AIRCRAFT CIRCULARS

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

No. 114

THE "POTEZ 39" OBSERVATION AIRPLANE (FRENCH)

An All-Metal High-Wing Two-Seat Monoplane

Washington
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THE "POTEZ 39" OBSERVATION AIRPLANE (FRENCH)*

An All-Metal High-Wing Two-Seat Monoplane.

The "Potez 39" has just begun its tests according to the new regulations for two-seat observation airplanes. It is all metal, including the covering of the wings and fuselage. Designed for the same uses as the "Potez 25," it represents the result of a new departure by a company long identified with mixed construction (Figs. 1, 2, and 3).

The wing has the form of an elongated rectangle with well-rounded tips, so as to obtain the maximum efficiency without the multiplicity of different parts which results from the use of decreasing profiles. It has the "Clark Y.H." profile of the N.A.C.A., whose qualities were demonstrated in comparative flight tests made with the "Potez 31" and "Potez 36." It has an aspect ratio of 7.3. It has neither dihedral nor sweepback and is attached to the fuselage by an inverted V cabane and two struts whose threaded ends serve for the initial adjustment. The cross bracing by means of struts or piano wires was prescribed so as to obtain an airplane incapable of getting out of adjustment. Each wing has two spars with diagonal bracing, widely spaced ribs, members parallel to the spars and a metal

*From L'Aéronautique, February, 1930, pp. 43-48.

covering (Figs. 5, 6, 7, and 20).

The spars (Figs. 8, 9, 17, and 24) consist of a plain duralumin web and four angles. The latter, stiffened by corrugations, are made from a special section steel, Jacob Holtzer 34 (110 kg/mm^2 = 156,460 lb./sq.in.). This steel can be filed and worked easily, which makes it preferable to steels of higher resistance. Moreover, its rustproofness and its insensitiveness to vibrations afford good guaranties of strength and longevity. This method of construction renders it possible to obtain a spar of uniform strength simply by sawing along the line corresponding to the four angles constituting the flanges. Assemblies in length are thus avoided, the successive flanges being riveted together, resulting in economy of weight and construction. The special profiles constituting the flanges are now delivered in 5-meter (16.4-foot) lengths, so that each spar has one joint (Fig. 9), which can be eliminated when the factories deliver sections of sufficient length. The spars are braced in their plane by diagonal stiffeners made by riveting together two duralumin half-tubes (Fig. 10). The ends of these stiffeners are attached to the spar webs by means of gussets.

The ribs, placed at intervals of 85 cm (33.5 in.), have a plain duralumin web, held throughout its whole contour by two angles. The ribs support U channels parallel to the spars (Fig. 11).

The covering (Figs. 12-13) is sheet duralumin 0.35 mm (0.014 in.) thick, stiffened at intervals of 85 mm (3.35 in.) by corrugations about 10 mm (0.4 in.) high. After many comparative tests, the Potez Company finally adopted these measurements which give satisfactory rigidity without excessively increasing the skin friction.

The wing covering has many removable sections (Fig. 14), in order to facilitate inspection and the repair of any damaged part. To the central portion there are attached, by outside fittings: the leading edge (Fig. 5), the wing tips (Fig. 16), the central-cutaway section and the partial trailing edge (Fig. 14) prolonged by the ailerons. The attachment fittings (Fig. 15) are placed in line with the ribs and consist simply of two sheet-metal angles, whose attachment bolts are aligned in the direction of the wind. Between the ribs of the central part and on the lower side of the wing, there are provided, moreover, removable panels about 35 cm (13.8 in.) wide, assembled by hinges (Fig. 14).

The covering of the central portion is attached by rivets to the flanges of the spars, ribs and cross pieces. This portion thus constitutes a rigid box girder. The covering assists the spars, in the different flight cases, to transmit their stresses from one to the other, but no account was taken of this fact in the strength calculations.

