AIRCRAFT CIRCULARS

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THE BREGUET 270 GENERAL-PURPOSE MILITARY AIRPLANE (FRENCH)

A Two-Seat All-Steel Sesquiplane

By R. J. De Marolles

From Aircraft Engineering, September, 1930

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THE BREGUET 270 GENERAL-PURPOSE MILITARY AIRPLANE (FRENCH)*

A Two-Seat All-Steel Sesquiplane.

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Constructors of metal airplanes since 1910, Messrs. Breguet have recently turned out a new airplane which represents a complete breakaway from accepted practice.

Basic Principles

Airplanes - especially those of military type - are frequently required to perform different duties, for which different installations are necessary. The idea has been conceived of following motor-car practice in this respect and providing a "chassis," upon which can be installed different "bodies" perfectly independent and each suited to a given use. Furthermore, the orthodox fuselage considerably restricts range of vision and fire for the observer, and it would be advantageous to reduce its dimensions to an absolute minimum.

The accepted principles of construction do not lend themselves readily to practical application of such a scheme. Furthermore, light alloys are not free from criticism when used for structural members. Their mechanical properties are not to be relied upon too strictly. So it was decided to use high-tensile steel for all stressed parts, light alloy being employed

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for secondary members only, such as coverings, cowlings, formers, etc.

The whole structure is rigid, no bracing wires or rods being used, either internally or externally, thus doing away with rigging.

Previous experience having shown that riveting was the best method of assembling parts together, it has been adopted throughout, with the exception of a few bolts in cases where possibility of disassembly was evident. Use of studs, as well as welding, was avoided. All parts are so designed that automatic riveting by machine is possible; the number of rivets being reduced to a minimum by such processes as corrugating of sheet metal, rolling of edges, etc., so that riveted stiffeners could be dispensed with.

In order to obtain the greatest facility for transport, repair, replacements, etc., the whole airplane was designed as an assembly of a few important components, junction being made by standardized pins or bolts. Interchangeability is attained by use of permanent jigs for all subassemblies.

Apart from these general principles, certain other new features were introduced. The landing gear, for instance, is formed of two completely independent wheels without any kind of leg or strut. Ailerons were divided into two portions, one of which is elastically mounted, so as to make uniform the effort required from the pilot and to increase the efficiency at low speeds.

The basic principles outlined above are applied to a series of new experimental airplanes at present under construction at the Breguet factory at Villacoublay. The first type of this series is the Mk. 270 two-seat, general-purpose military airplane, which has already passed the preliminary trial stage and is now in production.

General Design of 270 Type

The Breguet 270 is a two-seat tractor sesquiplane, fitted with an engine of 500 to 600 hp, and suitable for observation, photography, or bombing. Like former Breguet productions, it is a sesquiplane, the lower wing accounting only for 17.6 per cent of the total area (Figs. 1 & 2).

Structurally, the lower wing is the keystone of the whole design, bearing as it does the "backbone" which replaces the orthodox fuselage, as well as the landing gear. The upper wing is supported by struts attached to the tips of the lower wings, and a central cabane; there is no wing bracing of any kind.

The "backbone" is a steel beam of small cross section, attached at its forward end to the central "box," resting direct on the lower wing, to which is bolted the detachable engine unit.

The cockpits form an entirely independent unit superimposed upon the central "box" and forming together with the engine cowling, the "bodywork" of the airplane. Different types of bodies with appropriate equipment are provided according to the use for which the airplane is intended.

The general lines of the airplane are given in Figure 1. Although they are unorthodox, practice has shown that aerodynamic efficiency is as good as with more orthodox design and the military value of the new Breguet is markedly superior to that of any other tractor two-seat airplane, owing to the unusually large range of vision and fire provided for the observer. The view of the pilot is about the same as usual, although it seems the forward and downward sector could be improved upon.

Wing Construction

The lower wing is a one-piece unit of immense strength. It comprises a single spar of box construction, made of steel; the flanges are large drawn plates with reinforcing corrugations, joined by sheet webs stiffened in like manner, as shown in Figures 1, 3 & 8. Internal frames of stamped steel provide for strength. The ribs are of sheet steel with rolled-edge lightening holes, slid on the spar and secured by steel fittings riveted on.

