AIRCRAFT CIRCULARS

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

No. 134

THE AMIOT 140 M MILITARY AIRPLANE (FRENCH)

An All-Metal Multiplace High-Wing Monoplane

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THE AMIOT 140 M MILITARY AIRPLANE (FRENCH)*

An All-Metal Multiplace High-Wing Monoplane

The Amiot 140 M is the first of a series of airplanes which the S.E.C.M. (Société d'Etudes et de Constructions Mécaniques) has been developing for over three years (Figs. 1 & 22).

This airplane has a fineness of nearly 13, notwithstanding the fact that its military equipment necessitated a fuselage 2 m (6.56 ft.) high and despite the drag from the projecting guns. Its high performances were not attained by reducing the area and loading of the wing, which would have increased the landing speed.

The structural details of the wing are peculiar to the S.E.C.M., namely tubular elements assembled by stamped fittings secured by tubular rivets (Figs. 2 - 14). These devices were subjected to practical endurance tests on the Amiot 120 Bp 3 and were standardized in the new wing structures.

The wing (Fig. 15) has three spars which form a central box, to which the leading and trailing edges are attached. The sheet-metal covering (Figs. 11 & 12) is attached in panels, which can be easily removed and are subjected only to recoil

*From L'Aéronautique, December, 1930, pp. 480-484.

and torsional stresses. Preliminary tests showed that it was impossible for the covering to withstand compression stresses of the order of 100 metric tons without greatly increasing the weight of the airplane.

This three-spar system has been found advantageous for withstanding torsional stresses and preventing vibration, by giving the wing good torsional rigidity.

Of course, larger airplanes with cantilever wings having an area of 300 to 400 m² (3229 to 4306 sq.ft.) would probably need a larger number of spars, while smaller airplanes with a lower diving speed than the 140 M might require only two spars.

Transverse frames of duralumin tubing with stamped fittings are mounted at intervals of about 1.2 m (3.9 ft.) throughout the span (Fig. 15). All the joints are assembled with the same tools, although the angles vary for the different frames. Figures 4 to 7 show that the diagonals are attached by pin-jointed sockets, while the crosspieces are assembled by special connections which can be adjusted about the center of the spar and which differ only in their perforations.

After the transverse frames have been put in place on a support, the spars are then mounted, an operation facilitated by the fact that the tops of the connections were not riveted when the frames were mounted. The fittings are attached to the spars by tubular rivets by a special machine which presents the rivets on the inside. In like manner one rivets the "tulips" or removable connections (Figs. 4 - 6), which are joined together by eight bolts of special steel.

The diagonals, ending in stamped sockets, are then mounted, thus completing the wing structure. Although it may seem strange, numerous tests have shown that these diagonals are not subjected to torsional stresses in the covered wing, their special function being to transmit stresses from one part to another in case of rupture.

The covering panels (Fig. 11) are made separately. They consist of sheet duralumin with very narrow corrugations (5 mm or 0.2 in.). Their thickness varies from 0.5 mm (0.02 in.) at the fuselage to 0.35 mm (0.014 in.) at the wing tips. The corrugated plates are mounted on a latticework of closed U sections at sufficiently short intervals to afford the desired rigidity. The panels are attached to the wing structure by means of duralumin clamps or clips (Fig. 12) which encircle the spars and crosspieces. A centering stud in each clip insures the transmission of the stresses from the panel to the spar.

The leading and trailing edges are made from sheet duralumin 0.25 mm (0.01 in.) thick, in exactly the same manner as the wing panels, and are attached to the central portion of the wing by bolts. They do not participate in the recoil or torsional stresses, but simply transmit the aerodynamic stresses to the central box.

This subdivision of the wing facilitates construction, the manufacture of the panels being similar to covering with fabric, thus constituting work which can be done by women. It also facilitates repairs on military airplanes damaged in action. Moreover, it facilitates transportation by rail, because the wing can be reduced to very small elements by removing the leading and trailing edges and separating each half into three sections.

The cabane is imbedded in the fuselage (Fig. 2), to which it is permanently attached. It is only the continuation of the three wing spars, to which each half-wing is attached by six "tulip" connections.

The narrow ailerons cover the tapering portions of the wing, the ailerons themselves tapering toward the fuselage. Each aileron is controlled at two points by rigid rods.

