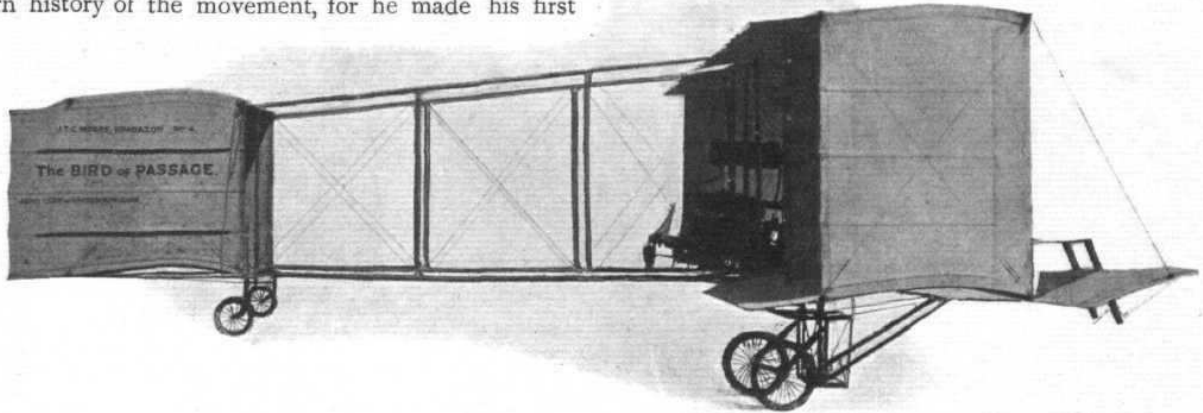


## THE VOISIN BIPLANE, 1908-9 TYPE.

A DETAILED DESCRIPTION OF MR. MOORE-BRABAZON'S "BIRD OF PASSAGE," TOGETHER WITH SCALE DRAWINGS WHICH HAVE BEEN OBTAINED THROUGH THE COURTESY OF THE OWNER FROM THE ORIGINAL MACHINE.

WHILE Farman and Delagrangé were arousing the enthusiasm of France, and attracting the keen interest of all nations to their brave and diligent attempts to conquer the air, the designer and constructor of the first practical type of French flyer remained in comparative obscurity; for the moment everyone overlooked the man behind the machine. M. Voisin commenced his experiences in flight at a sufficiently early period in the modern history of the movement, for he made his first

One of the first of those to secure a Voisin flyer was Mr. Moore-Brabazon, and it is of this machine, now housed at Shellbeach, that the owner has very kindly permitted us to make the accompanying scale drawings for the benefit of readers of *FLIGHT*. Mr. Moore-Brabazon's "Bird of Passage," as he has named his



"Flight" Copyright Photo.

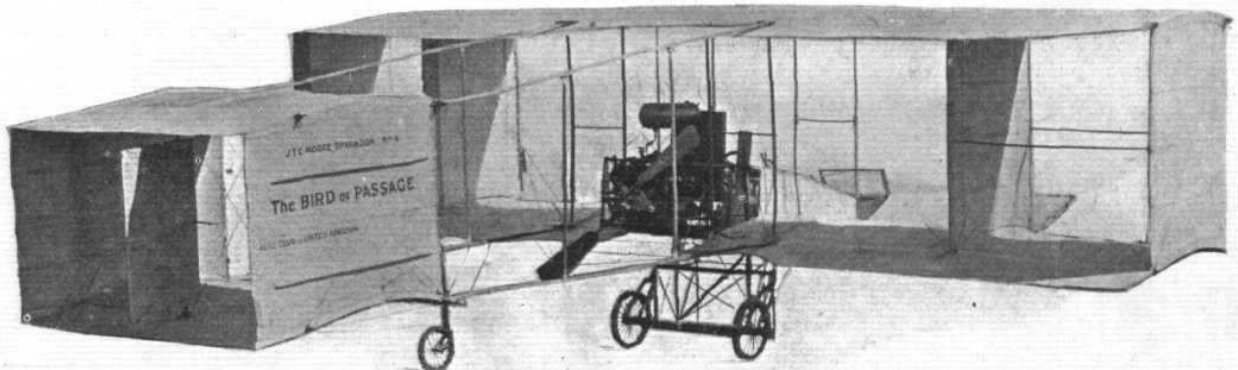
Side view of the Voisin biplane, showing the relative position of the engine and the construction of the outrigger which carries the tail.

public effort as pilot of the glider with which M. Bleriot inaugurated aerial experiments over the Seine. Bleriot's glider was towed by a fast motor boat, and more than once M. Voisin found himself prematurely plunged thereby beneath the surface of the water. When Voisin and his brother settled themselves down to the designing of a motor-driven machine, they made no particular outcry about the occasion. It was not until after the successful flights which Farman and Delagrangé had

flyer, is a machine with which he has achieved several flights. In fact, his early progress in the mastery of the air with it was remarkable. Since its arrival in this country he has also flown, but not to the same extent, partially owing to the inclemency of the present summer.

