

AIRCRAFT CIRCULARS

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

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FOKKER F.XX COMMERCIAL AIRPLANE (DUTCH)

A High-Wing Cantilever Monoplane

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A High-Wing Cantilever Monoplane

The Fokker F.XX is a three-engine high-wing monoplane with retractable landing gear and tail wheel (figs. 1, 2, 3, and 4).

Wing.- As is customary in Fokker aircraft, the wing is placed on the fuselage. In order to keep the section of the fuselage proper as small as possible, the plywood covering on the under surface of the wing has been removed from the center section, and the hollow space thus exposed forms the upper part of the cabin.

The profile of the wing presents less resistance, within the range of commercial speeds, than with the profile used hitherto. This profile has the further advantage that the center of pressure travels but little and, in consequence, the torsional loads during flight are reduced to a minimum.

This wing section, moreover, facilitates the making of luggage holds in the wing.

To secure the most favorable landing speed, flaps about half the span of each wing half have been mounted on both sides between the fuselage and the ailerons.

The wing, which is secured to the fuselage framework by means of four bolts, is constructed in the usual Fokker way; that is, with two box spars made up of spruce flanges and plywood webs, the ribs being of plywood with lime flanges and ash nose flanges. The entire wing is covered with plywood.

As the center section of the wing forms part of the cabin the fuel tanks are not, as usual, over the fuselage, but are installed inside the wing left and right of the fuselage.

Between the fuel tanks on either side and the respec-

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tive wing tip there is a luggage hold to which access can be gained through a large doorway in the under surface of the wing. There are, further, smaller luggage holds to the left and right of the fuselage, which are accessible from within the cabin.

In the part of the wing over the cabin there are two large trapdoors, which are intended as emergency exits.

The wing contains the conduits for the lighting system, the bonding for the wireless, the control mechanism for the outboard engines, as well as the cables and rods for operating the ailerons, the wing flaps, and the retractable landing gear.

Inspection lids have been provided wherever it was deemed necessary.

Fittings for hoisting purposes are mounted on the top of the wing.

Fuselage.- The fuselage of the F.XX is constructed on the standard Fokker principle, that is, a framework of seamless cold-drawn tubes installed transversely through the construction of the fuselage has been patented. The section of the fuselage being elliptical and the under surface accordingly not flat, as was hitherto customary and, moreover, no landing gear fittings being available for the purpose, special provision has been made for supporting the fuselage when the airplane is standing on the ground without resting on the landing gear.

The provisions made for lifting the after part of the airplane consist of steel tubes installed transversely through the fuselage, through which tubes it is possible to pass bars or tubes of smaller gage.

Subdivision.- Immediately behind the center engine there is a small luggage hold, separated from the engine by an aluminum fireproof screen. Then follows the cockpit.

Cockpit.- As far as the outlook of the pilots is concerned, this compartment is ideally located. It is before the wing and is entirely enclosed. The side windows are of the sliding type and are sufficiently large to serve as emergency exits. In the forward part of the cabin ceiling there are two windows of domed cellon.

The pilots' chairs are spacious and most comfortable. To the left of the first pilot there is a handwheel with which he can operate the wing flaps, and to the right he has a wheel for adjusting the stabilizer.

To the left of the second pilot's chair and within easy reach of both pilots there is a knob which, when pulled out, neutralizes the entire electric installation, so that the danger of fire from this source can be eliminated when a forced landing is made.

To the right of the second pilot there is a handwheel, by means of which the tail wheel may be drawn in or lowered. The instruments are logically arranged and are illuminated in such a way as not to hinder the pilots during flight (figs. 5 and 6).

The throttle levers are fitted with trimming gear. The levers for the altitude gas are apart from the others. The lever for operating the Dunlop wheel brakes is within easy reach of the pilot. The cockpit can be ventilated at will by the pilots.

The wireless and instrument cabinet forms one compartment with the cockpit and is immediately behind the pilots. The wireless set is suspended in a frame on the right-hand wall, and above it is the switchboard with the various instruments for engine control.

