Transport

Bloch (three Gnome-Rhone 14 Krsd) (30 seats)

Bloch (two Gnome-Rhone 14 Krsd) (18 seats)

Dewoitine 333 (three Hispano-Suiza 9 V) (8 seats)

Dewoitine 620 (three Gnome-Rhone 14 Krsd) (30 seats)

Wibault 670 (two Gnome-Rhone 14 Krsd) (18 seats)

Potez 62 (two Gnome-Rhone 14 Krsd) (14 seats)

SEAPLANES

Observation, Bombing and Torpedo

Bréguet 610 (Gnome-Rhone 9 Krse)

Bréguet Bizerte (three Gnome-Rhone 14 Krsd)

Loiré 70 (three Gnome-Rhone 9 Kbr)

S.E.C.M.-Amiot 150 B E (two Gnome-Rhone 14 Krsd)

Latécoère 550 (four Gnome-Rhone 9 Krsd)

Latécoère 29-8 (Hispano-Suiza 12 YCrs)

Latécoère 58-2 (three Gnome-Rhone 14 Krsd)

C.A.M.S. 110 (two Hispano-Suiza 12 Ybrs)

Lioré et Olivier 46 (two Gnome-Rhone 14 Krsd)

Transport

Bréguet Saigon (three Hispano-Suiza 12 Ydrs 1)

Latécoère 521 (six Hispano-Suiza 12 Ydrs 1)

Lioré et Olivier 27 (four Hispano-Suiza 12 Nbr)

During the Salon, Parisians were interested in the maneuvers over the city of the little "Zodiac" motorized kite balloon (fig. 50). The envelope is of the dilatable type (volume variable from 820 to 1,020 cubic meters). The ordinary kite-balloon basket can be replaced within 9 minutes by the long wood nacelle seen in the photograph, having in the nose a 60 hp. Salmson engine and a large surface elevator. There are two cockpits for the crew and the stem of the nacelle carries a directional rudder. The bottom lobe of the balloon is reefed in so as not to foul the rudder. The ceiling is 3,600 feet, given very pure hydrogen. The controls are arranged as in an airplane. While the speed is low - 30 miles per hour - and the lateral stability imperfect, the "Zodiac" motor balloon constitutes a distinct advance over previous experiments in this field in Italy and Germany.

ENGINES

The stands surrounding the main hall were occupied by engine manufacturers. Among those exhibiting were Renault, Hispano-Suiza, Gnome-Rhone, Lorraine, Farman, Salmson, Potez, Régnier, and Lilloise of France; Bristol, Rolls-Royce, and Napier of England; Hirth, Argus, Junkers, and Siemens-Halske of Germany; Fiat, Isotta-Fraschini, Piaggio,

Alfa-Romeo of Italy and the U.S.S.R.

Three Junkers Jumo 5 heavy-oil engines were mounted in the Junkers Ju 52 seaplane and both Napier and Lilloise showed heavy-oil engines built under Junkers license. The Salmson Company showed a 9-cylinder radial two-stroke heavy-oil engine designed by Szydlowski.

In the display of the French Air Ministry was the Clerget 500 hp. 14-cylinder radial heavy-oil engine, which has been flying in a Potez 25 for about a dozen hours. The sea-level power is maintained to 11,500 feet, and the time of climb to 16,700 feet is 22 minutes.

America was represented by Pratt and Whitney which showed the Hornet, the new H type Wasp, and the Wasp Junior engines.

Steady progress is being made in design, unquestionably aided by the use of fuels of high octane number which have just been accepted by the French Government. The increase in the power ratings was striking, such firms as Gnome-Rhone, Hispano-Suiza, Renault, and Lorraine having models rated at about 1,000 horsepower. The Renault and Lorraine engines, however, need not be taken seriously as yet. The Gnome-Rhone 14 Kfr has been homologated by the Air Ministry at 1,100 hp. at sea level at 2,400 r.p.m. for a weight of 1,245 pounds.

Interest in private touring is partly responsible for the great number of inverted 4- and 6-cylinder air-cooled engines - all, of course, originally derived from the De Havilland Gipsy.

Renault has augmented his range of inverted in-line engines now offering three 4-cylinder and three 6-cylinder models, excluding the racing-type winner of the 1934 Deutsch Cup. The Salmson, Régnier, and Walter companies also displayed new inverted engines. This type likewise was shown by the German makers Hirth and Argus and by Napier (the well-known Javelin).

Complete descriptions accompanied by installation plans and power curves have in most cases been obtained from the makers and are forwarded separately but a few notes on the new types may be given here.

Hispano-Suiza.- Hispano-Suiza displayed various models of their two supercharged water-cooled engines of 27 and 36 liters (1,647.6 and 2,196.8 cu.in.) capacity and using 85 octane fuel. The 12 Xbrs and the 12 XCrs, the latter with a cannon, are rated at 690 horsepower at 14,760 feet at 2,600 r.p.m. Their theoretical output at sea level ("equivalent de puissance") would be 1,160 horsepower. When fitted with a low-altitude supercharger the engine develops 720 horsepower at 9,000 feet.

The 12 Ydrs (fig. 51) and 12 YCrs engines are rated at 860 hp. at 13,120 feet at 2,400 r.p.m., and have a theoretical power at sea level of 1,360 horsepower. With the low-altitude supercharger for 8,000 feet the engine develops 880 horsepower. An outstanding feature of these engines continues to be the high power/weight ratio, the weights of the 12 Xbrs and 12 Ydrs engines being only 816 and 1,003 pounds, respectively, without generators.

The 20-millimeter Hispano-Oerlikon gun fitted in the 12 XCrs and 12 YCrs equips a number of the new pursuit and observation airplanes, notably the Dewoitine D 510 and 511, Mureaux 115 and 180, Nieuport 125, etc. The initial speed of the shell is 2,720 feet per second with a maximum gas pressure of 3,200 atmospheres. The horizontal range is 3 miles and the vertical range 2 miles. The shells weighing 0.55 pound each, are fired at the rate of 400 per minute. The weight of the gun itself is 106 pounds, and complete with container loaded with 60 shells, 161 pounds.

There were also shown the 5- and 9-cylinder Whirlwinds and several versions of the 9-cylinder Cyclone, the geared supercharged model of which is rated at 750 hp. at 6,560 feet at 2,100 r.p.m.

The firm showed the first time in public, the new twin-row 14-cylinder radial of 45.24 liters (2,760.7 cu.in.) capacity. The bore and stroke of this engine is 155.6 by 170 mm (6.126 by 6.69 inches). It is supplied either with direct-drive (fig. 52) or reduction gear and in the latter form, may have either a mixing fan for 3,280 feet altitude or a supercharger for 9,840 feet.

In the last-named condition the engine develops 950 hp. at 2,100 r.p.m. The compression ratio is 6.4. The supercharger (of 11 in. diameter) turns at 8.3 times engine-crankshaft speed, and the total weight without generator is 1,322 pounds. It will be remembered that steel is

used for the crankcase as in the Clerget-Hispano. The diameter is 1.27 m (50 in.).

The company is not yet in a position to place on the market the 26-liter (1,586.6 cu.in.) 14-cylinder engine, on which I reported to the Committee a year ago, as it has not yet completed factory tests. This engine will be a valuable addition to the range as it has a diameter of only 39 inches. It is rated at 750 hp. at 2,400 r.p.m. at 10,000 feet, and weighs 946 pounds.

Gnome-Rhone.- This company showed the range of their 5-, 7-, 9-, and 14-cylinder radial engines, the power and speeds of which have been increased. The following list includes the principal types now manufactured:

5 Kd	240 hp.	at 2,000	r.p.m.	
7 Kf	500 "	" 2,100	"	
7 Kds	360 "	" 2,000	"	at 12,100 ft.
9 Kfr	750 "	" 2,410	"	
9 Kers	600 "	" 2,450	"	at 13,280 ft.
14 Krsd	815 "	" 2,390	"	" 7,150 "
14 Krsd	800 "	" 2,390	"	" 12,630 "
14 Kfr	1,100 "	" 2,400	"	
14 Kfs	900 "	" 2,300	"	at 11,870 ft.
14 Kfrs	900 "	" 2,400	"	" 11,870 "

(Note: d, e, f = various series; r = reduction gear;
s = supercharger)

Renault.- As previously mentioned, Louis Renault showed half a dozen inverted in-line air-cooled engines. Figure 53 illustrates the new direct-drive 6 Pdis supercharged engine rated at 220 hp. at 2,400 r.p.m. at 13,130 feet. The bore and stroke are 120 by 140 mm (4.72 by 5.51 inches), giving a capacity of 9.5 liters (580 cu.in.). The weight is 496 pounds.

Figure 54 illustrates the largest engine in the Renault range, the 14-cylinder radial rated at 900 hp. at 1,950 r.p.m. at 13,120 feet, but not yet submitted to the Air Ministry for acceptance tests. The bore and stroke are 154 by 176 mm (6.06 by 6.93 in.), resulting in the enormous capacity of 46 liters (2,807 cu.in.)(as compared with 38 liters (2,318.8 cu.in.) for the Gnome-Rhone K 14). The weight is 1,235 pounds.

Lorraine.- In addition to their usual line of air-cooled engines the Société Lorraine showed the large water-cooled 18-cylinder Orion and the 12-cylinder Eider now fitted with superchargers. Figure 55 illustrates the latter, which is claimed to develop 1,050 hp. at 11,500 feet at 2,400 r.p.m., but has not passed the Government tests. The bore and stroke being 170 by 170 mm (6.69 by 6.69 in.), give a capacity of 46.3 liters (2,825.4 cu.in.). The weight is 1,312 pounds.

Salmson.- The Szydlowski engine (fig. 59) is an 18-cylinder double-row radial two-stroke water-cooled Diesel with only nine combustion chambers, each chamber being common to a front and rear cylinder. It is rated at 600 hp. at 1,600 r.p.m. The bore is 118 mm (4.64 in.) and the stroke 150 mm (5.91 in.). Scavenging is assured by a mechanically driven centrifugal compressor turning at 8.45 times crankshaft speed and blowing into a collector from which run pipes to the rear cylinders. The pistons of the two rows are staggered 15 degrees relative to each other. Injection is by nine pumps, each supplying two injectors to each chamber. Starting is by a Viet air compressor. The weight is 1,250 pounds, dry. The complete engine has been run only 15 hours on the bench.

The 6-cylinder air-cooled inverted 6 T E engine rated at 170 hp. at 2,300 r.p.m., is of 8 liters (488.2 cu.in.) capacity. The largest gasoline Salmson engine is the 18 A B S 500 hp. 18-cylinder radial air-cooled engine with a two-speed supercharger developing 630 hp. up to 5,000 feet and 570 hp. up to 11,500 feet. The ratios of the two speeds are 7.5 and 10.6 to 1.

Bristol.- The Bristol Company showed not only the new models of Pegasus and Mercury engines, but two sleeve-valve 9-cylinder radials, the Perseus and Aquila. The Perseus, announced several months ago, is the product of over seven years' development. It is interchangeable with the Mercury and has the same diameter. The smaller engine - the Aquila -

was revealed in public at Paris for the first time and is shown in figures 56-57. Both have passed the Air Ministry type tests in unsupercharged form as shown.

The characteristics of the two engines are:

	Perseus II	Aquila I
Capacity	24.8 liters (1513.4 cu.in.)	15.6 liters (952 cu.in.)
Take-off power	670 hp. at 2000 r.p.m.	430 hp. at 2250 r.p.m.
Maximum power	760 hp. at 2200 r.p.m.	505 hp. at 2600 r.p.m.
Weight	1010 lb.	750 lb.
Cruising consumption gasoline	0.47 Imp. pt./ hp./hr.	0.49 Imp. pt./ hp./hr.
Cruising consumption oil	8 Imp. pt./hr.	8 Imp. pt./hr.

Both types are fitted to take the Hamilton controllable pitch propeller, there being an oil control valve in a housing on the reduction gear casing operated by a cable by the pilot. The Aquila has a four-point mounting instead of the usual ring.

Figure 57 shows the mounting of the accessories on the Aquila: they include fuel pump, air compressor, generator, and electric starter. A new type of carburetor is used, fitted with automatic altitude and boost controls and hot- and cold-air intake.

The confidence of the Bristol Company in their sleeve-valve engines is expressed by the fitting of two Aquilas as standard in the new type 143 F transport monoplane.

Napier.- On the Napier stand were the 720 hp. Culverin heavy-oil engine (Junkers license), the inverted 6-cylinder Javelin, and the two H engines - the 16-cylinder 300 hp. Rapier and the 24-cylinder Dagger. The Dagger without any change has now passed the Air Ministry tests with leaded gasoline of 87 octane value, greatly raising its power.

The ratings now are as follows:

Normal power at sea level	630 hp.	at 3,500	r.p.m.
Take-off power	640 "	" 3,000	"
Normal power at 10,000 ft.	690 "	" 3,500	"
Maximum power (at 12,250 ft.)	760 "	" 4,000	"

The above figures are more than satisfactory for a 16-liter (976.4 cu.in.) engine with less than 7 square feet of frontal area - over 100 horsepower per square foot!

Rolls-Royce.- This firm showed their Kestrel VI engine having cylinders of the same size as the Kestrel II but developing 640 hp. at 2,900 r.p.m. at 14,000 feet. With an improved supercharger, the result of the Schneider Cup experience, and running on fuel of 87 octane, the power has thus been increased by over 100 horsepower.

The success of the Kestrel VI, coupled with difficulties in obtaining the proper power from the steam-cooled Goshawk, will probably result in the latter engine not being placed on the market, as it would be merely redundant - having the same size cylinders. Since the night and day fighters equipped with the Goshawk have so far proved unsatisfactory for structural or aerodynamic reasons, the question of their power plant is not urgent.

Fiat.- In the water-cooled class the Fiat company showed their 24-cylinder racing engine now developing 3,100 horsepower for a weight of 2,050 pounds, the standard 600 horsepower 12-cylinder A 30 R A engine which is unsupercharged but has a compression of 8 to 1 and gives its power at 10,000 feet, and the new supercharged development of the A 30 R A called the A 33 R C, having the same capacity (24.5 liters (1,495.1 cu.in.)) but rated at 700 hp. at 2,600 r.p.m. at 11,500 feet and weighing 1,020 pounds.

The air-cooled engines included the new type A 70 S (fig. 58), a 7-cylinder 180 hp. engine of 8.3 liters (506.5 cu.in.) capacity (115 by 115 mm (4.53 by 4.53 in.) for touring airplanes, and the Fiat-Hornet (type A 59 R) rated at 700 hp. at 2,150 r.p.m. at 6,500 feet.

Isotta-Fraschini.- In addition to their classic Asso models the firm raised the curtain on their new supercharged type XI R.C. 12-cylinder engine of 32.14 liters (1,961.3 cu.in.) capacity (146 by 160 mm (5.75 by 6.3 in.) bore and stroke). The supercharger turning at ten times crankshaft speed and blowing into 4 Solex carburetors, restores sea-level power at 14,760 feet. The standard compression ratio is 6.3/1 and the reduction-gear ratio is 0.743. At 2,320 r.p.m., 827 horsepower was given at the above height in the famous high-altitude wind tunnel at the factory. While the equivalent power at sea level is 1,475 horsepower, the engine actually gives 850 horsepower for take-off purposes.

The fuel consumption at full throttle is 260 gr. (0.573 lb.)/hp./hr. and at 7/10 power 240 gr. (0.529 lb.)/hp./hr., while the oil consumption is 22 and 15.4 lb. an hour. The weight of the engine dry is 1,212 pounds.

The 18-cylinder Asso 750 engine has also been fitted with a 10 to 1 supercharger blowing into 6 Solex carburetors. In tests the engine gave 958 hp. at 2,100 r.p.m. at 12,500 feet. For take-off purposes 900 hp. is available. It will be remembered that the engine has a capacity of 47.1 liters (2,874.2 cu.in.), the bore and stroke being 140 by 170 mm (5.51 by 6.7 in.). The weight dry is 1,609 pounds. The fuel and oil consumption figures are the same as for the XI R C.

In all the above tests the fuel consisted of 80 percent Stanavo gasoline, 20 percent alcohol, and 0.2 percent Pb Et 4. The fuel density was 0.748 at 13° C.

Compagnia Nazionali Aeronautica.- The C.N.A. displayed their tiny C.7 9-cylinder radial engine of 3 liters (183.1 cu.in.) capacity (bore and stroke 80 by 85 mm (3.15 by 3.35 in.)) and turning at 4,800 r.p.m. (propeller speed 1,440 r.p.m.), at which speed it is claimed to develop 180 horsepower. With an elektron crankcase, the weight is only 275 pounds.

