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No. 118

THE "JUNKERS-JUNIOR" LIGHT AIRPLANE (GERMAN)
A Two-Seat All-Metal Low-Wing Cantilever Monoplane

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NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS.

AIRCRAFT CIRCULAR NO. 118.

THE "JUNKERS-JUNIOR" LIGHT AIRPLANE (GERMAN).*

A Two-Seat All-Metal Low-Wing Cantilever Monoplane.

The "Junkers-Junior" is a cantilever all-metal low-wing monoplane (Fig. 15). The low cantilever wing consists of a central section, integral with the fuselage, and two outer sections. The junctions are made with four ample screw connections (Fig. 16).

The inside structure of the outer wings is very simple (Fig. 2). In contrast with all other makes, Junkers uses corrugated sheet duralumin as the supporting outer covering. This does away with the sensitive filagree work of the ribs and other supporting devices and facilitates construction, care and overhauling. It was thus possible to keep the weight of this all-metal airplane within the same limits as that of airplanes of mixed construction (wood, metal and fabric). The division of the wing into three sections has the advantage not only of enabling the possessor to take it apart easily and quickly for transportation, but also of removing an outer wing to be repaired by the nearest tinsmith, or to be replaced by a new wing without great expense. Bulges can generally be straightened by the owner himself. The middle section of the wing and the fuse-

*From a pamphlet published by the Junkers Flugzeugwerk A-G, of Dessau, Germany.

lage are indissolubly connected, thus affording the maximum simplicity and the minimum weight. By sitting in the rear seat, the pilot can fly, with or without a passenger or other load, without having to make any adjustment of the stabilizer. The front end of the fuselage carries the compactly built, air-cooled five-cylinder radial engine. The rear end of the fuselage tapers to a vertical wedge which is extended upward to form the fin (Figs. 10 and 13).

Since the "Junkers-Junior" was made especially for touring and industrial purposes, the seats for the pilot and passenger, as likewise the baggage compartment, were designed with particular care. Great stress was laid on perfect comfort. The occupants find broad well-upholstered chairs with arms at the right height and two compartments ready for the baggage. One of the baggage compartments is between the two seats within easy reach of both pilot and passenger. It lies at the C.G. of the airplane and, while it serves for stowing suitcases and lunch boxes for week-end trips, its most important use is for the reception of especially heavy baggage or for carrying spare parts on long cross-country flights. The other baggage compartment is behind the pilot's seat and is large enough to hold an ordinary steamer trunk. Adjustable chair backs make the seats equally comfortable for large and small persons. All pipes which might be disturbed or injured by the feet are enclosed in the double bottom of the fuselage, so that nothing is visible but the instrument

board and steering organs (Fig. 4).

The fuselage is, in principle, a carefully streamlined tube of corrugated duralumin supported by a number of formers and bulkheads, with easy accessibility for inspection and repairs (Fig. 5).

The two-part elevator is hinged to the stabilizer which rests on the top of the fuselage and can be adjusted on the ground (Fig. 6). The rudder is hinged to the fin and the tip of the fuselage (Fig. 7). The elevator, rudder and ailerons all have ball bearings, which make them easy to operate and lengthen their life.

The controls consist of accurately adjustable push rods supported so as to prevent undesirable vibrations. The "Junkers-Junior" is provided with large control surfaces (Fig. 13) which require only slight deflections. The maximum degree of controllability in stalled flight is thus assured. The stunt flier will find that complete harmony exists between the forces and deflections of the control stick and rudder bar. Without being supersensitive, the "Junkers-Junior" is not only an excellent sport and school plane for beginners and advanced pupils, but also a superior plane for the former airplane pilot, who wishes to keep in practice and prefers an easily flown airplane.

The normal arrangement in the "Junkers-Junior" is: passenger in front, pilot behind; or pupil in front, teacher behind. The private owner, for various reasons, should not deviate from

this arrangement. A flying instructor may prefer to sit in front in order to give visual instructions to his pupil by pre-arranged signals. Since the "Junkers-Junior" is provided with dual control and two complete sets of instruments, the instructor is at liberty to occupy either seat.