The metal fuselage is of the shell type with transverse frames and longitudinal stringers constructed of closed U sections (Fig. 3). The frames are so designed that they can all be made with the same tools. The fittings are alike for all the frames. The covering consists of 0.5 mm (0.02 in.) sheet duralumin supported by latticework. The fuselage consists of two separable parts joined at the top of the rear cockpit.

Each engine bearer (Figs. 13 & 14) is attached to the wing structure by four bolts. A special easily transportable frame can be attached to the wing, by means of which an engine can be quickly replaced without any external staging.

The landing gear (Figs. 16 & 17) consists of two faired V struts carrying short wheel axles. The vertical struts carry Messier shock absorbers. All the attachments are ball-and-socket joints. The wheels are cowled and provided with hydraulic brakes.

The elevator and ailerons are operated by a control column with a wheel. The fore-and-aft motions of the column actuate a system of rigid rods extending to the stabilizer. The rotary motion of the wheel is transmitted by chains to the torsional shaft which controls the ailerons. The rudder is operated by easily adjustable pedals, their motion being transmitted to the rudder by a system of rigid rods. Both elevator and rudder are balanced.

The second pilot station is the cockpit of the rear gunner (Fig. 8). It is almost the same as the first pilot station, but has, in addition, a lever for throwing the engine out of gear. The first pilot's cockpit has, on the left, a lever for raising both ailerons simultaneously. This maneuver has a two-fold object: to balance the airplane in normal flight by giving it a tendency to nose up; and to reduce the stresses on the wing in diving at over 300 km/h (186 mi./hr.).

All the tail surfaces are cantilever. The stabilizer is attached by four bolts (two for each spar) to the transverse frames of the fuselage (Figs. 18, 19, 20 & 21). The rear attachments are adjustable and enable changing the angle of setting while on the ground. The angle between the longitudinal axis of the stabilizer and the upper longeron of the fuselage can be varied from 0.5 to 1.5°.

Characteristics

Span		24.46 m		80.25 ft.
Total length		16.99 "		55.74 "
Height		5.3 "		17.39 "
Wing area		100 m^2		1076.39 sq.ft.
Weight empty		4220 kg		9303.5 lb.
Fuel	690 kg		1521.2 lb.	
Equipment	315 "		694.5 "	
Crew & mil. load	465 "		1025.2 "	
Useful load		1470 "		3240.8 "
Total weight		5690 "		12544.3 "
Wing loading		56.9 kg/m^2		11.65 lb./sq.ft.
Power loading		4.1 kg/hp		8.92 lb./hp

The Amiot 140 M is equipped with two 700 hp Lorraine "Orion" engines.

Performances

The performances, estimated from wind-tunnel tests for a total weight of 5690 kg (12544 lb.) and a wing area of 100 m² (1076.39 sq.ft.), are:

Speed at ground level	242 km/h	150.4 mi./hr.
" " 2000 m (6560 ft.)	240 "	149.1 "
" " 5000 " (16400 ")	235 "	146.0 "
Landing speed (full load)	85 "	52.8 "
Ceiling	8000 m	26240 ft.
Climb to 1000 m (3280 ft.)	2 min. 2 sec.	
" " 4000 " (13120 ")	15 "	
" " 5000 " (16400 ")	17 " 3 "	
Flight range	800 km	497 mi.

