AIRCRAFT CIRCULARS

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

No. 100

THE "K 47" OF THE A. B. FLYGINDUSTRI

An Armored Pursuit Monoplane

Washington
August, 1929

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS.

AIRCRAFT CIRCULAR NO. 100.

THE "K 47" OF THE A. B. FLYGINDUSTRI.*

An Armored Pursuit Monoplane.

By R. Schulz.

The A. B. Flygindustri in Malmö-Limhamn (Sweden), which builds military airplanes according to Junkers patents, has brought out the two-seat "K 47" as their latest model. This type represents considerable progress in the field of military-airplane construction not only because of its excellent, hitherto hardly equaled flight performances, but also because of its novel solution of certain problems.**

After it was recognized that the flight performances of heavy two-seaters were no longer satisfactory, the pursuit single-seater was developed from the normal two-seat general-purpose airplane. The utility of the pursuit single-seater, however, is very limited. In order to perform the task of the pursuit airplane satisfactorily, it therefore became necessary to return to the light two-seater.

It seems to be very difficult for airplane constructors, in designing a pursuit two-seater, to free themselves from the ordinary type of two-seat and multiseat airplanes. Nearly always a so-called pursuit two-seater has a gunner's cockpit with

*From Luftwacht, May, 1929, pp. 224-229.

**See also "Der Jagdzweisitzer" (The Pursuit Two-Seater), Luftwacht, May, 1929, pp. 211-215.

an ordinary machine-gun ring mount behind the pilot. The fuselage is usually very high and broad and, with the military equipment and projecting upper part of the gunner's body, offers so much head resistance (drag) that it can never match the performances of the pursuit single-seater. At the speeds already attained by single-seaters the gunner cannot stand in his cockpit during any change in the direction of flight and must therefore cease firing. These brief observations indicate the most essential requirements to be met by the designer of a satisfactory pursuit two-seater.

The speed of a pursuit two-seater at an altitude of 5000 m (16,404 ft.) must not be much less than that of a single-seater (even at the cost of rate of climb, if necessary).

The visibility and the facility of aiming should be the best possible for both the pilot and his companion gunner. This applies particularly to the latter, who must be able to watch the air space behind the airplane and to fire in any position, even during great accelerations and in curvilinear flight.

The above requirements were met in the design of the "K 47" in the following manner. A light air-cooled engine with supercharger was chosen, in order to attain good speeds at high altitudes. Moreover, the desired goal was reached by a favorable aerodynamic design of the cell, spindle-shaped fuselage, streamlined engine cowling and landing gear, and special design of the gunner's seat.

Since the "K 47" is a low-wing monoplane, the forward visibility for firing is good. This is still further improved by the compactness of the radial engine and by putting the pilot's seat as far forward as possible. The gunner is given a clear firing field rearward by having two rudders and slanting the fuselage downward. Aiming is facilitated by a special cradle gun mount. (Figures 1, 2, 3, 4, 5, 6 and 7).

Corresponding to the usual practice of the A. B. Flygindustri according to the Junkers Patents, the material used in the "K 47" is chiefly duralumin with sheet-steel joint fittings. It is especially worthy of note that the fuselage is covered with smooth sheet metal instead of the corrugated metal commonly used on Junkers airplanes

Each half of the wing has a trapezoidal shape. The wing structure passes through the fuselage a little below its middle line, the lower part of the fuselage consisting, at this point, of two dumpable fuel tanks. The wing is divided into a middle section and two outer sections, the former being firmly secured to the fuselage and the latter to the former. Each outer section is braced by a strut connected with the landing gear.

The wing structure is a statically determinate space framework consisting of tubular spars (six main spars and two auxiliary spars) and section-metal members, the torsional stresses being absorbed by the corrugated sheet-metal covering. In this way a very high degree of safety is attained, amounting to a

safety factor of 12 in straightaway horizontal flight (case A) with a full load of 1635 kg (3605 lb.) (Fig. 8). Even when the wing struts are removed, the wing as a cantilever has a safety factor of 4. Being covered with sheet metal, its torsional rigidity cannot be materially weakened by injuries from projectiles.

The fuselage has an oval uniformly decreasing cross section, which changes at the rear end to a horizontal knife edge. Its framework consists of three sections, the removable engine mount, the middle section containing the pilot's and gunner's cockpits, and the rear section, the tip of which can be removed for inspection purposes.