Cabin.— Immediately behind the cockpit and instrument cabinet, separated by a sliding door, is a cabin with accommodation for 12 passengers. The chairs are in two rows of six with an aisle between (fig. 7).

As was already stated under "Wing," the upper part of the cabin is actually the space between and behind the two wing spars. With this arrangement it has been possible in spite of the small section of the fuselage proper, to construct a cabin with a height of 2.05 m (6.73 ft.) declining to 1.80 m (5.9 ft.) in the rear.

In the forepart of the cabin; that is, the part between the wing spars, there is accommodation for four passengers. Above the windows on either side there is a locker in the wing, which may be used for provisions or luggage.

The forepart and the afterpart of the cabin are direct-

ly connected with each other. In the afterpart there is accommodation for eight passengers, and on either side a spacious compartment for luggage has been made in the wing behind the rear spar.

The windows are extremely large. The panes in the foremost and aftermost windows are of Securit glass, which can be smashed quickly and without danger of splinters in case of emergency by means of a mechanical device.

There are, moreover, two large trapdoors for emergency exits in the center section of the wing, that is, where it forms the roof of the cabin.

The windows cannot be opened, but a special ventilating system, which can be operated by the passengers enables them to get all the fresh air desired. The cabin is heated by means of hot air passed through gratings in the floor. Over each window there is a lamp which gives indirect light and which is shaded in such a way as not to cause any annoyance to the passengers.

Covering and cowling.— The covering immediately behind the engines consists of elektron sheeting. The lower surface of the fuselage to the rear of the center engine is likewise covered with elektron. The remainder of the fuselage and the afterparts of the outboard engine beds are covered with fabric.

Control surfaces and steering gear.— The ailerons, which form an integral part of the wing are, as customary, of wood throughout. They are not hinged on, but rotate on spindles a short distance from the leading edges. They are, moreover, compensated by means of weights in the wing, and are accordingly statically and aerodynamically balanced.

The ailerons are operated partly by means of rods in ball bearings and partly by cables led over large-sized pulleys. The wing flaps are likewise of wood throughout.

The tail unit is made up of a framework of welded steel tubes encased in fabric. The rudder and the elevator are interiorly balanced, i.e., the axis of rotation is behind the leading edge. The spindles are mounted in ball bearings. The tail fin is welded on to the fuselage. By means of a compensating device mounted on the first pilot's rudder bar, it is possible to adjust the rudder in such a way

as to render it unnecessary for the pilot to continually give rudder when flying with one outboard engine stopped. The stabilizer may be adjusted by the pilot during flight. The cables by means of which the tail surfaces and ailerons are operated run through the fuselage and wing over large-sized pulleys (fig. 8).

Landing gear.— The landing gear can be drawn into the outboard engine beds in its entirety. The shock absorbers consist of two Messier struts on either side of the wheel, held together at the top by an elektron casting and at the bottom by the axle of the wheel. The struts are supported in the rear by a framework of steel tubes.

The landing gear is lowered or drawn in mechanically by means of a handwheel. On the instrument board before the pilot there are a number of small signal lamps which correspond with the various positions in which it is possible to lock the landing gear.

The wheels are fitted with compressed air brakes. The tail wheel, which is fitted with a low-pressure tire, is likewise retractable.

Power plant.— The F.XX has been designed for three air-cooled engines of 600-700 horsepower each. The details given here refer to an airplane powered with three Wright engines of the type Cyclone R.1820 F, which develop 640 hp. at 1,900 revolutions.

The center engine is mounted on the fuselage proper, while the two outboard engines are suspended under the wing in nacelles, which are secured to the wing spars at three points. These engine beds have elektron cowlings directly behind the engine, while the remainder is covered with fabric.

The engines are all fitted with N.A.C.A. cowling, which may be removed in four sections for inspection purposes. The blades of the metal propellers are adjustable on the ground. The engines are fitted with electric Eclipse starters (fig. 9).

Fuel and oil systems.— There are four fuel tanks each with a capacity of 650 liters (143 imperial gallons), making an aggregate of 2,600 liters (572 imperial gallons) installed in the wing between the two spars. In view of the possibilities of so-called doped fuel being used the tanks are of welded sheet aluminum.