Translation by Dwight M. Miner,
National Advisory Committee
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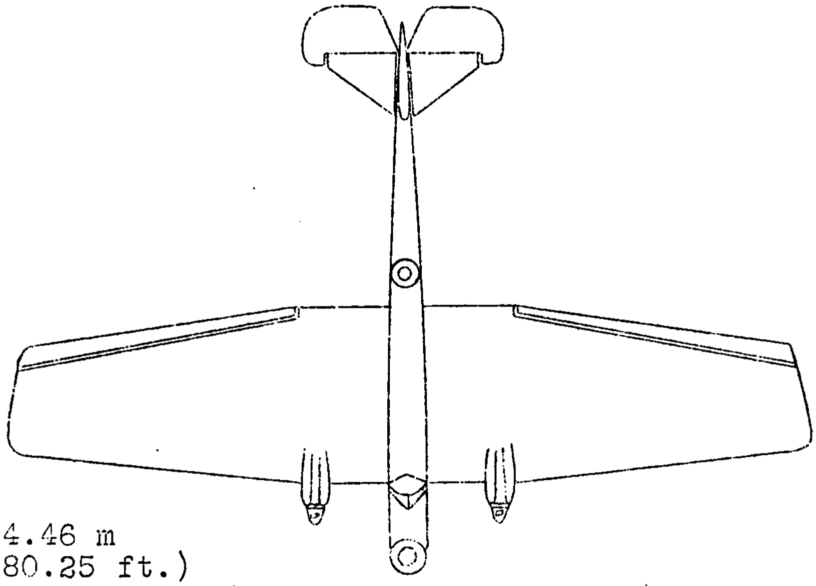
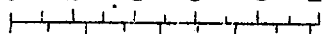
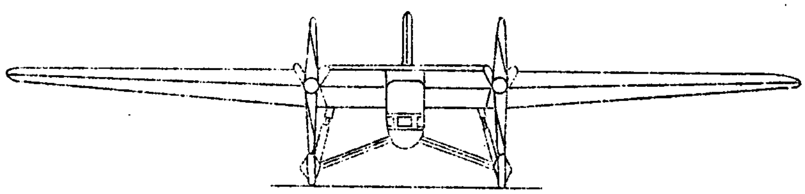


Span 24.46 m (80.25 ft.)
Length 16.99 m (55.74 ft.)
Height 5.3 m (17.39 ft.)
Wing area 100 m² (1076.39 sq.ft.)





Two Lorraine 700 hp "Orion" engines

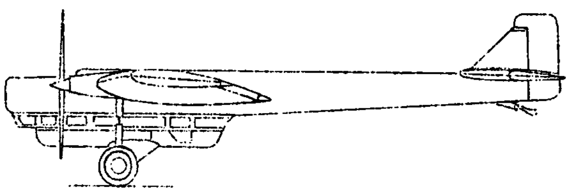


Fig.1 General arrangement drawings of the Amiot 140 M airplane.