The ailerons had a length of 4.25 m (13.94 ft.), a chord of 0.45 m (1.48 ft.) and an area of 1.9 m² (20.45 sq.ft.).

The fuselage (Figs. 4 and 21) has a general oval section and is very roomy in the vicinity of the pilot's and observer's cockpits, the largest section being 1.7 m (5.58 ft.) by 0.94 m (3.08 ft.). The side walls are vertical. It is formed by the assembly of two parts, the engine support and the fuselage proper. The engine support is made of sheet duralumin and is attached by four spherical fittings, each held by a bolt, to the front ends of the fuselage longerons. The fuselage proper is a trellis girder, constructed of sheet-duralumin profiles (two types in different thicknesses). The uprights and diagonals are joined to the longerons by means of riveted gussets of simple form (Figs. 22-23). The gussets of the principal attachments are made of high-resistance steel, which largely eliminates the dangers from corrosion.

The duralumin covering, of the same kind as used on the wing, is firmly secured to all the members of the fuselage. Each member thus becomes a closed profile which insures great rigidity to the whole assembly. The different members of the fuselage were calculated, however, without taking account of the additional strength furnished by the corrugated sheet metal, whence there is a considerable excess of strength. There is a removable plate near the tail for the inspection of the tail skid.

The aftermost fuselage frame carries the sternpost, which receives the fin in front and supports the hinges of the rudder in the rear.

The nonbalanced elevator is long and slightly tapered, with well-rounded tips. Its structure is similar to that of the wing, all the tail surfaces being likewise covered with corrugated sheet duralumin. The stabilizer is attached, in front, to a post integral with the fuselage and forming an articulation and, in the rear, to a movable support enabling adjustment during flight. It is supported by a strut on each side of the fuselage. Its position, in front of the rudder, makes it possible to reduce to a minimum the cutaway in the elevator. The adjustment during flight (Fig. 19) is effected by means of a vertical control provided with flexible joints and ball bearings. The requisite force is very small, because the center of lift is located near the axis of articulation. The stabilizer has an area of 2.25 m^2 (24.22 sq.ft.); the elevator, 1.35 m^2 (14.53 sq.ft.). The nonbalanced rudder swings above the tip of the fuselage. It has an area of 0.85 m^2 (9.15 sq.ft.). The fin has an area of 1 m^2 (10.76 sq.ft.).

The landing gear is of the axleless type with Potez elastic struts and wheel brakes. It has a track gauge of 3 m (9.84 ft.).

The Hispano 12 Hb develops 579 hp at 2000 r.p.m. It has "Voltex" magnetos and an S.E.V. starting magneto, a Viet starter, a Lamblin water radiator with a radiating surface of 11.5 m^2

(123.78 sq.ft.) under the fuselage and an A.Z. oil radiator. The fuel is delivered to the engine in the usual manner by two A.M. pumps.

The fuel tank, containing 360 liters (95 gal.), has a conical shape (Figs. 26-27), enabling it to be dumped despite deformations due to bullets. It is suspended at the top by means of an "Alkan" bomb release on the transverse bar of an "A." The weight of the fuel is therefore divided between the points A, B, and C. The forces exerted on A and C are transmitted, by means of a V in the median plane of the fuselage, to the front struts of the landing gear. The force at B is transmitted, by means of an inverted V to the lower right and left joints of the fuselage, to which are likewise attached the wing struts and the rear struts of the landing gear. Three shoulders, 120° apart, at the bottom of the tank, prevent lateral displacement.

The very simple releasing mechanism (Figs. 28-29) recalls the cocking and firing mechanism of a gun. A spring 6 holds together the two pipes 1 and 11 between which an elastic metal joint 4 is interposed. This spring rests against a sliding collar which blocks the pawl 9 ordinarily held by a notch. Figure 29 shows the position of the different parts in process of dumping. The device is operated by a flexible cable passing through a sheath. The operation is automatic in the sense that it can be controlled by the dumping of the tank. It is only necessary for the portion of the tubing which is integral with the tank, to tilt (as a result of the unhooking of the latter) at an angle b (Fig. 30), for the collar, released by the pawl, to liberate the spring. The device then functions without the necessity of pulling on the releasing cable.