PROPELLERS

Following the success of the Hamilton controllable pitch propellers, a number of firms are bringing out propellers of this class, generally operated mechanically or electrically and with infinite variations of pitch: Chau-

viere, Levasseur, and Gnome-Rhone of France, and Piaggio (d'Ascanio), Alfa-Romeo, and Savoia-Marchetti of Italy, have brought out such propellers. Ratier, who already has a highly successful automatic two-pitch propeller suitable for small airplanes, has produced a larger model in which an electric motor produces the pitch variation.

(Signed) John Jay Ide.

LIST OF FIGURES

1	Armstrong Whitworth "Scimitar".
2-3	Avia 534.
4	Breda 27.
5	Dewoitine D.500.
6	" D.511 (also Bréguet 46 T).
7	Fiat C R 32.
8	Hawker "Fury II".
9-10	Letov S.231.
11	Morane-Saulnier 275.
12-13	P.Z.L. P.24.
14	Mureaux 180.
14a	" 180.
15	" 115
16	Bloch 130
17	" 200
18-19	" 211
20	Bréguet 413

21 Potez 54

22-23 S.E.C.M. Amiot 142.

24 Hanriot 180.

25 Avia 51

26-27 Bréguet 46 T.

28 Wibault 670 T.

29 Bristol 143 F.

30 Bristol monocoque fuselage construction.

31 Potez 56.

32 U.S.S.R. Stal 2.

33 Dewoitine 620.

34 U.S.S.R. P 5.

35-36 B.F.W. Me 108

37-38 Caudron 520.

39 Farman 393.

40 Magni "Vale".

41 P.Z.L. 26.

42 Potez 60.

43-44 Levasseur P.L. 200.

45 Junkers Ju.52.

46 Lioré-Olivier H 242.

47 " " H 27.

48 Macchi M C 72.

49 Savoia S.80 bis.

50 "Zodiac" motor kite balloon.

51 Hispano-Suiza 12 Ydrs.

52 " " 14 H A.

53 Renault 6 Pdis.

54 " 14 F A S.

55 Lorraine Eider.

56-57 Bristol Aquila.

58 Fiat A 70 S.

59 Salmson-Szydlowski.

60 Fauvel "Flying Louse".

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Not for Publication.

	Aircraft			
No.	Make	Nation	Model	Type
1	Arado	Germany	A.R.69 B	Biplane
2	Armella-Sénemaud	France	Mistral	H.W.Monoplane A
3	Armstrong-Whitworth	Great Britain	Scimitar	Biplane
4	Avia	Czecho-Slovakia	51	H.W. Monoplane
5	Avia	Czecho-Slovakia	534	Biplane
6	Avro	Great Britain	626	Biplane
7	Avro-La Cierva	Great Britain	C.30 P	Autogiro
8	B.F.W.	Germany	M.35	L.W. Monoplane
9	B.F.W.	Germany	Me.108	L.W. Monoplane
10	Bernard	France	H.52	L.W.Monoplane F.S.
11	Bloch	France	200	H.W. Monoplane
12	Bloch	France	211 Bn 4	L.W. Monoplane
13	Breda	Italy	27	L.W. Monoplane
14	Bréguet	France	413 M 4	Biplane
15	Bréguet	France	46 T	L.W. Monoplane
16	Bristol	Great Britain	143 F	L.W. Monoplane
17	Bücker	Germany	Jungmann	Biplane
18	Caudron	France	C.450	L.W. Monoplane
19	Caudron	France	C.480 "Frégate"	H.W. Monoplane
20	Caudron	France	C.510 "Pélican"	H.W. Monoplane
21	Caudron	France	C.520 "Simoun VI"	L.W. Monoplane
22	Caudron	France	C.530 "Rafale"	L.W. Monoplane
23	Caudron	France	C.600 "L'Aiglon"	L.W. Monoplane
24	Dewoitine	France	D.500	L.W. Monoplane
25	Dewoitine	France	D.511	L.W. Monoplane
26	Farman	France	F.393	H.W. Monoplane
27	Farman	France	F.403	H.W. Monoplane
28	Farman	France	F.431	L.W. Monoplane
29	Fauvel	France	A.V. 10	Monoplane
30	Fiat	Italy	C.R.32	Biplane
31	Fiat	Italy	G.8	Biplane
32	Fieseler	Germany	Fi.97	L.W. Monoplane
33	Focke-Wulf	Germany	Steiglitz	Biplane

Abbreviations: H.W. = High Wing
L.W. = Low Wing
F.S. = Float Seaplane
F.B. = Flying Boat
A. = Amphibian

r = reduction gear
s = supercharged
e = estimated
+ = rotor diameter

CHARACTERISTICS OF AIRCRAFT

EXHIBITED AT PARIS AVIATION SALON NOVEMBER 16 - DECEMBER 2,1934

Prepared by

John Jay I d e

Technical Assistant in Europe,

National Advisory Committee for Aeronautics.

Purpose	No. Seats	Engines: Make	Model	Rated HP/R.P.M.	Maximum HP	Dimensions: Span ft.	Length ft.	Height ft.	Wing Area sq.ft.	Weights: Weight empty lbs.	Useful load lbs.	Total weight lbs.	Performances: Max. Speed at sea level m.p.h.	Max. Speed m.p.h. at - ft.	Cruising Speed m.p.h.	Minimum Speed m.p.h.	Climb to - ft. Min. Sec.	Service Ceiling ft.	Range at Cruis. Speed miles	
Training	2	Siemens-Halske	14 A	125/2075	150	29.5	23.7	9.0	223	1113	661	1774	114		93	49		13770	388	1
Touring	4	2 De Havilland	Gipsy Major	2x120/2100	2x130	49.2	32.8	9.8	269	2756	1653	4409	145 (e)		112 (e)	50 (e)		16400 (e)	680 (e)	2
Pursuit	1	Siddeley	Panther VII	635/2250 (a)	640	33.0	25.0	11.6	261	2956	1144	4100	178	225/14000	194(a)		16400 - 9'	31500	870	3
Transport	8	3 Avia	R.12	3x200/2000	3x260	49.5	35.3	11.5	409	5654	2701	8355	170		145	62		16400	590	4
Pursuit	1	Hispano-Suiza	12 Ybrs	860/2400 (b)		30.8	26.9	9.2	258	3044	979	4023	218	252/14760	212	84	16400 - 4'34"	26770	870	5
Training	2	Siddeley	Cheetah V	270/2100		34.0	26.7	9.7	300	2010	658	2668	130		108	50	3280 - 3'10"	18000	620	6
Touring	2	Siddeley	Genet Major	140/2200	152	37.0+	24.0	11.1		1265	635	1900	112		95	20		12000	550	7
Touring	2	Siemens-Halske	14 A	125/2075	150	38.0	24.6	9.0	183	1102	661	1763	145		121	50	9840 -12'46"	19000	680	8
Touring	4	Hirth	H M 8 u	225/3000		33.8	26.4	6.6	172	1235	1080	2315	186		124	37			680	9
Pursuit	1	Gnome-Rhône	9 Krsd	490/2280 (c)		37.1	28.4	14.2	196	3219	838	4057	177	203/13120		62			550	10
Bombing	4	2 Gnome-Rhône	14 Krsd	2x800/2390 (d)		73.7	51.8	12.8	721	8818	5335	14153		178/13120	155		19680 -16'51"	24600	680	11
Bombing	4	2 Hispano-Suiza	12 Ydrs	2x860/2400 (b)		82.3	60.4	12.0	829	9039	7055	16094		205/13120(e)	186 (e)	62 (e)			1860 (e)	12
Pursuit	1	Alfa-Romeo	Mercury IV	490/2250(f)	550	35.1	24.9	11.1	203	2778	1168	3946	202	236/16400		68	19680 - 10'	29530	620	13
Bomber-Fighter	4	2 Hispano-Suiza	12 Ydrs	2x860/2400(b)		66.3	37.7	16.7	722	8364	4854	13218		187/14760	155		16400 -11'98"	21160	780	14
Transport	14	2 Gnome-Rhône	14 Krsd	2x815/2390 (g)		67.2	51.1	15.8	609	9713	5225	14938		239/6890(e)	192(e)				885 (e)	15
Transport	10	2 Bristol	Aquila	2x505/2600 (h)		56.5	41.7	12.0	768	5720	2880	8600		224/6000	180				840	16
Training	2	Hirth	H M 60 R	72/2315	80	24.3	21.8	7.4	145	750	573	1323	105		93	45	9840 -28'48"	13120	400	17
Racing	1	Renault	Coupe Deutsch 1934	300/2900	325	22.1	23.3	5.9	75	1146	783	1929	279		248	62		31000(e)	700	18
Touring	3	Renault	4 Pei Bengali	140/2400	152	39.0	26.8	6.9	215	1323	992	2315	133 (e)		115 (e)	50 (e)		14760	620	19
Touring	4	Renault	4 Pei Bengali	140/2400	152	38.7	27.9	7.4	231	1378	1136	2514	115			46				20
Touring	4	Renault	6 Pfi	170/2400	192	34.1	28.5	7.2	172	1543	1102	2645	186 (e)		167 (e)	50(e)		19680	870	21
Touring	2	Renault	4 Pei Bengali	140/2400	152	30.2	24.6	6.2	128	1257	858	2095	186		164	53		19680	900	22
Training	2	Renault	Bengali Jr.	100/1800		38.4	24.9	6.6	161	970	573	1543	124 (e)		105 (e)	40 (e)		13120	430	23
Pursuit	1	Hispano-Suiza	12 Xbrs	690/2600 (i)		39.7	25.4	8.9	178	2791	968	3759	197	230/16400	155(p)	70	19680 - 6' 18"	26120	880	24
Pursuit	1	Hispano-Suiza	12 YCrs	860/2400 (b)		34.5	25.4	8.9	161	3055	1045	4100		261/16400(e)	155(e)		16400 - 6'0"(e)	26440 (e)	900	25
Touring	5	Farman	9 E D	190/2150	220	46.3	32.8	9.8	430	2414	1554	3968	127 (e)		108 (e)			16400 (e)	620 (e)	26
Touring	3	Farman	7 E D	170/2150	190	38.4	27.1	6.8	183	1565	948	2513	143 (e)		124 (e)			14760 (e)	620 (e)	27
Transport	6	2 Renault	6 Pdi	2x180/2200	2x 205	50.5	39.4	9.2	387	3494	2127	5621	146 (e)		124 (e)			24000 (e)	850 (e)	28
Experimental	1	Pobjoy	R	75/3000		32.8	11.5	6.6	194	617	529	1146	135 (e)		99(e)	30 (e)			340 (e)	29
Pursuit	1	Fiat	A.30 R A	550/2600 (j)		31.2	24.4	8.9	238	2811	1157	3968	211	242/9840		68	19680 - 11'	26580	620	30
Touring	2	Fiat	A 54	135/2100	150	28.7	23.0	8.2	203	1236	617	1853	131		114	53	9840 -17'41"	18740	870	31
Touring	4	Argus	As 17 a	200/2300	225	35.1	27.6	7.7	165	1236	1080	2516	155			36				32
Training	2	Argus	As 8 B	125/2200	135	29.5	24.0	8.9	215	1146	617	1763	118		108	41	13120 -32'42"		870	33

(a) - at 12000 ft.
(b) - at 13120 ft.
(c) - at 12430 ft.
(d) - at 12630 ft.
(f) - at 13000 ft.
(g) - at 7150 ft.
(h) - at 5000 ft.
(i) - at 14760 ft.
(j) - at 9840 ft.
(k) - at 14000 ft.
(l) - at 6890 ft.
(m) - at 11870 ft.
(n) - at 6560 ft.
(o) - at 12500 ft.
(p) - at 11800 ft.
(q) - at 16400 ft.

Continuation of Table

No.	Aircraft: Make	Nation	Model	Type	Purpose	No. Seats	Make
34	Hanriot	France	170	Biplane	Touring	3	Salmson
35	Hanriot	France	182	Biplane	Training	2	Renault
36	Hanriot	France	190	Biplane	Gunnery Training	2	Régnier
37	Hawker	Great Britain	Fury II	Biplane	Pursuit	1	Rolls-Royce
38	Heinkel	Germany	H.E.70	L.W. Monoplane	Transport	6	B.M.W.
39	Junkers	Germany	Ju.52/3m	L.W. Monoplane F.S.	Transport	18	3 Junkers
40	Letov	Czecho-Slovakia	S.231	Biplane	Pursuit	1	Gnome-Rhône
41	Levasseur	France	P.L.15	Biplane F.S.	Torpedo-Bomber	3	Hispano-Suiza
42	Levasseur	France	P.L.200	H.W. Monoplane F.S.	Observation	3	Hispano-Suiza
43	Lioré Olivier	France	H 242	Monoplane F.B.	Transport	14	4 Gnome-Rhône
44	Macchi	Italy	M C 72	L.W. Monoplane F.S.	Racing	1	Fiat
45	Magni	Italy	Vale	H.W. Monoplane	Touring	1	Farina
46	Mauboussin	France	112 Corsaire	L.W. Monoplane	Touring	2	Salmson
47	Mauboussin	France	120 C Corsaire	L.W. Monoplane	Touring	2	Salmson
48	Mignet	France		H.W. Monoplane	Experimental	1	Aubier-Dunne
49	Morane-Saulnier	France	M.S. 275	H.W. Monoplane	Pursuit	1	Gnome-Rhône
50	Morane-Saulnier	France	M.S. 315	H.W. Monoplane	Training	2	Salmson
51	Morane-Saulnier	France	M.S. 341-3	H.W. Monoplane	Touring	2	Renault
52	Mureaux	France	113 R 2	H.W. Monoplane	Observation	2	Hispano-Suiza
53	Mureaux	France	115 R 2	H.W. Monoplane	Observation	2	Hispano-Suiza
54	Mureaux	France	180 C 2	H.W. Monoplane	Pursuit	2	Hispano-Suiza
55	P.Z.L.	Poland	P.11 C	H.W. Monoplane	Pursuit	1	Skoda-Bristol
56	P.Z.L.	Poland	P.24	H.W. Monoplane	Pursuit	1	Gnome-Rhône
57	P.Z.L.	Poland	P.26	L.W. Monoplane	Touring	4	Menasco
58	Potez	France	54 M 4	H.W. Monoplane	Bomber-Fighter	4	2 Hispano-Suiza
59	Potez	France	56	L.W. Monoplane	Pas. Transport	7	2 Potez
60	Potez	France	58	H.W. Monoplane	Touring	3	Potez
61	Potez	France	60	H.W. Monoplane	Touring	2	Potez
62	R.W.D.	Poland	9	H.W. Monoplane	Touring	4	Skoda
63	Savoia	Italy	S.56 M	Biplane A.	Touring	2	Alfa Romeo
64	Savoia	Italy	S.80 bis	Monoplane A.	Touring	4	2 Pobjoy
65	S.E.C.M.-Amiot	France	142 M 4	H.W. Monoplane	Bomber-Fighter	4	2 Hispano-Suiza
66	U.S.S.R.	Russia	Air 9	L.W. Monoplane	Touring	2	U.S.S.R.
67	U.S.S.R.	Russia	Stal 2	H.W. Monoplane	Transport	4	U.S.S.R.
68	U.S.S.R.	Russia	P.5	Biplane	Postal		U.S.S.R.