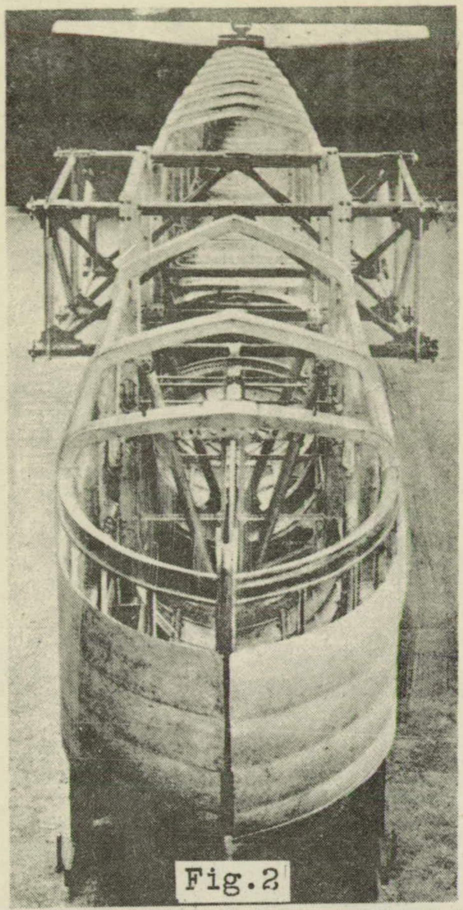


Fig.2

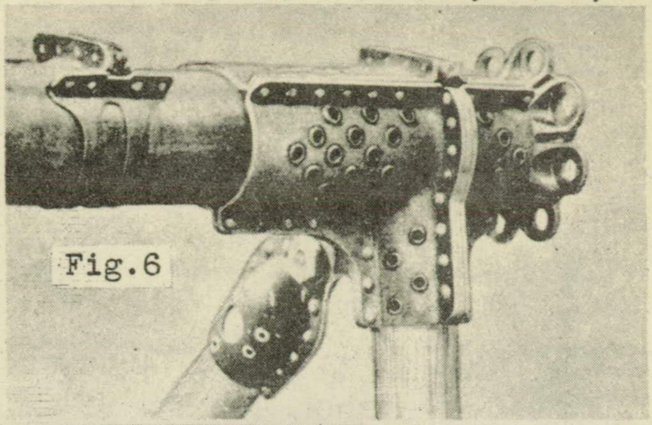


Fig.6

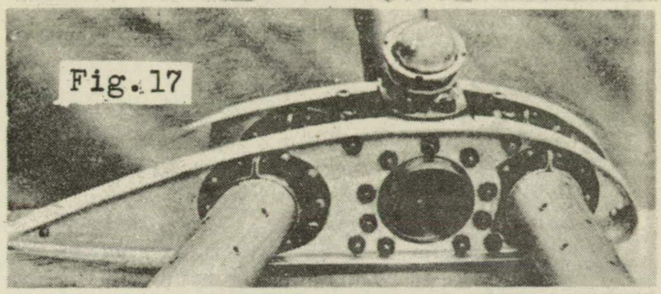
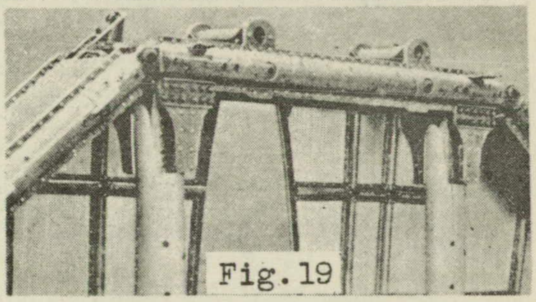


Fig.17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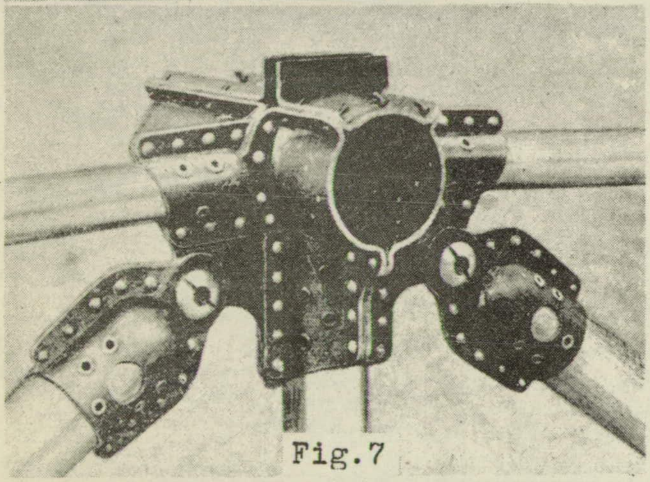
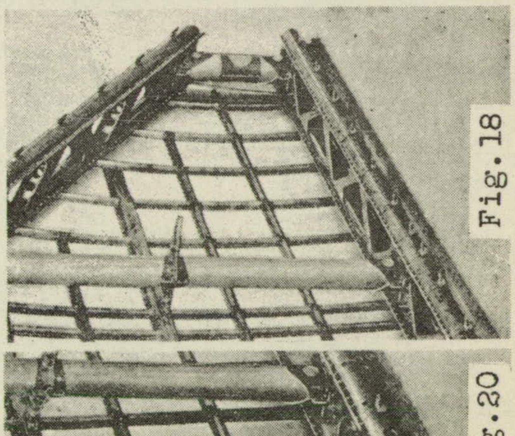


Fig.7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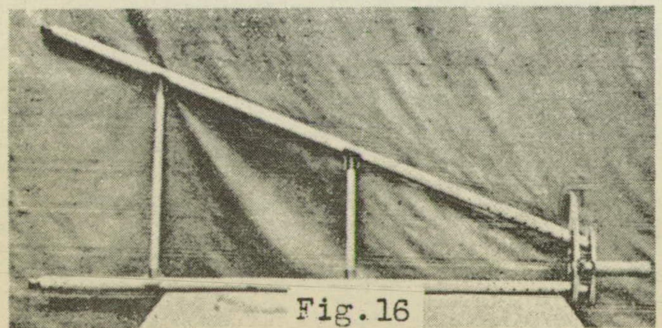