The front section, back of the engine mount, consists of vertical profile members connected and bound together by longitudinal profile members and the smooth outer covering of sheet metal, the latter constituting the principal element for the transmission of the thrust. The middle section of the fuselage is made especially strong for the protection of the crew and carries a strong protecting block on top. This is intended to shield the crew in case of capsizing and to facilitate egress from the airplane.

The controls are operated by means of the control stick and rudder bar through pushrods, levers and double cables. All the controls are inside the cell and all the connections are easily accessible. The ailerons are narrow and are balanced by

end flaps and by the rearward location of their axis of rotation.

The horizontal empennage consists of a continuous stabilizer and elevator. The former is attached to the fuselage at three points in such manner that the two rear points are on the last fuselage frame and form the axis of rotation, while the forward point serves for adjusting the angle of attack of the stabilizer. The adjustment is made by the pilot by means of cables connected with a hand wheel and by an automatic spindle. The elevator is balanced.

The vertical empennage is made double, one part being attached to each end of the stabilizer, which serves as a girder. Both rudders are balanced.

The landing gear consists of steel and dural tubes, namely, two main struts containing the shock absorbers, a continuous axle of chrome-nickel steel and two struts in V form on each side connected at the bottom by a chrome-nickel-steel tube. The ends of this tube serve also as supports for the wing struts. The oil shock absorbers are of the Vickers type. Their efficiency is so great that the airplane can taxi on rough ground. The struts are attached to the wings by exchangeable ball-and-socket joints. These are constructed in such a way as to spare the joints and the whole structure as much as possible in case of injury to the landing gear. The transverse bottom tube is braced to the fuselage by streamlined struts.

The tail skid is made of elektron. It is provided with Vickers oil shock absorbers, can turn laterally and is connected with the rudder bar by cables. The skid mount is accessible through the removable fuselage part and can be easily inspected.

The airplane is equipped with an air-cooled supercharged Bristol "Jupiter VII" with a compression ratio of 5.3 and 420 hp at 3500 m (11,483 ft.). The following engines can also be used: the "Jupiter," made under license by the Gnome-Rhone, Siemens or Walter companies; the 450 hp Pratt and Whitney "Wasp"; the 525 hp Pratt and Whitney "Hornet"; the 385-425 hp Armstrong-Siddeley "Jaguar"; the 450 hp Lorraine; the 500 hp Salmson A.B. 18. If an engine without supercharger is used (i.e., with maximum power at ground level) the "K 47" can also be used as a low-altitude pursuit plane.

The fuel system embraces two dumpable tanks, each of about 170 liters (45 gallons) capacity, under the middle section, a fuel pump driven by the engine, a hand pump, and the customary gauges. The lubricating system includes, behind the pilot's seat, a tank of about 35 liters (9.25 gal.) capacity, the upper part of which serves as a radiator. The engine is started by compressed air. The fire-protection system consists of an asbestos-lined fire wall and a TH II Minimax fire extinguisher.

The chief weapons of the "K 47" as of every pursuit airplane, are two fixed machine guns of normal caliber for the pilot. These guns are entirely inside the fuselage, so that

they produce no additional drag. A large trap door renders them easily accessible, however, for cleaning or removal. The gun bearings rest on specially reinforced frames, in order to reduce the scattering as much as possible. Since the guns are installed behind the fire wall, there is a large space for the ammunition holders, so that as many as 1000 cartridges can be stored. The cartridge holders (boxes or magazines) are easily accessible from the outside and can be easily exchanged.

The equipment of the gunner's cockpit also differs greatly from what has hitherto been customary on two-seaters. The machine-gun mount developed during the World War was so installed that the guns had to be served standing. Even then difficulties arose as a result of the wind pressure and of the acceleration forces in sharp curves, which have since been so greatly increased by the greater speeds of recent airplanes that fighting is practically impossible with the old-fashioned ring mount. A machine-gun mount, in order to meet present conditions satisfactorily, must therefore not only enable the gunner to serve his weapons sitting, but also relieve him from the strong acceleration forces. At the same time the requirements for a satisfactory firing field and good visibility must be met.