The covering is of duralumin sheet running lengthwise between two adjacent ribs and riveted along the edges of the latter through an interposed duralumin strip of inverted U section.

Attachments for steel fittings at each end of the spar are provided for the wing struts, as shown in Figure 3. The single spar also carries the mounting of the independent wheels of the landing gear.

The gasoline tanks are located inside the lower wing, four being provided: one on each side behind the single spar (openings for the filler caps are visible in Figure 4), while if more fuel is desired, the leading edge on each side is replaced by a tank having the same external shape.

A good idea of what the lower wing looks like is obtained from Figure 4. The photograph was taken with leading edge tanks removed. The span is 7.58 m (24.85 ft.), the maximum chord being 1.416 m (4.65 ft.), and the area 8.75 m^2 (94.2 sq.ft.).

The upper wing is in halves joined on the center line, there being no center section; its span is 17.012 m (56.9 ft.) and the maximum chord 2.585 m (8.5 ft.), giving an area of 40.92 m^2 (441 sq.ft.), and bringing the total lifting area to 49.67 m^2 (535.2 sq.ft.). Two identical steel spars of I section are used, the flanges being butterfly drawn profiles and the webs corrugated sheet steel. Internal bracing is rigid, without compression tubes, except where struts meet the spars. Bracing members are made of two channel steel profiles riveted together back to back and disposed at right angles, as shown in Figure 5. A third duralumin false spar is used for aileron anchorage.

Ribs are made of stamped sheet, with lightening holes and stiffening corrugations; ordinary ribs are of duralumin, while master ribs of steel are provided at intervals. Each rib is made in three sections, one for the leading edge, one between the spars, and the third up to the aileron spar - except for the tip ribs which are continuous.

The covering is of duralumin sheet, divided into panels, as shown in Figure 6. Each panel, provided with two longitudinal corrugations, is further stiffened by transverse lengths of duralumin angles riveted on the inside. The leading edge covering is quite independent of the rest of the wing and may be removed separately.

The ailerons extend the whole span of the upper wing, except at the tip. They are divided in two sections according to a recent Breguet patent and elastically mounted. The hinges correspond with the master steel ribs of the upper wing. The system of control is unusual, through pinion and toothed rods.

The inner ends of the upper wing spars are joined by two pins each to a substantial steel plate fitting rigidly fastened to the cabane struts.

The wing struts are of peculiar design. There is one pair of struts on each side, disposed V fashion. The front strut is nearly vertical and runs from the front upper spar to the single lower spar; its attachment to the former is shown in Figure 7. The rear strut is similarly attached to the rear upper spar, but its lower end does not meet the single lower spar, being pin-jointed to the front strut some distance above the lower end of the latter through an eccentric device shown in Figures

8 and 9. Adjustment of the upper wing incidence is thus very easy by means of a special spanner. There is no other rigging system of any kind for the whole cell, all other attachments being rigid. The wing struts are made of two half-shells of stamped steel, the edges of which are riveted together, with an inner stiffening plate, and reinforcing plates near the ends.

The tail surfaces are very similar in construction; the fin being attached to the backbone and the horizontal stabilizer inserted and bolted to it. The elevator is in one piece, the rudder being placed above. All tail surfaces are pure cantilever.

The "Backbone"

The very distinctive structure replacing the fuselage is made of two distinct parts; the "central box" and the "tail boom," both shown in Figure 10.

The former is a triangulated structure of steel sections replacing the usual forward fuselage portion. It receives the detachable engine unit at its front end and supports the cabane attached to its upper members. This "central box" rests directly on the single spar of the lower wing, filling the gap seen in Figures 3 & 4.

Behind the "central box," there is no more lattice work, but only a single steel spar of strikingly slender appearance. It is, however, in fact strong enough as its construction is exactly similar to that of the single spar of the lower wing, with the exception of the side members which are not corrugated but plain, though stiffened by channel sections riveted externally. The forward end of the tail boom is attached to the rear of the central box by means of a heavy triangular frame of stamped steel with three-point connection, as shown in Figure 11. Anchorage is completed by a diagonal member in the form of a U-shaped steel frame, the base of which is bolted to the upper flange of the tail boom, while the upper ends are fastened to the rear of the central box's upper longerons. The rear end of the tail boom supports the stabilizing surfaces and the skid, which is to be replaced in production models by a small swiveling wheel.