Fig.16

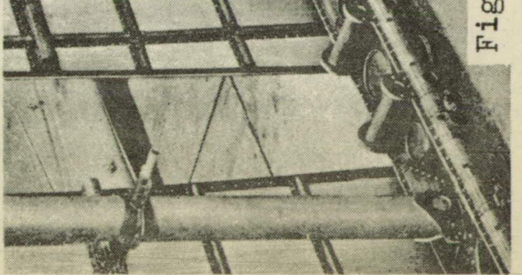


Fig.20

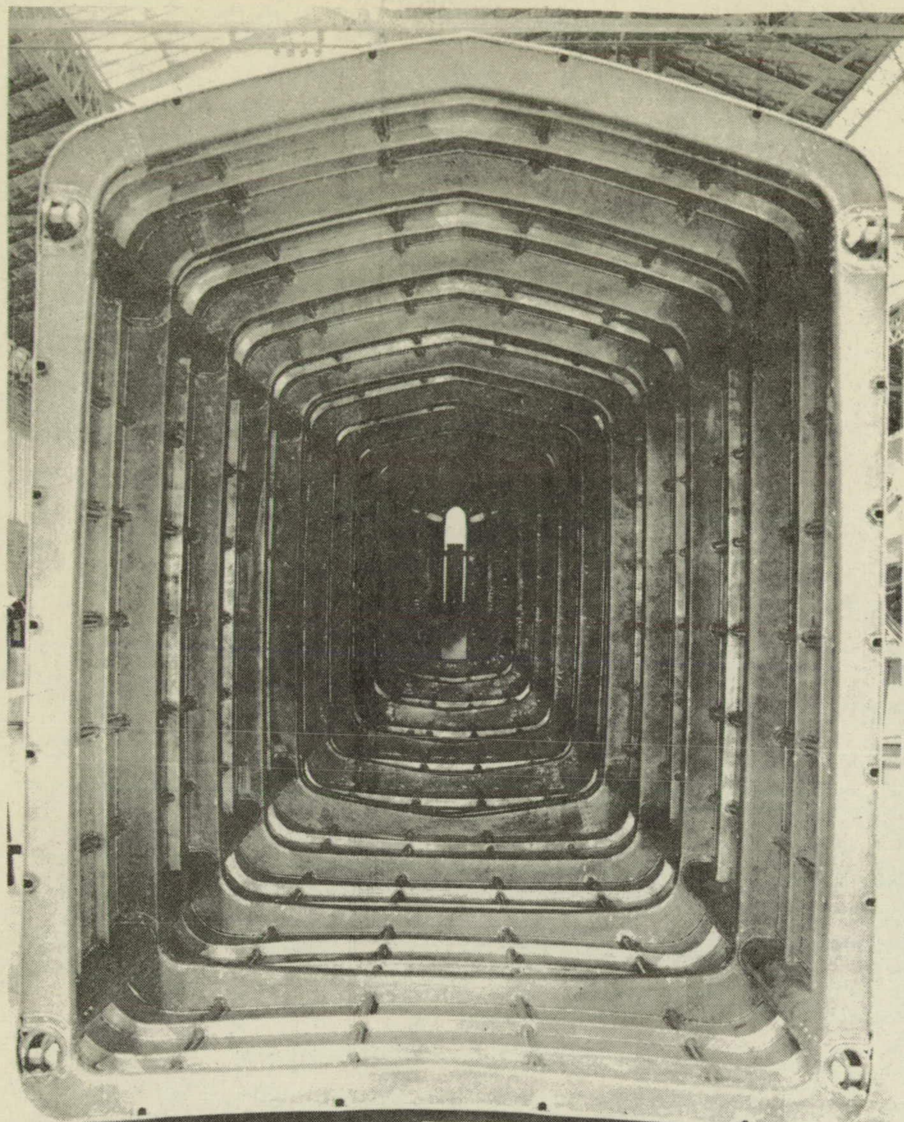


Fig.3

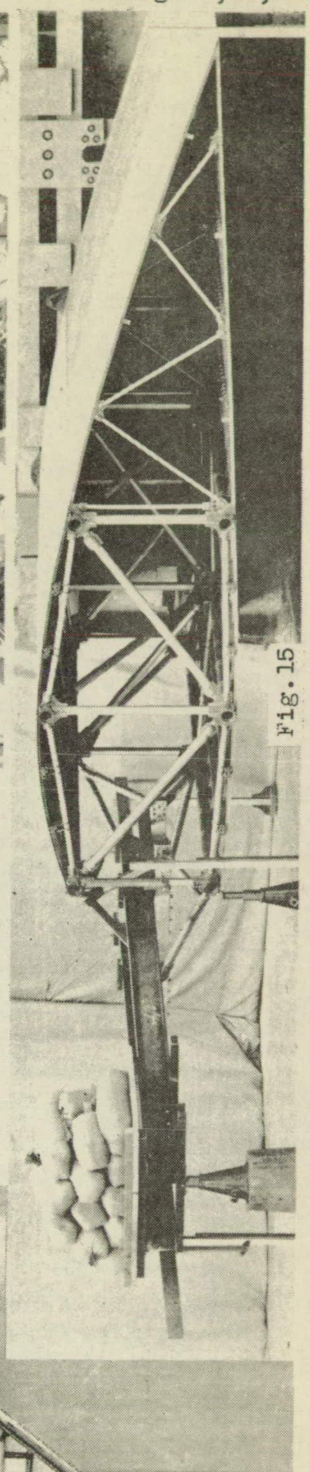


