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No. 57

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THE DE HAVILLAND "TIGER MOTH"

A Low Wing Monoplane

From "Flight," September 22, 1927

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Washington  
October, 1927

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THE DE HAVILLAND "TIGER MOTH"

A Low Wing Monoplane

With two such outstanding performances to its credit as a speed of 186.5 M.P.H. and an altitude (which does not by any means represent the ceiling) of 20,000 feet, more than usual interest attaches to the little "Tiger Moth" airplane produced by the de Havilland Company just before the race for the King's Cup. It is thought, however, that the general arrangement drawings (Figure 1), detail drawings (Figure 5), and notes dealing with various technical points, may assist those who desire a more than superficial knowledge of an airplane which represents a distinct advance over anything of the same power which has been produced in modern times.

Curiously enough, in the general arrangement of the "Tiger Moth" there is considerable similarity to the Supermarine S.5 and Macchi M.52 Schneider Trophy racers. The low-wing monoplane position, the reduction of strut bracing to the absolute minimum by having all members tension members except the landing gear struts, the location of the whole depending upon the attachment of the anti-lift wires to the top of the fuselage, and so on; all are features which the "Tiger Moth" has in common with the

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\* From "Flight," September 23, 1927.

Schneider airplane. It is even conceivable that the airplane could be turned into a seaplane, although with its short length it would presumably require an absolutely smooth sea. In this connection, it is not without interest to recall that the Schneider Trophy Race was won at Cowes in 1923, by an American Curtiss racer at the average speed of 177.38 M.P.H. That airplane had a Curtiss engine developing close upon 500 HP. It is not suggested that the "Tiger Moth" as a seaplane would equal that performance, although it might come very close to doing so, but perhaps this illustration may at least serve to bring home the merits of having attained more than 186 M.P.H. with an engine of only 130 HP.

Constructionally, the de Havilland "Tiger Moth" follows normal de Havilland practice fairly closely, i. e., the fuselage is a plywood-covered structure, generally speaking very similar to the fuselage of the standard club "Moth." The cross section is, however, different in that the sides have a pronounced outward slope towards the top longerons, while the rounded deck of the normal airplane has given place to a narrow fairing extending right back to the tail. Roughly, the cross section conforms to the shape of a man seated with his legs stretched out, the greatest width occurring where the shoulders are, and the top fairing being in line with the head. The usual flat bottom of the standard "Moth" fuselage has been supplanted by a rounded belly, and the work of getting the rounded covering of top and bottom to merge smoothly into the flat sloping sides has been extremely

neatly carried out, the joints being quite invisible.

Substantial transverse bulkheads or formers occur where the wing spars are attached, and the fuselage terminates in front in a fireproof bulkhead. The de Havilland engine, designed by Major Halford, continues the deck fairing in a forward direction, being a 4-cylinder, in-line, air-cooled engine. The engine accessories are very neatly placed, so that there are no excrescences on the sides of the engine. Consequently, the engine cowling is very neat, and the whole engine installation offers a minimum of resistance. The crank case is ribbed at the bottom, the ribs projecting through the bottom of the fuselage, thus providing cooling of the oil without offering any appreciable extra resistance.

The air intake is on the right-hand side, and the tube crosses over to the left where it bends forward and joins the inlet ports. Immediately above the induction pipe are the exhaust ports with their short stubs. The overhead valve gear is enclosed in a cowling, as is also the starboard side of the engine, but the port sides of the cylinders are left uncovered. The gasoline tank is mounted in the deck fairing in front of the pilot.

The cockpit is necessarily small, but although the airplane was designed specially for Captain Broad, a pilot of larger dimensions can be accommodated without undue cramping. The fairing in front of the pilot is provided with celluloid windows, and is made in halves joined by quick-release catches on the center line and hinged on the top longerons. Thus, when the pilot is in his

seat, the two halves of the cockpit coaming are closed, and only the pilot's head projects. The view is quite good, taking into consideration that the pilot is almost enclosed, since by leaning his head slightly to one side or the other he can look forward past the engine.