This system of a tail boom provides a particularly neat solution for the problem of pilot's controls. As clearly shown in Figure 11, the control column is mounted directly on a support anchored to the upper flange, all connections with the movable surfaces being concealed inside the spar. The rudder bar is replaced by two pedals very conveniently pivoted, one on each side of the spar. All connections with the tail surfaces and ailerons are rigid, of course, and provided with Tecalemit greasers. Dual control is fitted, the observer's stick being removable. Incidentally, it is interesting to mention that the use of tubes has been carefully avoided as far as possible in the whole construction; the sticks, for instance, are made of two stamped-steel halves riveted together. A loop handle is provided for the pilot, with the front machine gun's trigger at its center. A compensating device, allowing the pilot to release the column in any position, is provided by an elastic cord, the tension of which is governed by a small knurled knob below, and in front of, the loop handle.

This constitutes the complete structure of the fuselage, the remainder being pure bodywork. It is interesting to note that the parallel with the motor car is exact, for the controls are incorporated in the tail boom much in the same way as the driving wheel is part of a car chassis, the seat being in both cases part of the body.

Landing Gear

There are no legs or struts and, of course, no axle, in the landing gear. In front of the lower wing spar is attached on each side, at a distance of 1.76 m (5.78 ft.) from the longitudinal axis of the airplane, a strong bracket somewhat similar to the head lug of a motorcycle, which receives the upper end of a fork supporting the wheel, incorporating a special Breguet oleo pneumatic shock absorber of patented design (Fig. 3). A peg protruding through a slot in the casing prevents any rotating movement of the whole system (Fig. 12).

The fork is made of riveted steel pressings; the wheel being of a special type evolved by Messrs. Breguet. As can be gathered from Figure 13, it comprises a duralumin rim and a peculiar type of hub formed of two "Alpax" halves, the whole being secured by bolts and readily demountable. Internal brakes are fitted, with hydraulic control. The rim size is 19 mm by $3\frac{1}{2}$ mm, shod with 800 mm by 175 mm (31.5 in. by 6.9 in.) tires. The wheel is almost completely enclosed by a streamline "trouser" (Fig. 3).

This system of landing gear proved ideal under actual experience; the large track, 3.52 m (11.56 ft.), making it almost impossible for a wing tip to touch the ground, while air resistance is reduced to a minimum and there is no low member likely to hit some obstacle on the ground. The Breguet oleo pneumatic shock absorber, with its 120 mm (4.72 in.) travel, adequately deals with all landing impacts.

Engine Units

The Breguet 270 is designed to receive any engine from 500 to 650 hp. The engine mounting is very simple and consists of steel profiles giving remarkable accessibility to all parts requiring attention. It is secured to the forward portion of the "central box" by four pins, making its replacement a matter of minutes only (Fig. 15). The cowling is provided with horizontal hinges like the bonnet of a car, enabling instant access to be gained, a feature long overdue in the airplane field. The cowling immediately behind the propeller acts as an oil tank and cooler; the water radiator is mounted below the engine. It is of the honeycomb pattern and rigidly mounted, cooling being regulated by shutters fitted in the cowling in front of the radiator, as can be seen in Figure 14. All three air intakes are mounted on the same horizontal line; short exhaust stacks are provided, although some airplanes have special silencers for night work.

The propeller is a Breguet Series 7 duralumin propeller, machined from solid. Its mounting is peculiar, no hub being used. The propeller has four integral "ears" corresponding to the four arms of a small boss keyed to the engine shaft.

As already indicated, the gasoline tanks are located inside the lower wing. These are of duralumin with fireproof covering; they are droppable in flight. There are normally two tanks behind the single lower spar, the total capacity being 325 liters (85.9 gallons). If more fuel is required, two additional leading-edge tanks are provided, giving an extra 145 liters (38.3 gal.), and bringing the total capacity up to 470 liters (124.2 gal.). Fuel is supplied to the carburetors by two independent engine-driven self-regulating pumps.