### Leading Characteristics.

The Voisin flyer is an original type of machine, and it is therefore the more important to specifically state its



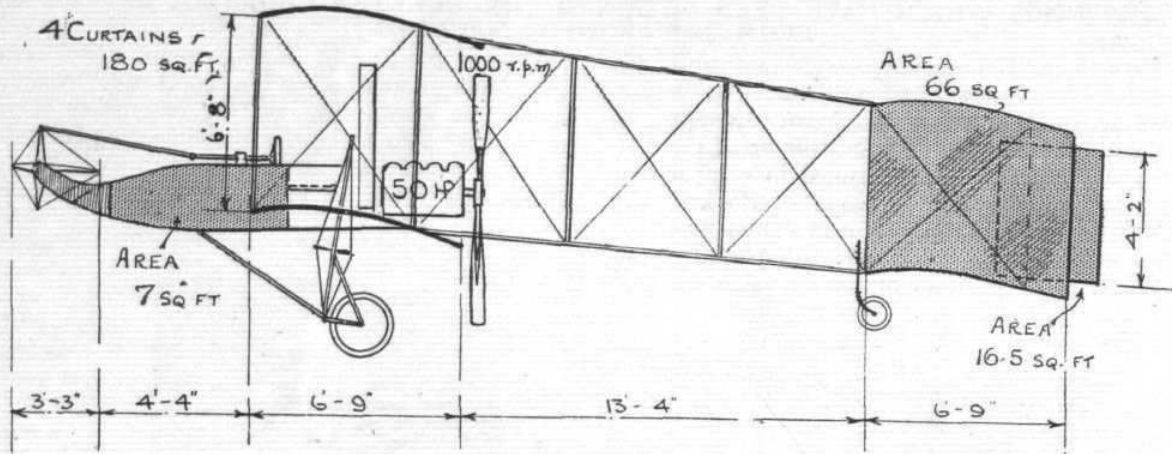
"Flight" Copyright Photo.

View of the Voisin biplane from behind, showing the relative size of the rudder and tail.

made with their device had been adequately applauded, that France herself began to realise who it was that produced them. For his work, however, M. Voisin has received the very just award of having his name included on the first list of decorations to be awarded in connection with the science and art of flight.