Owing to the small space available in the cockpit, the controls are somewhat unusual. The stick is universally mounted as usual, but the lateral control is somewhat less direct than normal, owing to the fact that the crank on the stick operates a T-shaped piece, which in turn actuates the ailerons via push-and-pull rods and torque tubes. The principle is illustrated in Figure 5.

Concerning the monoplane wings of the "Tiger Moth," little need be said, as they are of normal construction, with I-section spruce spars and normal wood ribs. The wing is built in halves, the spars forming a butt joint on the center line, where they are secured with steel plates and bolts, the spar roots, of course, passing through holes in the sides of the fuselage. The wing bracing is by streamline wires in duplicate. The ailerons, as already mentioned, are operated by torque tubes and cranks. A very neat arrangement has been adopted for closing the gap between main rear spar and aileron leading edge. This space is filled with a strip of sponge rubber, and incidentally the use of this material allows of a certain amount of damping, since working the aileron necessitates compressing the rubber at one edge or other. Thus, by choosing an appropriate thickness of rubber

strip, any desired "stiffness" in the lateral control can be obtained. An airplane like the "Tiger Moth" is naturally very sensitive on the controls, and so the amount of damping employed is fairly considerable. A similar form of damping and gap-closing is employed between elevator and stabilizer.

The landing gear is chiefly remarkable for the fact that the shock-absorbing gear is enclosed in the wheels, there being no axle. The central discs of the wheels are attached to the apices of the landing gear vees, and streamline wires run across from one wheel center to the other. Details of the wheel construction are shown in Figure 5.

Concerning performance, there is little need to say more than that the "Tiger Moth" has covered the 100-kilometer course at an average speed of 186.45 M.P.H., and has reached a height of 20,000 feet. The latter figure can certainly be improved upon, since during the flight the high-speed propeller was used, and there is little doubt that in the next attempt Captain Broad will reach a height of between 25,000 and 30,000 feet. On the recent altitude attempt, the airplane at 20,000 feet was still climbing at the rate of about 1000 feet per minute.

Following are the main characteristics of the "Tiger Moth":

Wing span		22.5 ft.	(6.86 m)
Wing area		76.5 sq.ft.	(7.12 m <sup>2</sup> )
Weight, empty		618.0 lb.	(281.0 kg)
Gasoline	(16.75 gal.)	124.0 "	(56.4 " )
Oil	( 2.00 " )	20 "	( 9.1 " )

## Characteristics (Cont.)

Pilot	143.00 lb.	( 65.0 kg)
Total load	287.00 "	(130.5 ")
Total loaded weight	905.00 "	(411.5 ")
Wing loading	11.83 lb./sq.ft.	( 57.8 kg/m <sup>2</sup> )
Power "	6.96 lb./HP.	( 3.17 kg/HP)

## "Everling Quantities"

"Wing Power"	1.7 HP./sq.ft.	( 18.3 HP/m <sup>2</sup> )
"High-Speed Figure,"	26	
"Altitude Figure,"	4.5	

## Performance

Average speed on a 62.1 mi. (100 km) course 186.45 M.P.H.

