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AIRCRAFT CIRCULARS

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No. 139

THE BERNARD 120 SEAPLANE (FRENCH)
A 1400 hp Single-Seat Monoplane Racer
By Pierre L glise

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A 1400 hp Single-Seat Monoplane Racer

By Pierre L glise

France was to have been represented in the Schneider Cup Race of 1929 by two seaplanes, a Nieuport and a Bernard. Neither of these was able to participate in the race, because the engines were not delivered in time. The Bernard 120 (Figs. 1 & 2) made its initial flights about four months after the race. Generally speaking, the technical press is not supplied with the data of high-speed aircraft, which are worked out with the greatest secrecy in the different countries. Hence our description of the Bernard 120 includes very few numerical data. Even in this form, however, it contains considerable information that has not yet been published.

The all-wood wing of the Bernard 120 (Fig. 3) is of the laminar type of construction, like that of the pursuit plane Bernard 20 C 1 (see N.A.C.A. Aircraft Circular No. 98), described in L'A ronautique, May, 1929, p. 145. The structural elements, which correspond to the spars of an ordinary wing, consist of narrow box girders of variable height and length, according to their location in the wing. These girders have plywood flanges and spruce webs glued together in such a way

as to produce a longitudinal multicellular structure or mul-

*From L'A ronautique, December, 1930, pp. 427-430.

tiple spars. The central part of each box girder is enlarged and then hollowed in such a way as to make in the middle of the wing a tunnel forming the front part of the cockpit and constituting at the same time a section of the fuselage (Fig. 4). There is thus obtained a one-piece wing with a large moment of inertia and offering considerable torsional resistance at its center, combined with some flexibility at the tips. To this wing framework are attached the leading-edge and trailing-edge formers and the interspar ribs. The wing is covered with plywood, after the flanges have been planed down to the desired profile. This profile, which is thick and biconvex, is derived from the 35 A.

The central part of the wing is traversed throughout its whole width by four steel tubes terminating in sockets at each end. The wing is attached to the fuselage by the four rear sockets, while the four front sockets receive the engine bearer. The float gear is attached to the bottom of this central part of the wing by means of a duralumin frame (Fig. 5). The ailerons are metal and are operated by torsion.

The fuselage has an oval section with its midsection reduced to a minimum. Its framework consists of two box girders forming two vertical walls united by several frames of spruce and plywood. Each girder consists of two longerons with spruce uprights and crosspieces assembled by gussets, the whole being covered, outside and inside, by plywood. The top and bottom of

the fuselage are also covered with plywood stiffened by longitudinal stringers.

The one-piece horizontal empennage is encased in the fuselage tip and secured by four bolts. It has a framework of two box spars and ribs and is covered with plywood. The fin, of similar design, is integral with the fuselage.

The duralumin floats (Figs. 9-13) have a single step and a rounded top. Each has a central keel of reinforced sheet metal, to which are riveted the sheet-metal frames. These frames are spaced by longitudinal bars, which also serve to stiffen the covering. Each float has, in front of the step, a sheet-steel section forming the fuel tank. The structure is continued through these tanks and the corresponding part of the keel is made of steel, since it is very difficult, with duralumin, to obtain absolute tightness of the riveting for the special fuels used.

The floats are mounted catamaran fashion and joined to the central part of the wing by wooden panels and tubes of high-resistance steel. Moreover, each float is connected with the wing by a pair of wires with elastic attachments, which prevent abnormal stresses in the wires due to a deformation of the wing or to an oblique landing.

The engine is a 1400 hp Hispano-Suiza having 18 cylinders in W, with angles of 80° between the rows, so that the cowling of the side rows fuses with the leading edge of the wing.

The unusual form of the engine necessitated a special mount. This consists of a cradle rigidly attached to the two lower front sockets of the central section of the wing. This cradle curves upward in front of the crankcase and is supported by two tubes, which pass over the side rows and are attached to the two upper front sockets of the wing (Fig. 18).