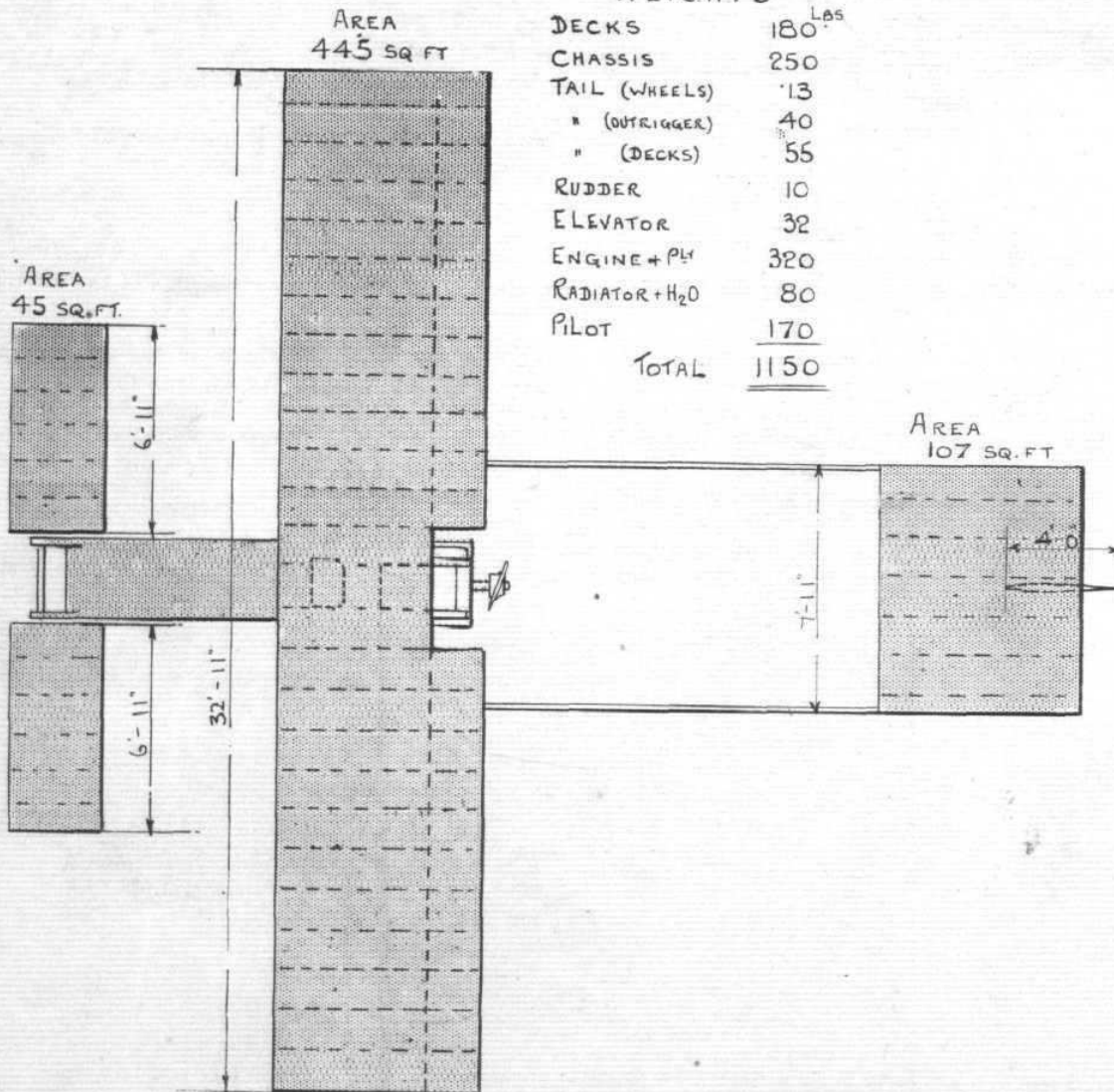
leading characteristics. Broadly speaking, the great point in the Voisin flyer is the fact that it has a tail, this member consisting of a kind of open-ended box carried at the rear upon a light outrigger framework extending some thirteen feet behind the main decks.

Having two principal supporting surfaces, the Voisin



WEIGHTS

DECKS	180 <sup>LB</sup>
CHASSIS	250
TAIL (WHEELS)	13
" (OUTRIGGER)	40
" (DECKS)	55
RUDDER	10
ELEVATOR	32
ENGINE + PLY	320
RADIATOR + H <sub>2</sub> O	80
PILOT	170
TOTAL	<u>1150</u>

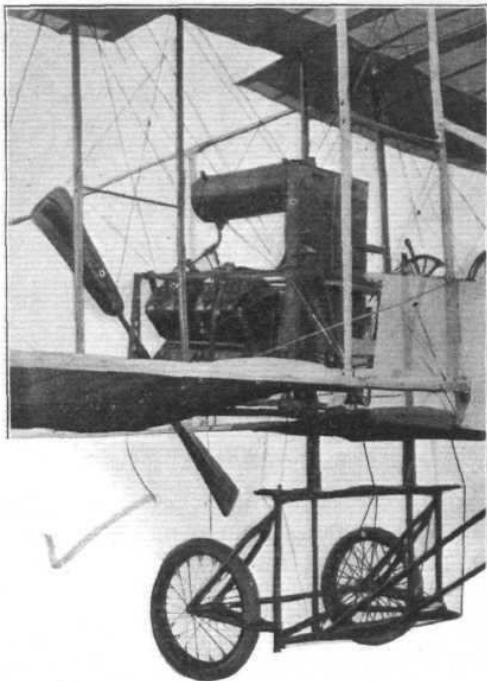


"Flight" Copyright.