Abbreviations: H.W. = High Wing
L.W. = Low Wing
F.S. = Float Seaplane
F.B. = Flying Boat
A. = Amphibian

r = reduction gear
s = supercharged
e = estimated
+ = rotor diameter

(a) - at 12000 f
(b) - at 13120 f
(c) - at 12430 f
(d) - at 12630 f
(f) - at 13000 f

CHARACTERISTICS OF AIRCRAFT

EXHIBITED AT PARIS AVIATION SALON NOVEMBER 16 - DECEMBER 2, 1934

Prepared by

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Technical Assistant in Europe

National Advisory Committee for Aeronautics

Engines			Dimensions			Wing Area	Weights			Performances						
Model	Rated HP/R.P.M.	Maximum HP	Span ft.	Length ft.	Height ft.	sq.ft.	Weight empty lbs.	Useful load lbs.	Total weight lbs.	Max. Speed at sea level m.p.h.	Max. Speed m.p.h. at - ft.	Cruising Speed m.p.h.	Minimum Speed m.p.h.	Climb to - ft. Min. Sec.	Service Ceiling ft.	Range at Cruis.Speed miles	
6 T E	170/2300	188	39.4	24.0	7.2	215	1323	981	2304	136(e)							34
4 Pei Bengali	140/2400	152	39.4	23.5	7.2	215	1325	882	2205	121		108	37	6560 - 13'	18070	300	35
R.6	180/2300		39.4	24.0	7.2	215	1290	891	2181	133							36
Kestrel VI	600/2500 (k)	640	30.0	26.8	10.3	252	2425	1102	3527		240/16400	200	62	9840 - 4' 0"	30500	350	37
VI u	630/1600		48.6	37.7	10.2	393	5170	2260	7430	234		200	59	6560 - 7'	19020	620	38
Jumo 5	3x420(l)	3x550	96.0	62.3	20.2	1190	16195	4751	20944	159		149(j)	62		23280		39
14 Kfs	900/2300 (m)		33.0	25.6	10.0	251	3127	1063	4190	208	251/13120 (e)			16400 - 6'	32800		40
12 Nbr	650/2000	725	59.0	42.2	16.7	802	6393	3197	9590	121		99	56	9840 - 20'	14760	400	41
9 Vbrs	750/2100(n)		52.5	33.5	11.8	377	4023	3086	7109		140/6560 (e)	124 (e)			19680 (e)		42
7 Kd	4x 350/2000	4x380	91.9	60.5	20.0	1248	10880	8962	19842	146		127	60	9840 - 18'	16400	620	43
A S 6	3100/3300		29.5	27.2	9.5	161	5516	1157	6673	440			130				44
T.58	130/1800		29.2	18.0	6.6	115	1190	496	1686	155		124			22960	630	45
9 A D	45/2200	55	38.5	22.3	7.3	143	728	533	1261	96		86	37	13120 - 60'	14760	870	46
9 A D R	60/2700	65	38.5	22.3	7.5	143	772	573	1345	108		93	37	16400 - 60'	18040	400	47
	17/4000		19.7	11.5						62			25				48
9 Krse	600/2460(b)		34.6	23.7	10.6	185	2837	800	3637		225/14760	155(i)		29520 - 18'	32800	560	49
9 N C	135/1800	156	39.4	24.9	9.2	253	1521	595	2116	105				6560 -13'25"	16400		50
4 Pei Bengali	140/2400	152	33.5	22.2	7.7	170	1208	688	1896	124		105		6560 - 13'	18040		51
12 Ybrs	860/2400 (b)		50.5	32.6	12.8	376	3385	2130	5515		203/16400	155	62	16400 - 8'10"	34120	570	52
12 YCrs	860/2400(b)		50.5	33.0	12.8	375	3505	2006	5511		211/16400(e)	155 (e)		16400 - 8'(e)	34120 (e)	570 (e)	53
12 XCrs	690/2600(i)		37.4	28.9	12.0	210	2725	1360	4085		236/16400 (e)	155 (e)	64 (e)	16400 - 6'27" (e)	32800 (e)	550 (e)	54
Mercury VI	605/2400(o)	645	35.1	24.8	9.0	193	2443	1062	3505	186	242/16400	155 (q)	62	16400 - 6'	32800	420	55
14 Kfs	900/2300 (m)		34.7	24.6	9.0	194	2800	1113	3913		258/14760		74	19680 - 8'40"	32800	540	56
B-65 Buccaneer	210/2175	265	34.1	24.6	6.9	176	1235	981	2216	186		155	57		24600		57
12 Xbrs	2x690/2600 (i)		72.5	53.1	12.8	818	8276	3981	12257		198/13120	155		13120 -10'20"	29530	630	58
9 A B	2x185/1720	2x235	52.5	38.9	10.1	355	3763	1788	5551	171		149		3280 - 4'30"	18040	490	59
6 B	120/2100	140	37.1	24.4	7.7	204	1122	862	1984	118		99	37		18400	480	60
3 B	60/2200	70	32.8	23.0	7.7	151	651	575	1206	90			31	3280 - 7' 30"	11480	440	61
G R 760	260	306	38.2	26.2	6.6	172	1255	816	2051	174		152	54	3280 - 1'45"	28540	500	62
D.1	240/2000	275	33.8	27.0	9.2	280	1746	1102	2848	118		102	52		14100		63
R	2x75/3000		36.1	25.6	9.5	194	1720	882	2602	124		108	46	13120- 32'2"	16400	370	64
12 Ybrs	2x860/2400 (b)		80.2	58.9	18.7	1076	11341	4561	15902		186/16400	161	59	13120 - 12'		760	65
M.11	100		33.5	23.0		167			1764	124			40		18040	550	66
M.36	300		49.9	32.0	9.2	334	2535	1653	4188	130		108	52	3280 - 4'	16400	370	67
	500		50.9	34.6		540			6548	133		105	56		16400	680	68

(g) - at 7150 ft.
(h) - at 5000 ft.
(i) - at 14760 ft.
(j) - at 9840 ft.
(k) - at 14000 ft.
(l) - at 6890 ft.
(m) - at 11870 ft.
(n) - at 6560 ft.
(o) - at 12500 ft.
(p) - at 11800 ft.

(q) - at 16400 ft.

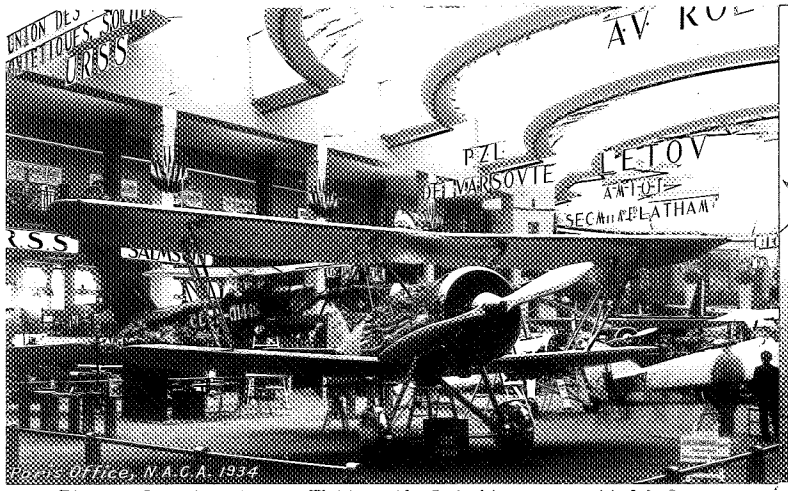

Figure 1.- Armstrong Whitworth Scimitar pursuit biplane (635 hp. Siddeley Panther engine).

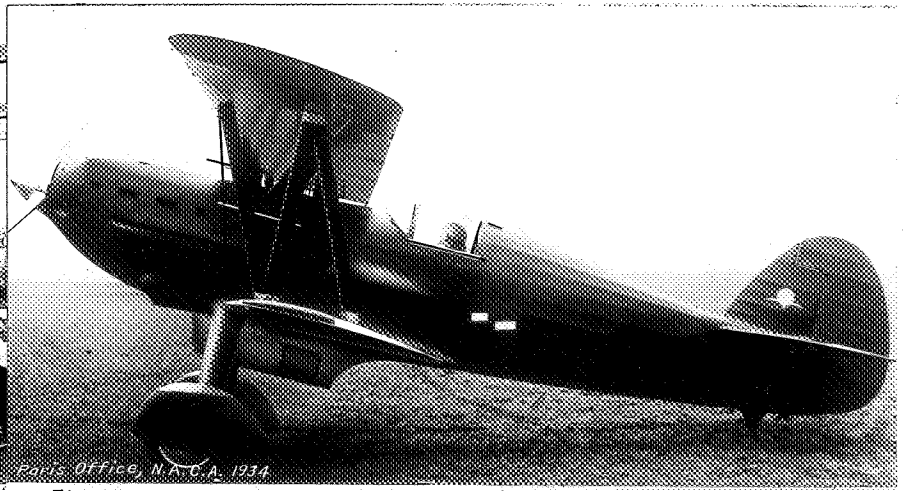

Figure 2.- Avia 534 pursuit biplane. (860 hp. Hispano-Suiza engine).

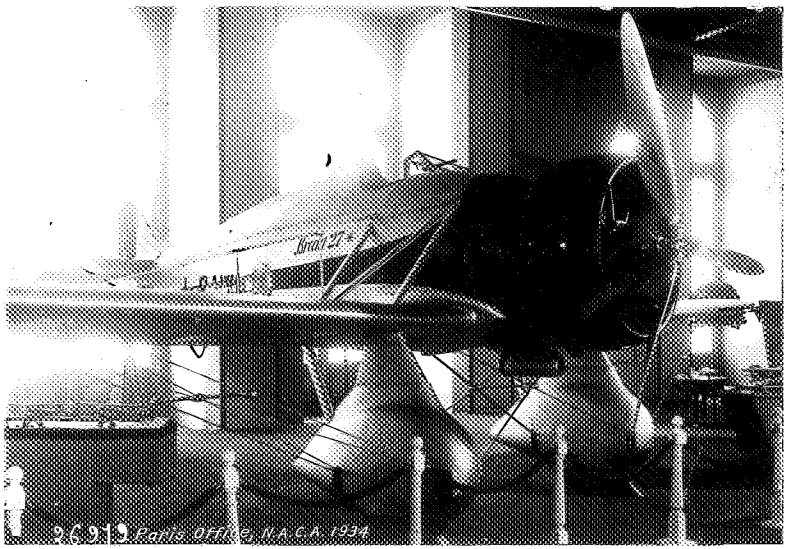

Figure 4.- Breda 27 pursuit monoplane. (Alfa Romeo Mercurius IV engine).

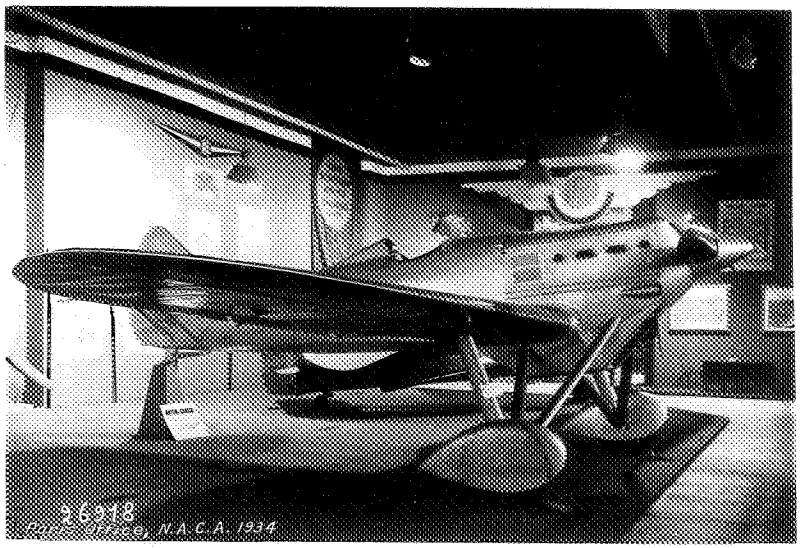

Figure 5.- Dewoitine D.500 pursuit monoplane. (690 hp. Hispano-Suiza engine).

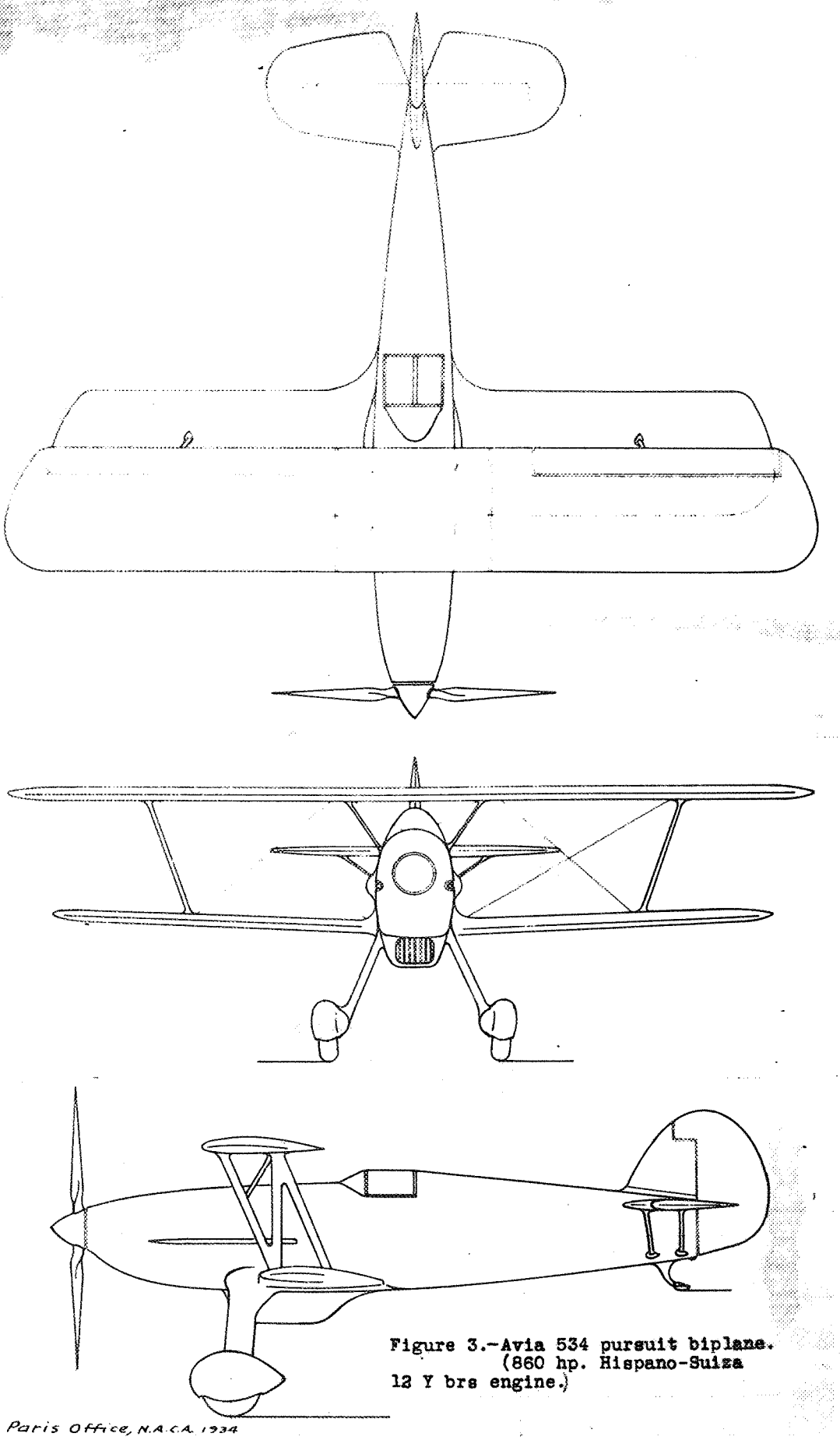

Figure 3.-Avia 534 pursuit biplane. (860 hp. Hispano-Suiza 12 Y brs engine.)

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Figure 6.- Dewoitine D 511 pursuit monoplane. 860 hp.Hispano-Suiza engine. 1 20 mm cannon, 2 machine guns. (in foreground) Breguet 46 transport monoplane. (in background)

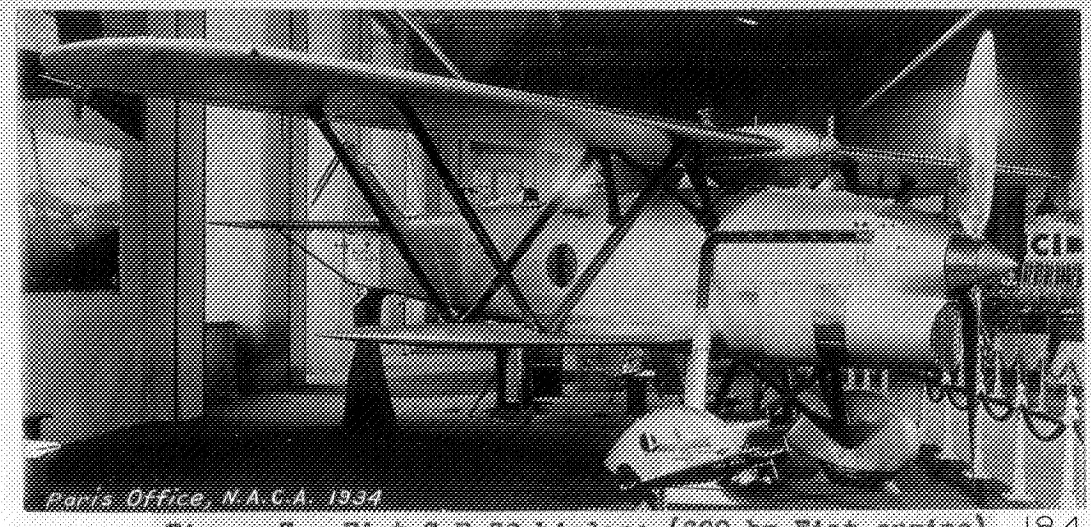

Figure 7.- Fiat C.R.32 biplane (600 hp.Fiat engine) 18433A.C.