When the same pump draws simultaneously from two tanks, they may not empty in the same time. Hence, before the end of the course, air might enter from the tank first emptied, thus causing failure of the fuel delivery. Moreover, the unequal emptying of the tanks is increased by banking.

On the Bernard 120 the tank in the left float empties automatically into the right float, from which alone the fuel is pumped. In order to avoid trouble with the fuel delivery during turns, a five-liter fuel tank is installed in the fuselage on practically the same level as the carburetors. This tank is tight and communicates with an air chamber forming a shock absorber. The fuel is pumped from the right float into this tank, thereby creating pressure in the air chamber which causes the fuel to flow to the carburetors.

In the Bernard 120, the delivery height of the pumps is about 1.5 m (4.92 ft.). In some turns the acceleration may reach 4, in which case the theoretical height of the liquid column to be pumped would be 6 m (19.7 ft.), which exceeds the normal capacity of the pumps. At this time, however, fuel is delivered to the carburetors from the reserve under the in-

fluence of the compressed air. Of course, if the bank is continued too long, the air pressure might become too weak to insure the delivery.

As on other modern racers, the water and oil are cooled by wing radiators. These cover about three-fourths of the surface of the wing. Openings for the pipes are made in the leading-edge and trailing-edge formers (Figs. 6 & 14). The oil radiator, of welded duralumin tubing, is located on the side of the fuselage. The oil tank is inside the fuselage, behind the pilot.

Several other Bernard seaplanes (including the H 42), of similar construction to the 120, are equipped with 1000 hp Hispano-Suiza engines and are designed to serve for the training of pilots. They attain speeds of over 400 km (249 mi.) per hour, while the Bernard 120 has already exceeded 500 km (310 mi.) per hour.

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

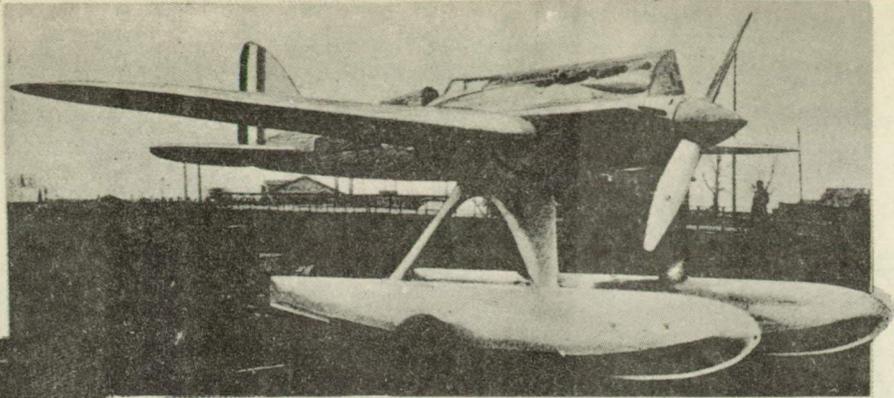


Fig.1

Figs.1,2
Views of
the
Bernard
120
seaplane.

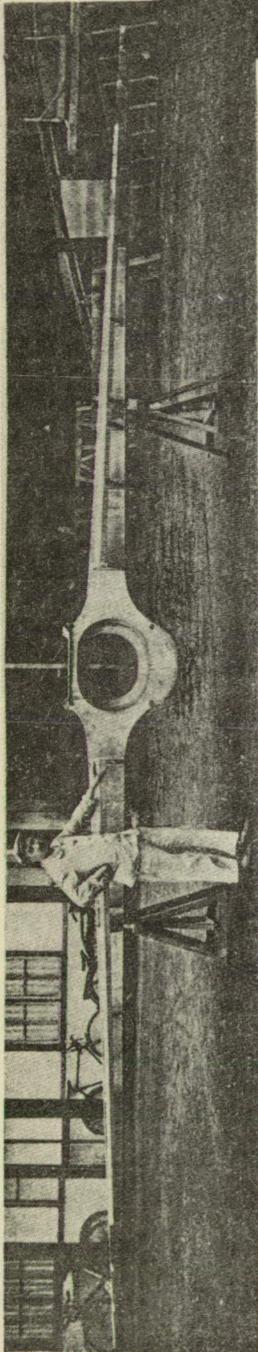


Fig.4 Body of wing (inverted).



