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AIRCRAFT CIRCULARS

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

No. 133

THE HANRIOT H 431 MILITARY AIRPLANE (FRENCH)

A General Purpose Biplane

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THE HANRIOT H 431 MILITARY AIRPLANE (FRENCH)*

A General Purpose Biplane

The Hanriot H 431 was designed to meet the requirements of the French War Ministry for general purpose airplanes. As recently established, these requirements are as follows.

1. Provision for the economical training of pilots by having all the qualities of an airplane for advanced training and the staunchness of a stunting airplane; also for practice in photography, gunnery, radio and signalling, piloting with dual control and night flying.

2. Ease of piloting, perfect installation of equipment, facilities for taking off and landing.

3. Dual control with special seats and seat-pack parachutes. Perfect visibility from both seats, particularly downward. The observer's cockpit must permit the use of four different equipments, one at a time:

a) Radio transmitting and receiving instruments;

b) Photograph camera f 26 with large field;

c) Machine-gun camera;

d) Night-flying equipment.

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*From a pamphlet issued by the manufacturers.

4. Permanent armament:

a) An O.P.L. bomb sight;

b) A Lewis twin machine gun on ring mount T.O.7 with 300 cartridges:

c) An S.T.Aé. sight support;

d) Apparatus for signalling with rockets.

5. Radius of action of 450 km (280 miles) in still air. The airplane carries fuel for 2.5 hours flight at full power. The fuel tank can be emptied quickly, but is not protected.

Due to its good flight qualities, and in particular to its easy controllability and maneuverability, it can be used as a training plane for preparing less experienced pilots for operating military airplanes (Figs. 1, 2 & 3).

Description

1. Wings.- The wings have a positive stagger, duralumin struts, and brace wires of high-resistance steel. The wing structure is composed of duralumin spars and compression members with steel brace wires. The ribs are wood. The ailerons are controlled by cables running over ball-bearing pulleys (Figs. 4 & 5). The wing structure was approved by the French Government February 4, 1928.

2. Fuselage.- The fuselage structure is rectangular and composed of four tubular longerons of duralumin, with cross-pieces and uprights of the same material. It is sheathed

throughout its entire length with duralumin plates which can be quickly removed, thus facilitating the upkeep of the airplane and the installation of the various equipments (Figs. 6, 7, 8 & 9).

3. Landing gear.- This is formed by two lateral V struts. The sandow shock absorbers can be readily exchanged (Fig. 10).

4. Tail surfaces.- The tail surfaces are constructed of duralumin with fabric covering. Each empennage consists of a fixed and a movable component (Fig. 11). The stabilizer is adjustable during flight (Figs. 12, 13 & 14) while the fin can be adjusted on the ground.

5. Controls.- The elevator control is perfectly rigid, being mounted on ball bearings with a ball-and-socket joint. The rudder and aileron cables are perfectly flexible and run over large grooved ball-bearing pulleys.

6. Power plant.- The H 431 is equipped with a 240 hp Lorraine air-cooled engine. Other engines of similar characteristics can be used. The engine mount is sheet duralumin and is attached to the front end of the fuselage by four ball-and-socket joints (Figs. 15, 16 & 17). A fire extinguisher and a starter are provided.

7. Tanks.- The duralumin fuel tanks are placed in the bottom of the fuselage and can be dropped at the will of the pilot. The fuel is supplied by pump. The copper oil tank is placed over the engine.

Principal Characteristics of the H 431

The H 431 has exceptional flight characteristics, due to the form of its wing structure. It is a remarkable glider. Due to the shape of the wing profile, the large gap and stagger, it has an aerodynamic efficiency of the first order. This assures great facility in taking off and landing and excellent behavior of the airplane when flying at low speed. The stagger of the wings, the cutaways in the wings and the relatively high cabane afford a remarkable visibility upward, forward and downward.

The 240 hp Lorraine engine, which has demonstrated its reliability on commercial lines, has made possible a very compact airplane. The pilot and observer can communicate orally with each other. Its extreme compactness, together with its perfect balance and the efficacy of its controls, explains its remarkable aptitude for stunt flying. It can make the most difficult and dangerous evolutions with impunity. Its safety has been demonstrated by severe static tests. Lastly, its equipment amply satisfies all exigencies.

The H 431 is equipped with dual control. The spacious observer's cockpit enables the simultaneous installation of radio, photographic and night-flying equipment. The supports for all the instruments are mounted permanently on the airplane and all four installations can be used during the same flight.

In short, the H 431 provides economically, in time of peace, for the training of pilots and observers, while, in time of war, its excellent equipment enables it to perform all sorts of observation work of secondary importance.