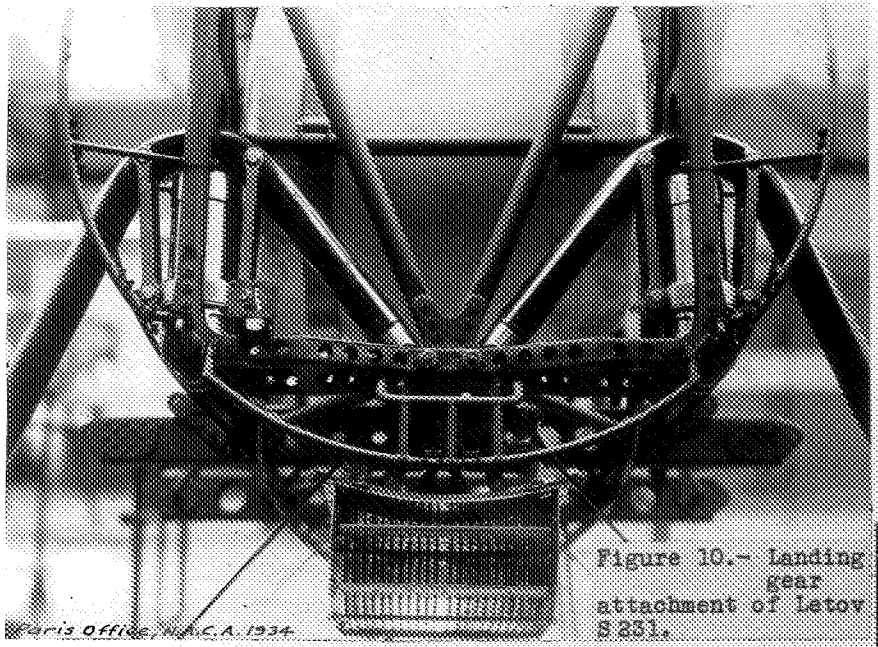

Figure 10.- Landing gear attachment of Letov S 231.

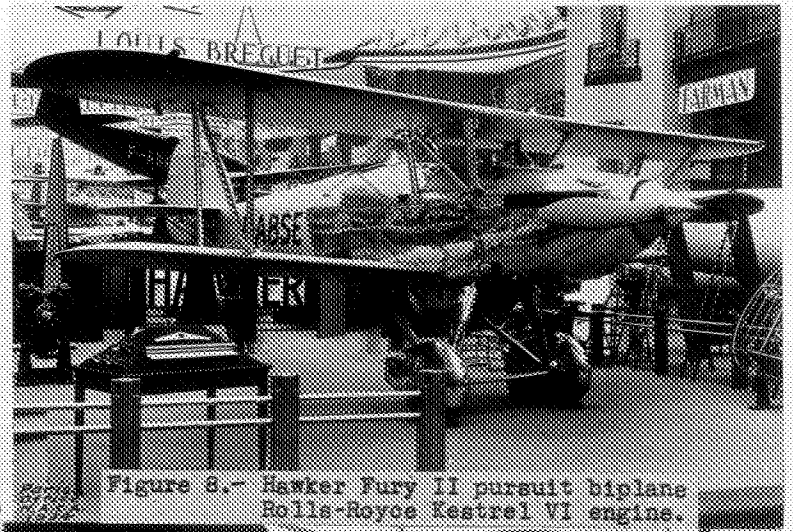

Figure 8.- Hawker Fury II pursuit biplane. Rolls-Royce Kestrel VI engine.

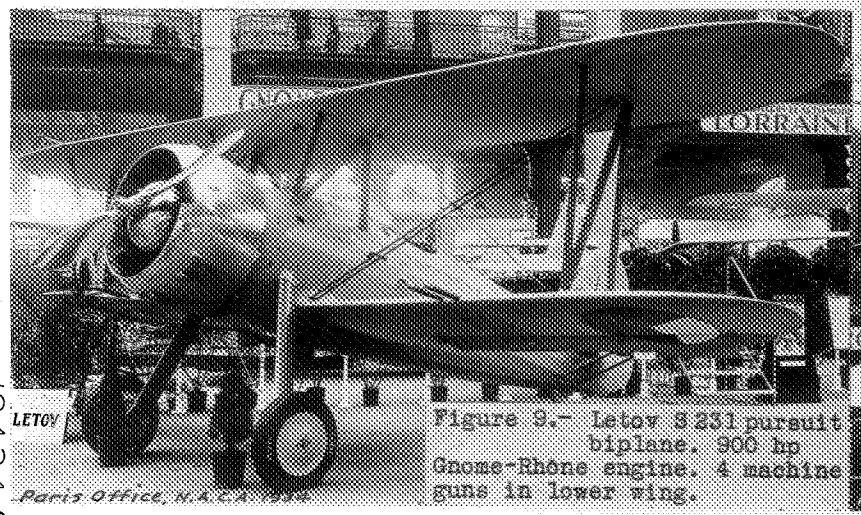

Figure 9.- Letov S 231 pursuit biplane. 900 hp Gnome-Rhône engine. 4 machine guns in lower wing.

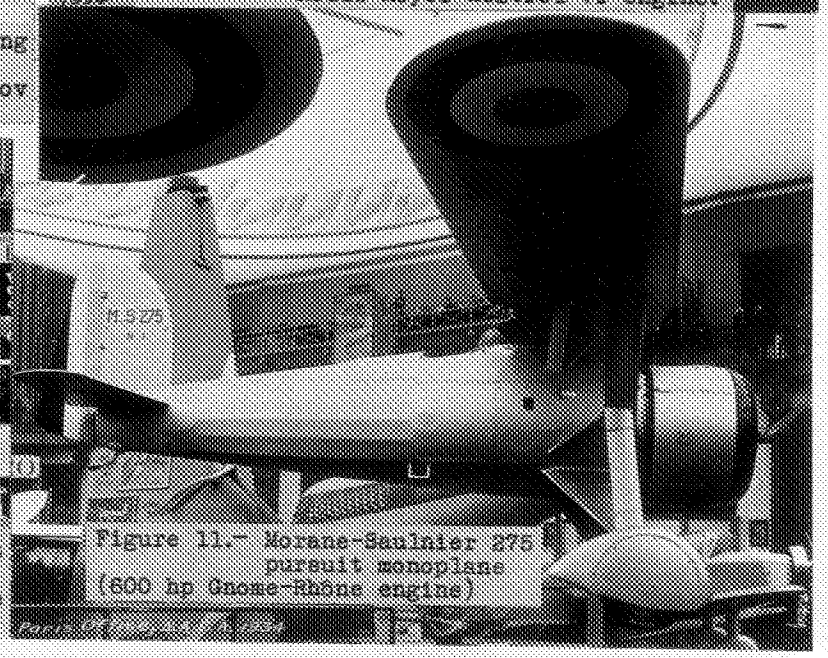

Figure 11.- Morane-Saulnier 275 pursuit monoplane (600 hp Gnome-Rhône engine)

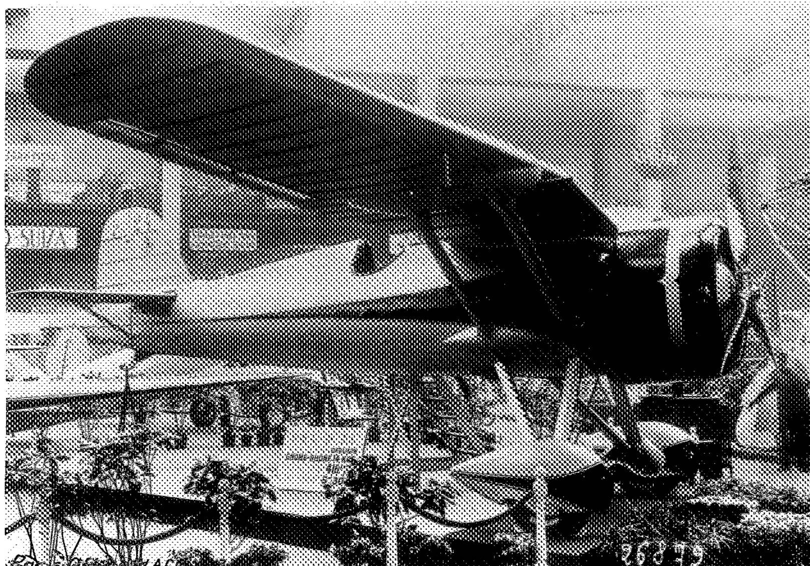

Figure 12.- P Z L P 24 pursuit monoplane. 900 hp. Gnome-Rhône engines. 2 Oerlikon cannon.

Figure 15.- Mureaux 115 R 2 observation monoplane (860 hp. Hispano-Suiza engine. 20 mm cannon)

Figure 14.- Mureaux 180 C.2 Two seat fighter. (860 hp. Hispano-Suiza engine. 20 mm cannon)

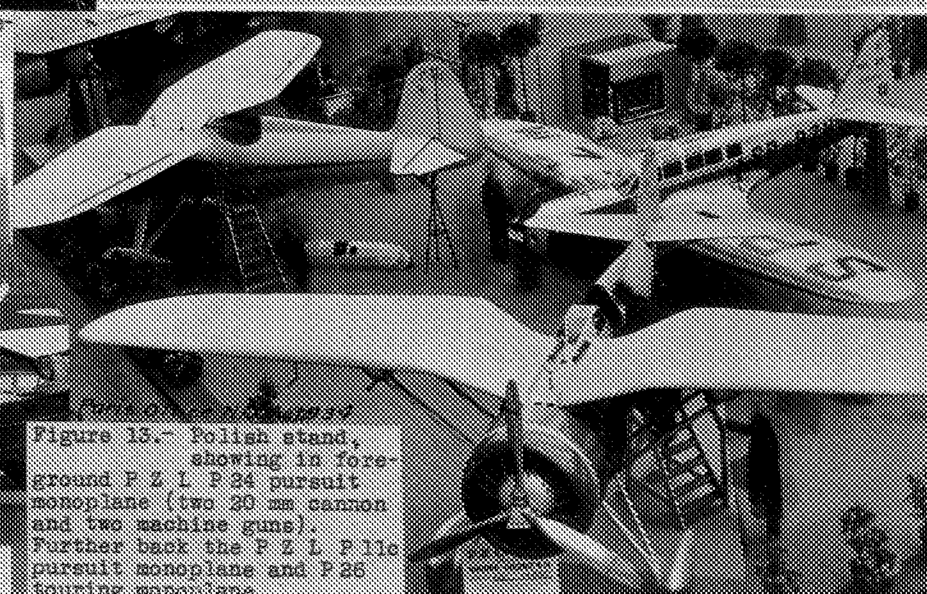

Figure 13.- Polish stand, showing in foreground P Z L P 24 pursuit monoplane (two 20 mm cannon and two machine guns). Further back the P Z L P 11c pursuit monoplane and P 26 touring monoplane.

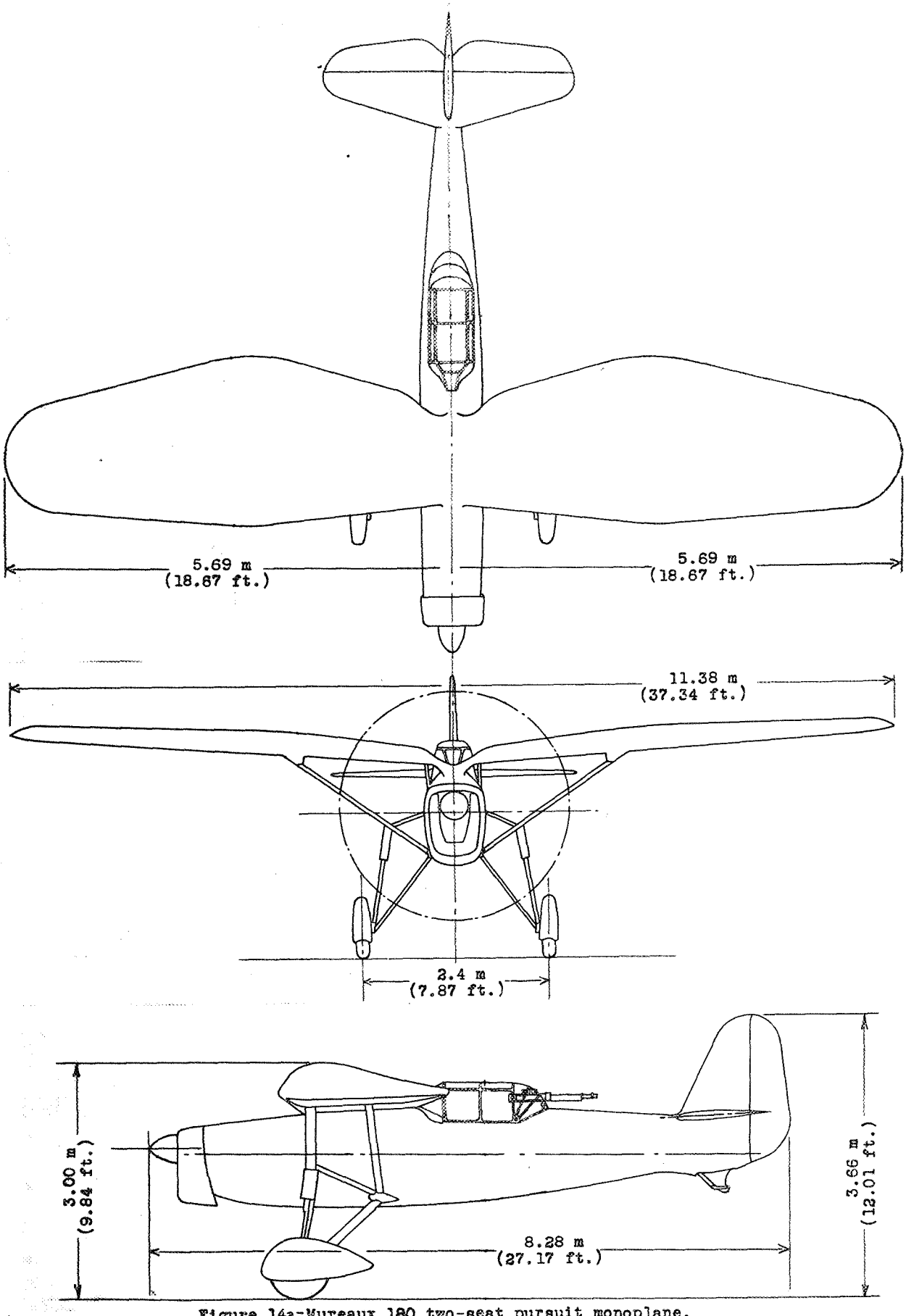

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Figure 14a-Mureaux 180 two-seat pursuit monoplane.
(Hispano-Suiza 12 XCrs engine)

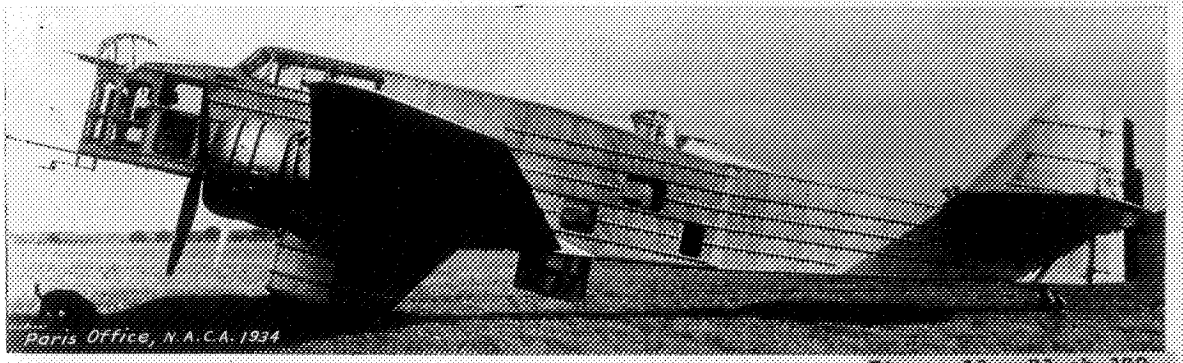

Figure 16.- Bloch 130 multiplace-fighter-bomber observation monoplane. (Two 900 hp. Gnome-Rhône 14 Kred engines. Speed 211 m.p.h. at 13,120 ft. Wing area 613 sq.ft.)