The carburetors are fed by means of motor pumps, while there is also a hand pump with a 4-way tap fitted to the distributing piece. This pump is chiefly used for starting the engines, but it may be used also in case of emergency. There is further attached to the distributing piece a pipe, with an intermediate 30 mm Bezac tap, leading out through the right-hand side of the fuselage, about 1.5 m (5 ft.) above ground level, before the door of the luggage compartment. By means of this pipe, it is possible to fill the tanks very rapidly (approximately 30 minutes) without the necessity of anyone climbing on to the wing. Moreover, the pipe may be used for dumping the fuel in case of emergency.

An oil tank of welded elektron with a capacity of 75 liters (16.5 imperial gallons) including an allowance of 8 liters (1.8 imperial gallons) for foaming is provided for each engine. These tanks are installed behind the respective engines.

CHARACTERISTICS

Dimensions:

Span	90 ft. 2 in.
Length	54 " 9 "
Height	15 " 7 "
Wing area	1,033 sq.ft.
Wheel track	19 ft. 8 in.
Length of cabin	16 " 1 "
Width of cabin	5 " 1 "
Average height of cabin	6 " 3 "
Capacity of cabin	406 cu.ft.
Capacity of luggage compartments outside of cabin	235 cu.ft.

Engines:

3 Wright Cyclone R.1820 F

Maximum r.p.m. 1,900 r.p.m.

Cruising speed 1,650 "

Maximum output 3 times 640 hp.

Output at cruising speed 3 " 427 "

Fuel consumption at maximum
r.p.m. taken at 250 g/hp/h
(0.55 lb./hp./hr.) 3 " 353 lb.

Capacity of fuel tanks 572 imperial gal.

Weights:

Airplane empty 12,122 lb.

Useful load 7,715 "

Total 19,837 "

Useful load may be divided as follows:

Working load:

Crew (3) 530 lb.

Fuel and oil for 400 miles 1,850 "

Equipment:

Cabin (12 chairs), lavatory, electric-
al equipment, wireless, sound proofing
and miscellaneous (55 lb.) 1,100 "

Pay load 4,235 "

If a range of 750 miles (1,200 km) is
required, the weight of fuel and oil
is 3,438 lb. In this case there is
2,650 lb. available for pay load.

Wing loading 19.25 lb./sq.ft.

Power loading 10.25 lb./hp.

Speed:

Maximum	186 m.p.h.
Cruising	154 "
Minimum	64 "
Landing	about 59 "

Climbs (corrected up to standard atmosphere):