Engine controls, again, are not of the orthodox type. Instead of the usual levers, push-and-pull knobs are provided, mounted at the end of sliding tubes protruding through the instrument panel.

C o c k p i t s

The body housing the pilot and observer's cockpits is a light duralumin structure easily demountable as a unit. It is unusually well-designed from the practical point of view. Access to both cockpits is gained through doors - a feature not generally associated with military airplanes (Fig. 16). Each door, three in all, is so mounted that it can be instantly dropped in flight by merely knocking a lever, making a parachute jump easy in all circumstances for the pilot as well as for the observer.

The pilot's cockpit is exceptionally roomy and comfortable; in fact, it appears too wide, which necessitates a fairly big movement of the head to obtain a good view downwards. All instruments are conveniently placed and the generous curved windshield affords protection in the worst weather. Padded armrests are provided.

The observer, who is also provided with a windshield, has a phenomenal range of vision, thanks to the complete suppression of the usual fuselage. A particularly ingenious camera mounting is installed in front, which, coupled with sliding apertures in the bodywork, allows of photographs being conveniently taken vertically as well as obliquely (Fig. 16).

General Characteristics

The Breguet 270 sesquiplane may be fitted with any engine from 500 to 650 horsepower. The data below refer to the airplane equipped as an observation two-seater with 500 hp Hispano-Suiza Mk. 12 Hb.

Span, upper	17.012 m	56.9 ft.
" lower	7.580 "	24.85 "
Length	9.760 "	32.00 "
Height	3.582 "	11.75 "
Gap	1.950 "	6.4 "
Maximum chord, upper	2.585 "	8.5 "
" " lower	1.416 "	4.65 "
Area, upper	40.92 m²	441 sq.ft.
" lower	8.75 "	94.2 "
Total area	49.67 "	535.2 "
Wheel track	3.52 m	11.55 ft.
Weight, empty (including all fixed equipment and 25 kg (55 lb.) of silencer)	1756 kg	3865 lb.
Disposable load	382 "	841 "
Fuel	255 "	562 "
Total load	637 "	1403 "
Total weight loaded	2393 "	5268 "
Weight per horsepower	4.78 kg/hp	10.53 lb./hp
Weight per unit of area	48 kg/m²	9.9 lb./sq.ft.

Load factors (C.I.N.A. requirements).

For normal C. of A.	7.35
For aerobatic C. of A.	8.35
Actual load factors	9.32 (obtained by actual static test)

Performance

The following figures are actual performances, figures resulting from official flight tests, corrected to standard atmosphere, with 500 hp Hispano-Suiza engine. Total weight, 2393 kg (5268 lb.) with full equipment (silencer, 600 w. fan-driven electric generator, twin M.G. on rear ring, navigation lights, external course indicator, radio antenna's tube; rear windshield closed).

Altitude	Speed	Climb
Sea level	216.5 k.p.h. (134.5 m.p.h.)	-
1000 m (3281 ft.)	228.0 " (141.6 ")	3 min. 9 sec.
2000 " (6562 ")	230.5 " (143.2 ")	6 " 10 "
3000 " (9842 ")	227.0 " (141.0 ")	9 " 52 "
4000 "(13123 ")	221.5 " (137.5 ")	14 " 16 "
5000 "(16404 ")	214.0 " (133.0 ")	20 " 23 "
6000 "(19685 ")	205.0 " (127.2 ")	29 " 16 "

(Engine rated below 1300 m (4265 ft.)

Maximum speed at sea level (at max. permissible r.p.m. - 2000)	236.5 k.p.h.	148 m.p.h.
Minimum speed at sea level	91.0 "	56.5 "
Absolute ceiling	7900 m	25919 ft.
Landing run, without brakes	180 "	590 "
" " with brakes	75 "	246 "
Take-off (without brakes)	95-100 "	312-328 "
Take-off with use of brakes was not officially measured; the distance was about	20 m	66 ft.

Span:-
Upper and Lower wings. 17.012 m (56.9 ft.) 7.58 m (24.85 ft.)
Length 9.76 m (32.0 ft.)
Height 3.582 m (11.75 ft.)