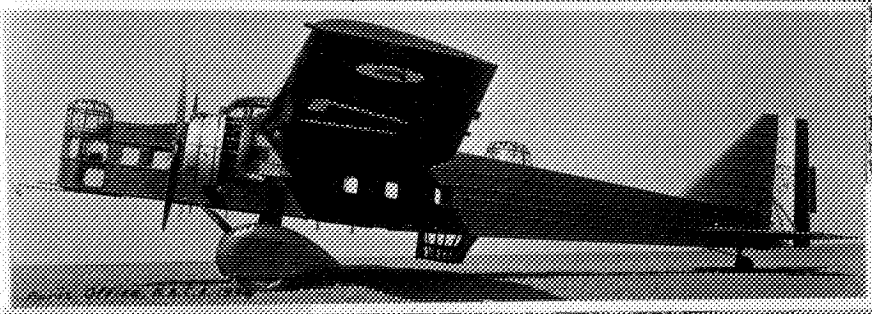

Figure 17.- Bloch 200 bomber. (Two 800 hp. Gnome-Rhône engines)

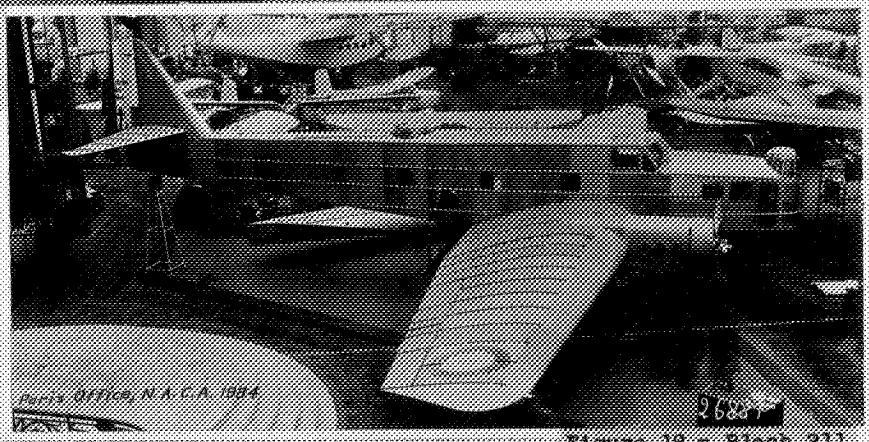

Figure 18.- Bloch 211 bomber (Two 860 hp. Hispano-Suiza engines)

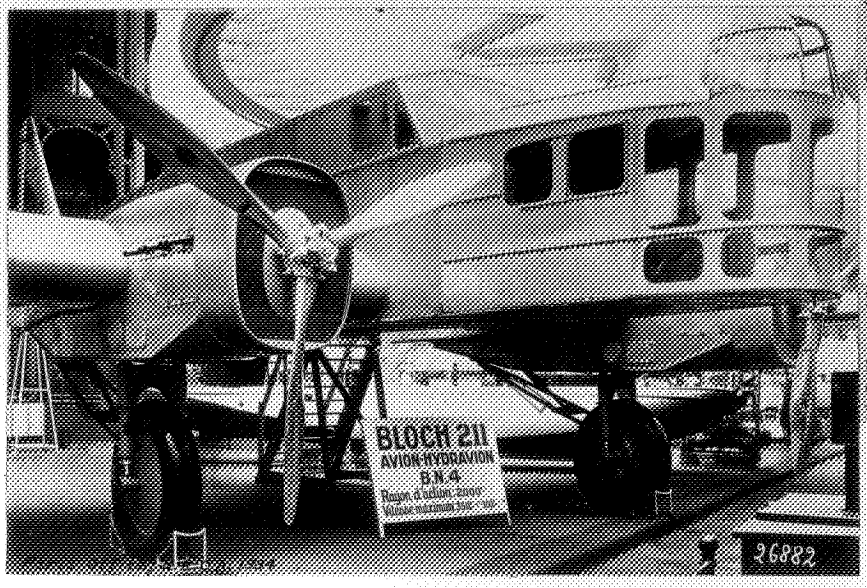

Figure 19.- Bloch 211 bomber (Two 860 hp. Hispano-Suiza engines. Hamilton controllable pitch propellers)

18436 A.C.

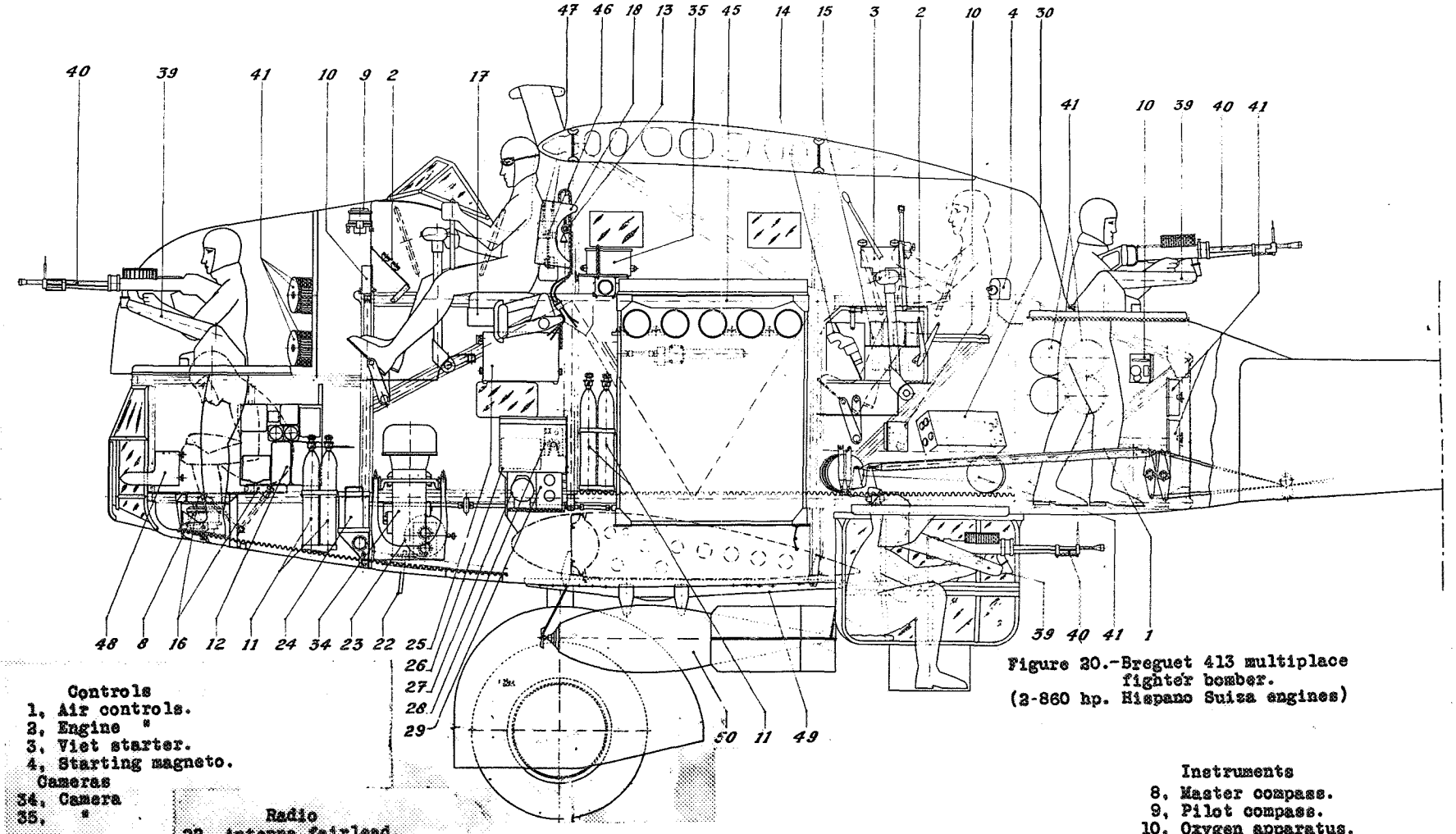

Figure 20.-Breguet 413 multiplace fighter bomber.
(2-860 hp. Hispano Suiza engines)

Controls
1, Air controls.
2, Engine "
3, Viet starter.
4, Starting magneto.

Cameras
34, Camera
35, "

Radio
22, Antenna fairlead.
23, " reel.
24, Storage batteries.
25, Radio transmitter.
26, Control panel.
27, Converter.
28, Switch.
29, Rate of climb indicator.
30, Radio receiver.

Gun mounts
39, Gun ring type T.O.10.
40, Twin machine guns.
41, Magazines.

Bombing
45, Bomb release, vertical, 10x50.
46, Emergency release, 10x50.
47, Flare release control.
48, Sight.
49, Bomb release, type G.P.U.
50, Bombs, 200 kg .

Instruments
8, Master compass.
9, Pilot compass.
10, Oxygen apparatus.
11, " bottles.
12, Main instrument board.
13, Interphone.
14, Flare pistol.
15, Flares
16, Commanders seat.
17, Adjustable pilots seat.
18, " seat back.

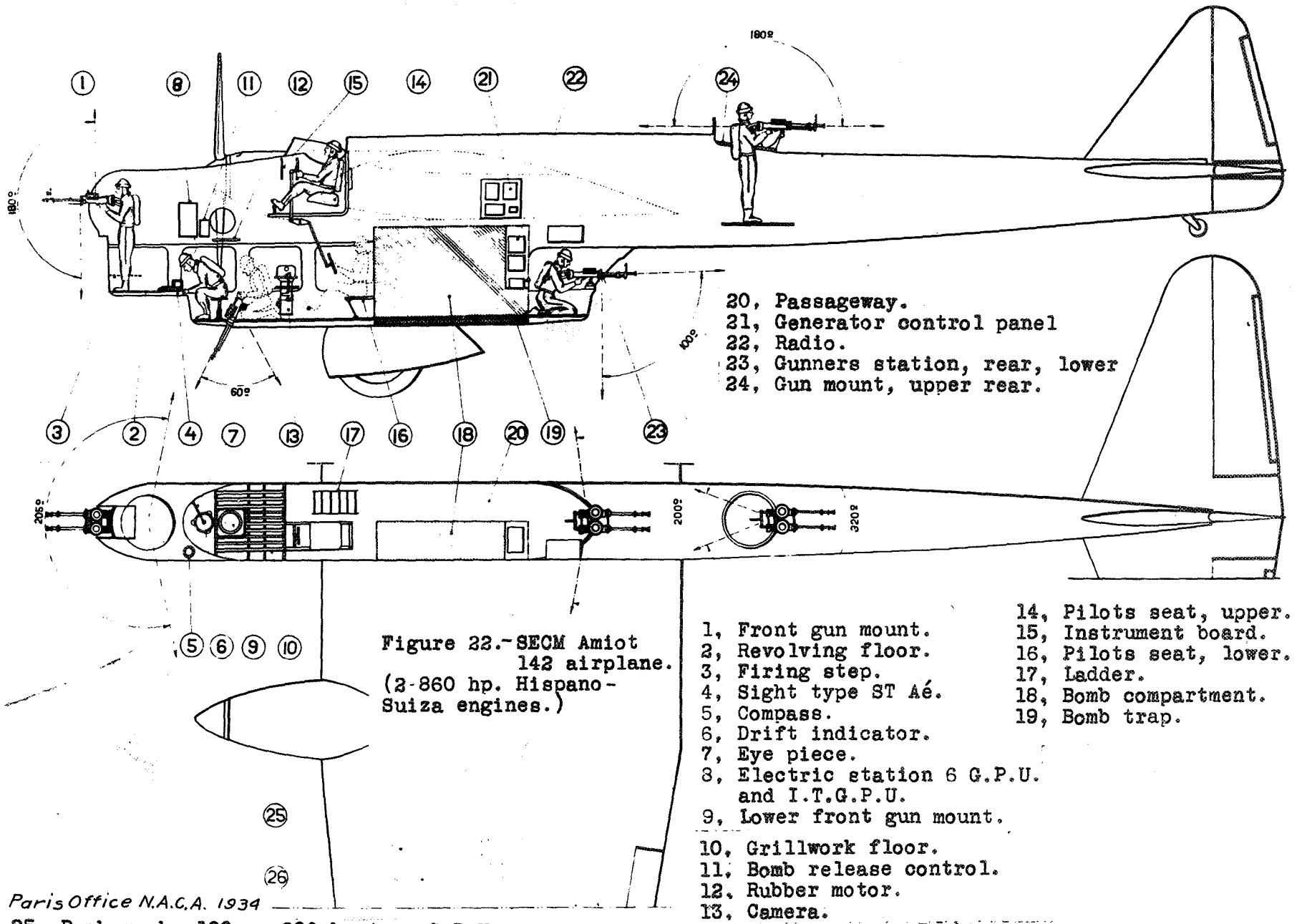

Figure 22.- SECM Amiot 142 airplane.
(2-860 hp. Hispano-Suiza engines.)

1, Front gun mount.
2, Revolving floor.
3, Firing step.
4, Sight type ST Aé.
5, Compass.
6, Drift indicator.
7, Eye piece.
8, Electric station 6 G.P.U. and I.T.G.P.U.
9, Lower front gun mount.
10, Grillwork floor.
11, Bomb release control.
12, Rubber motor.
13, Camera.
14, Pilots seat, upper.
15, Instrument board.
16, Pilots seat, lower.
17, Ladder.
18, Bomb compartment.
19, Bomb trap.
20, Passageway.
21, Generator control panel
22, Radio.
23, Gunners station, rear, lower
24, Gun mount, upper rear.
25, Bomb racks 100 or 200 kg type G.P.U.
26, Bomb racks 100 or 200 kg type G.P.U.

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Figure 34.- Hanriot 180 as ambulance. (140 hp. Renault engine).

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A, Trap door for bomb sight.
B, Navigation compass.
C, Gun mount for firing below the fuselage.
D, Space for photographic equipment.
E, Navigators seat.

Figure 21.- Potez 54 multiplace fighter, 2 - 690 hp. Hispano-Suiza engines.

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Figure 23.- Bomber-navigator compartment of S.E.C.M. Amiot 143 showing clear vision floor.

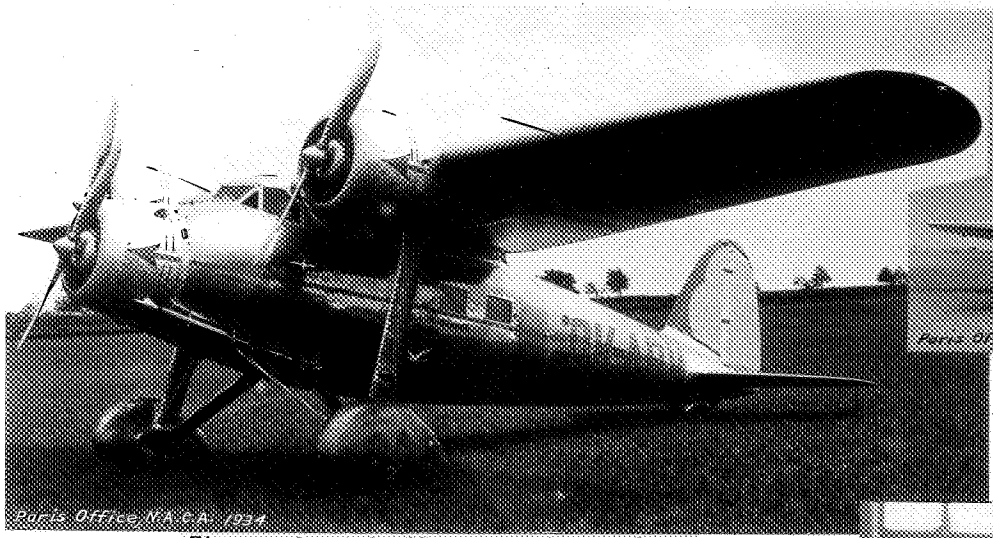


Figure 25.- Avia 51 transport monoplane
(3 Avia 200 hp.engines)

Figure 31.- Potez 56 transport monoplane
(2-185 hp.Potez engines)

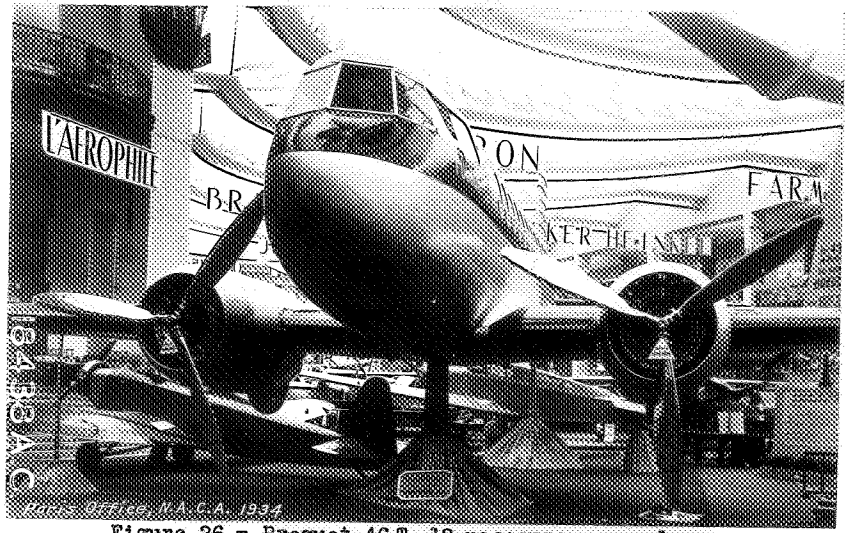


Figure 26.- Breguet 46 T 12 passenger monoplane
(2-815 hp.Gnome-Rhône engines)

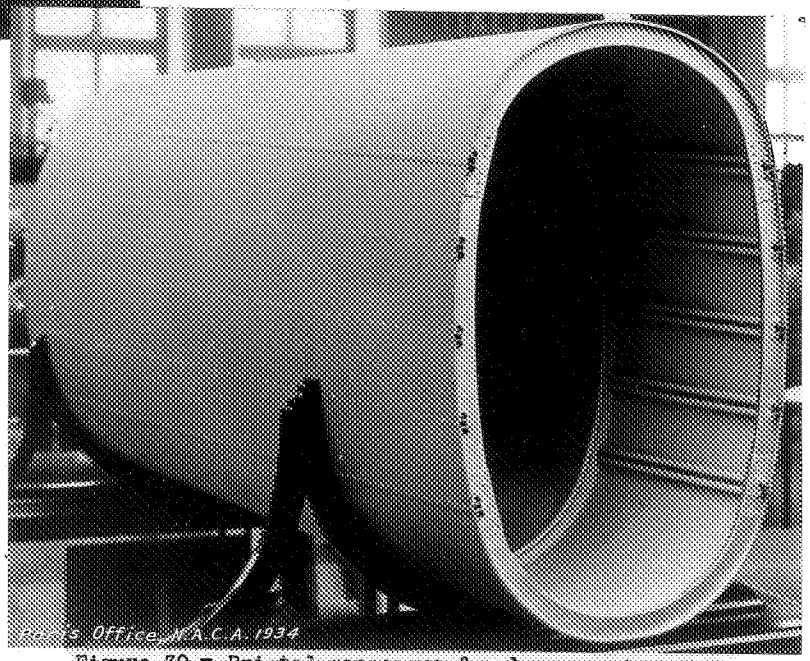


Figure 30.- Bristol monocoque fuselage construction.