Characteristics

Weight (equipped as a training plane)	1270.5 kg	(2800.94 lb.)
Span of upper wing	11.40 m	(37.40 ft.)
Span of lower wing	8.56 "	(28.08 ")
Over-all length	8.12 "	(26.64 ")
Height	3.30 "	(10.83 ")
Chord of upper wing	1.80 "	(5.91 ")
Chord of lower wing	1.80 "	(5.91 ")
Wing gap	1.76 "	(5.77 ")
Area of upper wing	18.36 m^2	(197.62 sq.ft.)
Area of lower wing	11.88 "	(127.88 " ")
Total wing area	30.24 "	(325.50 " ")
Area of stabilizer	1.94 "	(20.88 " ")
Area of elevator	1.20 "	(12.92 " ")
Area of fin	0.69 "	(7.43 " ")
Area of rudder	1.12 "	(12.06 " ")
Capacity of fuel tanks	200 liters	(52.83 gal.)
Capacity of oil tank	16 "	(4.23 ")
Track gauge	1.92 m	(6.3 ft.

Safety factors:

Flight case I	13
Flight case II	10
Flight case III	4
Flight case IV (inverted flight)	6.5.

Performances of the Prototype

Altitude	Climbing time	Horizontal speed at full throttle	
Ground level		180 km/h	111.9 mi./hr.
500 m (1640 ft.)	3 min.	178 "	110.6 "
1000 " (3281 ")	6 "	176 "	109.4 "
2000 " (6562 ")	13 "	175 "	108.7 "

Landing speed	85 km/h	(52.8 mi./hr.)
Practical ceiling	4300 m	(14110 ft.)
Theoretical ceiling	5300 m	(17390 ")
Radius of action	450 km	(280 mi.)

Armament: 2 Lewis machine guns.

Equipment:

Fire prevention: Automatic extinguisher.

Navigation: Flight indicator, etc.

Illumination: Night-flying equipment.

Photographic: Large field f 26 and f 30 Labrely cameras.

Radio: Sets S and R 7, etc. 100 km set with damped waves.

Table of Weights

Equipment	Training	With Radio	With Armament
Cell	468 kg (1031.8 lb.)	468 kg (1031.8 lb.)	468 kg (1031.8 lb.)
Power plant	388 kg (855.4 lb.)	388 kg (855.4 lb.)	388 kg (855.4 lb.)
Fixed equipment	28.5 kg (62.8 lb.)	28.5 kg (62.8 lb.)	28.5 kg (62.8 lb.)
General equipment	52 kg (114.6 lb.)	52 kg (114.6 lb.)	52 kg (114.6 lb.)
Special equipment		40.5 kg (89.29 lb.)	58 kg (127.87 lb.)
Weight of airplane empty	936.5 kg (2064.6 lb.)	977 kg (2153.9 lb.)	994.5 kg (2192.5 lb.)
Personnel with parachutes	176 kg (388 lb.)	176 kg (388 lb.)	176 kg (388 lb.)
Fuel	144 kg (317.5 lb.)	144 kg (317.5 lb.)	144 kg (317.5 lb.)
Oil	14 kg (30.9 lb.)	14 kg (30.9 lb.)	14 kg (30.9 lb.)
Munitions			22 kg (48.5 lb.)
Airplane in flying order	1270.5 kg (2801.0 lb.)	1311.0 kg (2890.3 lb.)	1350.5 kg (2977.4 lb.)

Permanently Installed Instruments on the H 431

1 fuel-pressure gauge	2 fuel-level gauges
1 oil-pressure indicator	2 switches
1 oil thermometer	1 Viet starter
1 revolution counter	1 automatic extinguisher

Instruments for which supports are provided and which can be furnished on a separate invoice for the equipment of messenger (liaison) airplanes.

1 O.P.L. sight with battery and rheostat or large Chrétien model,

1 machine gun camera,
2 compasses,
1 Philippe drift meter,
2 map holders,
2 clocks,
2 altimeters,
2 inclinometers,
1 night-flying equipment (navigation lights, lamps, storage batteries and wiring).
1 speed indicator,
1 flight-control instrument,
1 rear-view mirror,
1 starting magneto,
1 machine gun mount,
1 photographic camera,
2 radio sets,

Improvements of the Hanriot 431 Airplane*

The Lorraine-Hanriot Company has resumed the study of the two-place military H 431, a general-purpose airplane which it expects to manufacture in quantity. This study has resulted in numerous improvements in details, such as the axleless landing gear, the shoe with oleopneumatic shock absorber instead of the conventional tail skid, stabilizer adjustable during flight, height of rudder bar adjustable on the ground, etc. The installation of the equipment has also been improved. All these improvements are indicated by the drawings and the accompanying legends.

Figs. 16-17. Engine support.- Figure 16 shows the engine support, consisting of a sheet-metal ring provided with four reinforced arms which are attached to the ends of the fuselage longerons. The engine is bolted to a ring which forms an oblique cut in the cone of the engine support. The arms are therefore of unequal length. The effect of this arrangement

*From L'Aéronautique," October, 1930.

is to deflect the nose of the engine so as to offset the turning moment (torque), without affecting the drift. It only remains to make a slight adjustment of the drift. The engine compartment is closed by two side doors which afford access to the different parts of the engine. The engine support is very strong. It is simpler than the tubular support, because it does not have special joints, but simply sheet-metal gussets attached to the framework. Its shape enables it to serve also as a cowling.

Figure 17 shows the details of one of the corners of the engine support. Since the drawing was made during the installation, the exhaust orifice is closed by a rag. Note the gusset at the corner of the fuselage and the cut in the U arm of the engine support.