Total wing area:- 49.67 m^2 (535.2 sq.ft.)

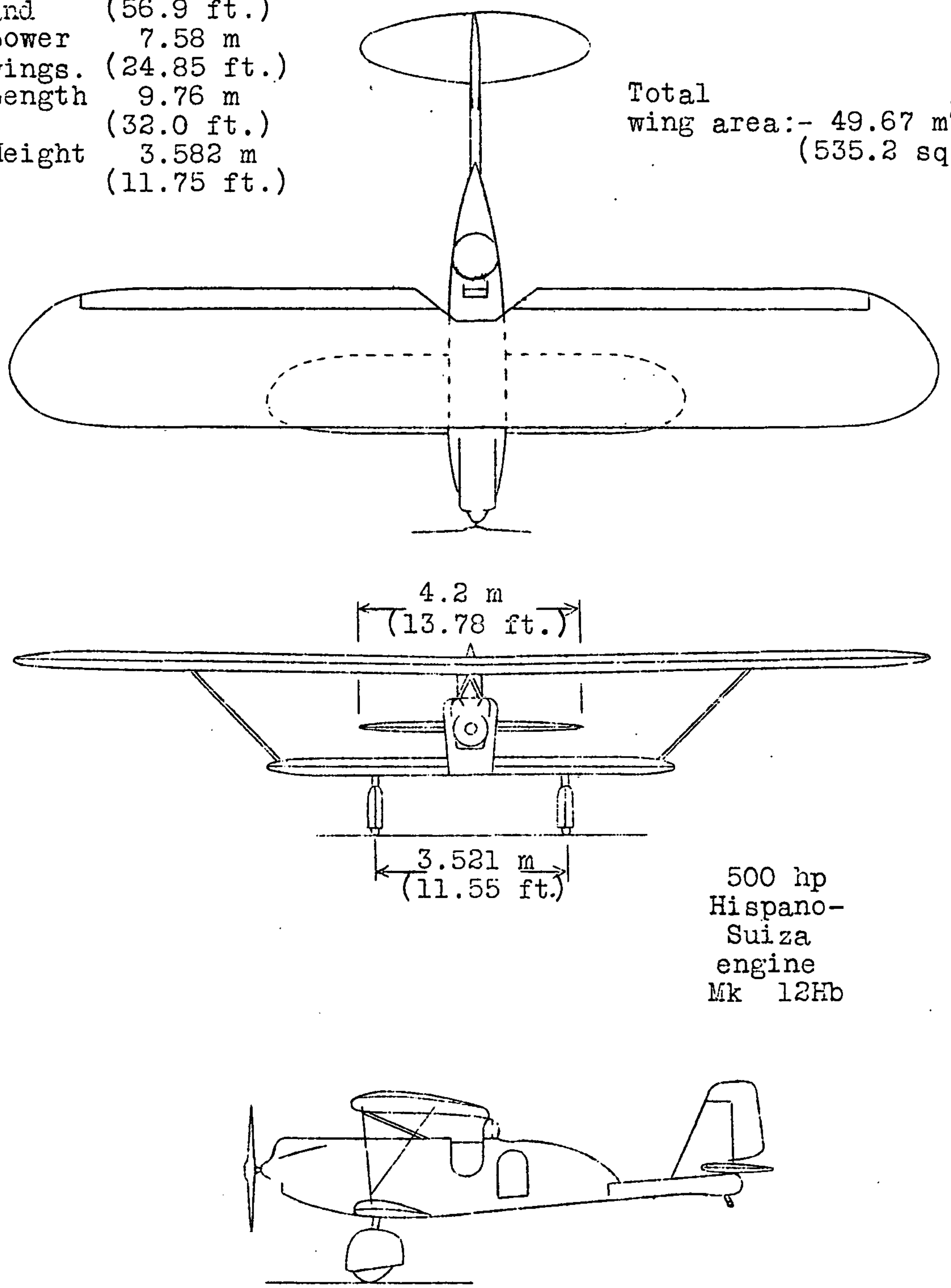


Fig.1 General arrangement drawings of the Breguet 270 airplane.