The "Potez 39" is the result of a methodical study conducted by Méaulte under the direction of Coroller, first on an ordinary monoplane and then on metal airplanes best adapted for quantity production.

Characteristics

Span	16 m	52.49 ft.
Length	10	32.81 "
Height	3.4 m	11.15 "
Wing area	35 m^2	376.74 sq.ft.
Weight empty	1450 kg	3197 lb.
Weight loaded	2250 "	4960 "

Translation by Dwight M. Miner,
National Advisory Committee
for Aeronautics.

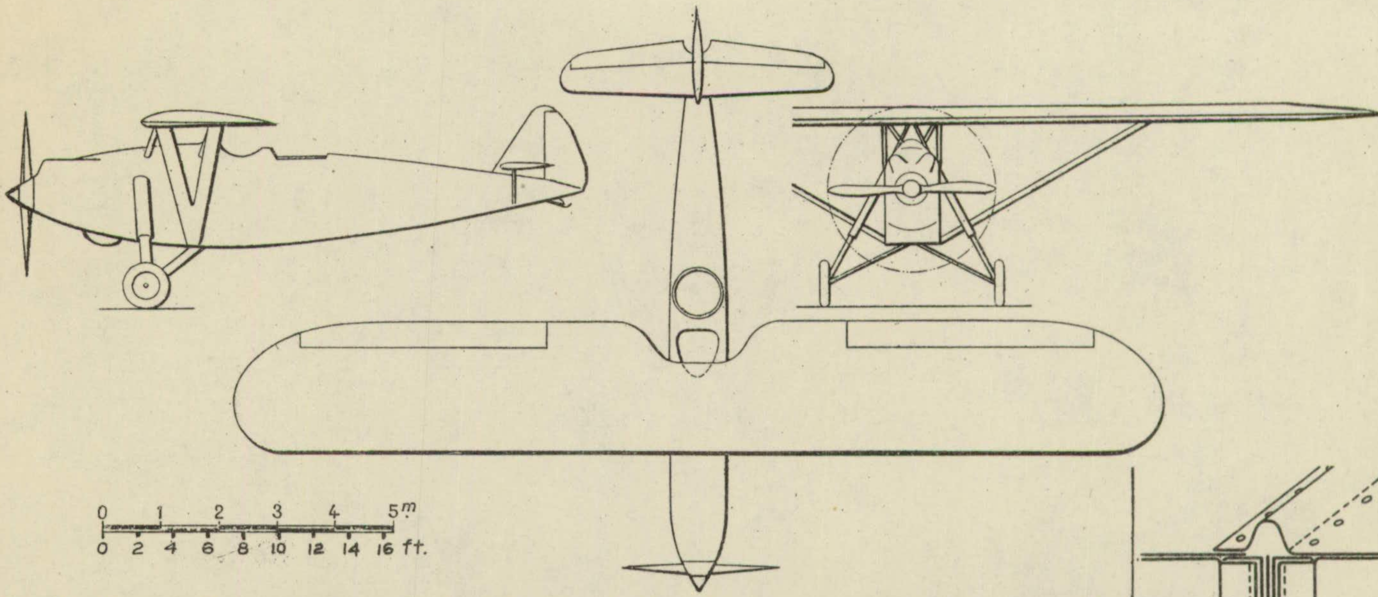


Fig.1 General arrangement drawings of the Potez 39 all-metal airplane with 600 hp Hispano-Suiza engine.