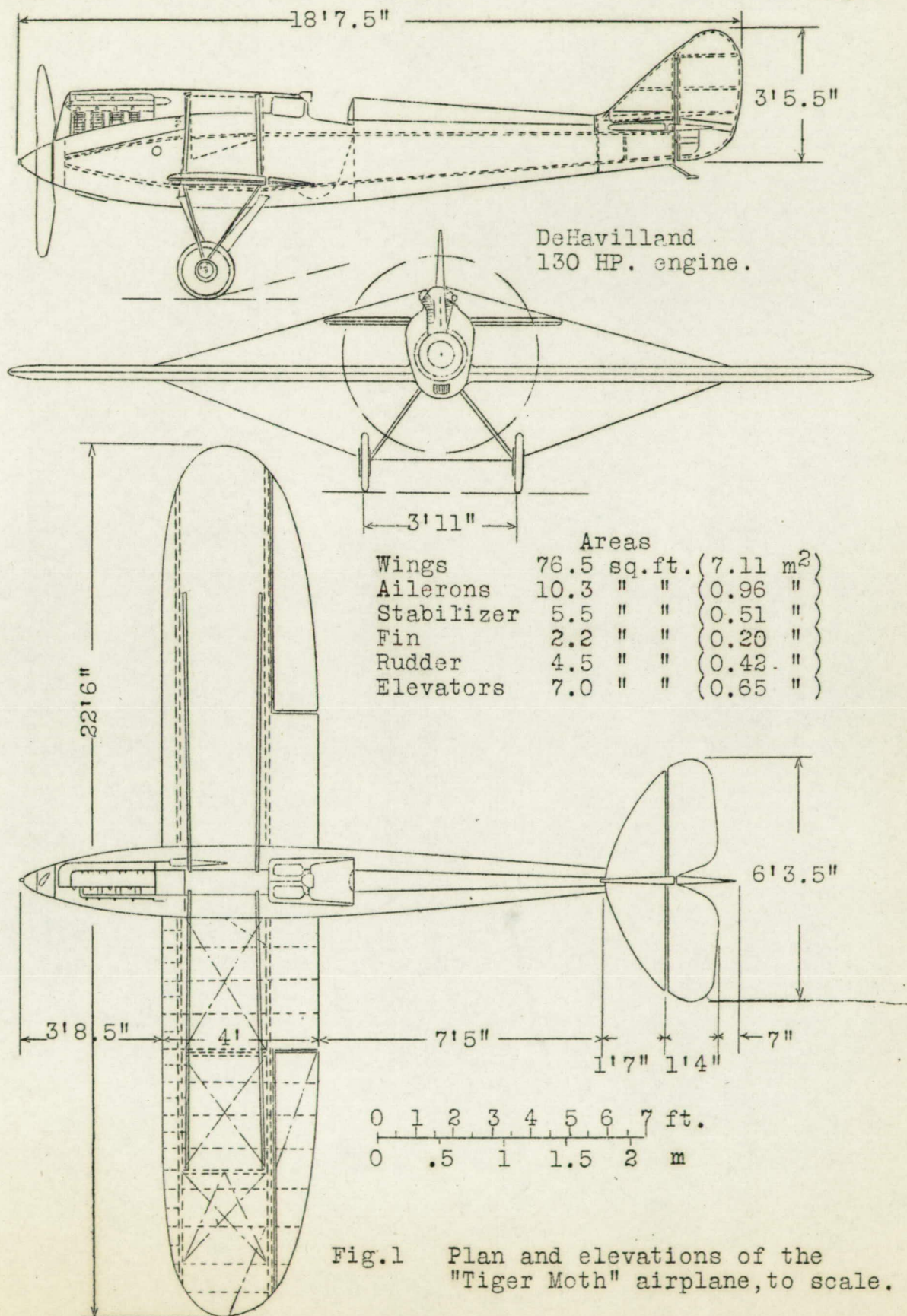


Fig.1 Plan and elevations of the "Tiger Moth" airplane, to scale.