Fig.15

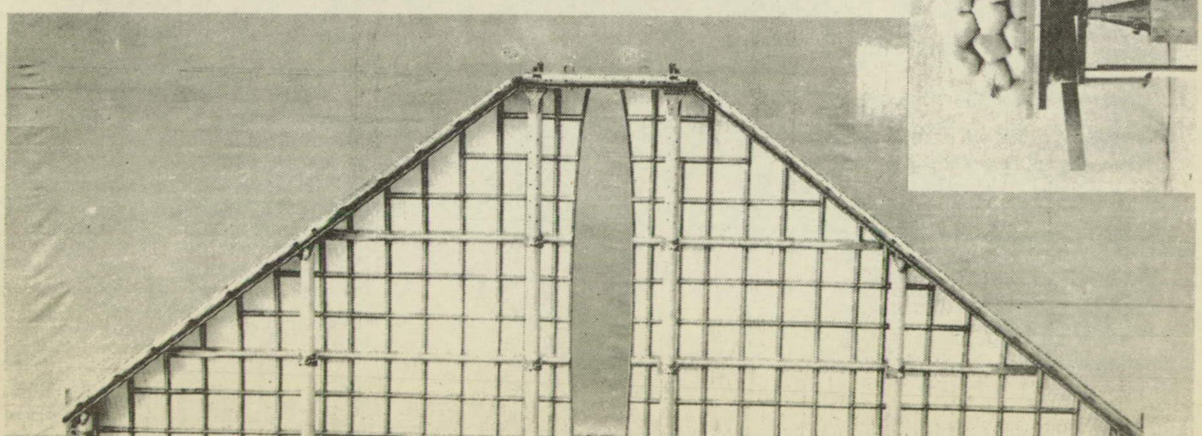


Fig.21

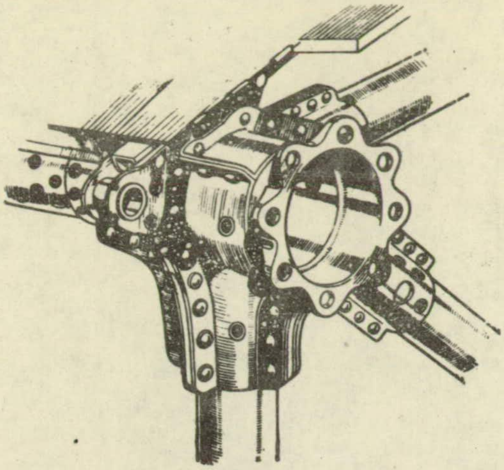
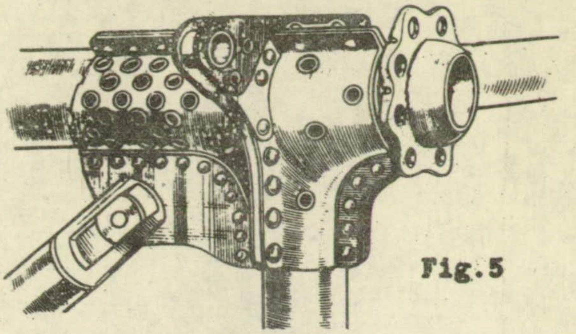