Figure 8 shows how the front landing-gear strut is hinged to the fuselage. The landing gear consists of two entirely independent parts. Each part consists of a lateral panel hinged to the side of the fuselage and of a bent axle hinged to the center of the fuselage. The lateral panel has the form of a V with the point down. The front strut (Fig. 10) consists of two tubes between which the axle moves. The latter is connected with a Hanriot oleopneumatic shock absorber and is guided between the two tubes of the strut. The whole system is easily adjusted.

Figure 18 shows the tail skid in the form of a box girder of great rigidity. Its rear end (Fig. 19) carries a spherical cap of special steel attached to its lower side at four points forming a square. When this cap becomes worn, it can be given a quarter-turn thus exposing another side to wear and correspondingly lengthening the life of the skid. The cap, moreover, is easily replaced. The upper side of the skid carries lugs for attaching an oleopneumatic shock absorber similar to those of the landing gear. The rod of the shock absorber is located inside the stern tube. The base of the triangular skid, forms a fork, the branches of which are bolted to the fuselage longerons. In case of injury, the skid can be replaced by means of these bolts without disturbing the fuselage.

The oleopneumatic shock absorber has an oil chamber and an air chamber separated by a valve. This valve is lifted from its seat by the effect of a shock and allows the passage of the oil, which compresses the air in the second chamber. After the shock, the compressed air forces the oil back, and the valve returns to its seat, leaving only a small central opening for the passage of the oil and thus retarding its return.

A remarkable characteristic of the H 431 is the facility with which all its parts can be inspected. Both sides of the fuselage are sheathed with duralumin panels, all turning

on fixed hinges situated near the upper longerons. The fuselage can therefore be inspected, from the outside, from one end to the other. The panels, being hinged and not detachable, remain on the fuselage during the inspection and are therefore not exposed to the risk of deterioration from being left on the ground.

Figure 14 shows the stabilizer-control mechanism: from left to right, the pilot's wheel, the observer's wheel and the eccentric. The H 431 is a general purpose airplane capable of performing six different services with correspondingly different loads and trims. For this reason it is provided with a stabilizer that can be adjusted during flight from the pilot's seat by a wheel actuating a rigid control rod with a hinge joint. The movements of the wheel are instinctive, that is to say the pilot pushes the upper edge forward to make the airplane nose-heavy and pulls it backward to make the craft tail-heavy. From the observer's cockpit the stabilizer is controlled by means of a wheel perpendicular to the pilot's wheel and which can be operated either from the inside of the cockpit or from the outside on the ground. A mechanic can also place the control, before the departure, in the position corresponding to the correct trim for the mission to be accomplished. The transmission is effected through a series of tubes connected by hinged joints. It can thus follow the tapering shape of the

fuselage and dispense with special devices while retaining great ease of operation. It actuates an endless screw which controls a pinion integral with two eccentrics, the latter being hinged to the front spar of the stabilizer which they move up or down. There is no play, so that the effect is immediate and, because of the rigidity, the stabilizer acquires no vibration.

Each rudder bar of the dual control (Fig. 20) consists of a double crank, whose axis carries a pinion which is controlled by an endless screw. The latter terminates in a key, by turning which the pilot can elevate or depress the cranks at will and thus adjust them to the length of his legs.

The framework of both the stabilizer and elevator (Fig. 11) consists of U-section ribs mounted on rectangular and round tubes, thus affording great strength and lightness. The hinges have ball bearings.

Figure 3 shows the annular cowling of the "Mizar" type of the Lorraine-Hanriot H 431.

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

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11.40 m (37.40 ft.)
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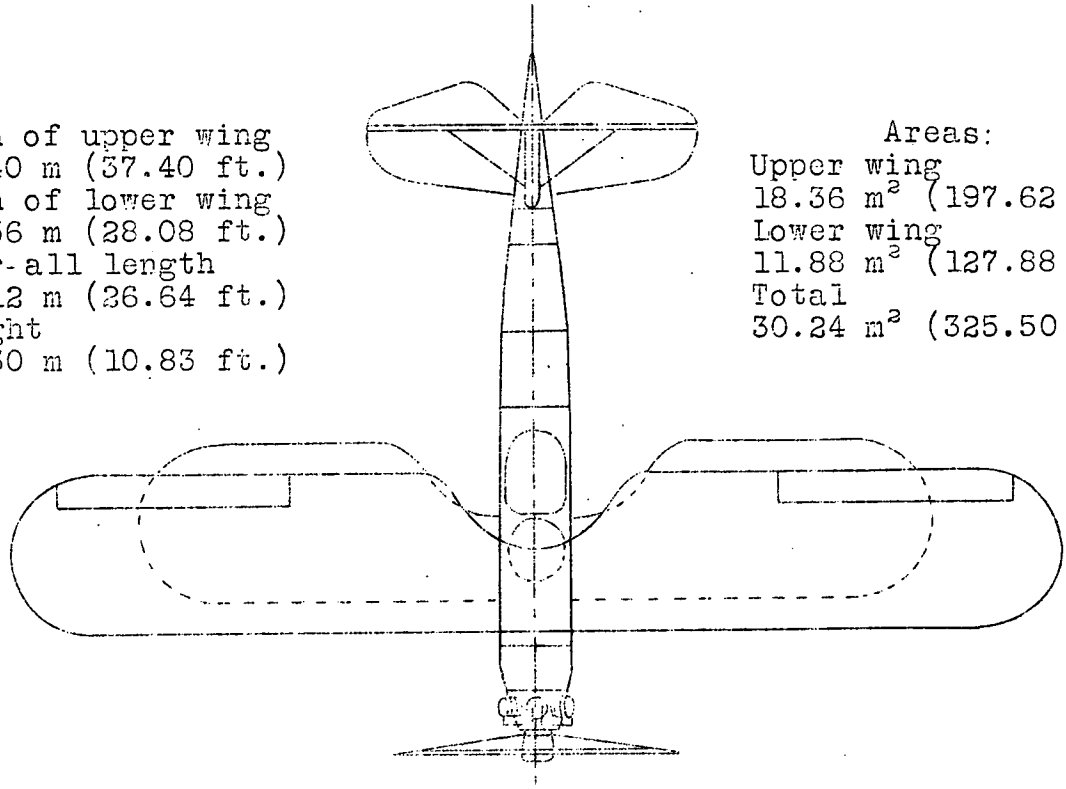
8.12 m (26.64 ft.)
Height
3.30 m (10.83 ft.)