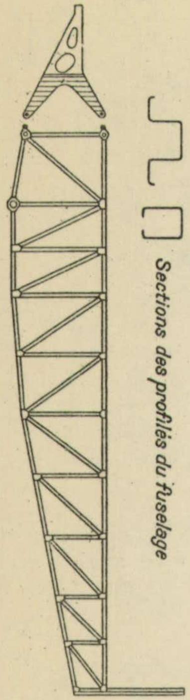


Fig.4 Diagram of fuselage and sections of members used.

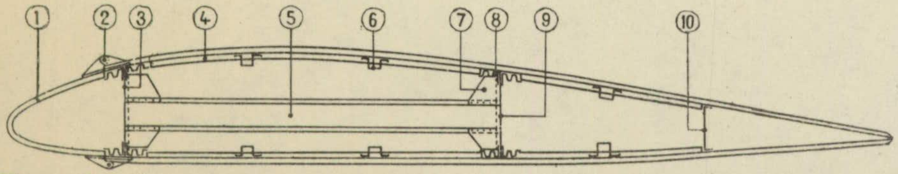


Fig. 5 Cross section of wing: 1, Removable leading edge held by fittings 2, the details of which are shown in Fig.15; 3 and 9, spar webs; 4, angle bordering a rib; 5, diagonal stiffener attached to spar at 7; 6, members, cut at their contact with a rib, serving to support the wing covering; 8, spar flange; 10, auxiliary spar for aileron hinges.

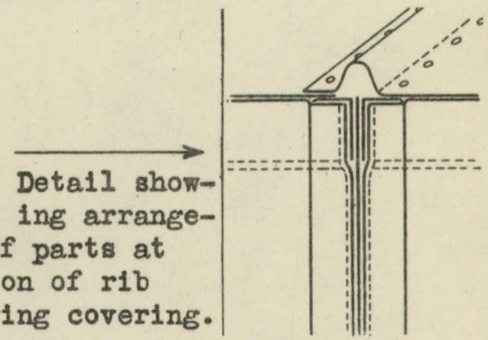


Fig.7 Detail showing arrangement of parts at junction of rib with wing covering.

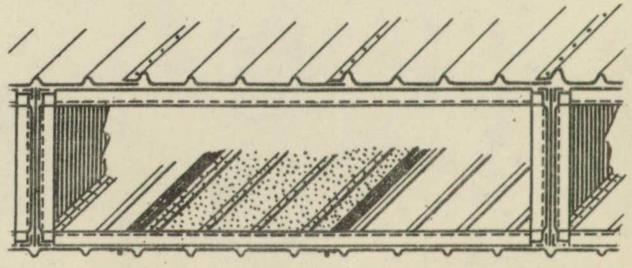


Fig.6 Section of wing at right angles to the chord. Etched portion represents removable panel for inspection of structure between ribs.

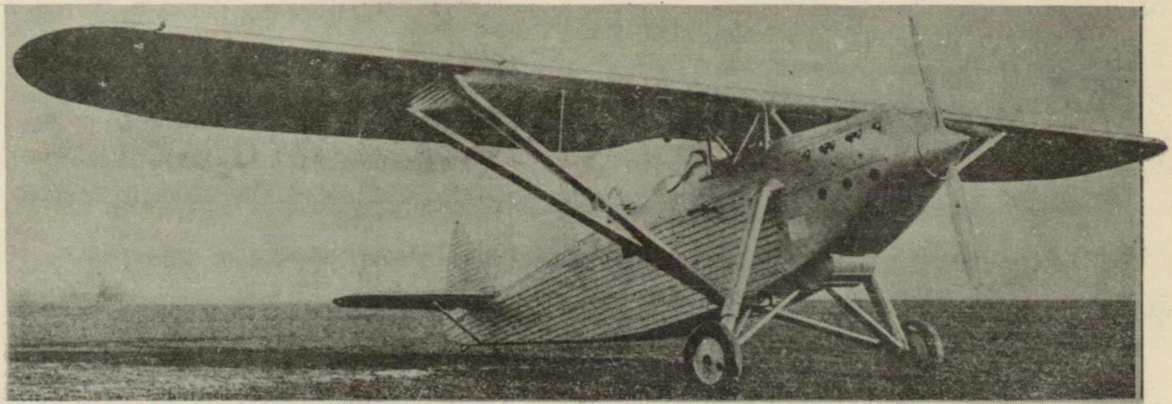


Fig.2 View of Potez 39 airplane.