The strong middle section of the wing carries the supporting points for the landing gear and floats. The landing gear has no continuous axle, which would increase the weight and air resistance and interfere with taxiing in tall grass or otherwise obstructed fields (Fig. 8). Contact of the wing tips with the ground, even on rough fields, is practically excluded by the wide track gauge. Even in slow taxiing, the rudder is so effective as to overcome the former disadvantage of a wide track gauge, namely, poor maneuverability on the ground.

The shock absorbers are of the reliable rubber-cable type. The light-metal shock-absorber struts have hardened steel heads which fit the sockets of the junction pieces (Fig. 9), thus assuring their durability. The wheels are so large and strong that there is little danger of damage even on unprepared fields. The tail skid with its rubber shock absorber is mounted in an orientable fork at the fuselage tip (Fig. 10).

Like all Junkers airplanes, the "Junkers-Junior" can be converted into a seaplane without any special fittings. The duralumin floats are divided into several water-tight compartments by bulkheads, in order to preserve the greatest possible

buoyancy in case of injury. The floats are so large that, even with one float missing, the normally loaded airplane would not sink (Fig. 1).

The landing-gear wheels can be even more readily replaced by skis than by floats. In cooperation with the airplane industries in northern countries, special skis from selected Finland wood have been made for the "Junkers-Junior."

The "Junkers-Junior" can be used in summer or winter, on land or on water, in the tropics or in the far north. It is an adaptable nonsensitive light airplane of high performance.

For a light two-seater which must be absolutely reliable and capable of carrying two persons with baggage at high speed a distance of 600 km (373 miles) and have a high ceiling and a low landing speed, it was necessary to have an engine possessing great reserve power, reliability and endurance. The "Junkers-Junior" is equipped with the air-cooled five-cylinder Armstrong-Siddeley "Genet" engine. The engine is mounted on the front fire-wall bulkhead by means of an easily removable supporting frame. It is enclosed by smooth sheet duralumin forming a continuation of the fuselage covering and leaving only the cylinder heads exposed. The B.T.H. magnetos on the front of the engine are protected from rain and dust by easily removable metal casings, which are provided with ventilation openings protected by wire gauze (Fig. 11). The direct-drive propeller of 2 m (6.56 ft.) diameter is attached directly to the engine shaft by means of a

plain uncowled hub. The few engine controls (throttle, compressed air for high-altitude flying, and ignition switch) are conveniently arranged on the left side of the pilot and passenger. The throttle lever has no notched quadrant, but is held by adjustable friction. The engine is started by a special "atomizer" (injection of atomized gasoline into the intake manifold) and by a very light B.T.H. starting magneto (Fig. 17).

The fuel for starting the engine flows from a 12.5-liter (3.3-gallon) gravity tank, which can be filled by a hand pump from the two main tanks in the central section. After the engine starts, the A.C. membrane fuel pump begins to function and delivers the fuel directly to the carburetor through a filter and an automatic pressure regulator. Any interruption of the fuel delivery is impossible, since the short pipes are under constant pressure from the pump to the carburetor. The normal fuel, at a compression ratio of 5.2, may be either an 80/20 mixture of gasoline and benzol or (with suitable nozzle adjustment) a commercial gasoline of 0.735 to 0.740 specific gravity. The "Junkers-Junior" requires only 10 kg (22 lb.) of fuel to fly 100 km (62 miles).

For lubrication, Castrol R, Gargoyle BB, Golden Shell, or any other equivalent mineral oil may be used. The oil flows to the pump from the 12.5-liter (3.3-gallon) oil tank located near the gravity fuel tank. Between the tank and the pump there is the main oil cock, which also functions as an electric safety

switch (Fig. 12). The engine ignition is short-circuited while the oil cock is closed. This relieves the pilot of one thing to remember and gives him a greater sense of security.