Areas:
Upper wing
18.36 m^2 (197.62 sq.ft.)
Lower wing
11.88 m^2 (127.88 sq.ft.)
Total
30.24 m^2 (325.50 sq.ft.)



Lorraine
"Mizar"
240 hp
engine

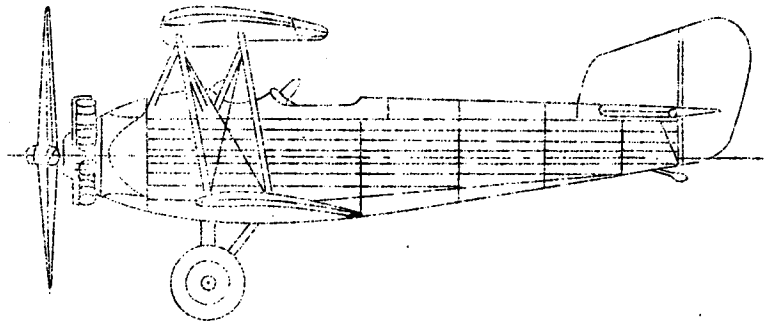


Fig.1 General arrangement drawings of the Hanriot H.431 general purpose airplane.

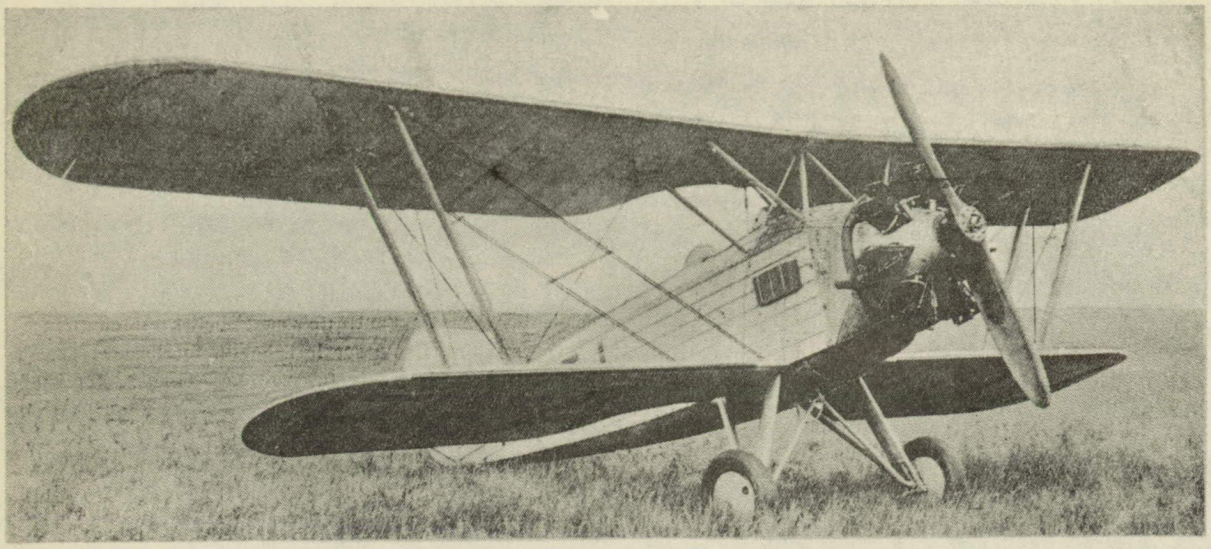
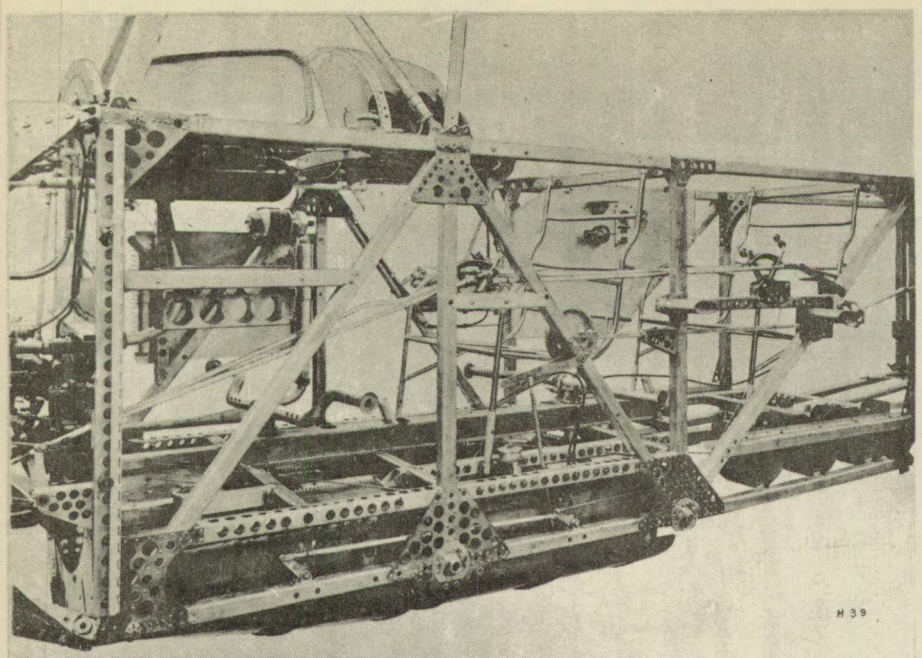


