AIRCRAFT CIRCULARS

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

No. 141

THE C.A.M.S. 60 SEAPLANE (FRENCH)

A Twin-Engine Bombing and Torpedo Monoplane

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A Twin-Engine Bombing and Torpedo Monoplane

The C.A.M.S. 60 (Figs. 1, 2, 2a, and 3) which was built by the "Chantiers Aero-Maritimes de la Seine," and whose prototype, the C.A.M.S. 52, recently began its tests at Sartrouville, is a twin-engine monoplane with a wing of medium thickness and is mounted on two floats. It is of mixed construction, much use being made of high-resistance noncorrosive steel, and is covered with fabric.

Each half of the wing has a root section which supports the engine and connects the wing proper to the top longerons of the fuselage. The two root sections form a decided downward dihedral. Each half of the wing proper consists of a long rectangular portion of uniform section terminated by a tapering portion of diminishing thickness on the lower side, thus forming a slight upward dihedral. It has two parallel box spars connected by box crosspieces, the latter being braced by rods and, in the tapered portion, by piano wires. The trailing edge of the tapered portion is occupied by two stabilizing ailerons conjugated differentially with a large cambered aileron covering the whole of the rectangular portion. The unbalanced stabilizing ailerons are encased a short distance from the wing tip. Their division

*From L'Aeronautique, March, 1931, pp. 79-81; and Les Ailes, October 18, 1930.

makes them more rigid and avoids dangerous deformations.

Each half-wing is attached to the root section by iron fittings at the ends of the spars (Figs. 4-8). This section is rigidly braced by oblique tubular struts of special steel ending in the axis of the forward part of the float, where they join the vertical struts from the engine bearer and the oblique struts from the bottom of the fuselage. Two streamlined struts run from the float to the spars at the end of the rectangular portion of the wing. All the struts are made of noncorrosive steel tubing.

The wing has two parallel wooden box spars with multiple solid webs. These spars are interconnected by box members and by a bracing system consisting of round rods in the rectangular portion and piano wires in the tapering portion of the wing. The bracing lies in the plane of each flange of the box members. The ribs are likewise of wood and have sections in I. Their trailing ends are joined by an auxiliary spar to which the ailerons are hinged. The forward ends of the ribs, between which intermediate leading-edge formers are inserted, are covered with plywood as, likewise, all the central or root section of the wing. This section, which is of the same structure as the rest of the wing, is covered with plywood from the leading edge to the rear spar. It is covered on top with finely corrugated aluminum panels, enabling passage and access to the inspection ports. Its central bracing divides it into two compartments, one contain-

ing a 600-liter (158.5-gallon) fuel tank and the other a 100-liter (26.4-gallon) oil tank and radiator.

The engine support is attached to a box on the front spar, connected with the rear spar by a cone of steel tubes reinforced by an intermediate system of braces (Figs. 9-12). In Figure 11 the fitting for the float strut is at the left and for the fuselage strut at the right.

The fuselage has a streamlined plan form and rectangular sections. The front-central and rear-central portions have a dissymmetrical section, raised on the left, thus affording excellent visibility for both of the tandem pilot posts. Its structure consists of four longerons joined by crosspieces and uprights reinforced either by diagonals of steel tubing or by brace wires with socket attachments.

The large dimensions of the fuselage led the constructors to make it in three parts, thus greatly facilitating transportation and repairs. The front part, with a rounded bow, is attached to the central part at the height of the leading edge of the wing. It consists, like the rear part, of four box longerons joined by box uprights and crosspieces. Moreover, this framework is reinforced by diagonal steel tubes and brace wires.

The central part, which absorbs and distributes all the stresses, is all metal. It constitutes a large prismatic girder extending to the height of the pilot's seats. It likewise consists of four riveted sheet-metal box longerons, joined together

by box uprights and crosspieces and box diagonals or tubes of special steel. Intermediate frames and laths insure the fine streamlining of the fuselage. The front part, the "bridge" or root sections of the wings and part of the bottom are covered with plywood, the rest of the fuselage being simply covered with fabric.