The solution of these problems was found for the "K 47" in the cradle gun mount. This mount is constructed on the principle of a balance beam, one end of which serves as a seat for the gunner and the other end as a gun mount. The cradle mount is

suspended on the side walls of the fuselage so as to be rotatable. The pivot is so placed that the gunner has a slight excess moment and can effect the desired vertical rotation by pressure with his legs against a supporting device. The amount of power required for this purpose is so adjusted that the vertical motion can be easily produced in any attitude of the airplane. The cradle is provided with a locking device for various positions, so that the gunner can maintaim the position corresponding to the requirements of battle or of rest for the time being. This completely relieves the pilot's legs and gives them a chance to rest.

The gunner's seat has a back which extends high enough to serve as a windshield (Fig. 7). The back is shaped so as to afford room for an Irving back-pack parachute. The gunner is securely strapped to his seat, in order to be safe in all flight positions.

The opposite end of the cradle carries the gun mount. In order to make it easier for the gunner to jump with his parachute, both gun and mount can be detached by means of a lever and thrown overboard. The gun mount has a slide rail on which, by means of a handle, the gun can be turned horizontally 18° in either direction (Fig. 3). Thorough tests have shown that this horizontal sweep of a total of 36°, in combination with the vertical field of the weapon, satisfactorily meets all requirements. In the vertical direction the firing field is 93°, of which 90° is

upward and 3° downward, due to the downward slope of the fuselage. The wind pressure against the gun at its highest elevation is offset by a balancing device.

The cradle mount not only renders it possible to operate the gun while sitting, but also relieves the gunner from the acceleration forces. Since the cradle mount operates on the principle of a balance beam, the acceleration forces in sharp flight curves act on both lever arms simultaneously and thus offset each other. The gunner is therefore able to direct the gun against his adversary at all times.

The modern machine-gun mount requires an adequate firing field. The space swept by the vertical and horizontal motion of the gun can be perfectly covered only if no part of the airplane encroaches on this firing field. For this reason the central rudder was replaced by two smaller rudders located so far to either side as to lie outside the horizontal firing field of 36°. For further increasing the firing field, the fuselage was given a downward slope, so that the gun could cover a downward angle of 3° below the horizontal.

Thorough tests at all flight attitudes have shown that putting the seat on the cradle mount with its back to the pilot, causes no bodily discomfort. Elimination of the acceleration forces, combined with the fact that the gunner sits all the time, gives him freedom of motion in all positions and enables him to - to serve the gun continuously.

In order to enable the gunner to accomplish his tasks, he must enjoy good conditions of visibility. This problem is also solved by the cradle mount, since it automatically enables the gunner to observe the air space behind the airplane. In comfort and convenience the gunner enjoys a clear view rearward, upward, toward either side and even downward, due to the slope of the fuselage.

The above description shows that the "K 47" differs greatly from previous pursuit two-seaters. The performances of the "K 47", which almost equal those of the best single-seat pursuit airplanes, together with the cradle mount and the double rudder, enable the perfect performance of its tasks.

C h a r a c t e r i s t i c s

With Bristol "Jupiter VII"

Length	8.55 m	28.05 ft.
Height (with tail on ground)	2.80 "	9.19 "
" " " propped up)	2.60 "	8.53 "
Span	12.40 "	40.68 "
Wing area	22.80 m²	245.42 sq.ft.

Weights (tolerance 3%)

Weight, empty		1050 kg		2315.0 lb.
Crew, about	166 kg		366.0 lb.	
1 fire-extinguisher charge	4 "		8.8 "	
2 Irving parachutes	14 "		30.9 "	
Breathing apparatus	15 "		33.0 "	
Communication "	4 "		8.8 "	
Mirror	1 "		2.2 "	
Fuel (300 liters = 79 gal.)	225 "		496.0 "	
Oil (32 liters = 8.5 gal.)	30 "		66.1 "	
Armament, about	126	585 kg	277.8 "	1289.6 lb.
Weight loaded		1635 "		3604.6 "
Wing loading	71.5 kg/m²		14.6 lb./sq.ft.	
Power " at 3500 m (11483 ft.)	3.64 kg/hp		7.91 lb./hp	

Performances

With full load of 1635 kg (3604.6 lb.)