The "Junkers-Junior" has a fully equipped instrument board.

The service cost of the "Junkers-Junior" is only 20 pfennig a kilometer (about 8 cents a mile), calculated on the basis of 200 hours' flying in a year.

Characteristics

	<u>Touring plane</u>	
Span	10.00 m	32.81 ft.
Length	6.97 "	22.87 "
Wing area	12.60 m ²	135.63 sq.ft.
Weights:		
Airplane, empty	300.0 kg	661.39 lb.
Fuel	72.5 "	159.83 "
Student or passenger	72.5 "	159.83 "
Gasoline	65.0	143.30 "
Oil	10.0	22.05 "
Baggage	30.0	66.14 "
Total weight	550.0	1212.54 "
Wing loading	43.6 kg/m ²	8.93 lb./sq.ft.
Power . "	6.25 kg/hp	13.59 lb./hp

Performances, with Full Load

Maximum speed	170 k.p.h.	105.63 m.p.h.
Cruising "	140 "	87.00 "
Landing " (about)	75 "	46.60 "
Radius	700 km	434.96 mi.
Ceiling	4000 m	13123.00 ft.
Climb to 1000 m (3281 ft.)	5.0 min.	
" " 2000 " (6562 ")	11.9 "	
" " 3000 " (9842 ")	22.0 "	
" " 4000 " (13123 ")	40.7 "	