In the bow there are twin Lewis machine guns on an adjustable mounting. Under this station is the post for the observer, provided with bomb-dropping device, sights and drift indicators. Next comes the station for the navigator-bomber, provided with levers for releasing the bombs and, at his left, the radio transmitter. In front of him, in the floor, is a trapdoor which is entered from a ladder underneath. This compartment also contains a map cabinet, a folding table, a compass for taking bearings at all azimuths, etc.

The chief pilot's post is elevated, in front of the leading edge, on the left side of the fuselage. There is room for an observer beside the pilot. The second pilot, likewise in an open cockpit, is directly behind the chief pilot.

The floor of the central part is partly occupied by the vertical bomb rack, the torpedo release, and a fuel tank. Back of this comes the acoustically insulated radio station for both transmitting and receiving either during flight or when on the water.

The rear part of the fuselage contains a Bristol starter

and a machine-gun mount. The last compartment has, in its longitudinal axis, a mount for a photograph camera, which can be pointed in any direction. Windows enable the taking of panoramic views. Moreover, a large door affords access to the compartment when the craft is on the ground and can be used for casting the floating anchor during maneuvers on the water. Communication between the different compartments is by means of "aviophones." Dorsal parachutes and life preservers are provided for the safety of the crew.

The floats each have a single step just back of the rear wing spar. The bottom forms a double curve. The structure consists of transverse frames and bulkheads and of a keel and keelsons. Certain bulkheads are water-tight. These are made of plywood reinforced on both faces by strips arranged in the form of fans. They have hermetically sealed removable doors which enable the inspection of the float interior from one end to the other. The longitudinal rigidity is increased by oblique bracing from the bottom of one bulkhead to the top of the next. The covering is of plywood covered with fabric and reinforced on the sides and bottom. Though equipped for the Navy as a bomb-dropping torpedo seaplane, the floats can be replaced by a landing gear. Each half of this landing gear consists of two axles, joined in V and oscillating at the base of the front vertical struts. These carry at their ends, by means of a universal joint, an oleopneumatic shock absorber and a wheel 1000 x 180 mm (39.37 x 7.1 in.).

A dirigible tail skid is permanently mounted on the fuselage. Auxiliary skids are also provided at the base of the rear vertical struts.

The stabilizer has two spars with ribs and diagonal brace wires. The balanced elevator has a steel-tubing framework covered with fabric. It consists of two parts rigidly attached to the same transverse member. Lateral projections provide for balancing in normal flight. A wooden flap, adjustable during flight, is hinged to the trailing edge of each part of the elevator. These flaps are designed to insure the balance in case of the stopping of either engine or of decentering. The vertical empennage consists of a trapezoidal fin, of wood reinforced by steel tubes and covered with fabric. The rudder is balanced like the elevator. In addition to the usual controls, the pilot has two levers for operating the balancing flaps on the elevator and rudder.

From front to rear, the fuselage contains the posts of observation, navigation and bombardment; the tandem pilot posts; the acoustically isolated radio post; the posts of the rear gunner and of the gunner in the bottom of the fuselage; and, lastly, the post of the photographer.

The C.A.M.S. 60 is equipped with two 480 hp air-cooled Gnome-Rhone "Jupiter" engines with reduction gears and Bristol starters. Each engine is bolted to a steel ring supported by a conical group of struts attached to the front spar of the central part

of the wing (Figs. 9-12). The propeller hub, the crank case and the conical support are enclosed in a streamlined cowling of sheet aluminum. A removable panel affords access, when the craft is on the water, to the principal engine accessories.

The 1800 liters (475.5 gallons) of fuel is distributed among three tanks of equal capacity. Two of these tanks are in the central portion of the wing and are provided with quick-emptying devices. The third tank, which is removable and quick-emptying, is located under the seat of the chief pilot. The two oil tanks containing 100 liters (26.4 gallons) each, are located in the wing, their radiators being mounted under the front spar. The engines are shut off by fire walls and equipped with automatic extinguishers. Each fuselage compartment is provided with a hand fire extinguisher.