Fig.2

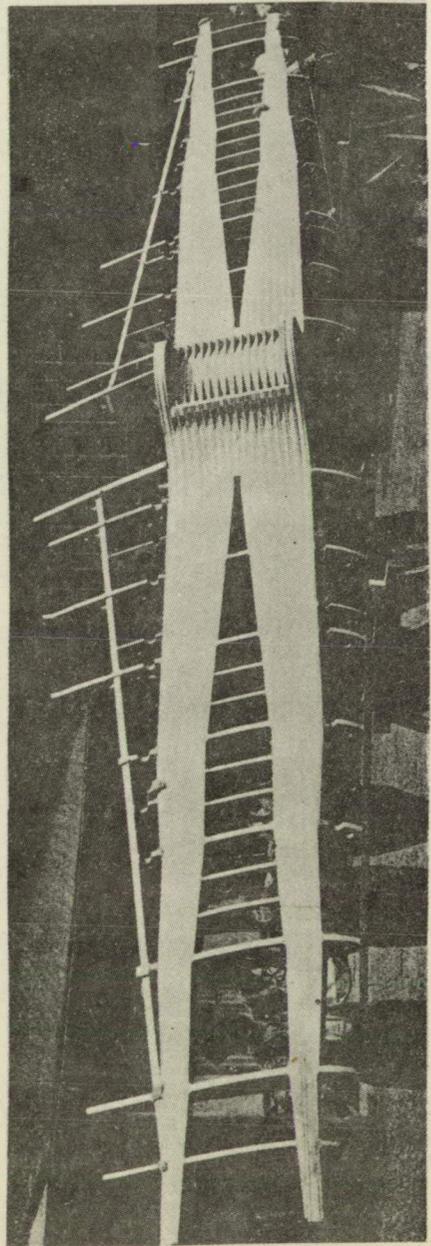


Fig.3 Structure of wing with central enlargement.

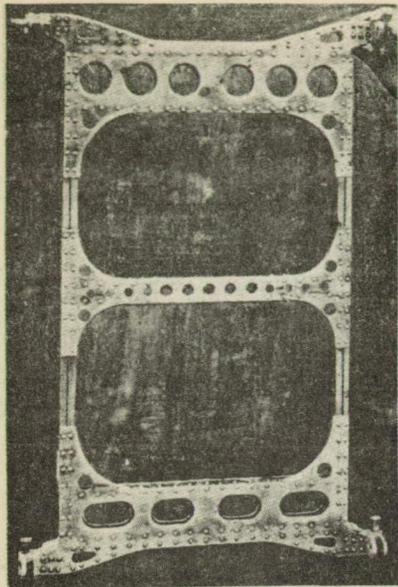


Fig.5
Duralumin
frame
under
fuselage.

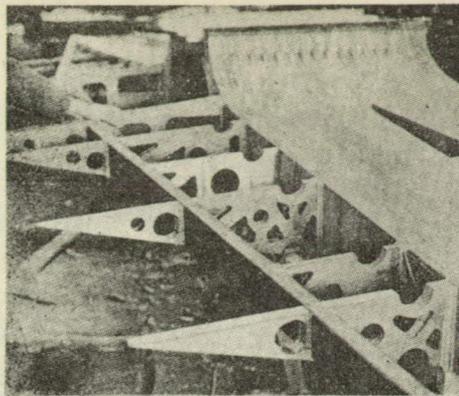


Fig.6 Trailing-edge
structure with
openings for radiator
pipes.

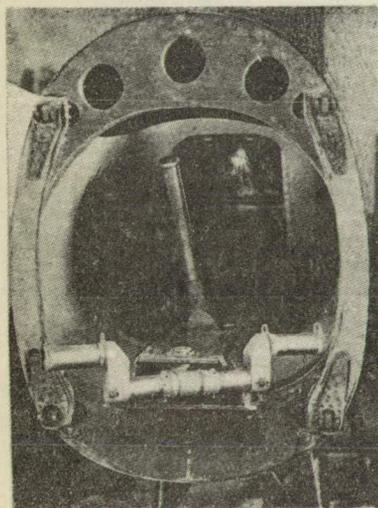


Fig.7
Fuselage
section
showing
controls
and wing
attachments.