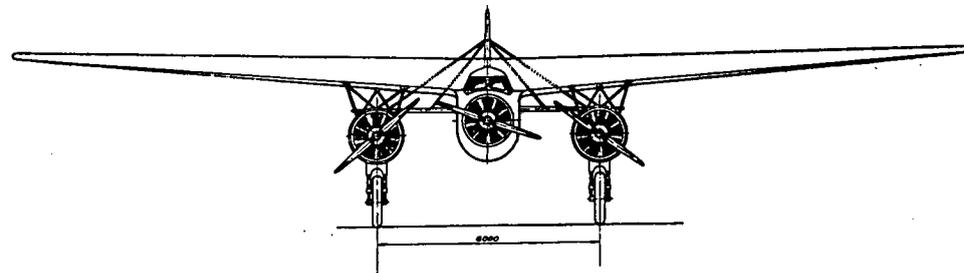
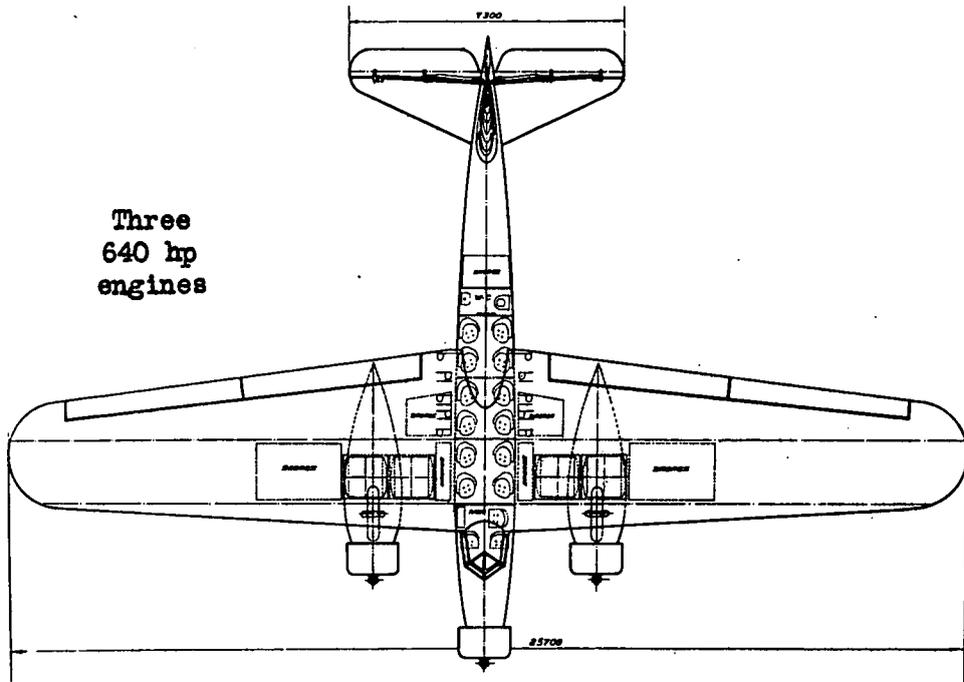
Time of climb to 3,280 ft.	4 minutes
" " " " 6,560 "	9 "
" " " " 9,840 "	15.5 "
" " " " 13,120 "	25.3 "

Ceiling:

Absolute, with 17,600 pounds total weight	21,700 ft.
Service, with 17,600 pounds total weight	20,000 "
Absolute, on two engines with 17,600 pounds total weight	12,500 "

Range of action:

With fuel tanks, at cruising speed, in steady air, with an assumed fuel consumption of 230 g/hp/h (0.5 lb./hp./hr.) 1,000 miles



Length 54 ft. 9 in. Span 90 ft. 2 in. Height 15 ft. 7 in.
Wing area } 1033 sq. ft.

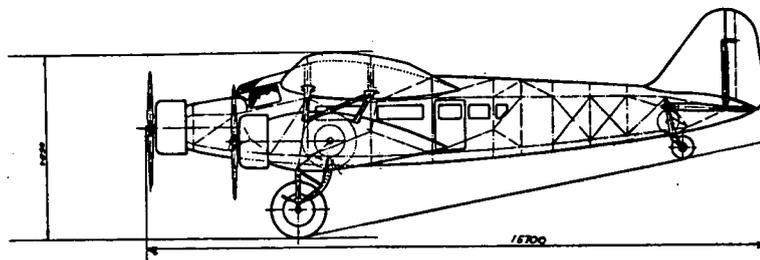


Figure 1.-General arrangement drawings of the Fokker F.XX. commercial airplane.



Figure 2.-Side view of the Fokker F.XX. commercial airplane.