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

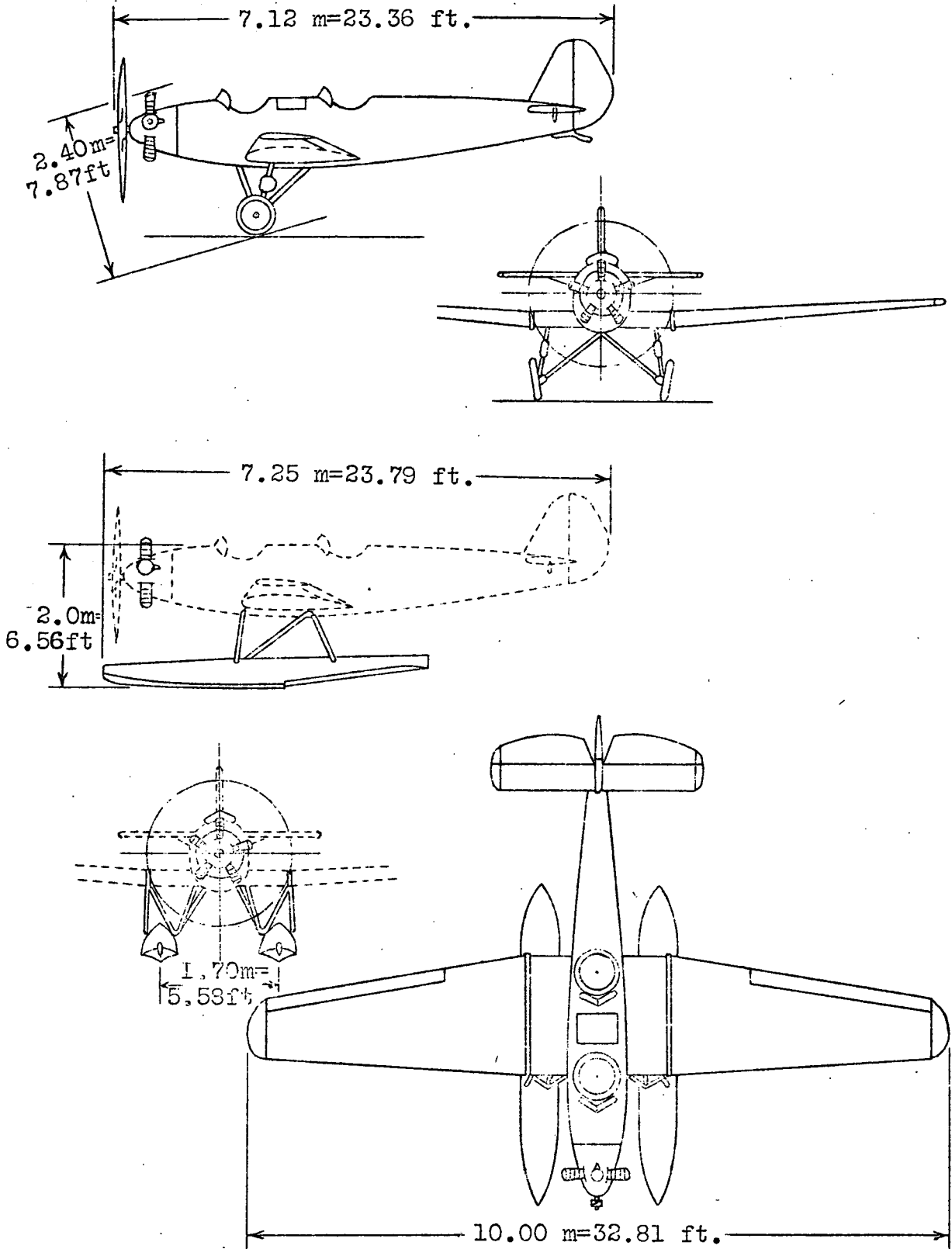


Fig. 1 Line drawings of "Junkers Junior" land and seaplane.