Fig. 2 Three-quarter front view of the Lorraine-Hanriot H-431 general purpose military biplane with the Lorraine "Mizar" 240 hp air cooled engine.

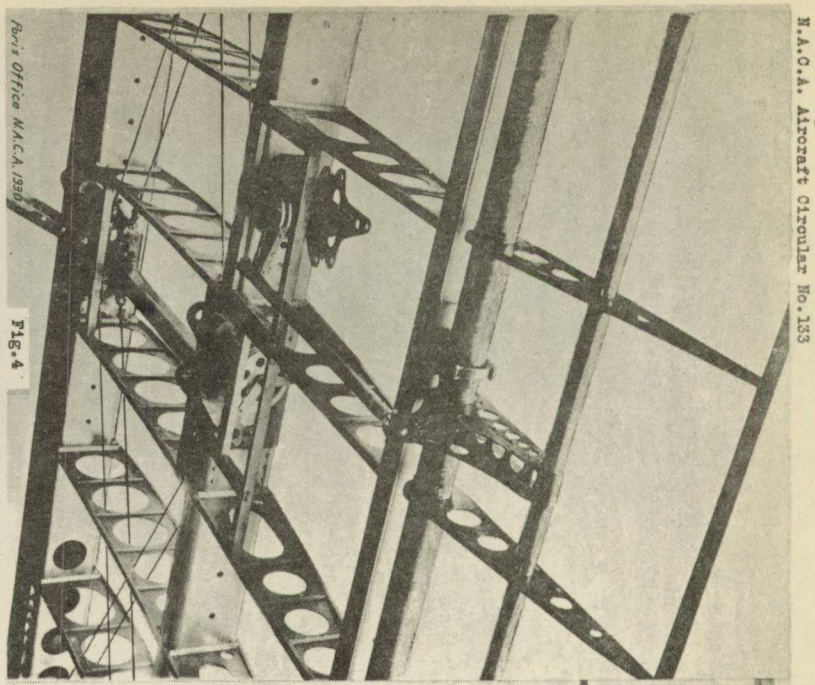
Taken from L'aéronautique October 1930

Fig. 3 Side view of the Lorraine-Hanriot H-431 showing the annular cowling of the "Mizar" type.