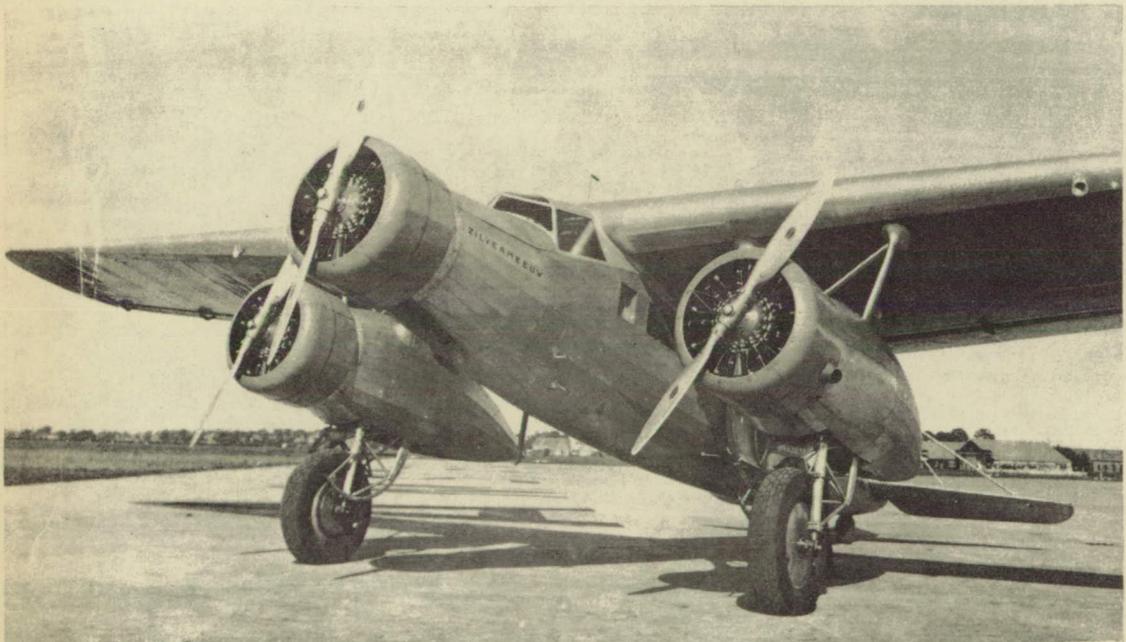


Figure 3.-Three-quarter front view of the Fokker F.XX. with three Wright Cyclone engines.



Figure 4.-The Fokker F.XX. in flight with landing gear retracted.