Characteristics

Span	30.36	m	99.61	ft.
Length	16.00	"	52.49	"
Height	4.80	"	15.75	"
Wing chord	3.90	"	12.80	"
Wing area	120	m^2	1291.67	sq.ft.
Weight empty	4750	kg	10471.95	lb.
Weight loaded	7220	"	15917.36	"
1800 liters (475 gal.) fuel	780	"	1719.60	"
Wing loading	60.17	kg/m^2	12.32	lb./sq.ft.

Power loading	7.52 kg/hp	16.35 lb./hp
Power per unit area	8 hp/m²	.743 hp/sq.ft.

Performances

Maximum speed near ground	200 km/h	124.3 mi./hr.
Climb to 3000 m (9842 ft.)	28 min.	
Ceiling	5000 m	16,404 ft.
Range of action	1400 km	870 mi.

Translation by Dwight M. Miner,
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for Aeronautics.

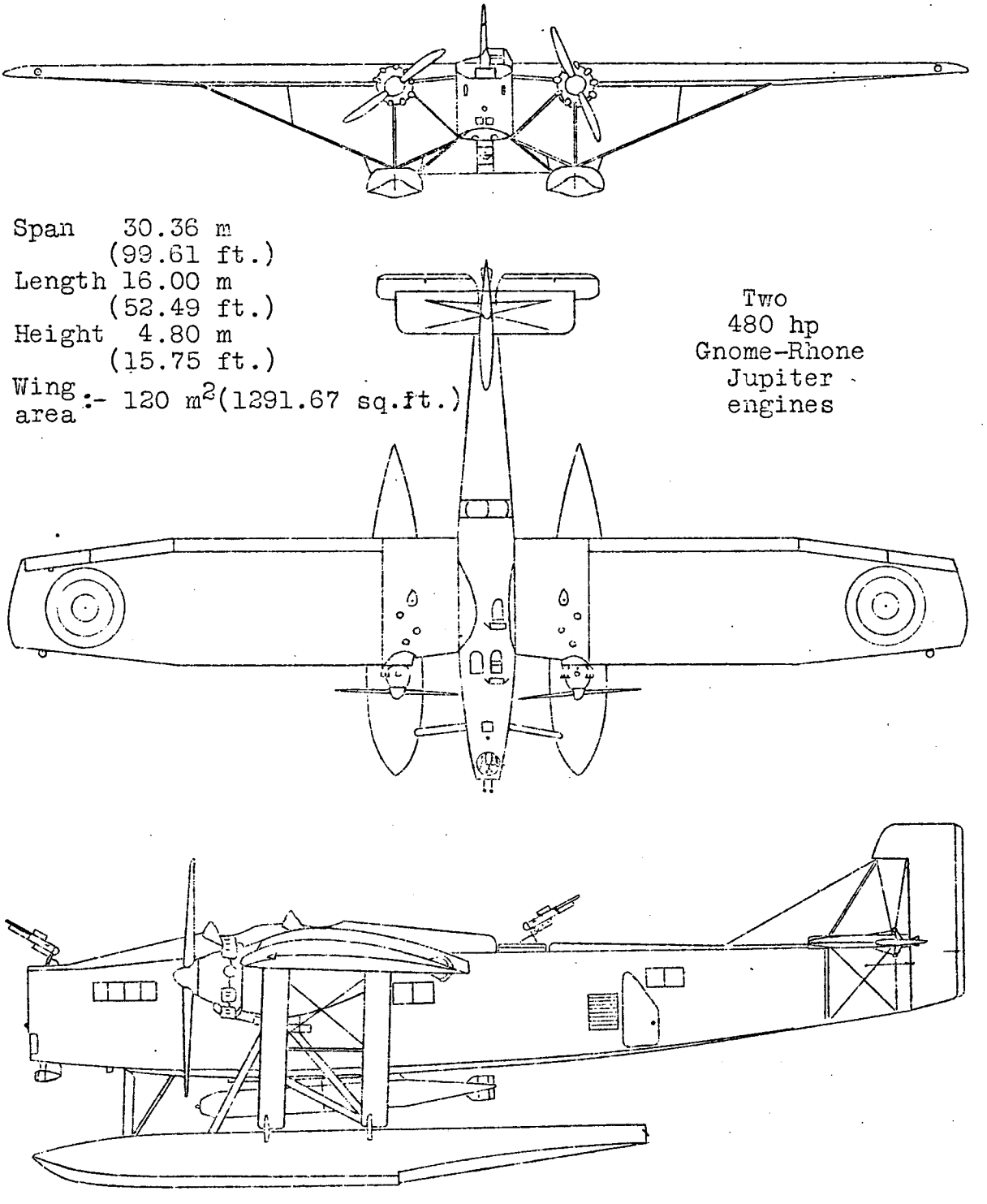


Fig.1 General arrangement drawing of the C.A.M.S.60 seaplane.

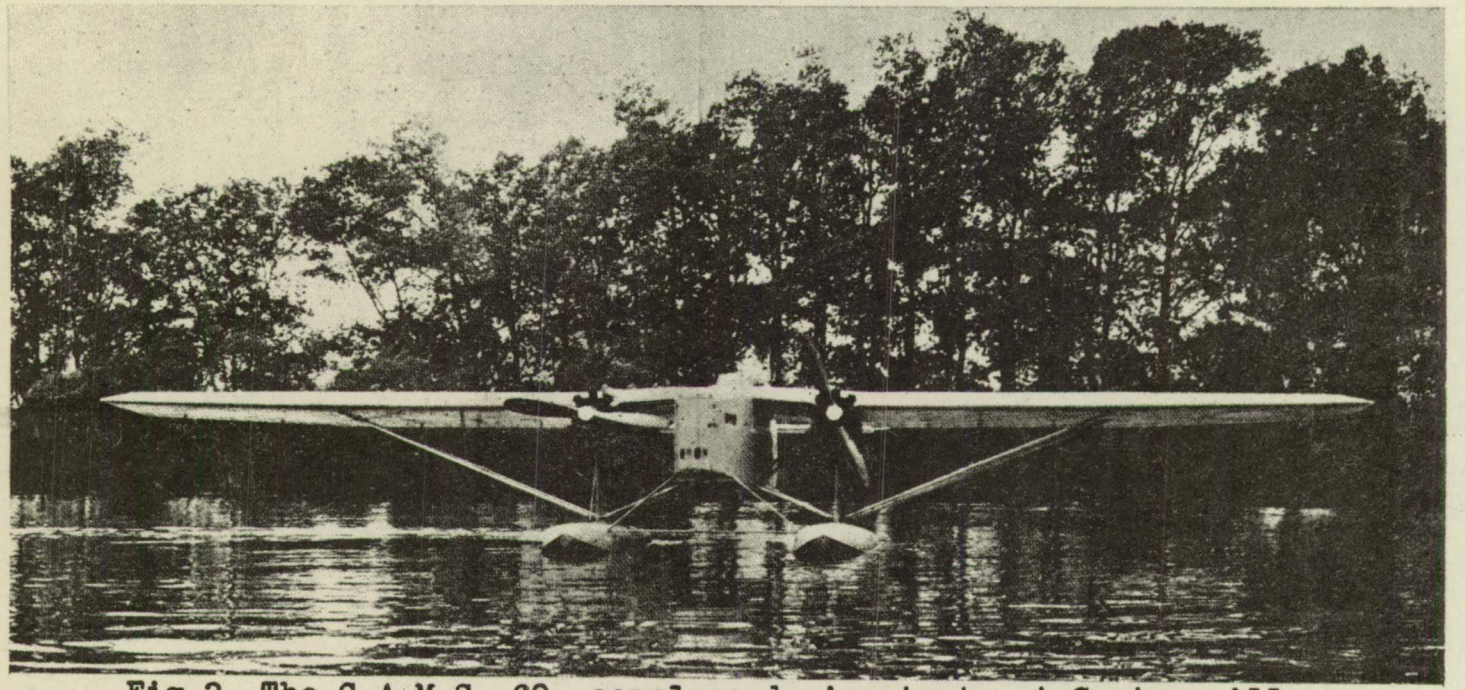


Fig.2 The C.A.M.S. 60. seaplane during tests at Sartrouville.