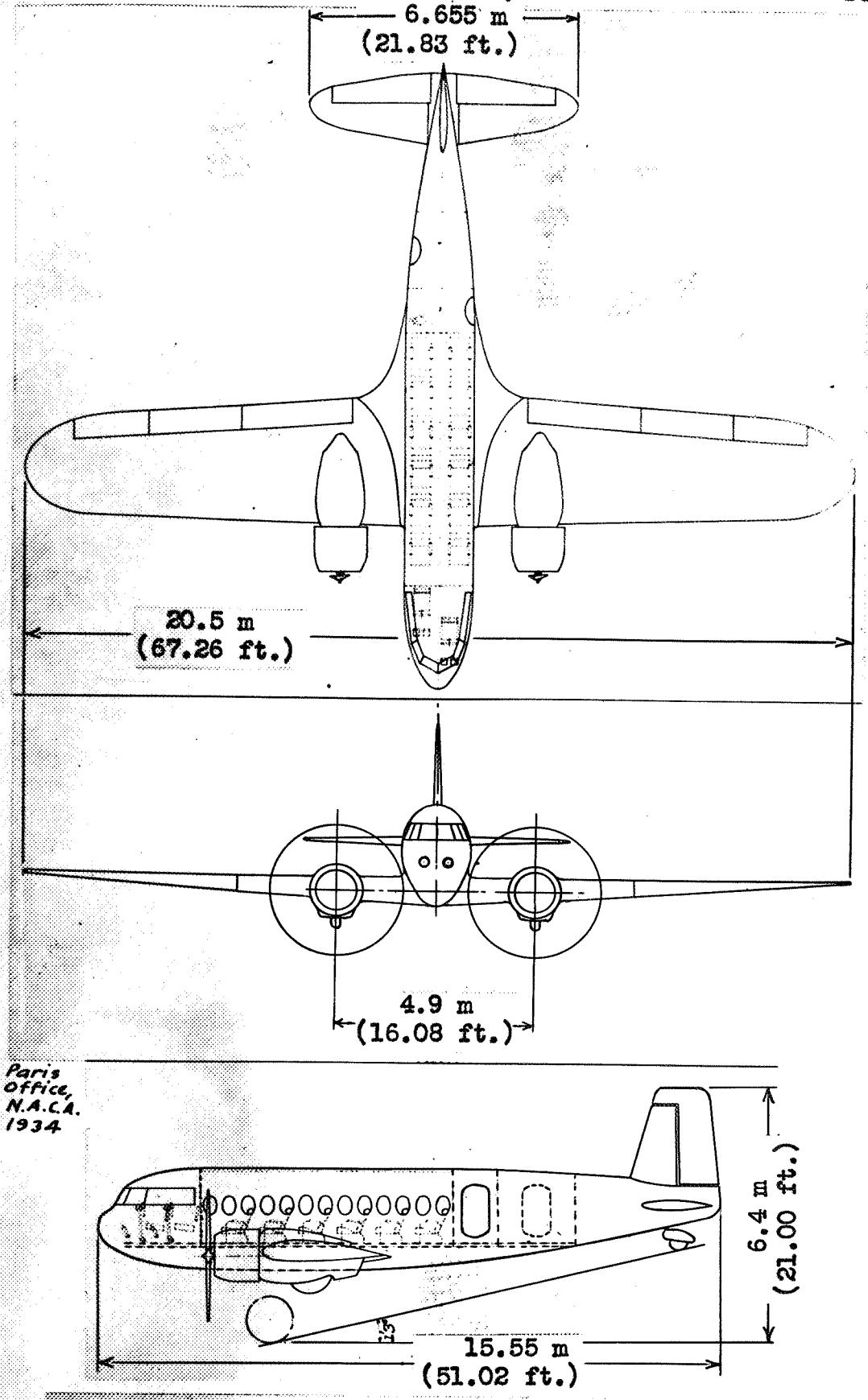
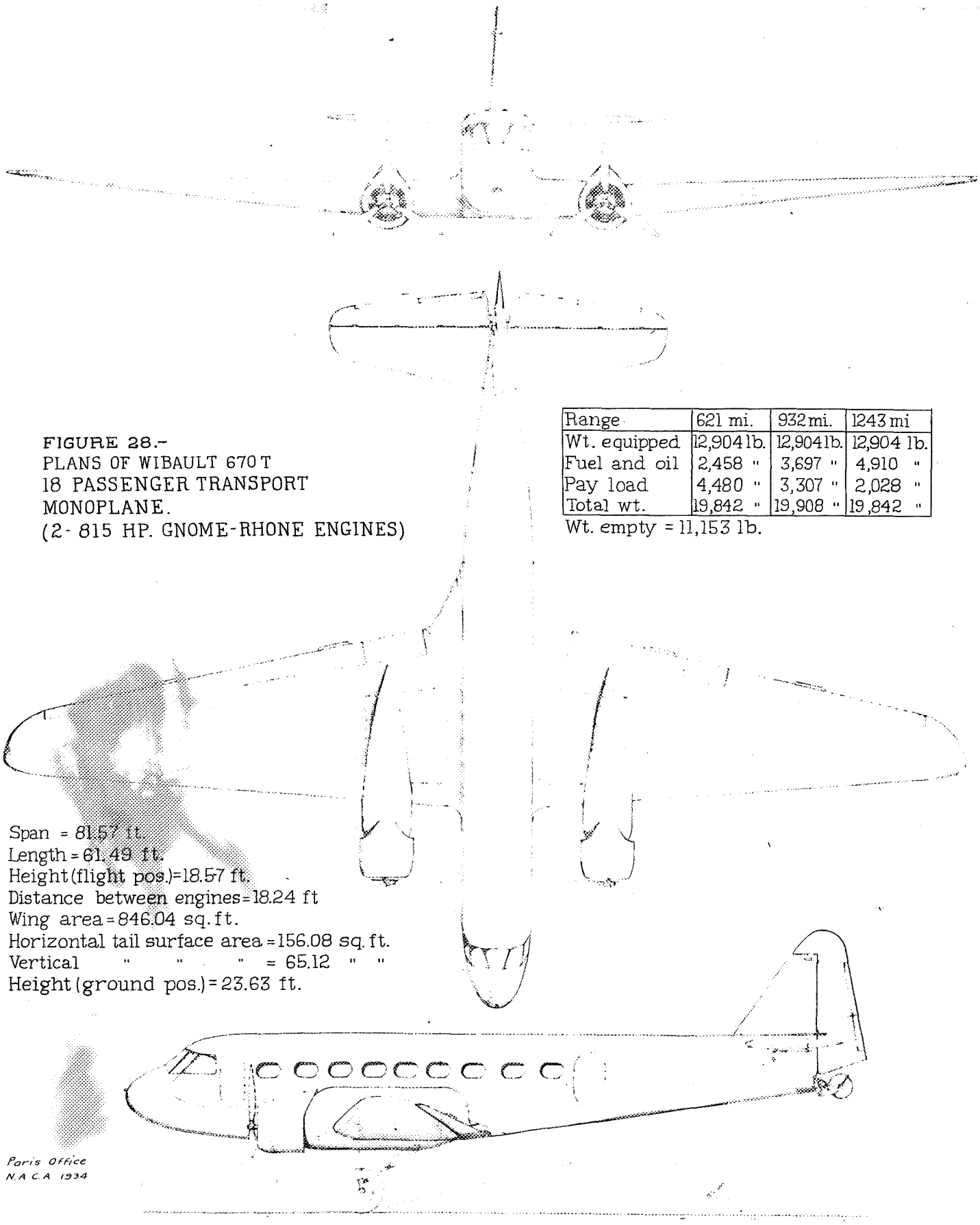


Figure 27.-Breguet 46 T low wing transport monoplane. (Two Mistral Major engines)



Range	621 mi.	932 mi.	1243 mi
Wt. equipped	12,904 lb.	12,904 lb.	12,904 lb.
Fuel and oil	2,458 "	3,697 "	4,910 "
Pay load	4,480 "	3,307 "	2,028 "
Total wt.	19,842 "	19,908 "	19,842 "

Wt. empty = 11,153 lb.

FIGURE 28.-
PLANS OF WIBAULT 670 T
18 PASSENGER TRANSPORT
MONOPLANE.
(2 - 815 HP. GNOME-RHONE ENGINES)

Span = 81.57 ft.
Length = 61.49 ft.
Height (flight pos.) = 18.57 ft.
Distance between engines = 18.24 ft
Wing area = 846.04 sq. ft.
Horizontal tail surface area = 156.08 sq. ft.
Vertical " " " = 65.12 " "
Height (ground pos.) = 23.63 ft.

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Figure 29.-Bristol 143 F transport monoplane.
(2 Bristol Aquila sleeve-valve engines)

Figure 32.- U.S.S.R. Stal 2 touring monoplane of shot welded stainless steel.

Figure 35.- B.F.W. Me 108 monoplane (225 hp. Hirth engine).

Figure 34.- Stand of U.S.S.R. showing P.5. postal biplane, gondola of stratosphere balloon and wheels of "Maxim Gorky".

Figure 36.- B.F.W. Me 108 monoplane (225 hp. Hirth engine).

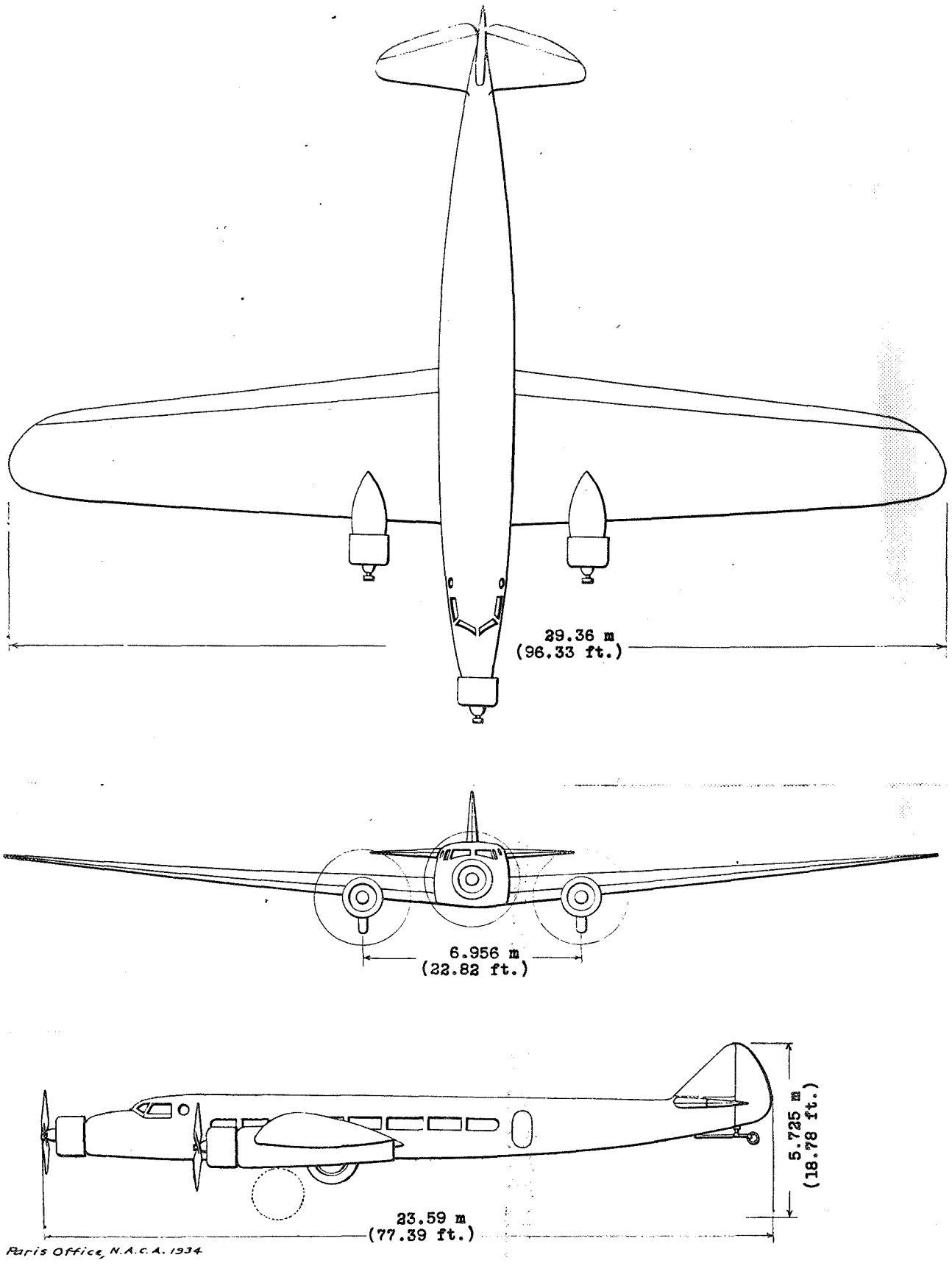

Figure 33.-Dewoitine D.620 30 passenger monoplane.
(Three 800 hp. Gnome-Rhône engines)

Figure 37.- Caudron 530 4 seat touring monoplane. (170 hp. Renault engine)

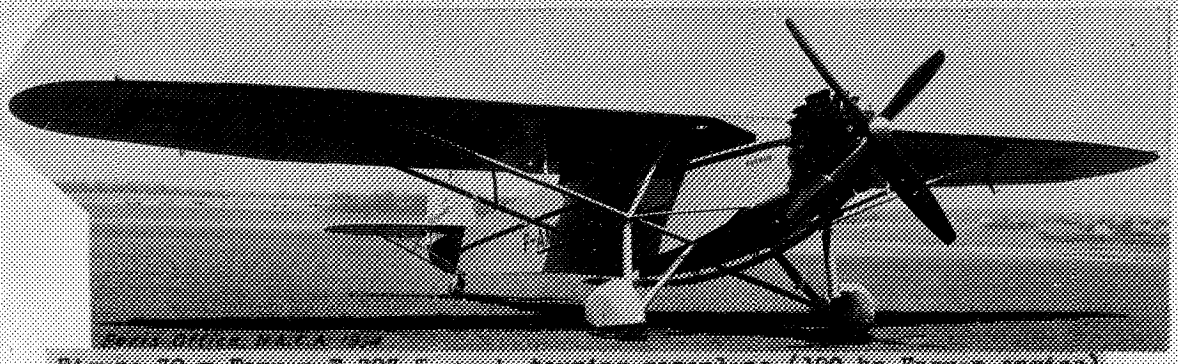

Figure 39.- Farman F 393 5 seat touring monoplane (190 hp.Farman engine)

Figure 40.- Magni "Vale" monoplane (130 hp.Farina engine)

