AIRCRAFT CIRCULARS

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

No. 1

LIORÉ-OLIVIER AIRPLANE

(Type 12 Night-Bomber or Type 20 Commercial)

By J. Serryer

From "Les Ailes," January 28, 1926

Washington
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The Lioré-Olivier Company, one of the oldest French aeronautic construction companies, has been as successful in building land airplanes as in the manufacture of its remarkable seaplanes. For want of the necessary data, we have not previously described the interesting airplane of large-carrying capacity, which was built and tested by this company in 1924.

It was built on very simple lines and, except its covering, is all metal. For the sake of reducing its cost as much as possible, the constructors not only simplified the design, but made each part of a very small number of stamped and riveted pieces. The framework consists chiefly of light-metal standard tubes and sections.

Equipped as a military airplane, Bn 2, the L-O large airplane, type 12, brilliantly passed its official tests. Among its performances, we would call special attention to its good behavior at 2000 m (6562 ft.), where, with its full load and one engine stopped, it not only could hold its course, but could also describe a figure eight, thus demonstrating its excellent manageability.

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It has two 400 HP. Lorraine-Dietrich engines, which give it a maximum speed of 204 km (127 mi.) per hour at an altitude of 5550 m (18209 ft.) with a useful load of 1944 kg (4286 lb.). Its radius of action, 875 km (544 mi.) makes it especially suitable for long trips. It has been adopted by the French army as a night bomber with two or three seats.

The type 12 can be converted easily into a commercial airplane. It then becomes the L-O 20, capable of carrying 15 passengers and 300 kg (661 lb.) of freight at a speed of 190 km (118 mi.) per hour with 450 HP. engines.

Cell.- The wing structure of the large L-O military airplane, type 12 Bn 2, or of the commercial airplane, type 20, is a biplane cell with a wing area of 105 m^2 (1130.21 sq.ft.). It has two equal unstaggered rectangular wings, without lateral dihedral or longitudinal sweep back. Each wing has a span of 22.2 m (72.83 ft.) and a chord of 2.5 m (8.2 ft.). The non-compensated ailerons are four in number, each being 4.375 m (14.35 ft.) long and 41 cm (16.14 in.) wide.

Each half-cell has three pairs of vertical struts braced diagonally by steel cables. Moreover, at the center of the cell, the upper wing is connected with the fuselage by a series of oblique struts.

The wing structure is all-metal, each wing having, as spars, two box girders and a certain number of ribs, thus form-

ing a braced girder, which is normally covered with fabric.

Fuselage.- Equipped as Bn 2, i.e. as a bomber, the L-O airplane, type 12, has a fuselage 1.3 m (4.27 ft.) wide and 1.5 m (4.92 ft.) high at its largest cross section. Its framework is all-metal.

The pilot's cockpit is behind the cell and contains two seats side by side. In order to increase the visibility, both wings are cut away in this vicinity. Immediately back of the pilot's cockpit, there is a turret for twin machine guns. Another gunner's cockpit is arranged inside the fuselage, for firing down and back.

The horizontal "empennage" is as simple in shape as the wings. It consists of an adjustable stabilizer and an unbalanced elevator in two parts, both being in the same horizontal plane. The incidence of the stabilizer can be adjusted during flight, so that when it has been set at the desired angle, the pilot does not have to exert any force on the control stick.

The vertical "empennage" consists of a large fin and a rudder which, contrary to the accompanying diagram, is not balanced. Due to a suitable device, patented by the L.-O. Company, the fin is adjustable. In case of the stopping of one of the engines, the pilot can therefore prolong the flight, even if the airplane is fully loaded, by suitably adjusting the fin so as to compensate, without fatigue, the change in the direction

of thrust, thus retaining perfect rudder control.

The framework of both empennages is likewise of light metal and normally they are all covered with fabric. The adjustable stabilizer is guyed to the rear of each side of the fuselage, above and below, with the interposition of double steel turnbuckles. Each turnbuckle is attached, at its lower end, to the base of the last upright of the fuselage and also to the spar of the plane. Its lower end is integral with the rudder post. Moreover, this stabilizer is braced by two small oblique struts which likewise serve to modify its incidence in flight. These struts are disposed vertically to the front spar and are bolted to this spar at their upper ends. The lower fittings of these struts are assembled with a tubular triangle, whose apex can be shifted vertically by means of an endless screw controlled by the pilot. The two fuselage struts serve as guides for this assembly, as also for the front spar of the plane.

Power Plant.- The L.-O. military airplane, type 12, Bn 2, can be equipped either with two 400 HP. Lorraine-Dietrich engines or with two 420 HP. Jupiter engines. The commercial airplane, type 20, derived from the military airplane, is equipped with two 450 HP. engines.

Each engine is mounted on a removable frame in front of the lower wing. Two compression struts of light-metal tubing con-

nect the cross members of the engine bed with the landing-gear struts. These cross members are made of standard light-metal sections. They rest on a box girder joined to the front spar of the lower wing. An assembly of struts, cross members and diagonals, likewise of standard sections, connect the two cross members to the compression struts of the engine frame.

Attachments are provided on each engine to facilitate its removal. Thus an engine can be replaced by another engine in three hours. The engines are entirely outside the cell and are perfectly accessible to the mechanics. All the hoods are removable, thus facilitating the cleaning and thorough inspection of all the parts.

The cooling is done by a frontal honeycomb Vincent Andre radiator located above and behind each engine. This radiator is movable vertically and can be drawn into the cockpit behind the engine. On the side, a water tank, with a capacity of 40 liters (10.57 gal.), also acts as a radiator.