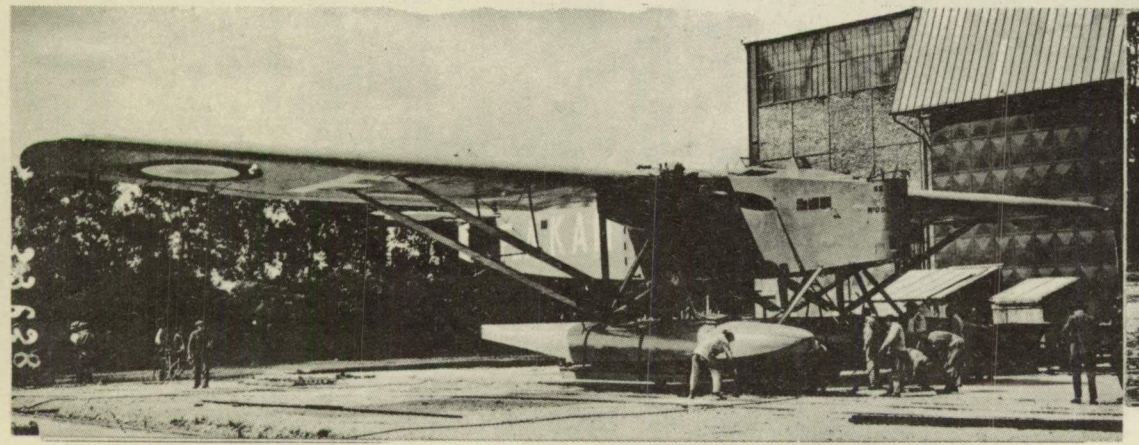


Fig.2a Three-quarter front view of the C.A.M.S. 60.

Fig.3 The C.A.M.S. 60. alighting.

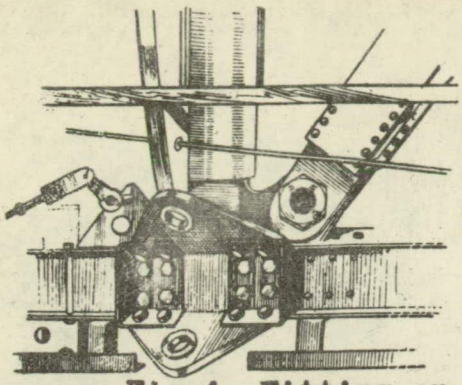


Fig.4 Fitting on lower longeron of fuselage.

Fig.5 Joint at junction of front and rear portions of fuselage.

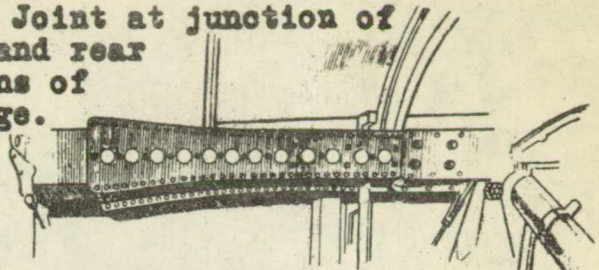


Fig.8 Tubes in upper central fuselage.

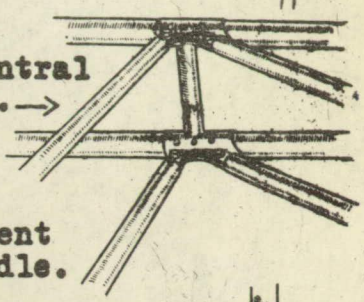


Fig.7 Radio compartment door handle.