Fig.3 View of Potez 39 airplane.

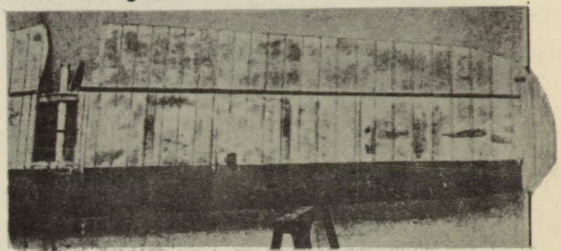
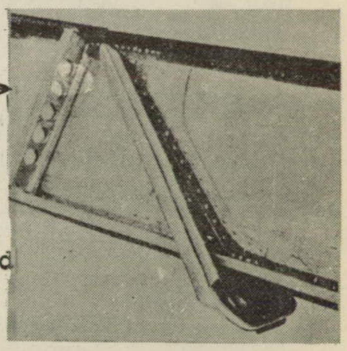


Fig.18 Horizontal empennage.

Fig.17 Diagonal brace for attaching wing strut to spar. Note the perforated stiffener at the left.



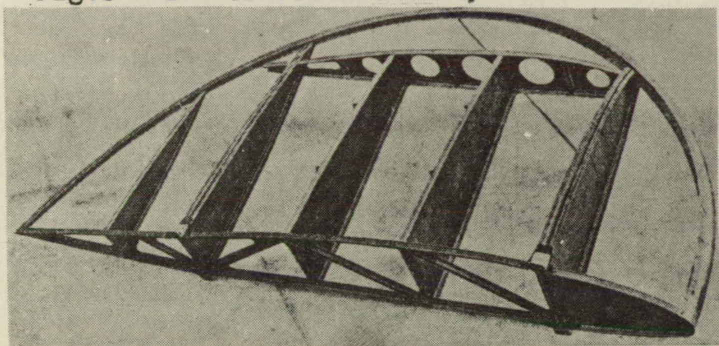


Fig.16 Structure of wing tip; attached to wing at four points.

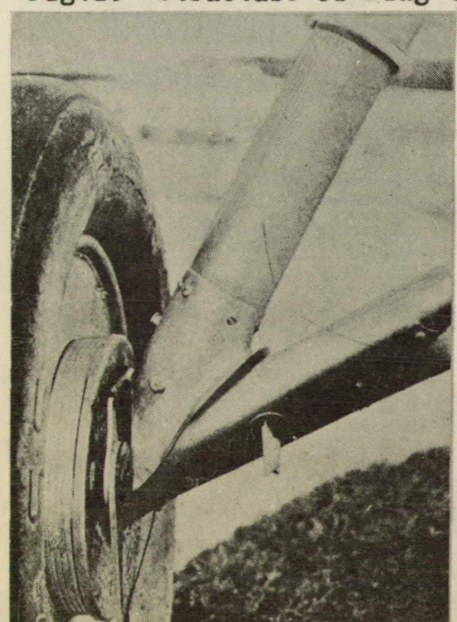


Fig.25 Elastic strut and wheel brake. Note, in the apex of the V, the play provided for the settling of the landing gear during flight.