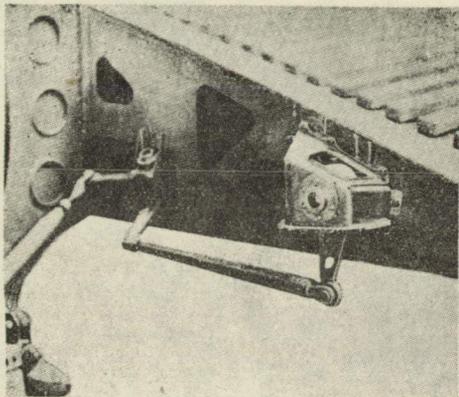


Fig.8 Aileron control.

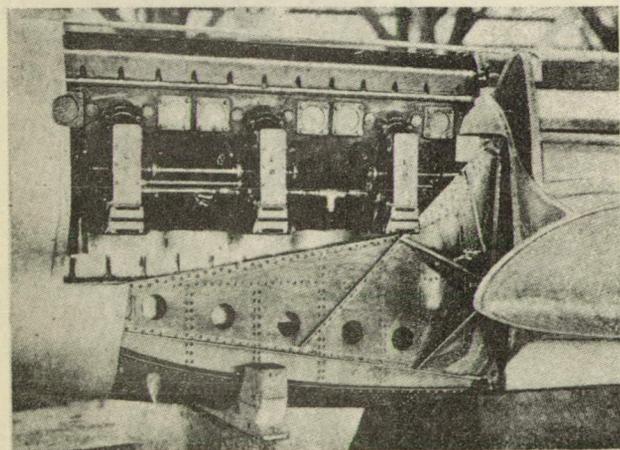


Fig.18 Mount of 1000 hp Hispano-Suiza engine on the H 42.



Fig.17 One of the floats
of the Bernard
120 seaplane.

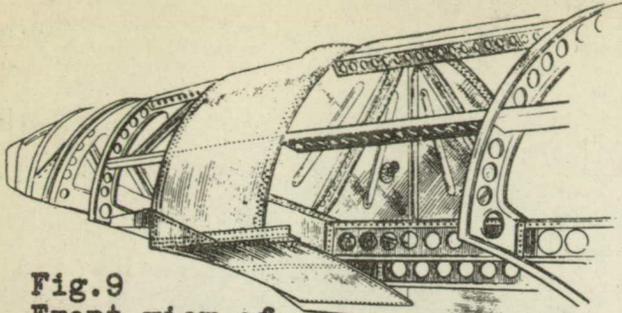


Fig. 9
Front view of
central part of float showing
steel fuel tank.

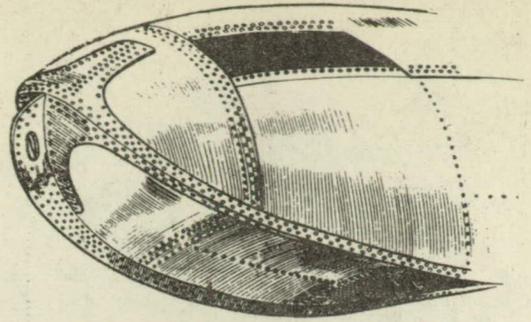


Fig. 12 Front end of float
covered, with
projecting keel.

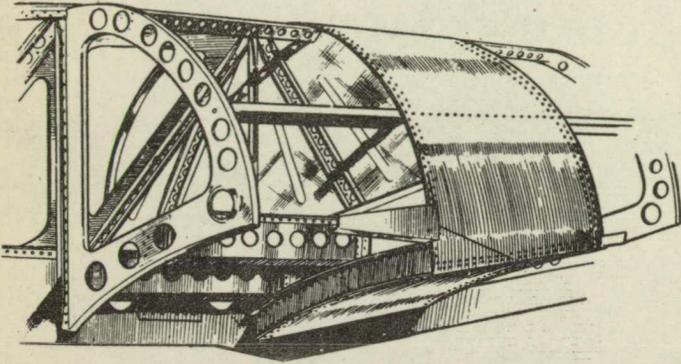


Fig. 10 Rear view of central
part of float.