Fig.2

Fig.4

Fig.3

Fig.7

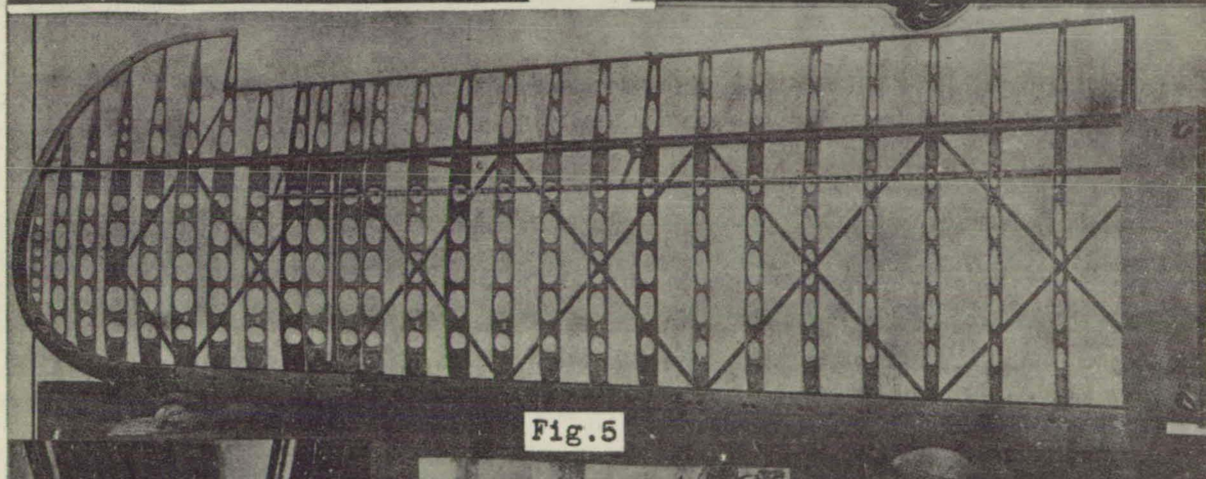


Fig.5

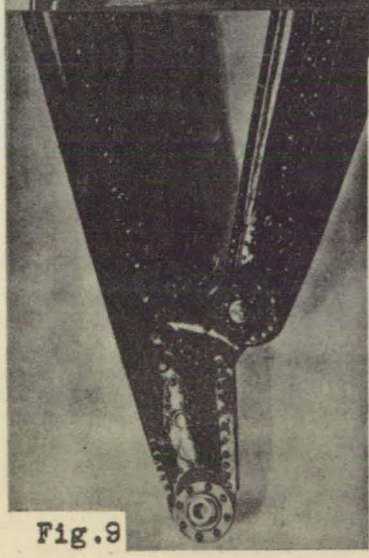


Fig.9

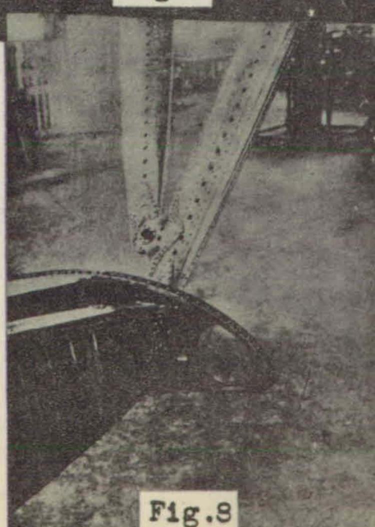


Fig.8

Fig.6

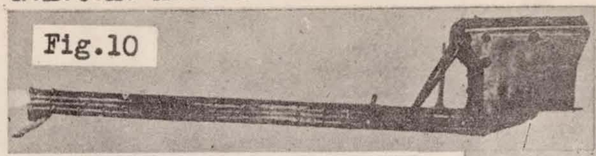


Fig.10

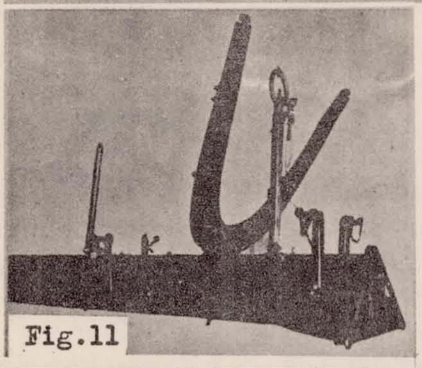