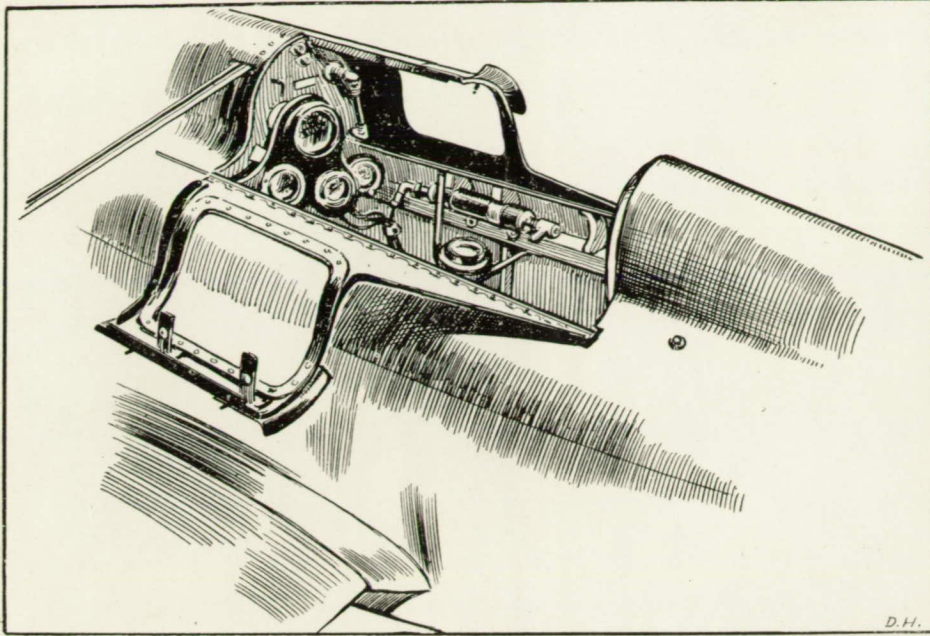
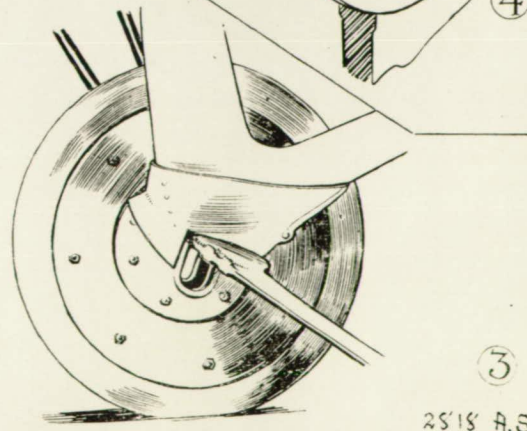
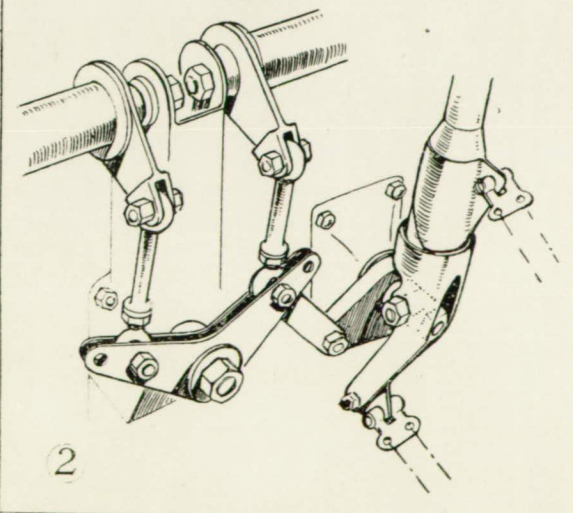
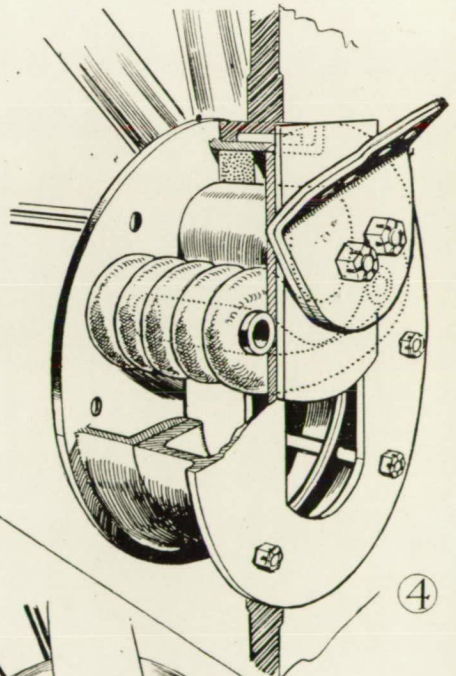
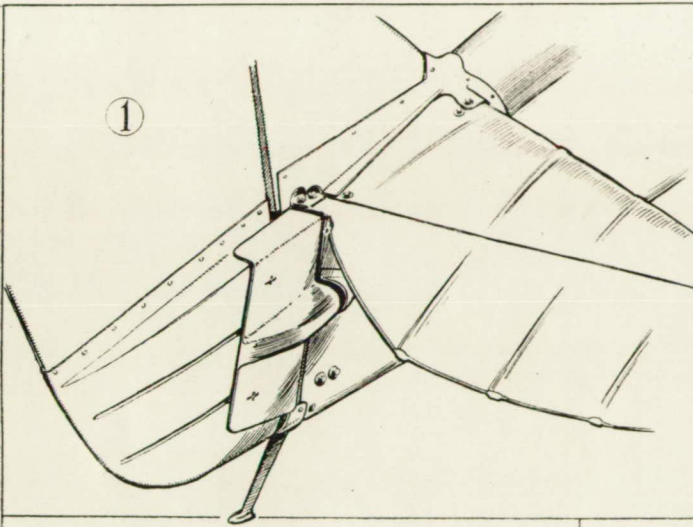