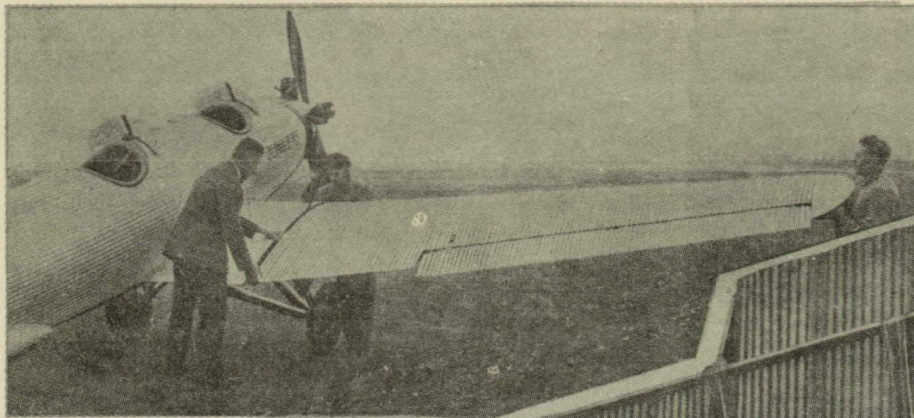


Fig. 3
Removing
outer
wing

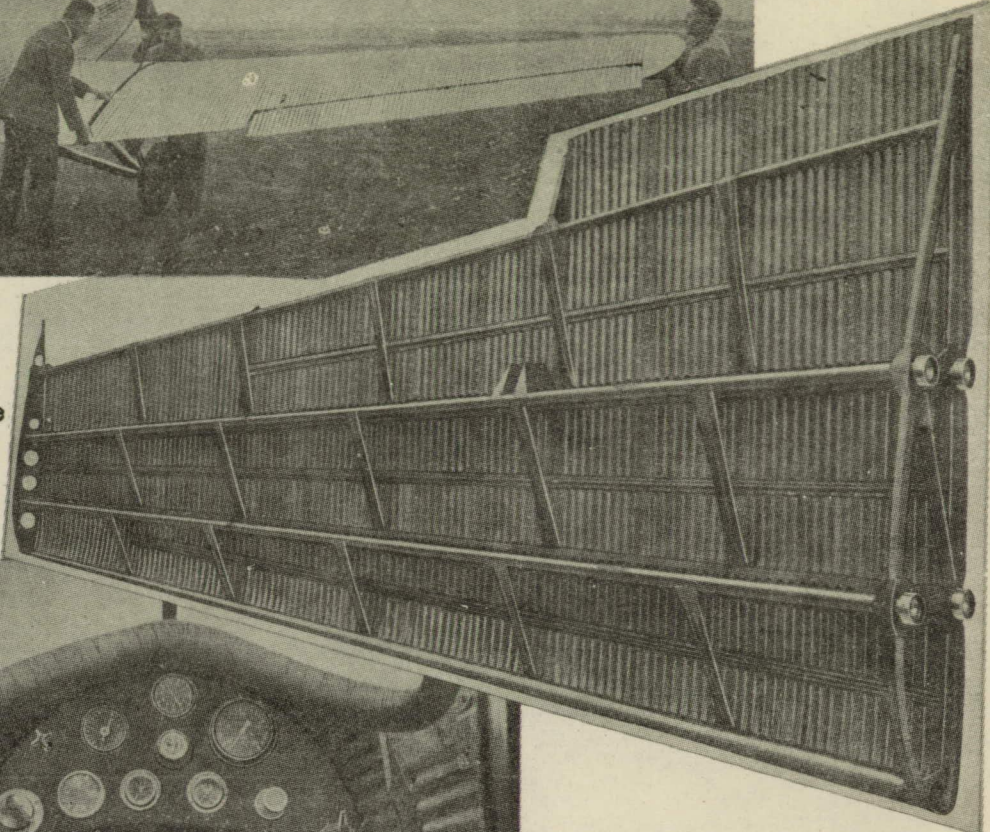
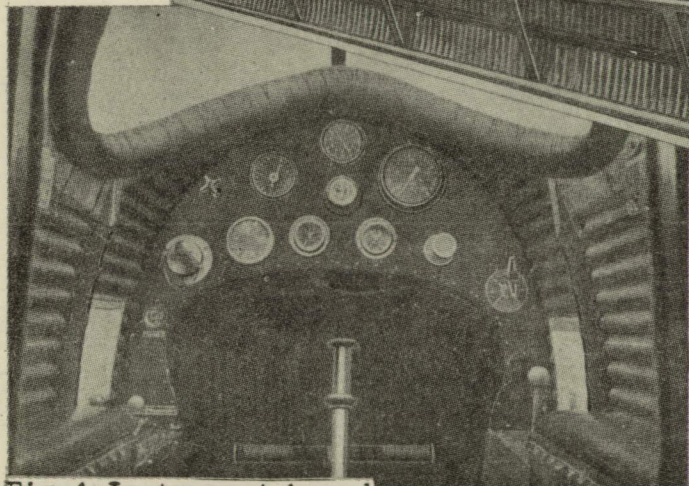