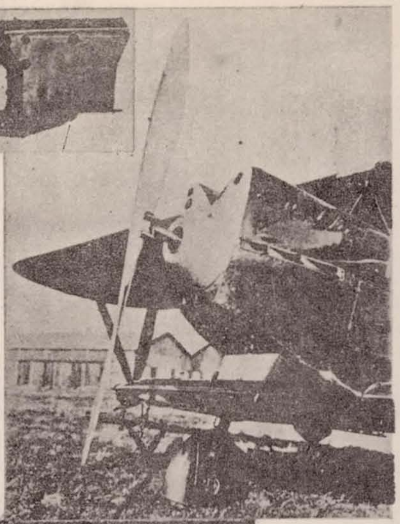


Fig.11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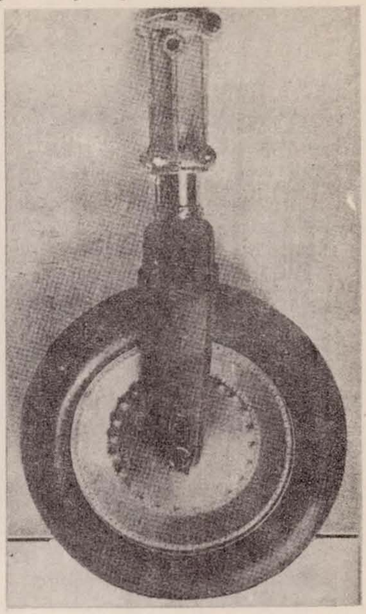
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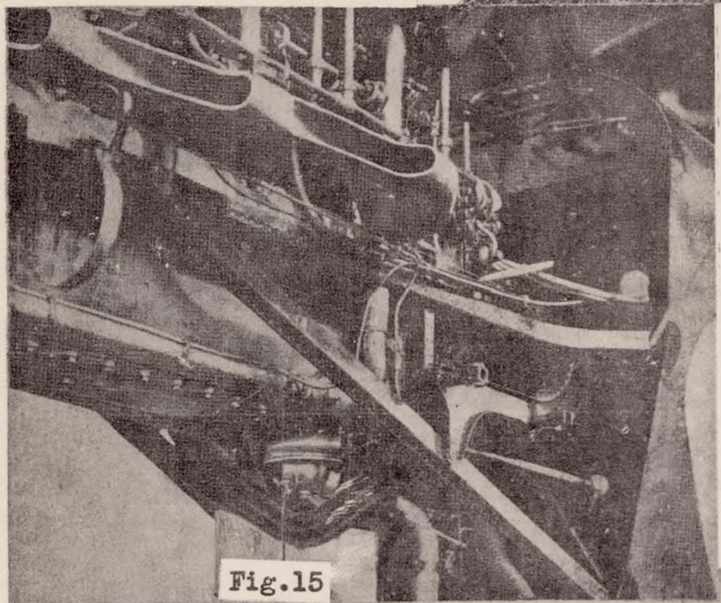
Fig.15

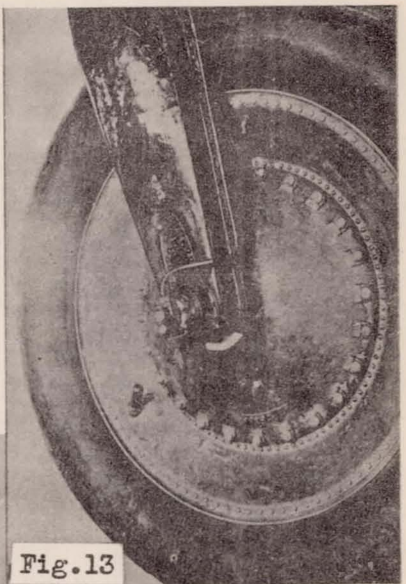
Fig.13


Fig.16