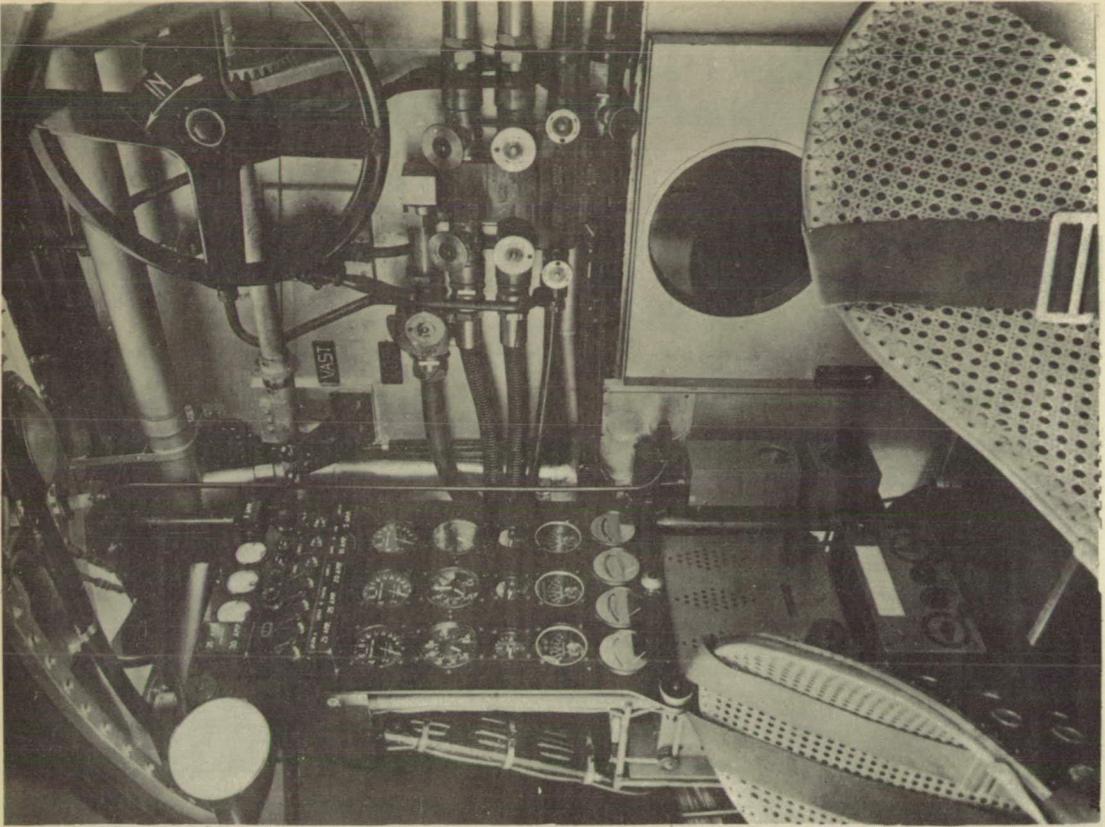


Figure 5.-Pilots cockpit and instrument cabinet looking aft.

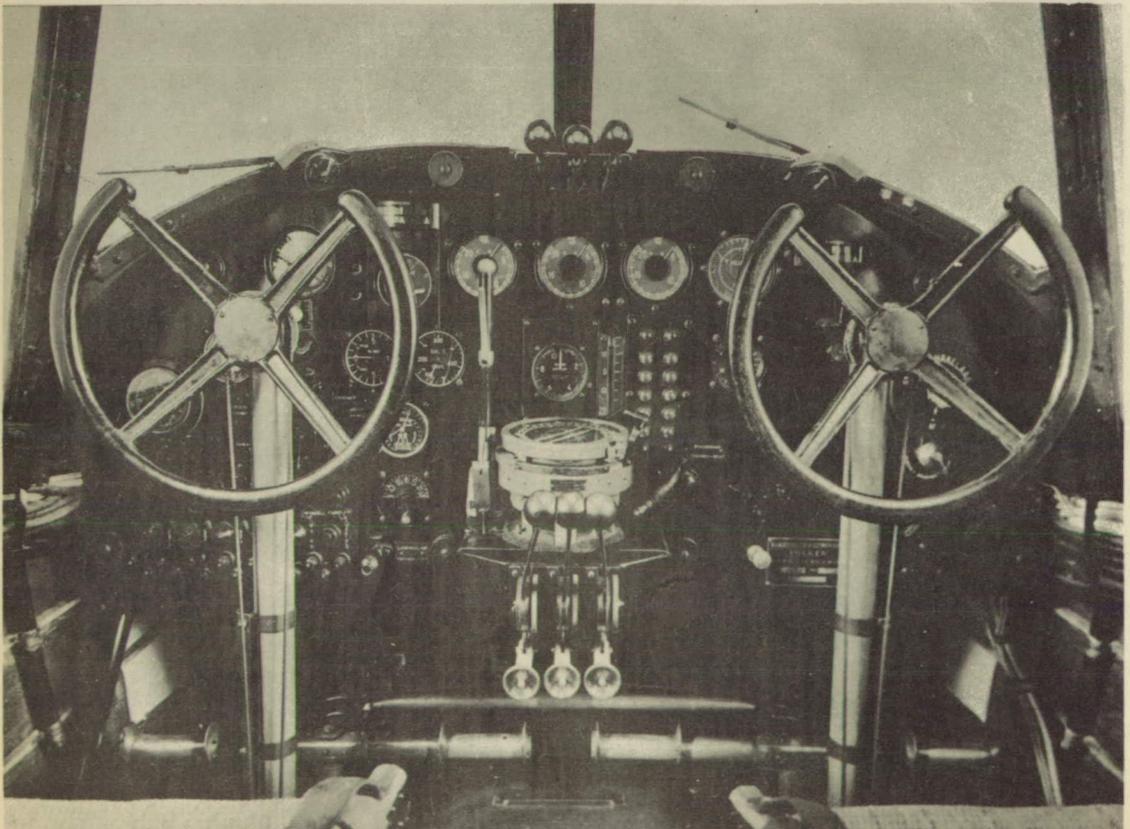


Figure 6.-Pilots cockpit and instrument cabinet looking forward.



Figure 8.-Close-up view showing structure of right half of stabilizer and elevator of the F.XX. commercial airplane.