Landing Gear.- This is composed of two entirely independent parts, the wheel-gauge being 4.44 m (14.57 ft.). Each part of the landing gear is directly under one of the engines. The system adopted comprises a fixed frame and a movable frame of steel tubes and weighs 70 kg (154 lb.), both being vertical and enclosed in a housing. The fixed frame serves as a guide to the movable frame, which supports a single wheel 1100 × 120/ mm

(43.30 × 4.72 in.). Sandows, wound about the upper cross members of these two frames, absorb the landing shocks. This landing gear is very strong. It has supported six times the weight of the airplane, without breaking. The large diameter of the wheels keeps them from sinking in soft ground and enables them to pass over rough ground more easily.

General Characteristics

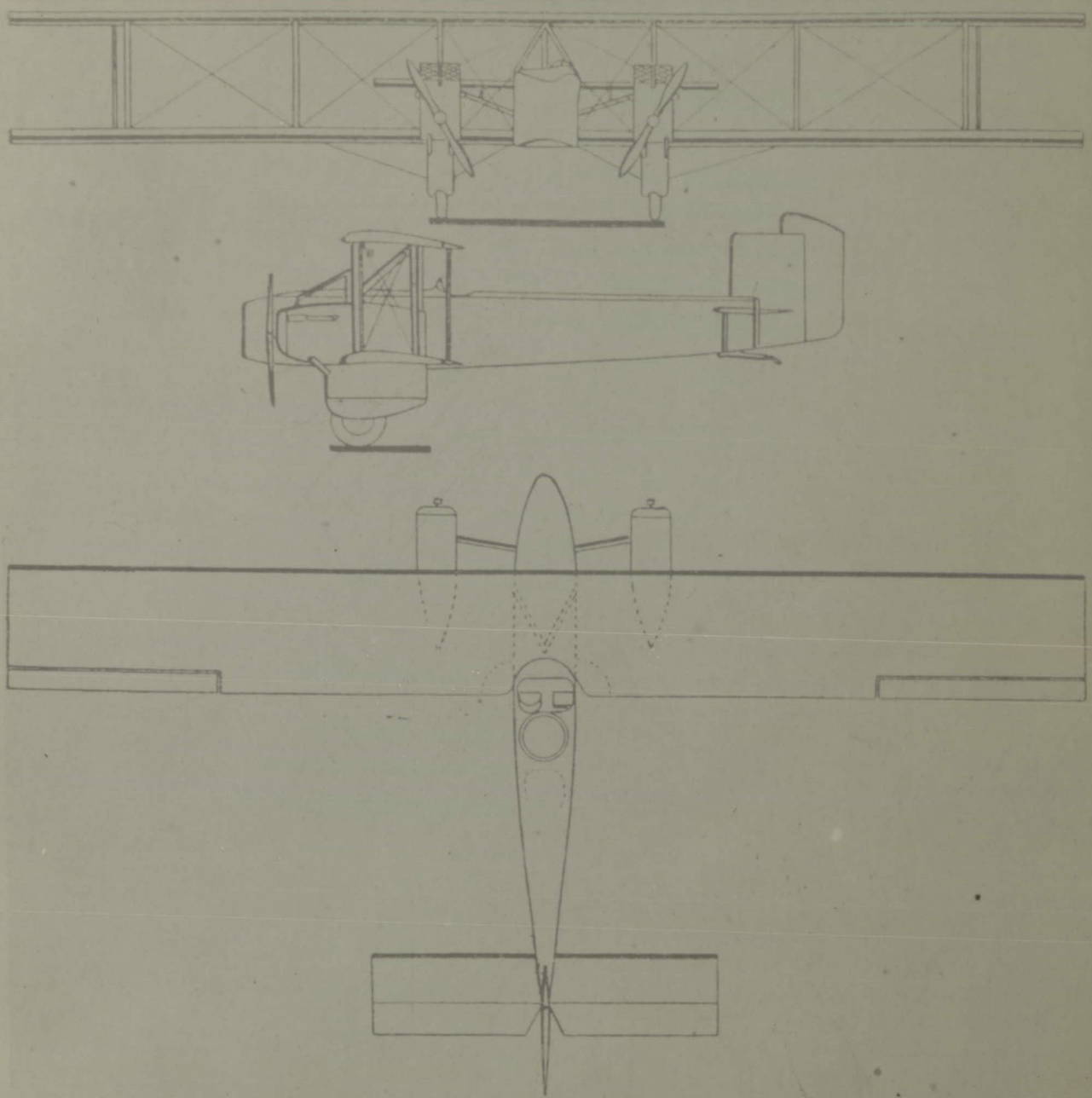
Span	22.2 m	72.83 ft.
Chord	2.5 "	8.2 "
Gap	2.426 m	7.96 "
Height	4.26 "	13.98 "
Length	12.6 "	41.34 "
Wing area	105.0 m^2	1130.21 sq.ft.
Dead load	2650.0 kg	5842.00 lb.
Useful load	1950.0 "	4299.00 "
Full load	4600.0 "	10141.00 "
Wing loading	43.70 kg/m^2	8.95 lb./sq.ft.
Load per horsepower	5.75 kg/HP.	12.68 lb./HP.
Power per unit area	7.65 $HP./m^2$	.711 HP./sq.ft.

Performances

Maximum speed	204 km/hr.	126.75 mi./hr.
Speed at 2300 m (7546 ft.)	190 "	118.06 "
Climb to 2000 m (6562 ft.) with 1600 kg (3527 lb.) useful load	9 min. 18 sec.	9 min. 18 sec.
Climb to 5500 m (18045 ft.) with 1800 kg (3968 lb.) useful load	1 hour	1 hour

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

Liore & Olivier night bomber type 12
2-400 HP. Lorraine-Dietrich engines.



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