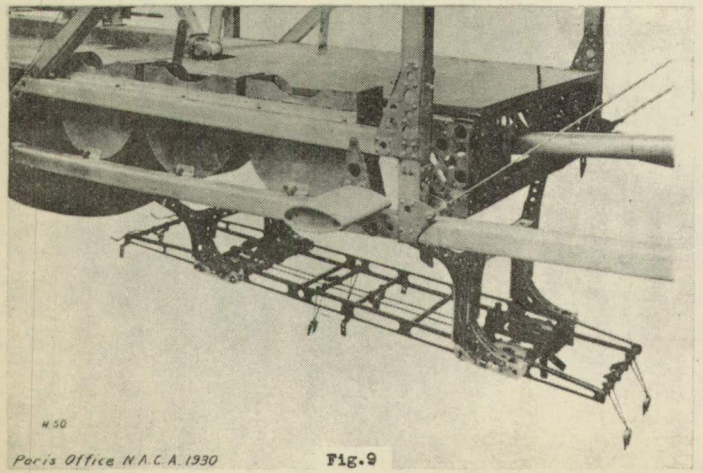


H 39

Paris Office N.A.C.A. 1930 Fig.7

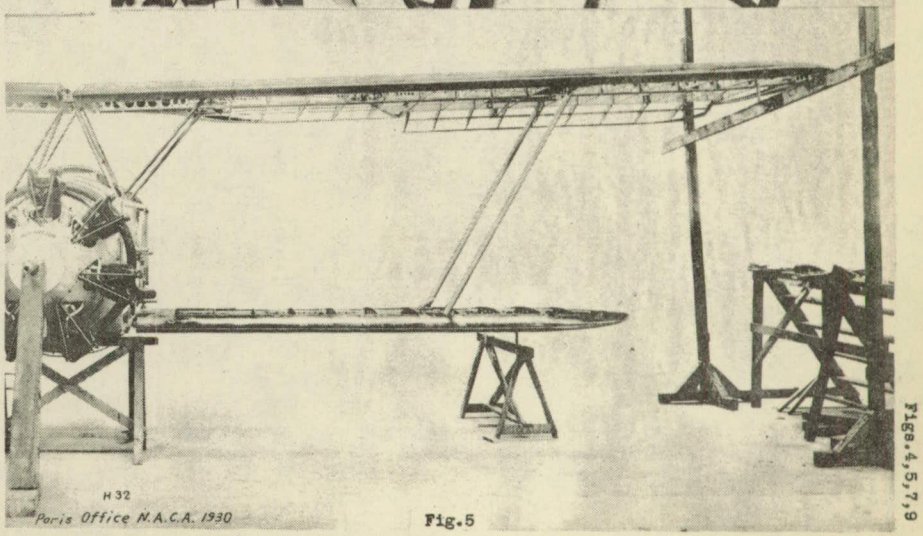


Paris Office N.A.C.A. 1930 Fig.4



H 50

Paris Office N.A.C.A. 1930 Fig.9



H 32

Paris Office N.A.C.A. 1930 Fig.5

Figs. 4, 5, 7, 9

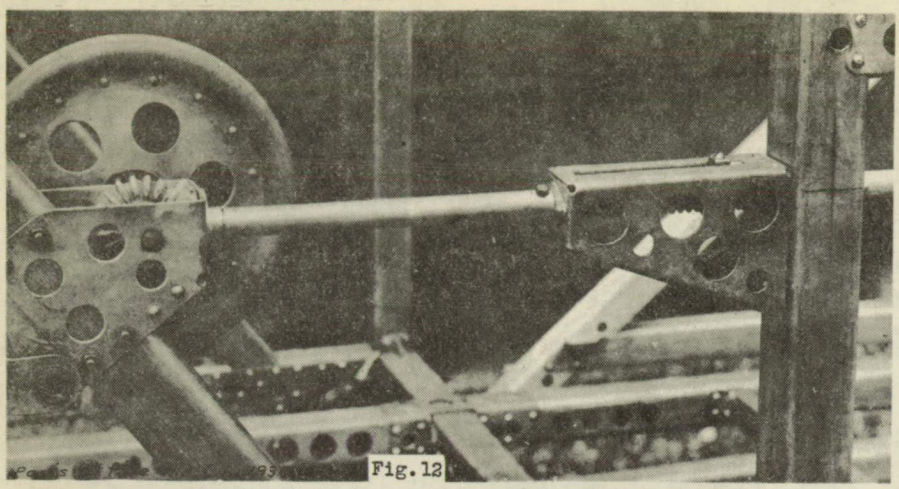