Fig. 2
Structure
of outer
wing



Views of parts of the
Junkers Junior airplane

Fig. 4 Instrument board

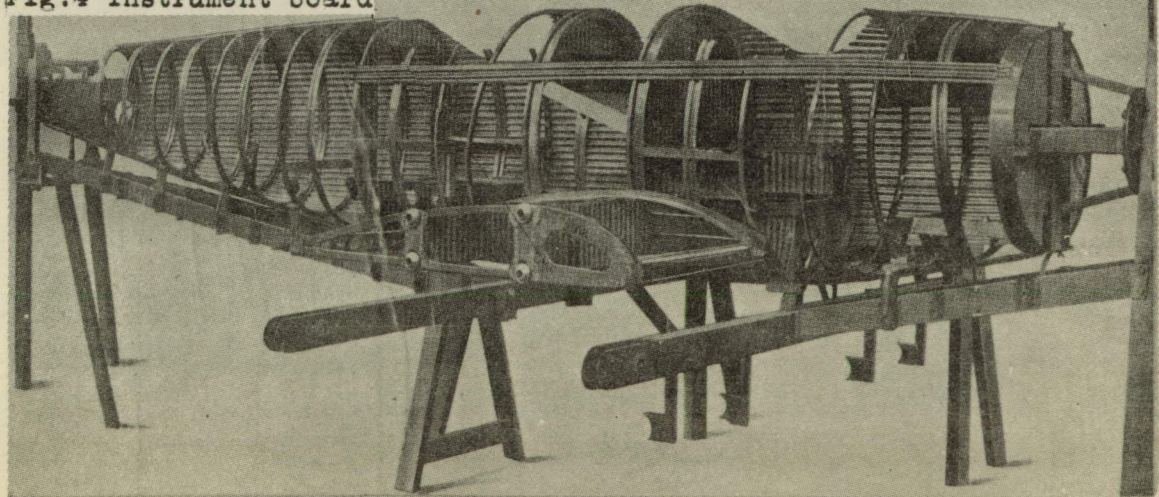


Fig. 5 Fuselage structure

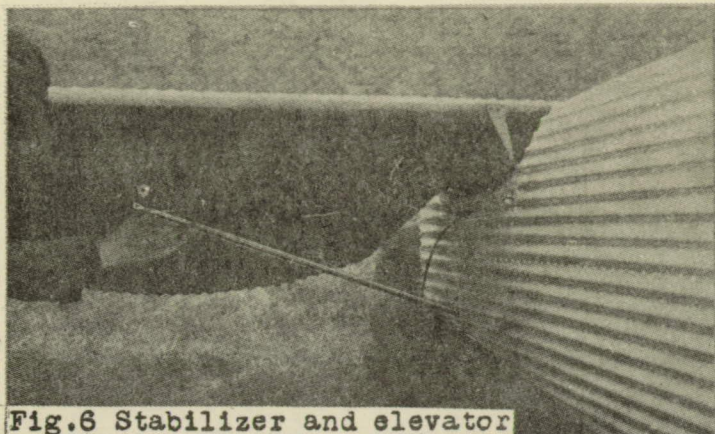


Fig. 6 Stabilizer and elevator

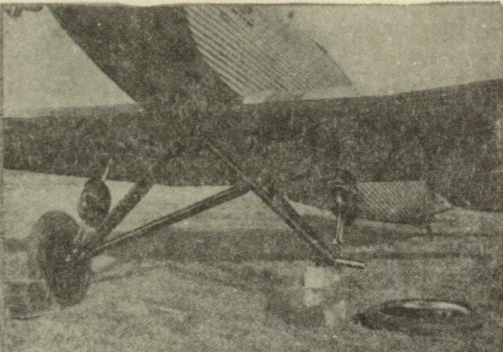


Fig. 8 Landing gear



Fig. 7 Fin and rudder