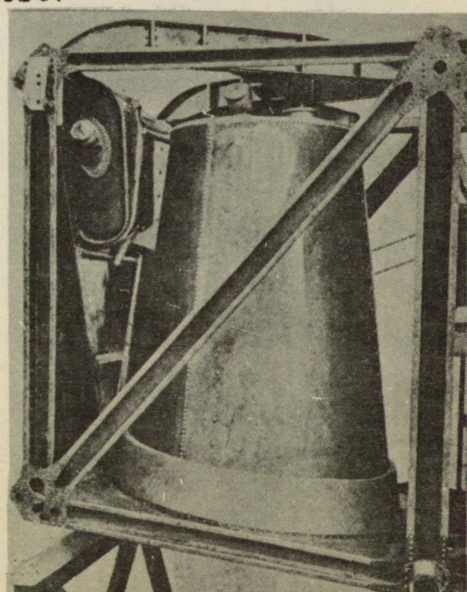


Fig.26 Conical fuel tank.

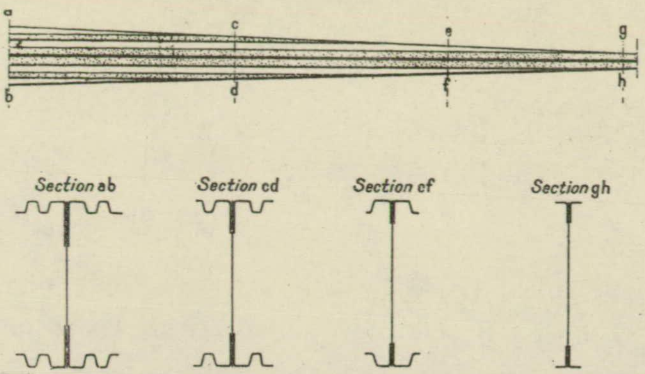


Fig.8 Construction of wing spar showing taper of flange.

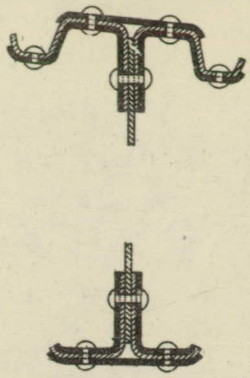


Fig.9 Spar joint: flanges of 1.5 mm (0.06 in.) steel; butt strap of 0.8 mm (0.03 in.) duralumin; web held between gussets.

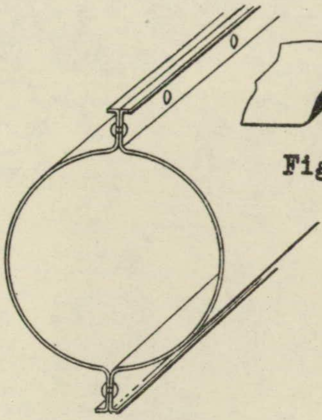


Fig.10 Diagonal tubing between spars.

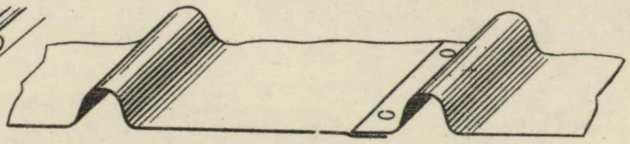


Fig.12 Corrugations in covering (scale about 1/2).

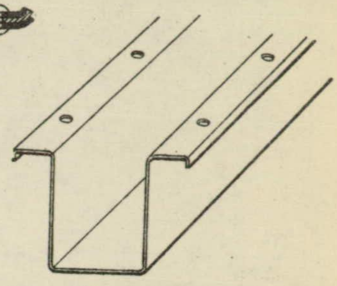


Fig.11 Wing covering support.

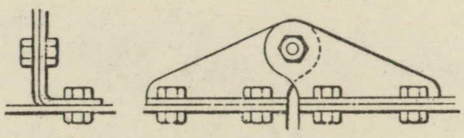


Fig.15 Assembly fittings, indicated in Fig.14 by small rectangles.