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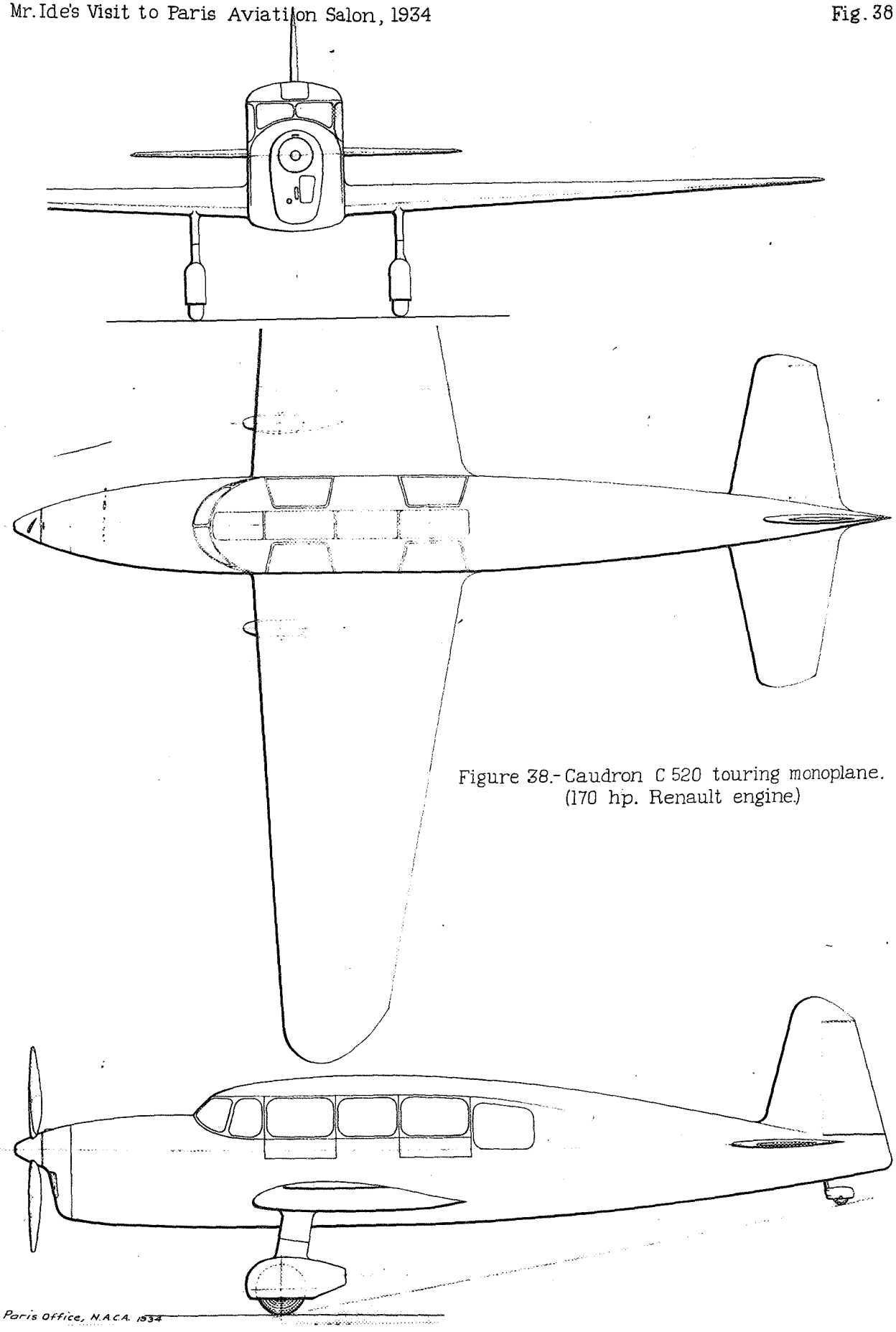

Figure 38.- Caudron C 520 touring monoplane.
(170 hp. Renault engine.)

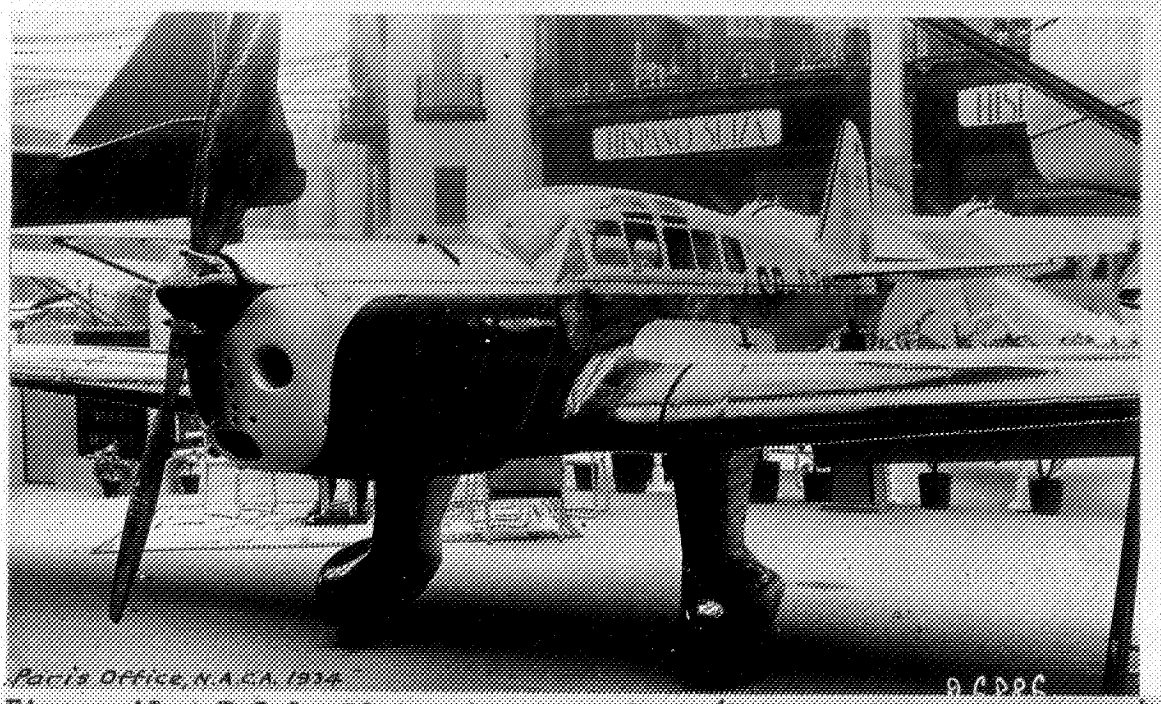

Figure 41.- P.Z.L. 26 touring monoplane (Menasco Bucaneer engine).

Figure 42.- Potez 60 touring monoplane (60 hp. Potez engine).

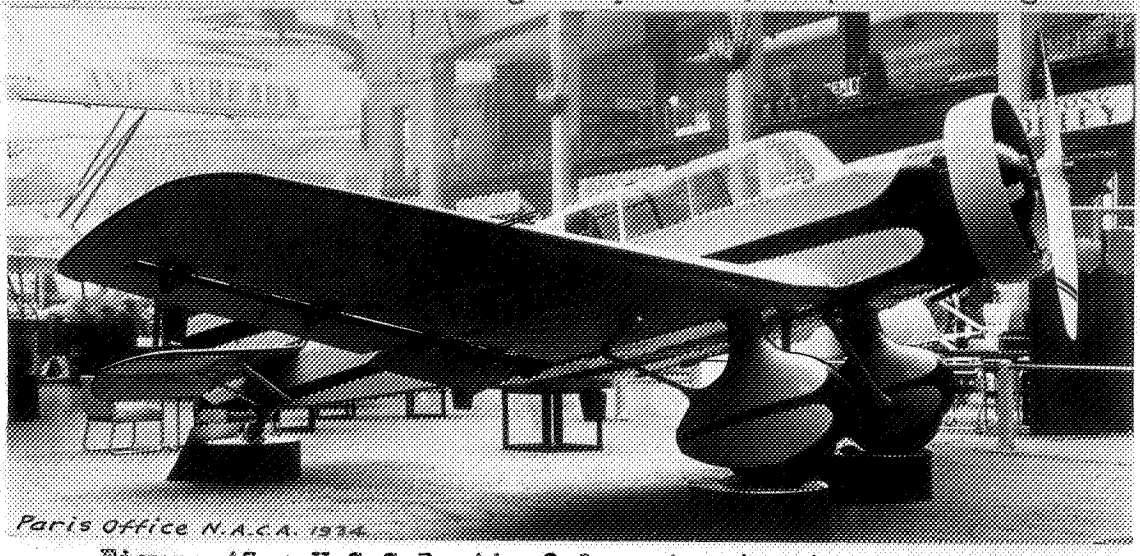

Figure 43.- U.S.S.R. Air 9 low-wing touring monoplane.

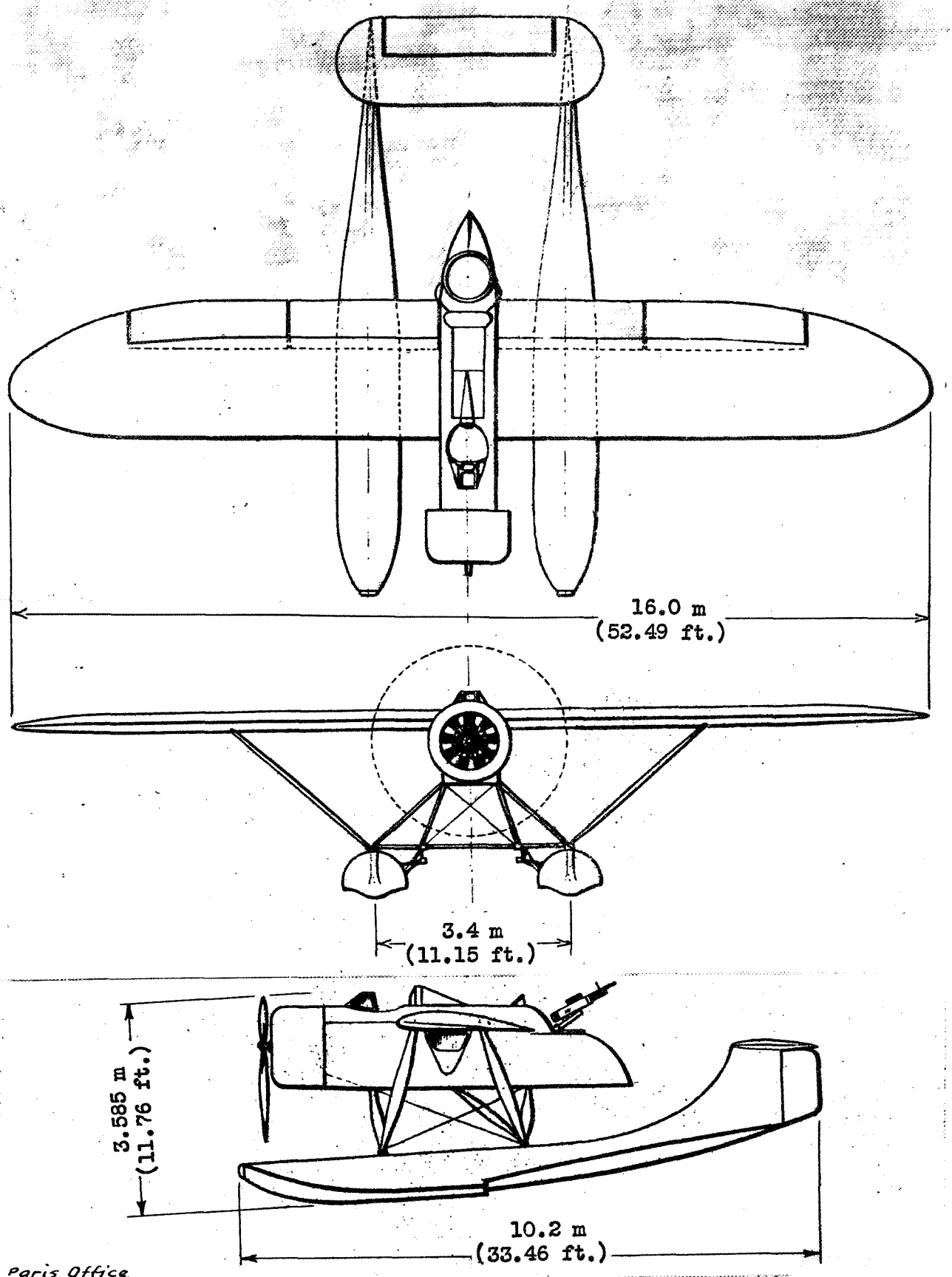

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Figure 44.-Levasseur P.L. 200 observation seaplane.
(750 hp. Hispano-Suiza engine)

Figure 44a.- Levasseur 200 seaplane(750 hp. Hispano-Suiza engine)

Figure 46.- Liore-Olivier H 242 seaplane
(4 Gnome-Rhone 7 Kd engines)

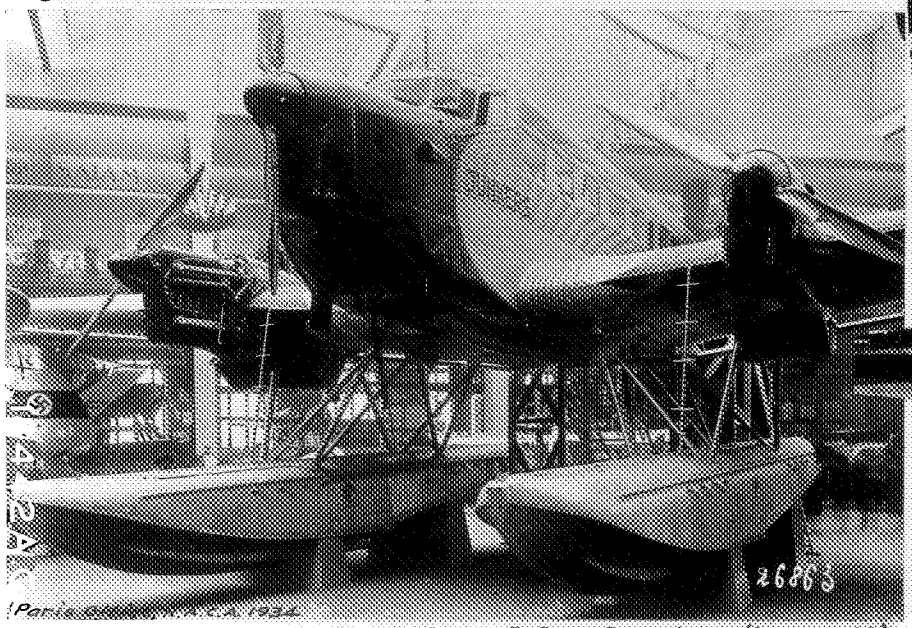


Figure 45.- Junkers Ju 52 seaplane. 3 Juno 5 engines (heavy oil)

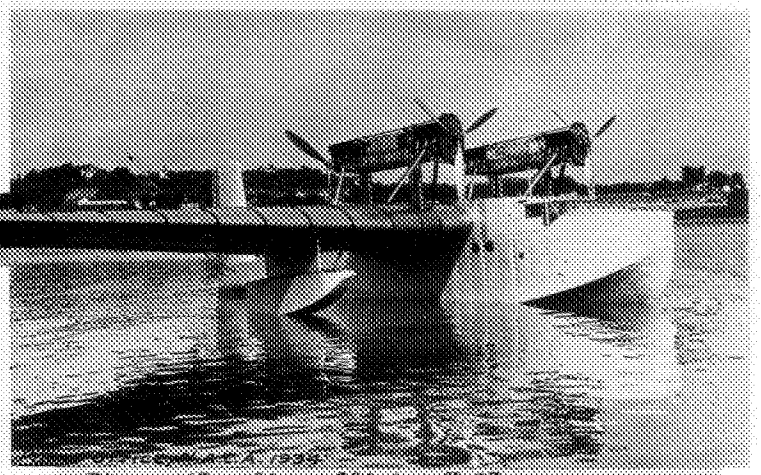


Figure 47.- Liore-Olivier H 27
(4 650 hp.Hispano-Suiza engines)