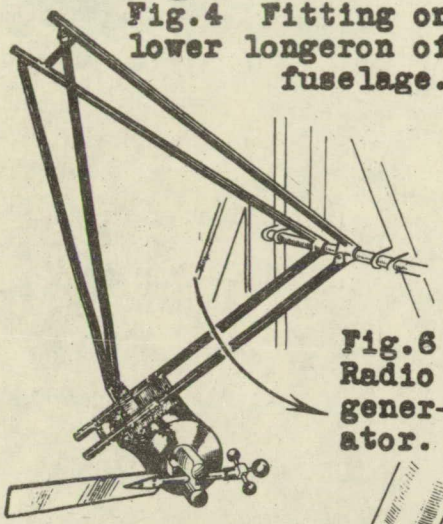
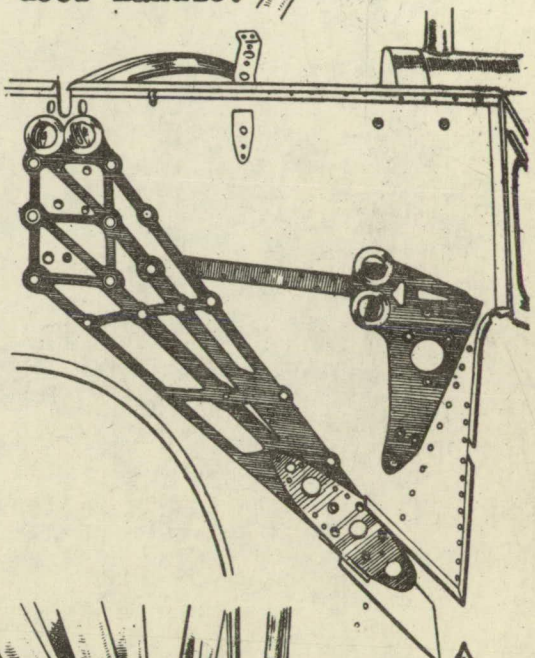


Fig.6 Radio generator.



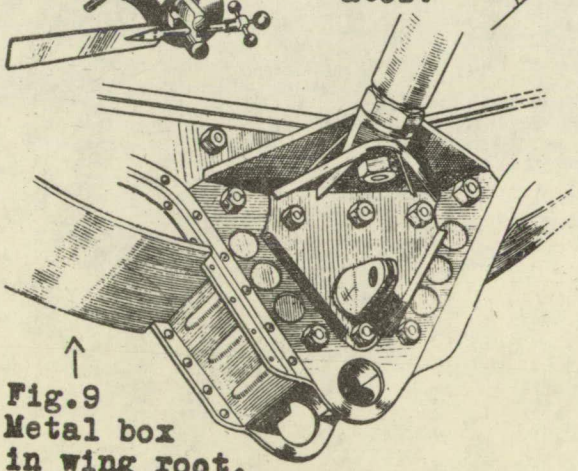


Fig.9 Metal box in wing root.

Fig.10 Engine support fittings.

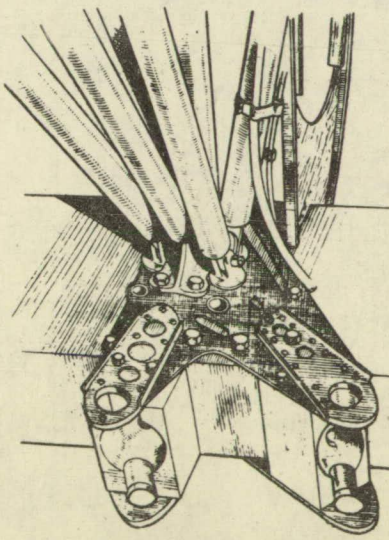


Fig.11 Apex of engine support.

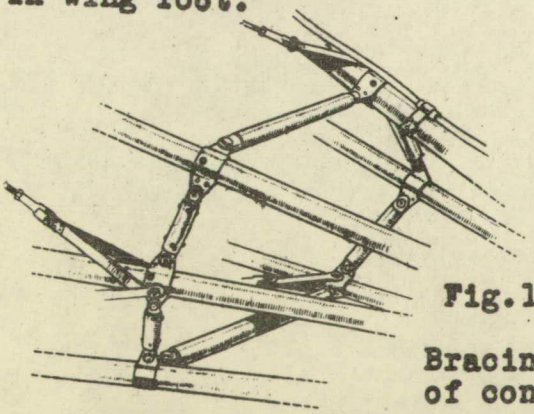


Fig.12 Bracing of cone.