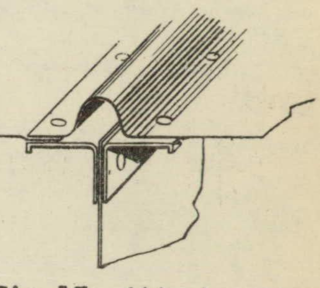


Fig.13 Attachment of covering to rib flanges.

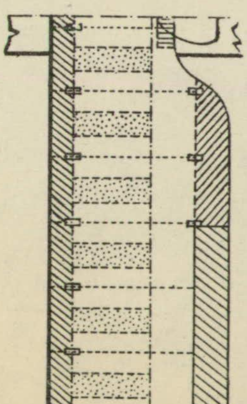
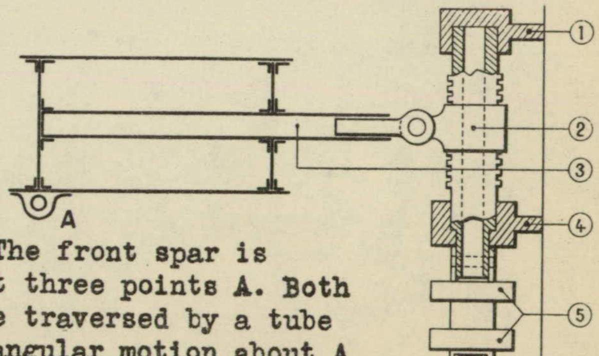


Fig.14 Diagram of wing. Etched portions represent inspection panels.

Fig.19



Stabilizer adjustment during flight. The front spar is hinged at three points A. Both spars are traversed by a tube 3 whose angular motion about A is controlled by a threaded sleeve 2 moving on a vertical screw held between the thrust bearings 1 and 4. By means of cable 8, the pilot rotates the shaft 7 held by ball bearings 6 and 9. The parts 5 represent two joints having some elasticity in the vertical direction.

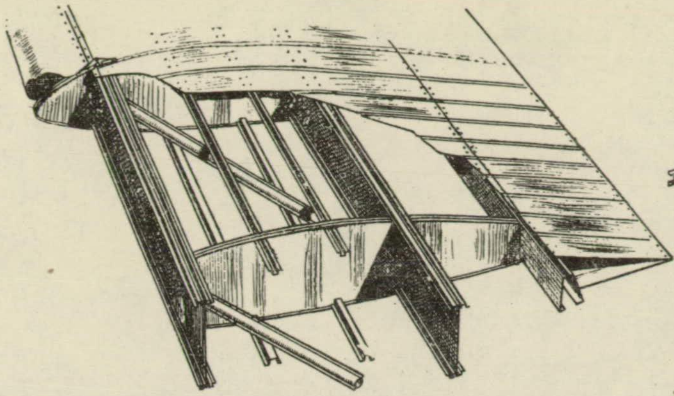


Fig.20 Wing structure. Note the plain ribs, the spars, U channels, diagonal stiffeners, leading edge and one of the attachment fittings.

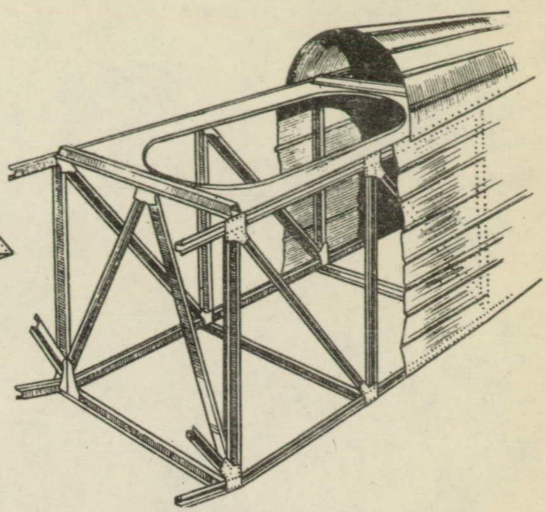
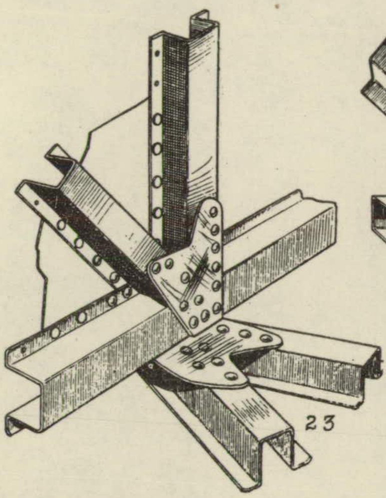
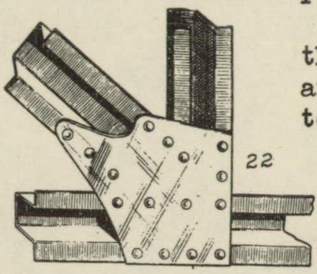