Fig.4



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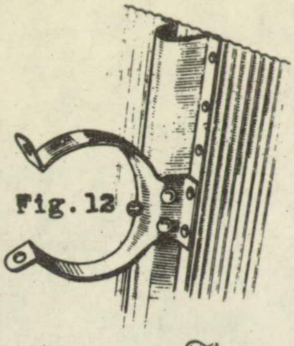

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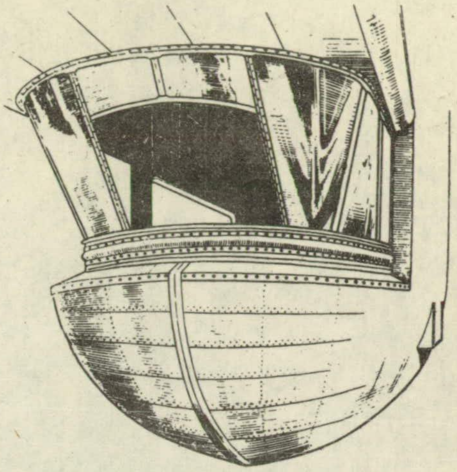

Fig.8

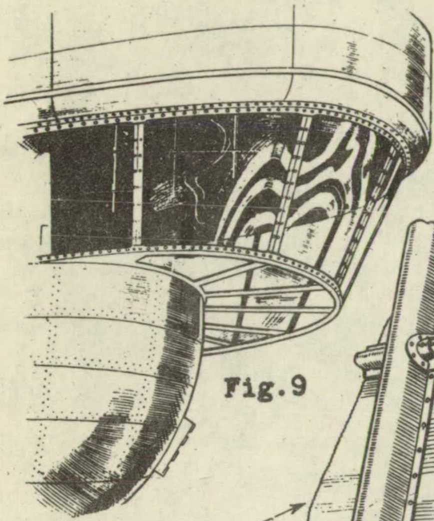

Fig.9

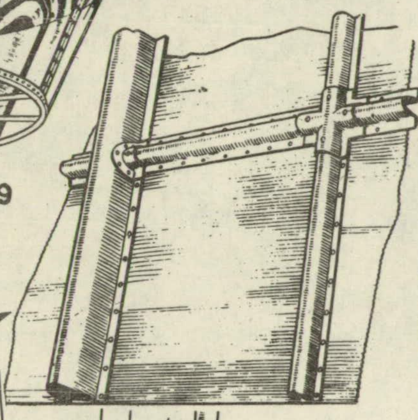

Fig.11

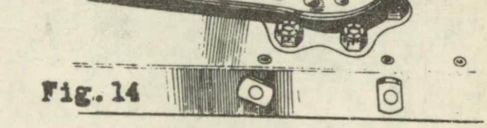

Fig.14

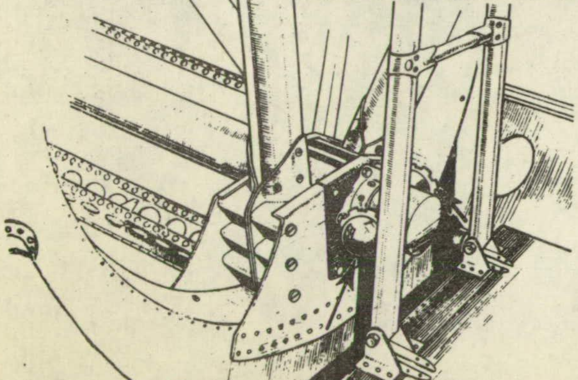

Fig.10 Ball-and-socket joints (indicated by arrows) for attaching landing gear to fuselage.