Fig.12

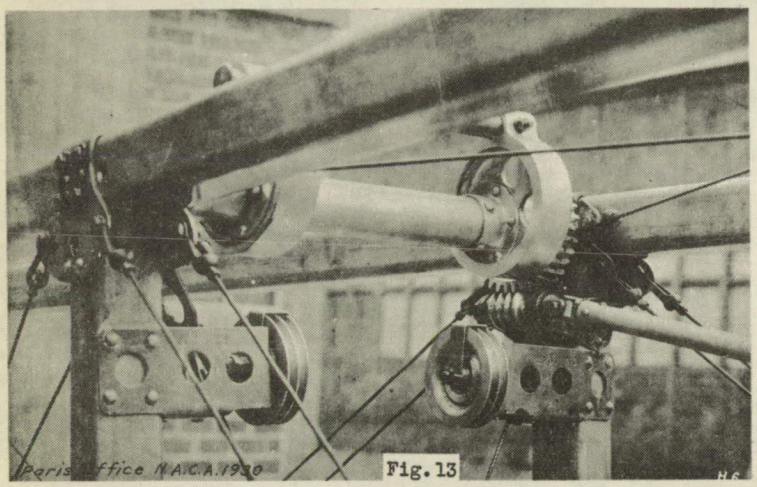


Fig.13

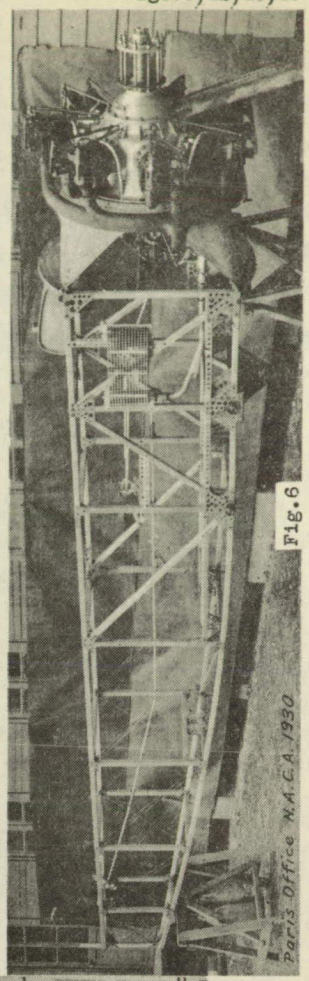


Fig.6

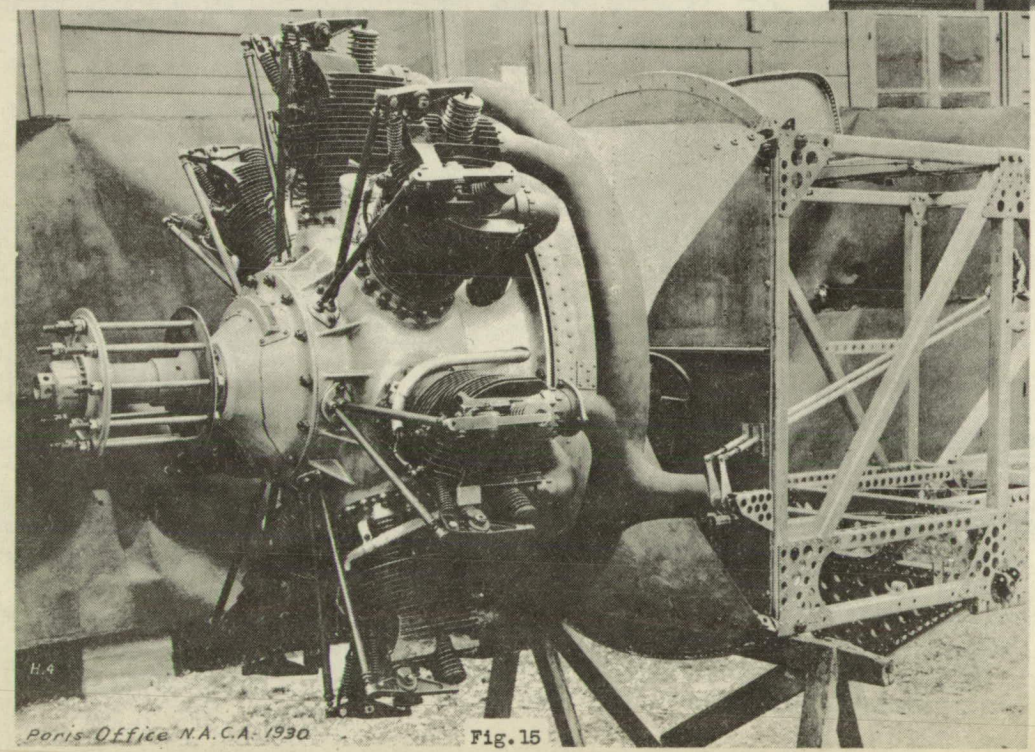


Fig.15

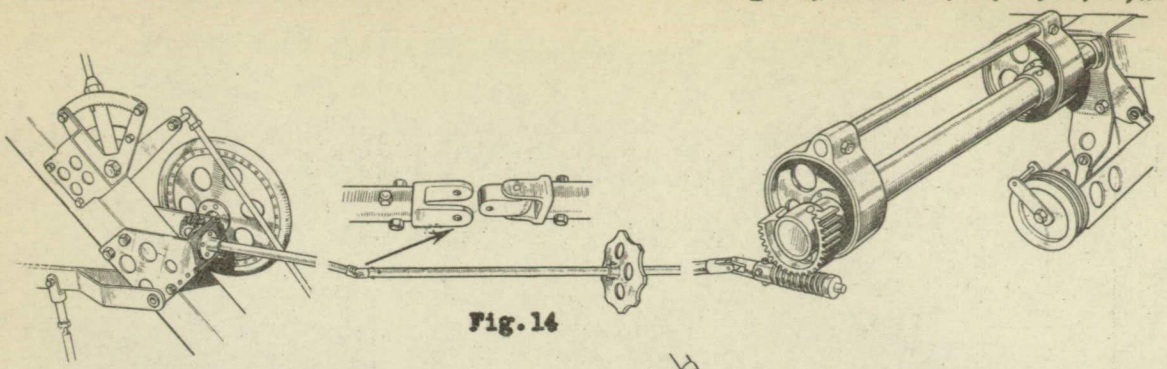


Fig.14

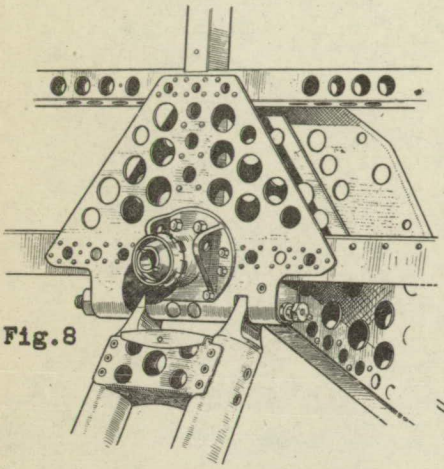


Fig.8

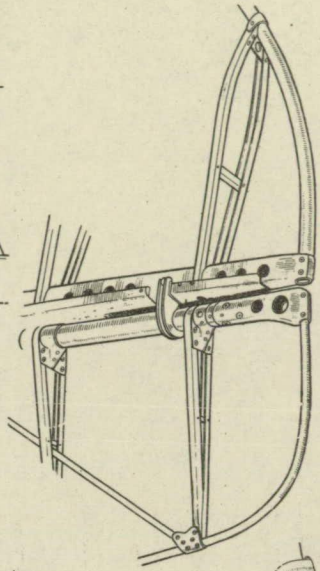