Max. speed at 900 m (2953 ft.)	and 1640 r.p.m.	242 km/h	(150.4 mi./hr.)
" " " 3000 m (9842 ft.)	" 1920 "	290 km/h	(180.2 mi./hr.)
" " " 3400 m (11155 ft.)	" 1910 "	288 km/h	(178.9 mi./hr.)
" " " 4000 m (13123 ft.)	" 1900 "	283 km/h	(175.8 mi./hr.)
" " " 4650 m (15256 ft.)	" 1890 "	282 km/h	(175.2 mi./hr.)

Landing speed			105 km/h		(65.2 mi./hr.)	
Climb to	1000 m	(3281 ft.)	in	2.2	minutes	
" "	2000 "	(6562 ")	"	4.3	"	
" "	3000 "	(9842 ")	"	6.3	"	
" "	4000 "	(13123 ")	"	8.6	"	
" "	5000 "	(16404 ")	"	11.7	"	
" "	6000 "	(19685 ")	"	15.7	"	
" "	7000 "	(22966 ")	"	21.3	"	
" "	7500 "	(24600 ")	"	25.5	"	

Ceiling (w = 0 m/s, extrapolated)	8400 m	(27559 ft.)
Service ceiling (w = 0.5 m/s)	8100 "	(26575 ")
Highest altitude flown (w = 1 m/s)	7900 "	(25919 ")

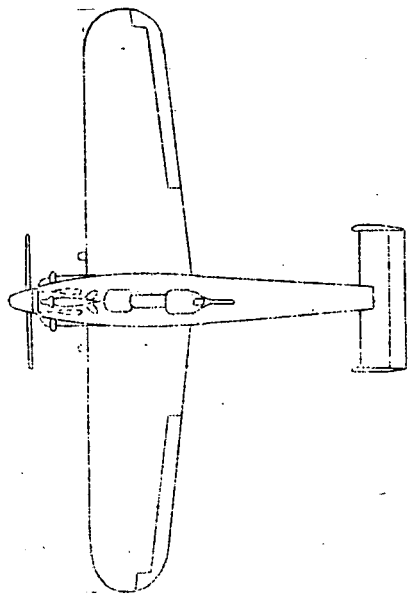
Fuel consumption at full throttle:

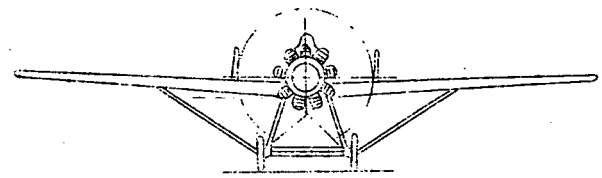
At 3500 m (11483 ft.) (uniform barometric pressure) and
V = 290 km/h (180.2 mi./hr.) about 98 kg/h (216.1 lb./hr.)

At 6000 m (19685 ft.) and
V = 270 km/h (167.8 mi./hr.) about 75 kg/h (165.3 lb./hr.)

During the trial flights, the "K 47" was equipped with a movable machine gun of the magazine type.

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





Length = 8.55m (28.05 ft.)
Height = 2.60m (8.53 ft.)
Span =12.40m (40.68 ft.)
Wing area =22.80m^2 (245.42 sq.ft.)

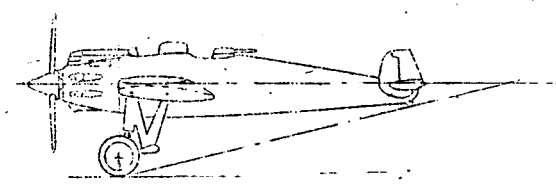


Fig.1 Elevations and plan of the K 47 pursuit airplane.