Fig.21 Fuselage. All the channels, except the top ones, have their grooves turned outward. These are closed by the covering, applied to them by a double line of rivets.





Figs.22 and 23

Fuselage gussets; outside and inside views.

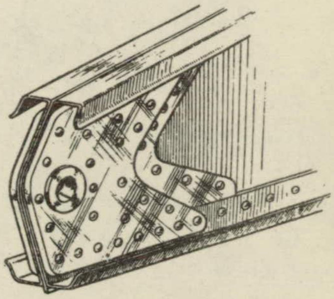


Fig. 24

Reinforced end of spar for receiving attachment bolt.

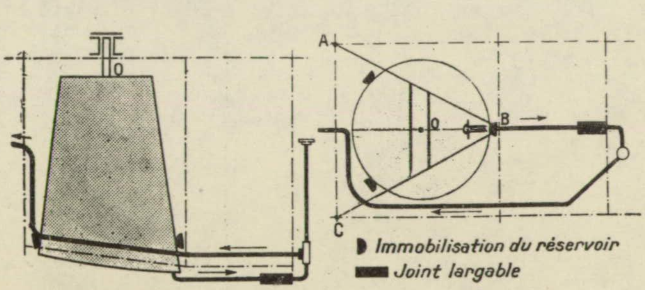


Fig.27 Diagram showing distribution of forces at points A,B,C and location of dumping joint.
▶ Tank-stops. ▬ Dumping joint.

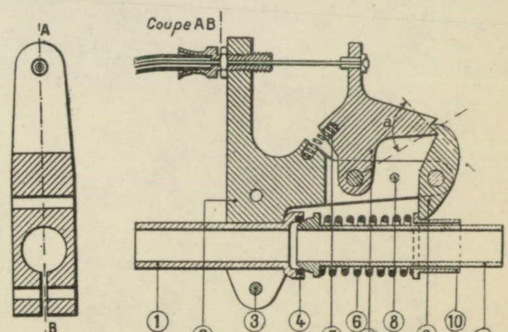


Fig.28 Releasing mechanism: 1, fixed tube; 2, fixed support on airplane; 3, bolt for fastening tube 1 in support; 4, flexible metal joint; 5, ratchet spring; 6, compression spring; 7, releasing mechanism; 8, stop; 9, pawl; 10, sliding collar; 11, dumping tube (spherical end); a, angle which regulates the sensitiveness of the device.

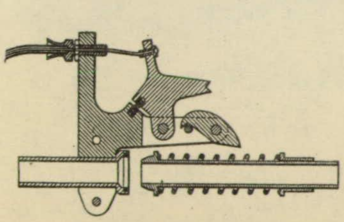


Fig.29

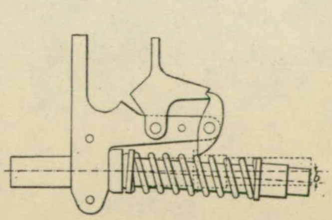


Fig.30