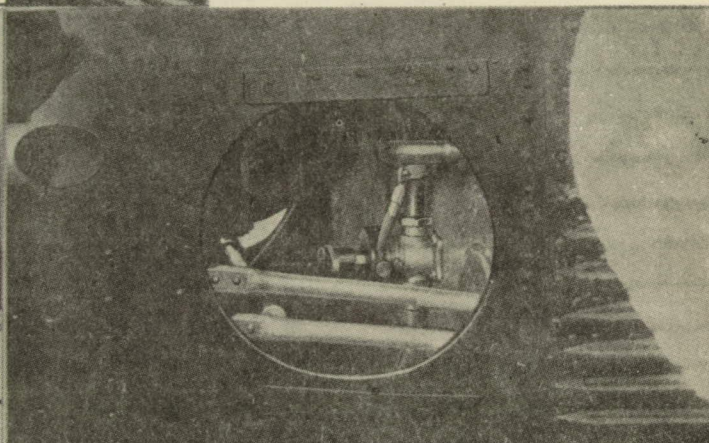


Fig. 12 Main oil cock in form of safety switch between tank and pump

Junkers
Junior
airplane

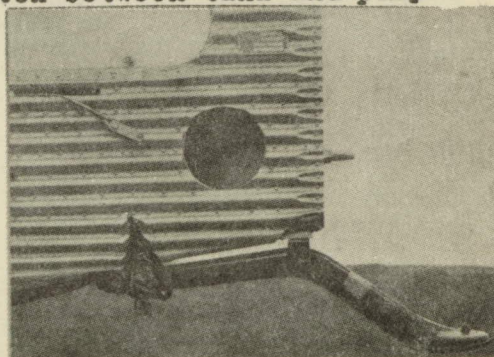


Fig. 10 Tail skid

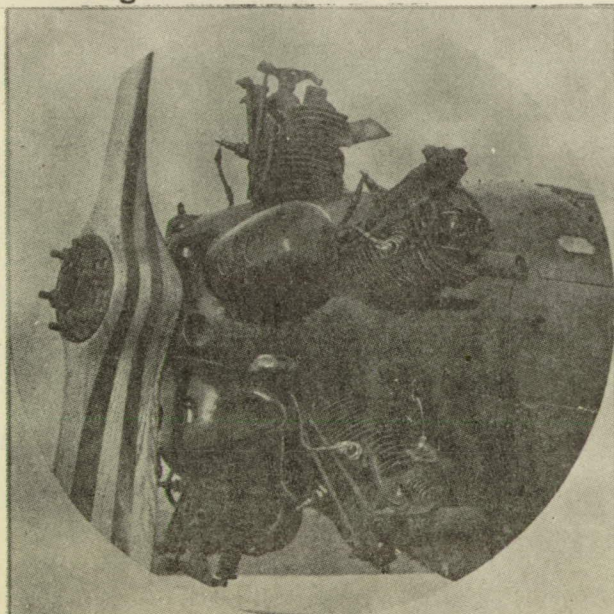


Fig. 11 Magnetos in metal housings

Views
of
parts
of
struc-
ture