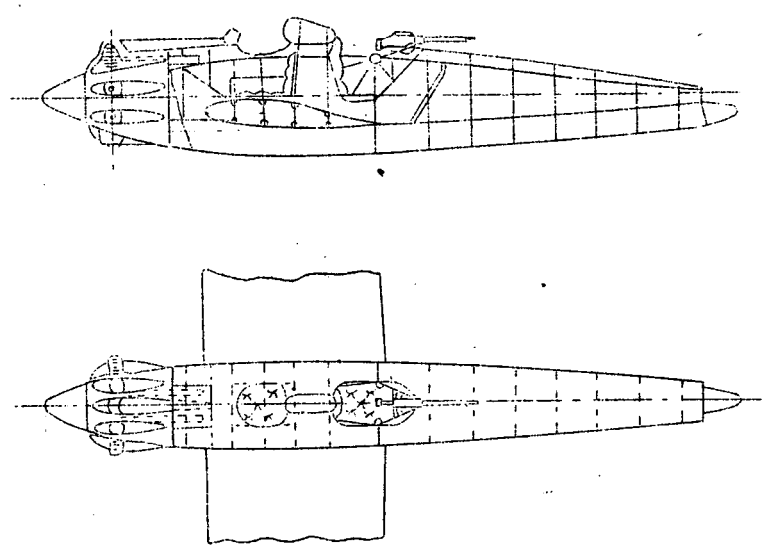


Fig.2

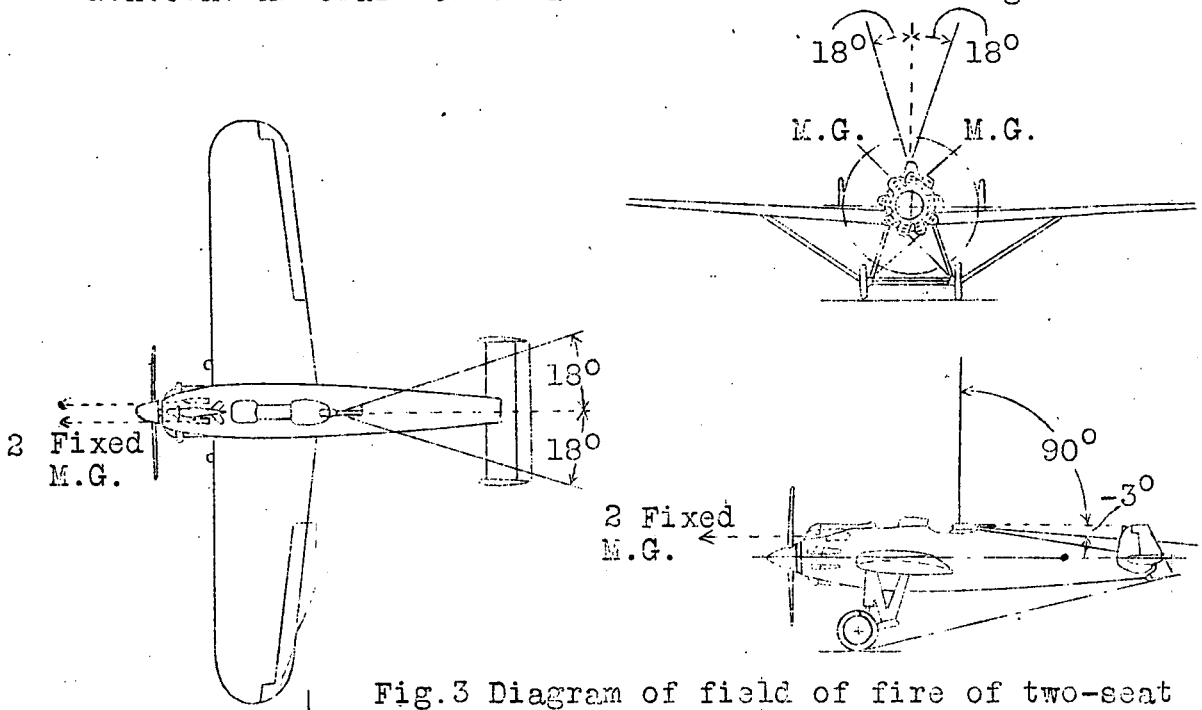


Fig.3 Diagram of field of fire of two-seat pursuit plane, K 47. Armament 2 fixed M.G. 1 movable M.G. (cradle mount.)