Fig.5

The De Havilland "Tiger Moth." Top, sketch showing hinged coaming of cockpit. Below, 1 shows how the rudder is thickened to carry out the lines of the fuselage, the gap and cranks being enclosed in hinged casings. The controls are of somewhat unusual type, as shown in 2. 3 illustrates the sprung wheel, enclosing the shock absorbers, some of the details of the mechanism being shown in 4.

"Flight" sketches



Figs.3 & 4 Views giving a good idea of the extremely clean lines.

"Flight" photographs

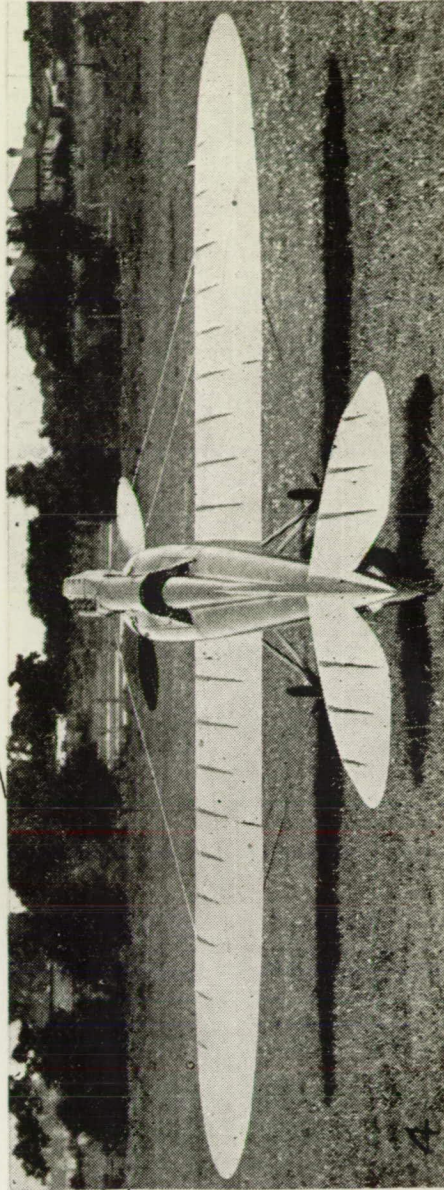
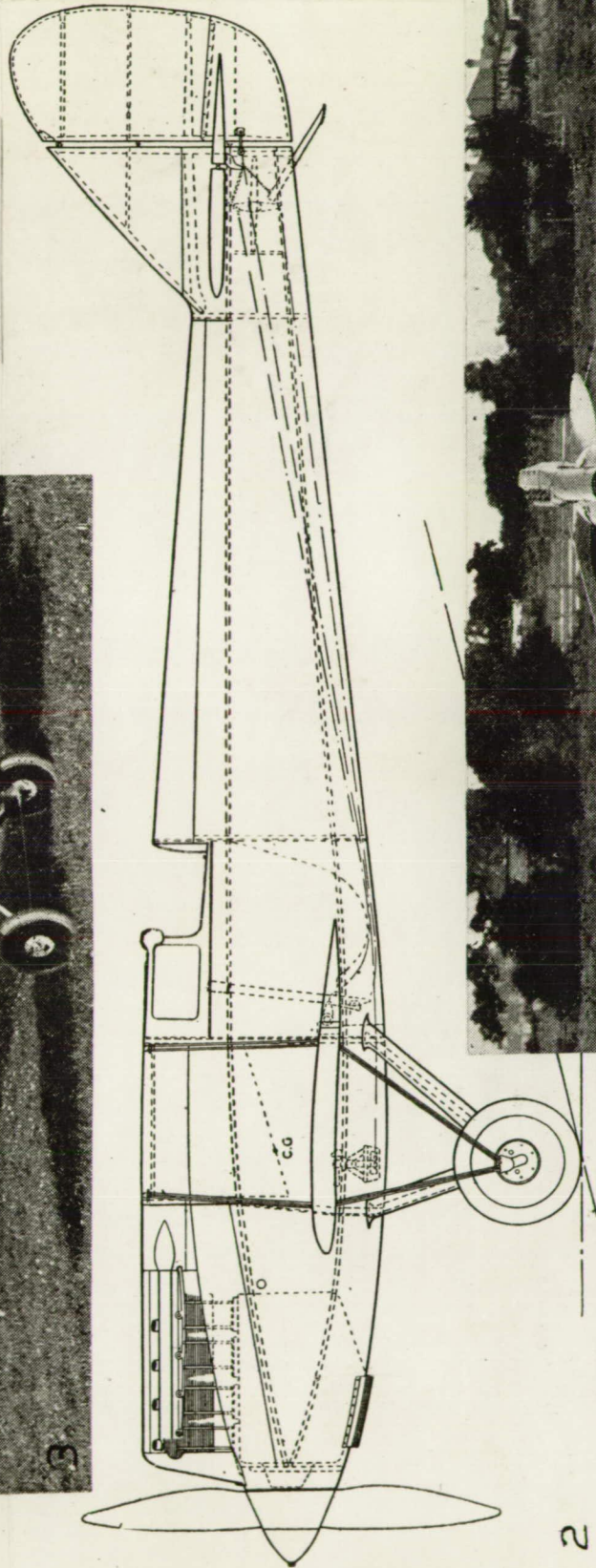
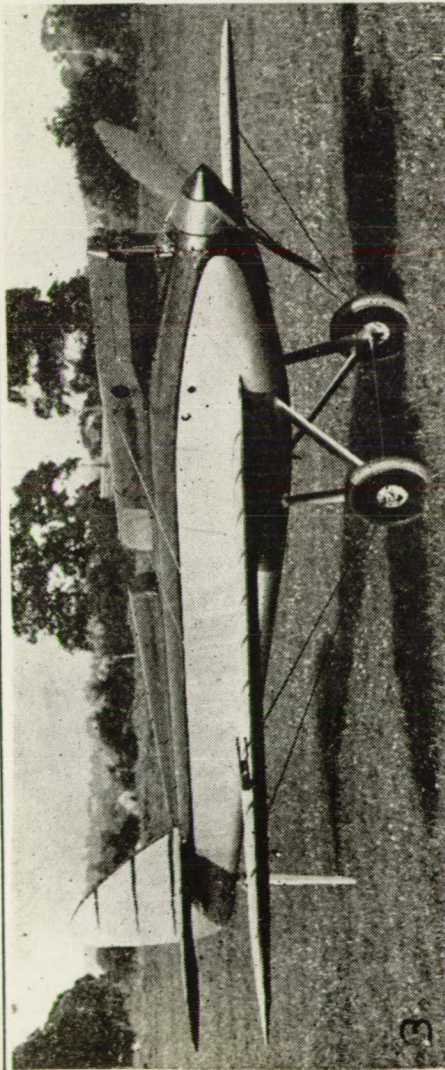


Fig.2 Enlarged view of fuselage of the "Tiger Moth" showing detail construction.