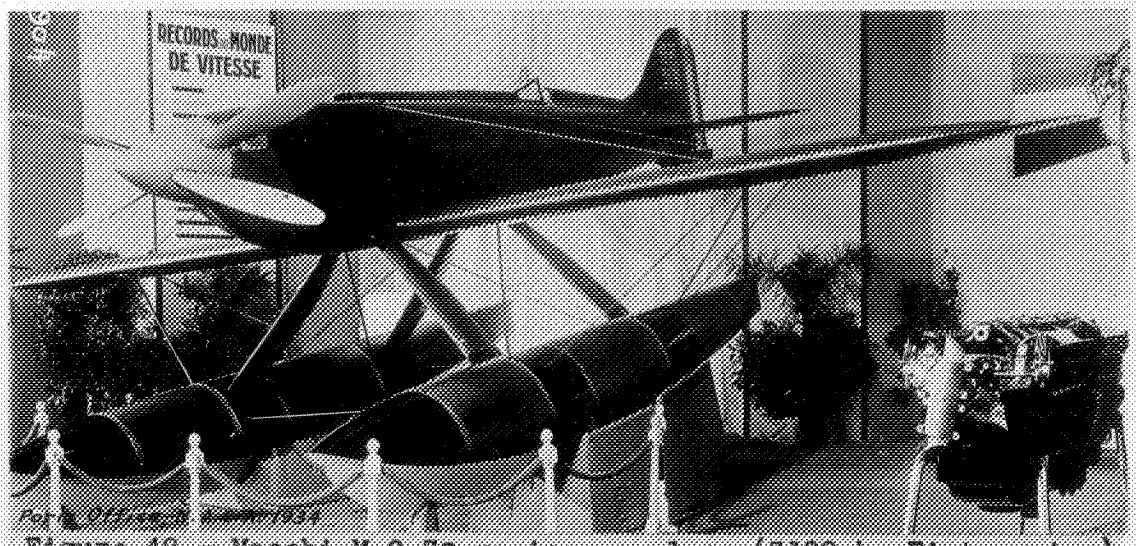


Figure 48.- Macchi M C 72 racing seaplane. (3100 hp. Fiat engine)

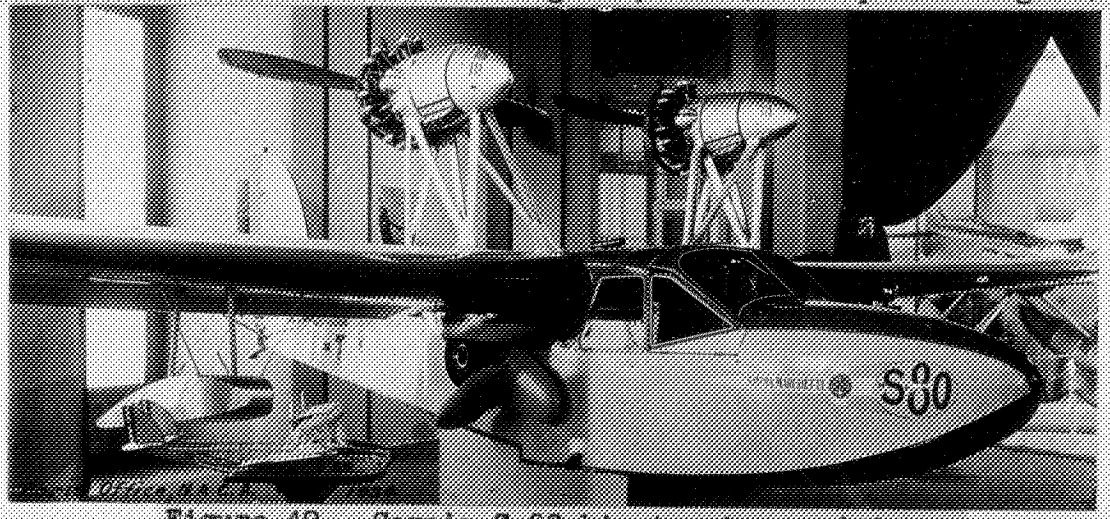


Figure 49.- Savoia S 80 bis touring amphibian.
(Two 75 hp. Pobjoy engines)

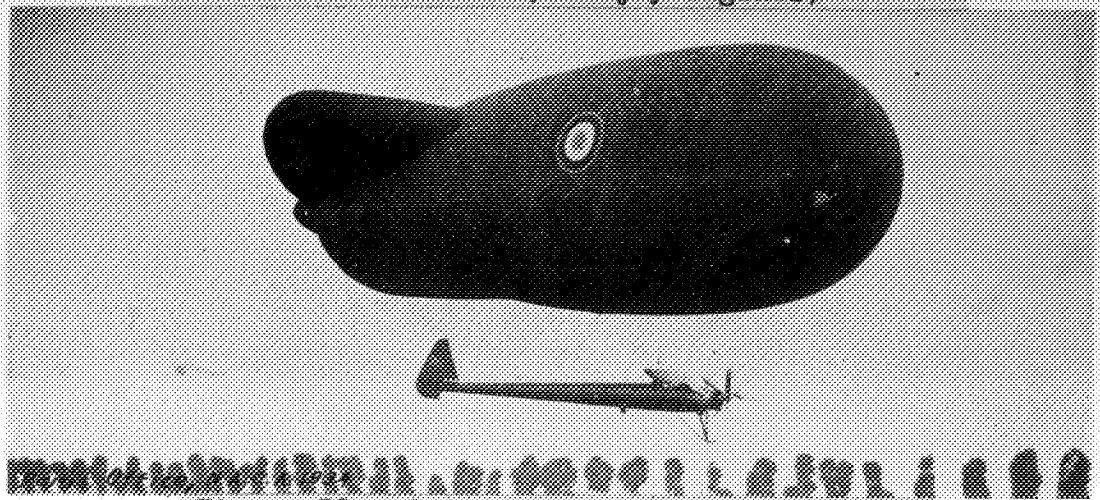
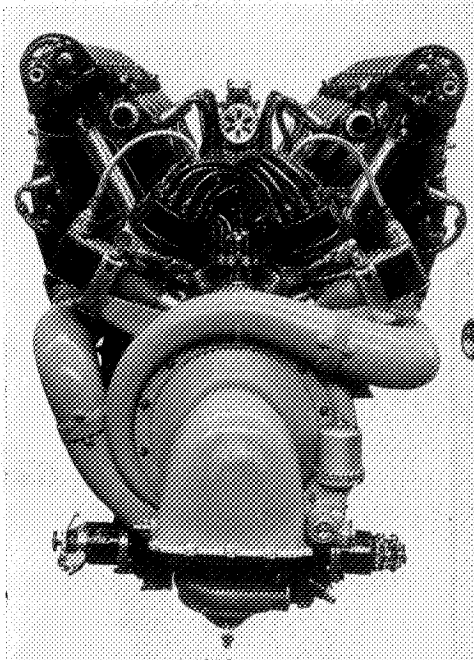
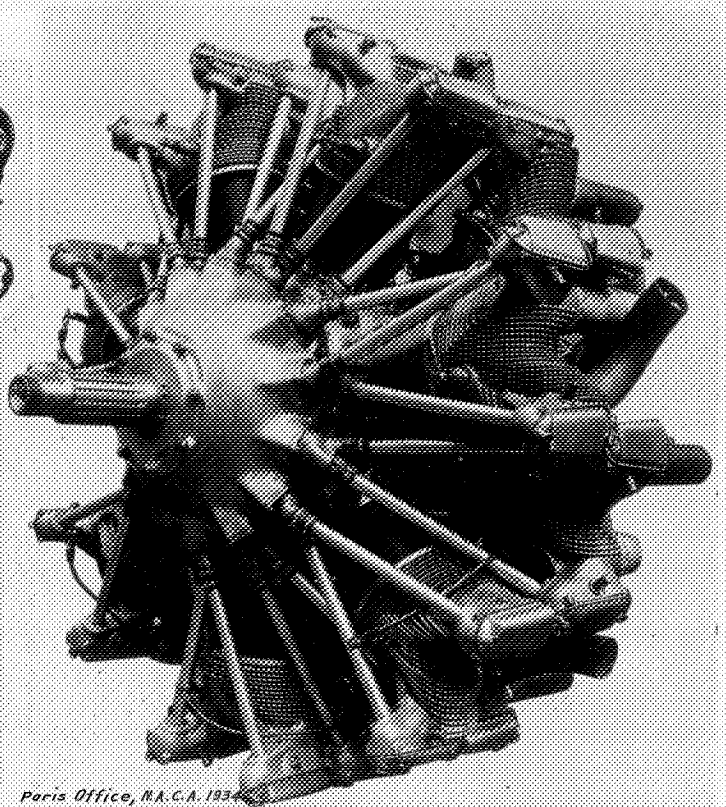


Figure 50.- Zodiac motorized kite balloon.



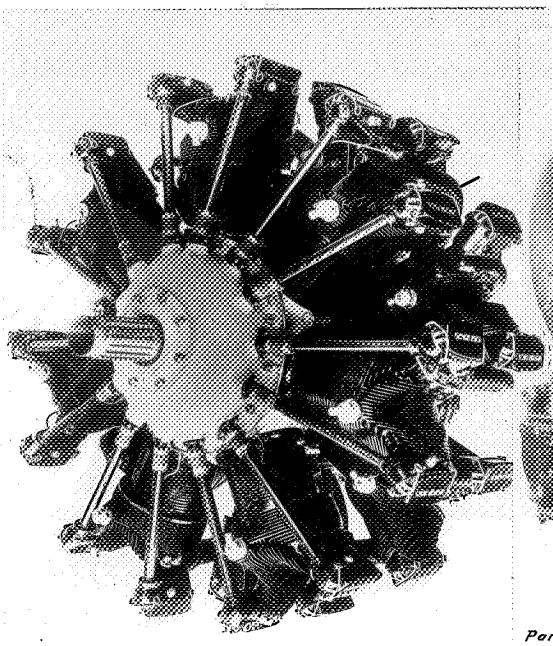
Paris Office, N.A.C.A. 1934

Figure 51.- Hispano-Suiza 12 Ydrs. engine. (860 hp. at 13,120 ft.)



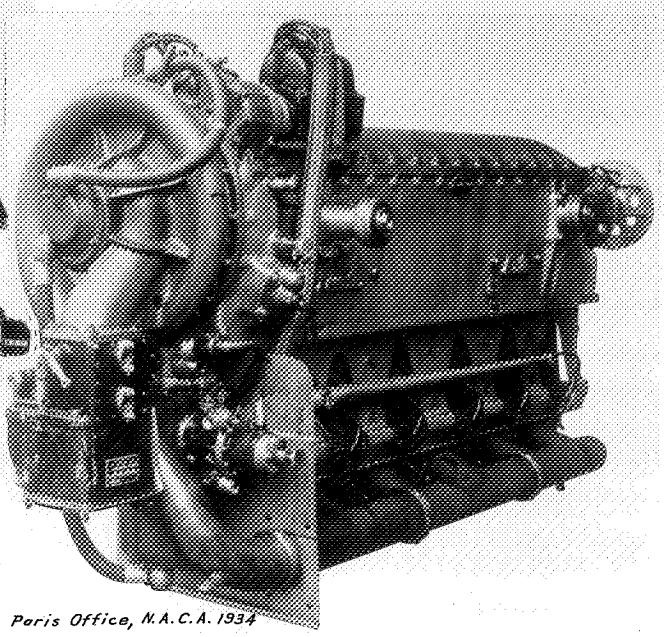
Paris Office, N.A.C.A. 1934

Figure 54.- Renault 14 cylinder radial engine type 14 P A 5. (Rated: 1,000 hp. at 13,120 ft.)



Paris Office, N.A.C.A. 1934

Figure 52.- Hispano-Suiza 14 H A. 14 cylinder engine. (1,000 hp. at 3,280 ft.)



Paris Office, N.A.C.A. 1934

Figure 53.- Renault inverted 6 cylinder 6 Pdis supercharged engine. (220 hp. at 13,120 ft.)

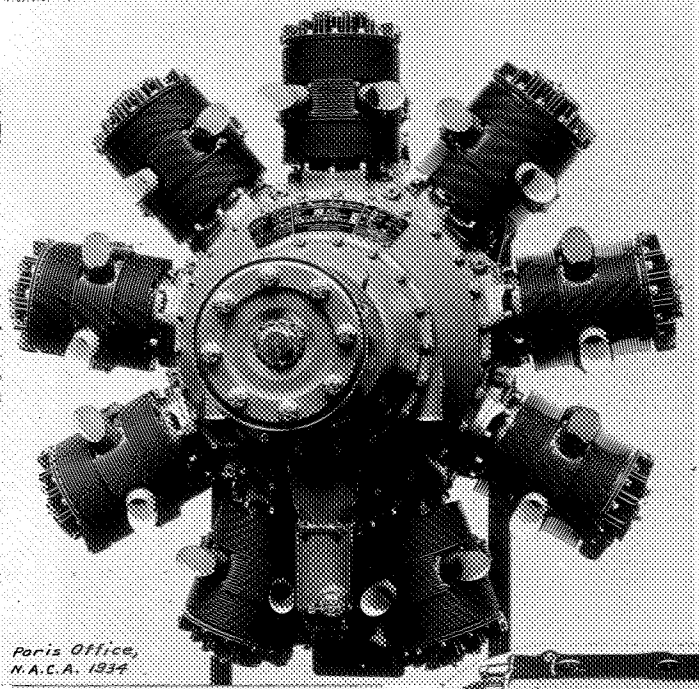


Figure 56.- Bristol Aquila I sleeve valve engine. 15.6 liters (952 cu.in.) capacity. 505 hp. at 2,600 r.p.m. Weight 750 lb.

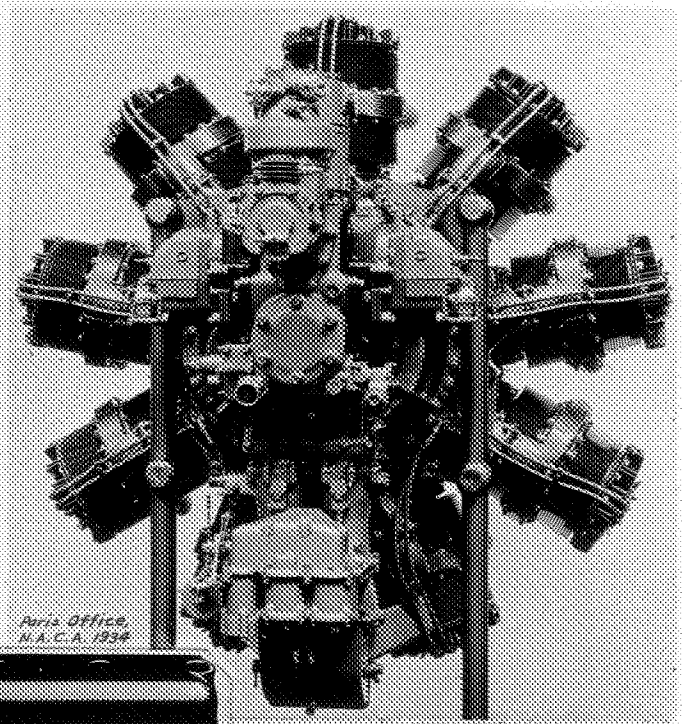


Figure 57.- Bristol Aquila I (Note four point mounting)

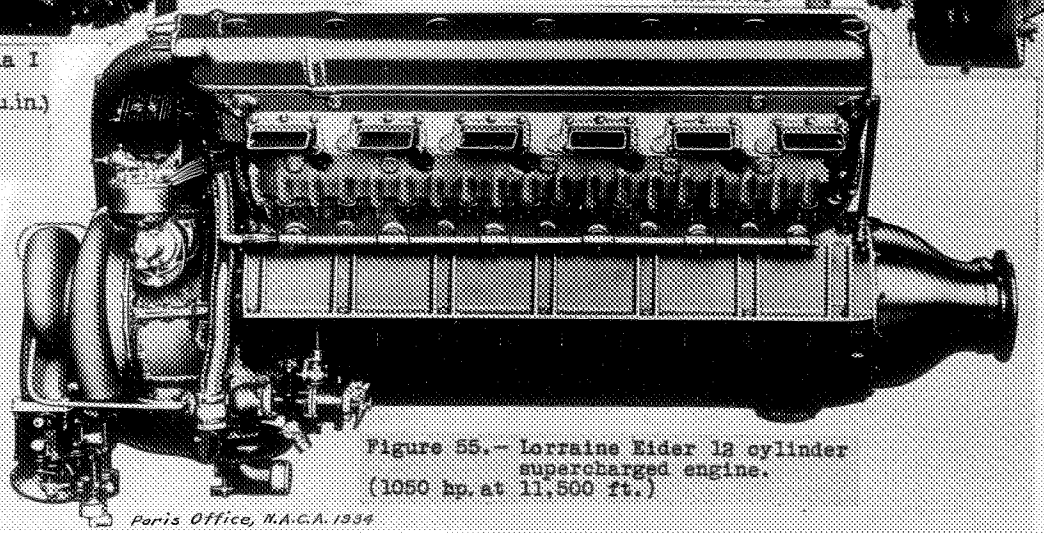


Figure 55.- Lorraine Eider 12 cylinder supercharged engine. (1050 hp. at 11,500 ft.)

Figure 58.- Fiat A 70 S 180 hp. engine.

Figure 59.- Salmson Szydlowski 600 hp. diesel engine. 18 cylinders and 18 pistons but 9 combustion chambers.

Figure 60.- Fauvel "Flying Louse".