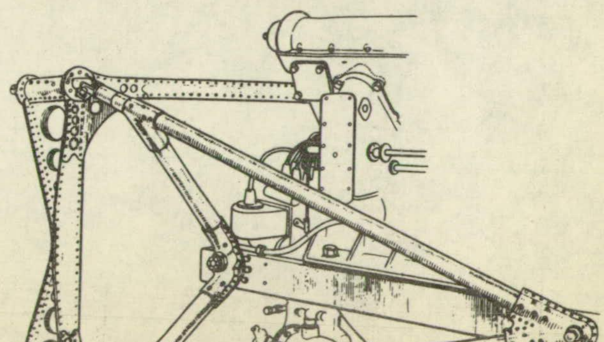

Fig.13

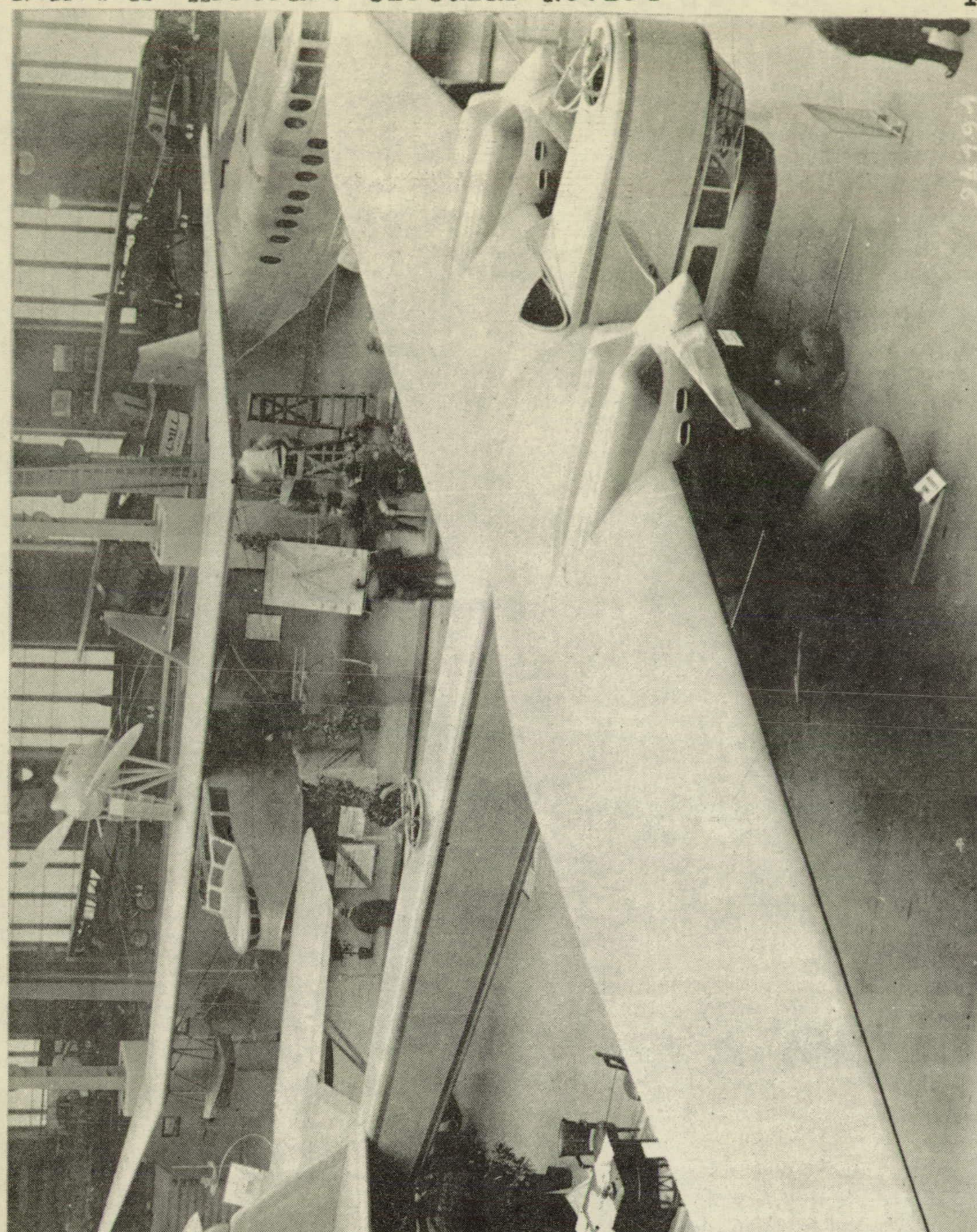

Fig. 22 S.E.C.M. Amiot 140 multiplace fighter (2-700 hp Lorraine engines) Note double deck fuselage