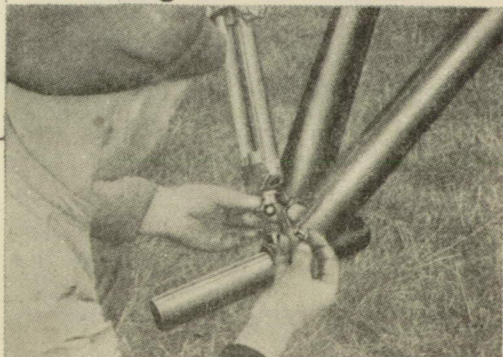


Fig. 9 Shock absorber

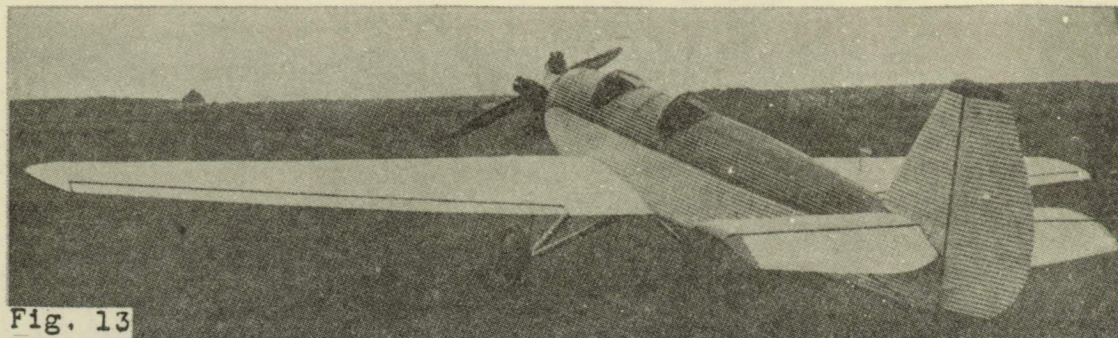


Fig. 13

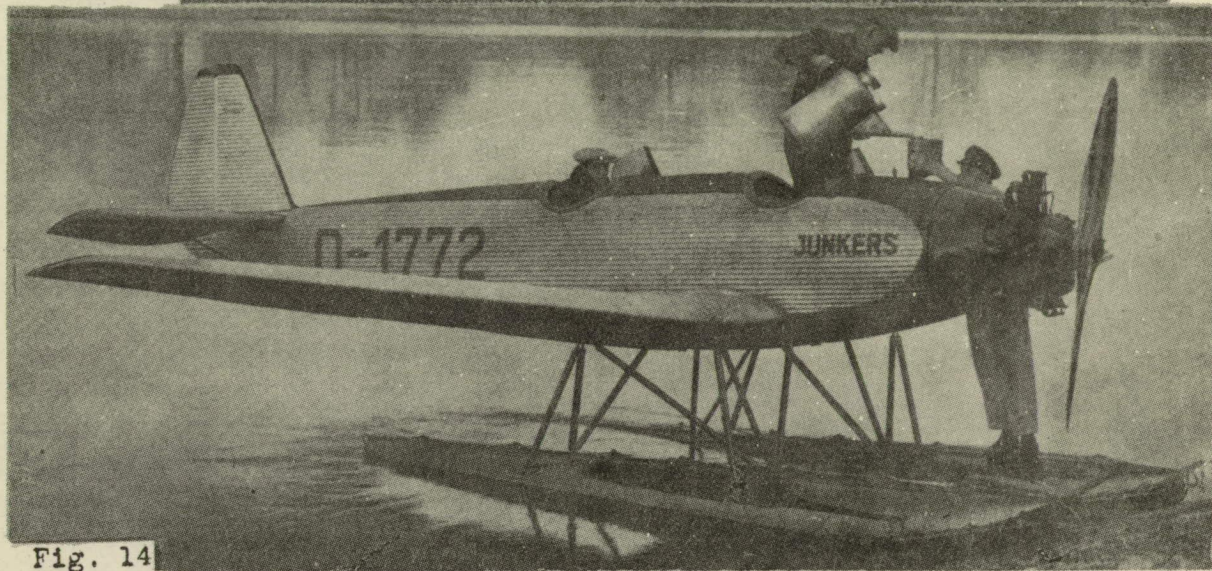


Fig. 14



Fig. 15

Views of Junkers "Junior" all metal airplane used as land or seaplane

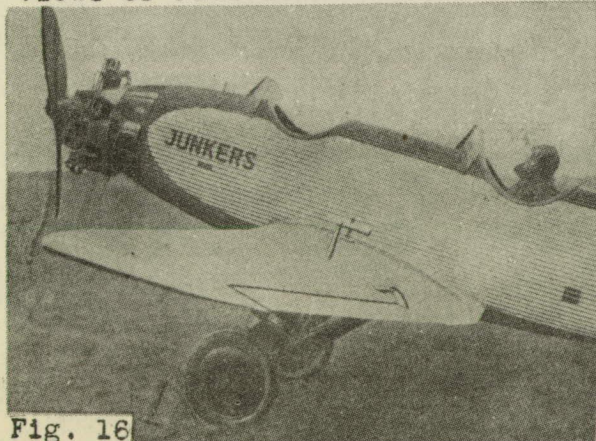


Fig. 16

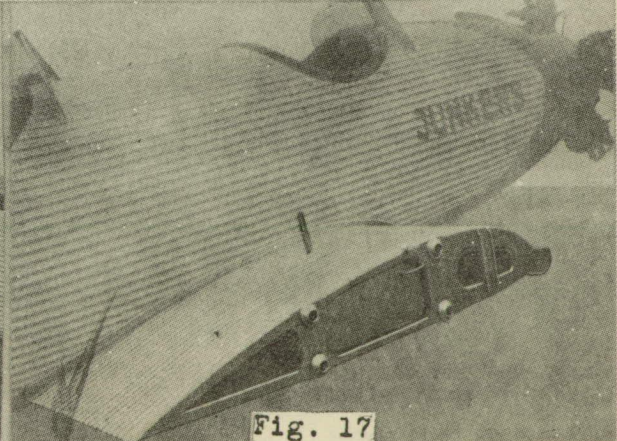


Fig. 17