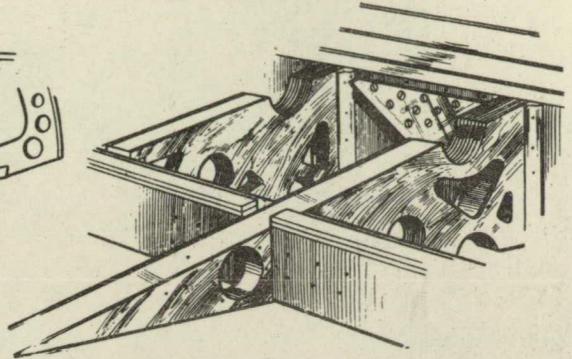


Fig. 14 Trailing-edge
of wing.

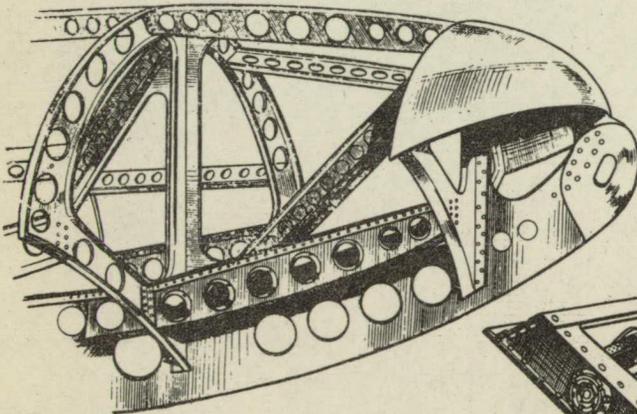


Fig. 11 Front end of float
showing hole for mooring.

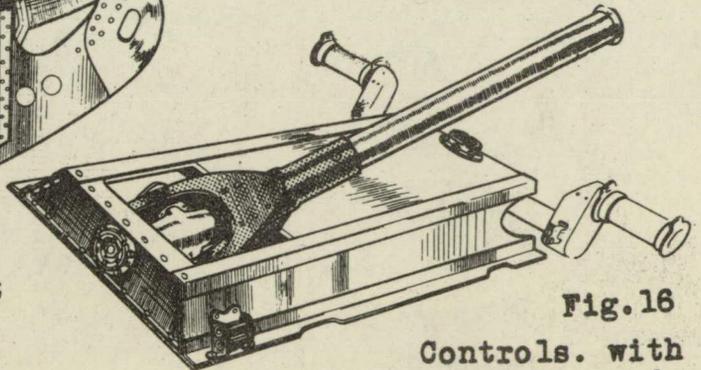


Fig. 16
Controls. with
stick tipped forward.

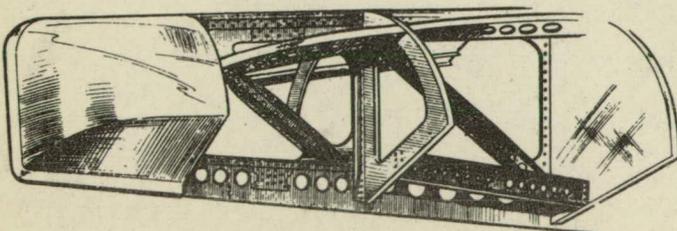


Fig. 13 Rear end of float
with steel casing.

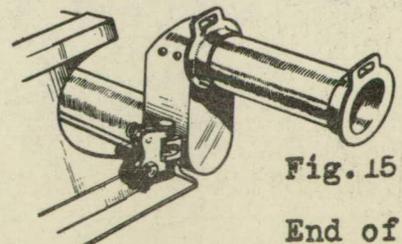


Fig. 15
End of
rudder bar.