Fig.11

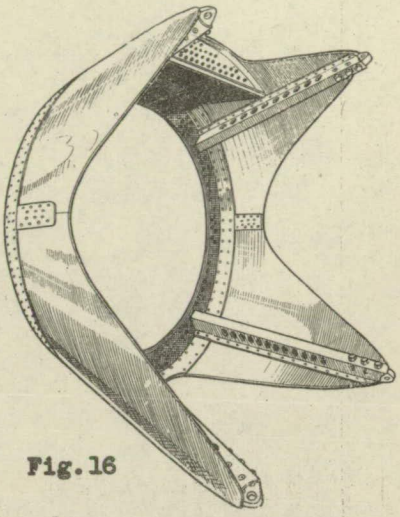


Fig.16

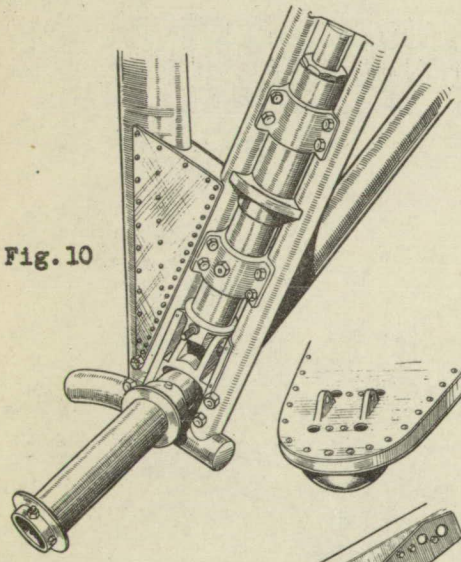


Fig.10

Taken from
L'aéronautique
October 1930

Fig.19

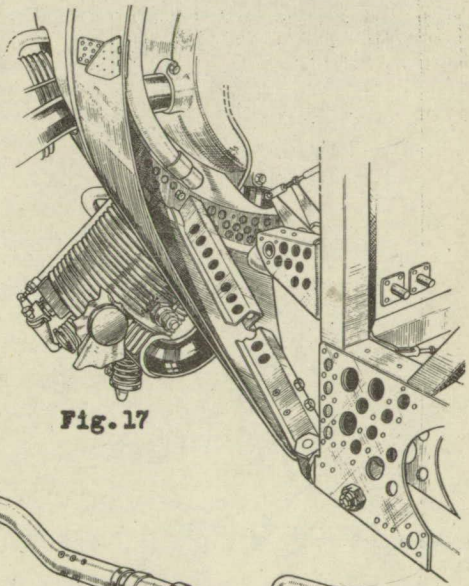


Fig.17

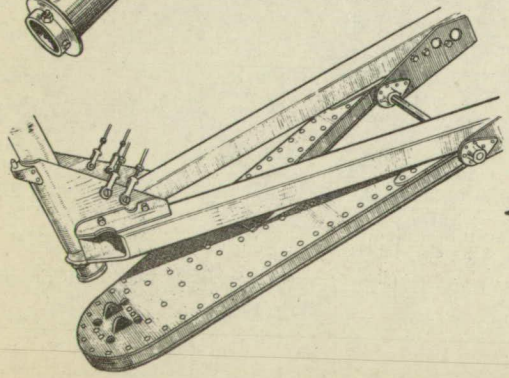


Fig.18

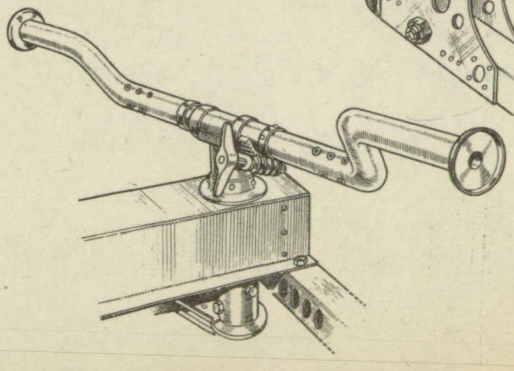


Fig.20