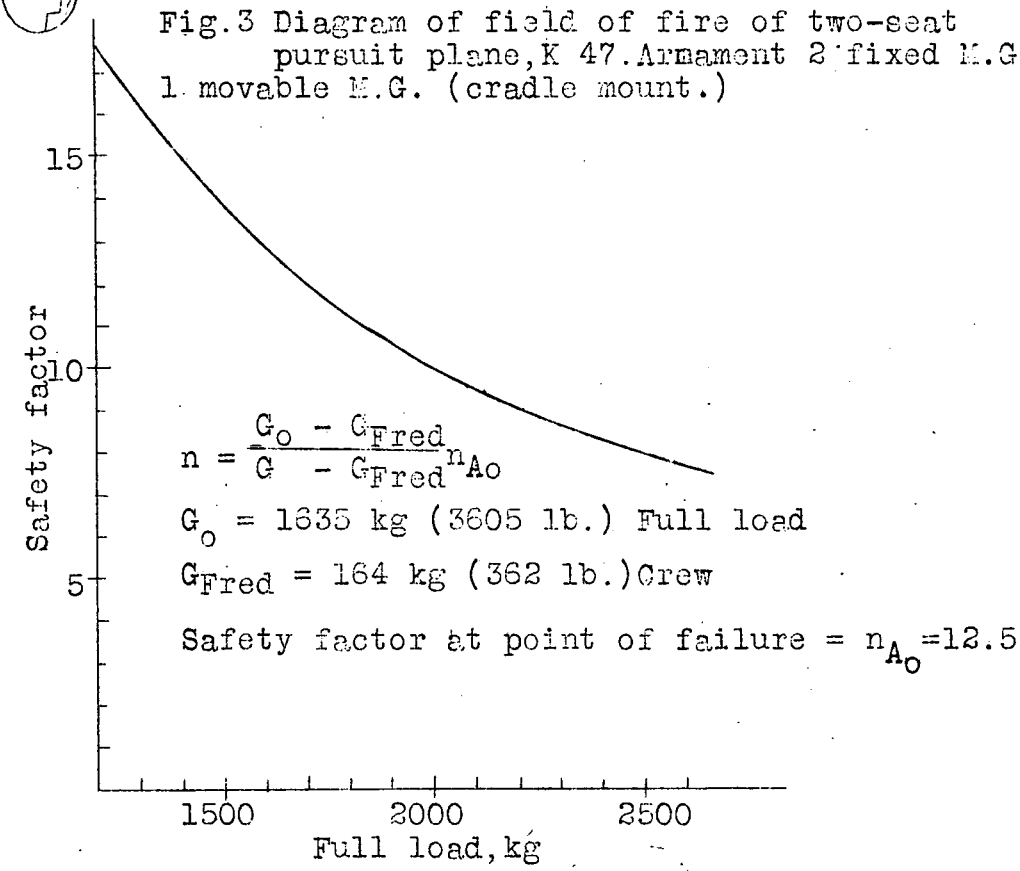


Fig.8 K 47 safety factor plotted against full load (Case A)

Fig.4,5 & 6 Views of the Swedish Junkers K 47 pursuit airplane.

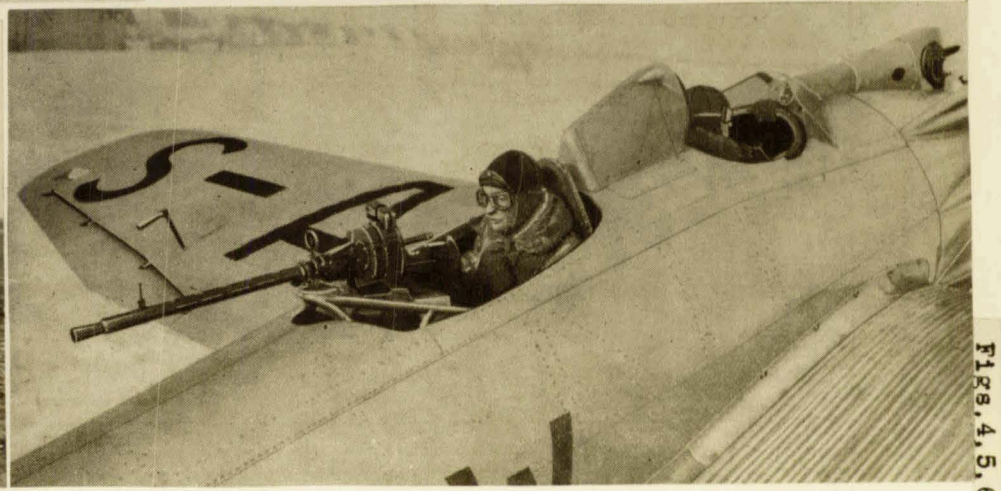


Fig.7 View showing gunner in position

Figs.4,5,6,7