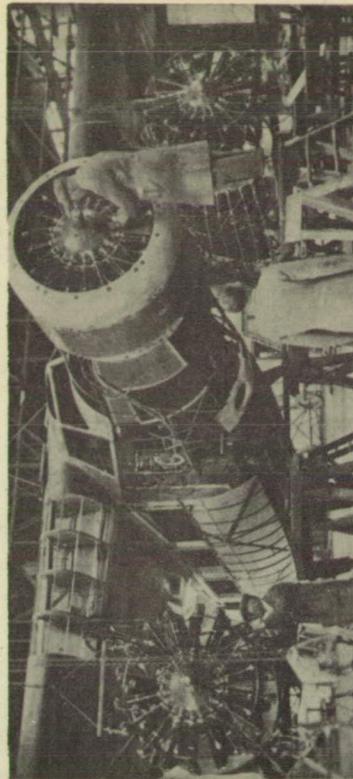


Figure 9.-View showing general assembly, of the F.XX., in progress. One of the N.A.C.A. cowlings is being installed over the center engine.

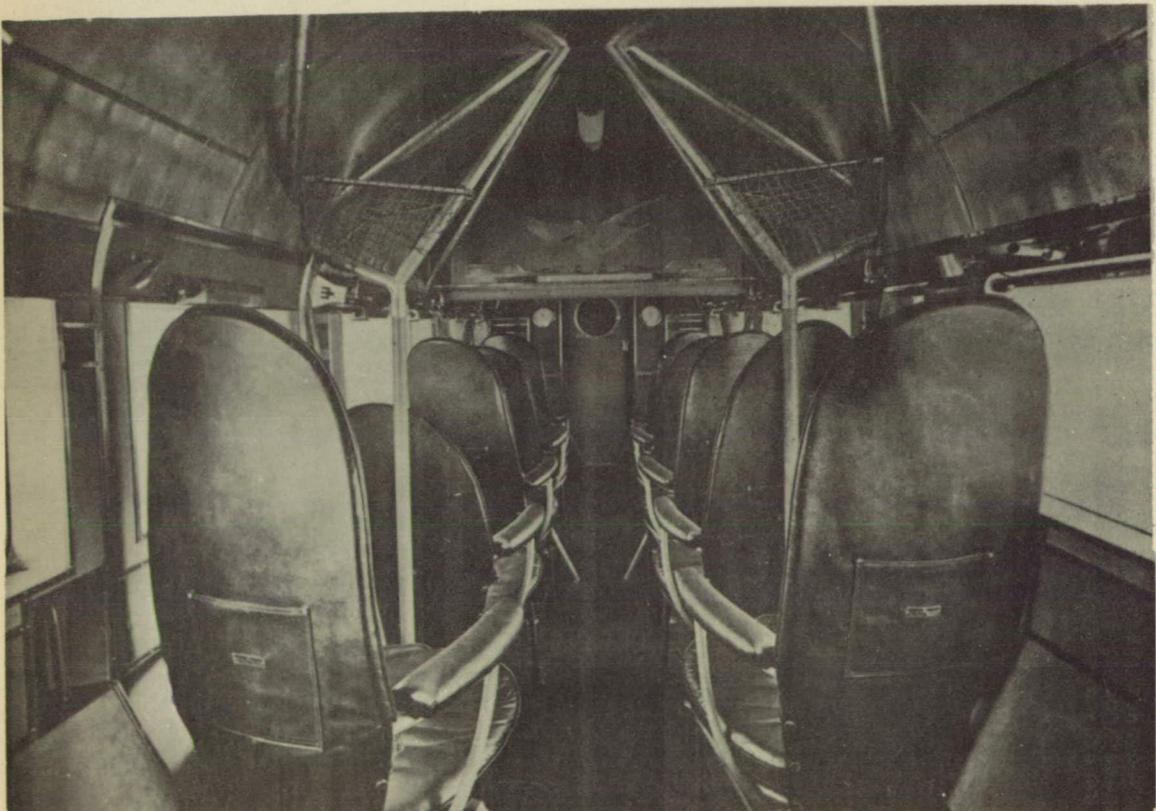


Figure 7.-View of cabin, of Fokker F.XX., looking toward cockpit.