MR. J. T. C. MOORE-BRABAZON'S "BIRD OF PASSAGE."—The Voisin biplane, 1908-9 type.

flyer belongs to the biplane class, and in this respect is similar to the Wright machine, with which it has another point in common, in the presence of an elevator. The elevator consists of a pivoted plane mounted about six feet in front of the main decks. Apart from the presence of the tail, the greatest contrast between the Voisin and

apart, and the ribs, which end up flush with the front spar, overlap the rear member a matter of 21 ins., whereby the trailing edge of the decks becomes flexible to a limited extent. This flexible trailing edge is a feature of Voisin construction, as also is the single-surfacing of the decks.



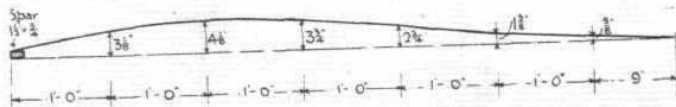
"Flight" Copyright Photo.

General view of the central part of the Voisin biplane, showing its suspension on the chassis.

Wright types lies in the absence of any wing warping or other special method of maintaining lateral stability in the Voisin flyer, beyond what is available from the effects of steering by the rudder.

Unlike the Wright flyer, which is supported upon runners or "ski," the Voisin machine, when on the ground, rests upon a wheeled chassis, and it is a leading characteristic in the construction of the machine that this chassis is attached to a kind of girder which supports the engine, contains the driver's seat, and carries an extension on which the elevator is mounted. This chassis-frame is one of the elements into which the machine can be dismantled for transport.

The last, but by no means the least important, characteristic of the Voisin flyer is its use of a single high-speed propeller mounted direct on the crank-shaft of a 50-h.p. engine.



"Flight" Copyright.

Diagram showing the camber of the decks on the Voisin biplane.

**The Main Decks.**

The main decks have a total span from tip to tip of approximately 33 ft., and a fore and aft chord of 6 ft. 9 ins. They are single-surfaced with fabric which is stretched over a foundation consisting of ash ribs lying across two transverse main spars. Two spars are placed about 5 ft.

The "Continental" surface fabric is so attached that it lies beneath the ribs, but these members are enclosed in pockets of the same material; it is this feature of the construction which gives the uneven appearance to the upper surface of the deck. In order to avoid sharp angles, the main transverse spars are also covered by strips of fabric so fastened that they give the spars a virtual triangular section.



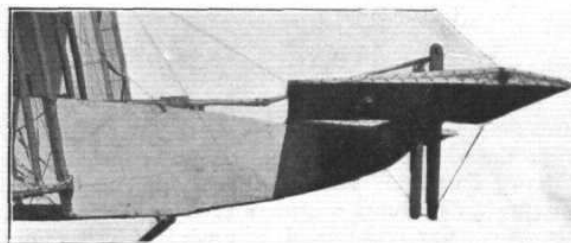
"Flight" Copyright Photo.

Detailed view of the tail on the Voisin biplane, showing method of mounting the rudder, and also the small wheels which support it on the ground.

All the ribs which lie between the two main spars are not alike, for at intervals coinciding with the vertical struts which separate the decks the ribs are considerably larger, and are built up to form an inverted T section. Before being mounted, the ribs are permanently set to the required shape, so that the decks when surfaced shall have the proper camber.

**The Tail.**

The tail, which is also of biplane form, is constructed



"Flight" Copyright Photo.

Detailed view of the elevator on the Voisin biplane, showing how it is mounted and stayed.

on exactly similar lines to the main decks, and although it has a smaller gap, and a much shorter span, the chord is the same dimension. The area of the two decks of the tail is nearly one-quarter of the area of the main decks, and it is necessary to bear its value in mind when considering the effective supporting area of the whole



"Flight" Copyright Photo.

Mr. J. T. C. Moore-Brabazon's "Bird of Passage" outside Short Brothers' factory at Shellbeach. The elevator in this view is shown tilted.

machine. The aspect ratio of the tail is only a little more than unity.

#### The Elevator.

Unlike the tail, the elevator does not resemble the main decks, either in its form or construction, for in the first place it is of the monoplane type, secondly it is double-surfaced. The elevator is, owing to its method of mounting, divided into two equal portions on either side of the girder frame, which juts out in front of the main deck. The area of both parts combined is 45 sq. ft. or a little more than one-tenth of the area of the main decks. Its effective span is 13 ft. 10 ins., and as its chord is 3 ft. 3 ins. the aspect ratio of each portion is about 2.

The ribs which stiffen the elevator are sufficiently thick at the maximum section to allow the hinge-rod to pass through them, and fore and aft of this point, which lies 10½ ins. behind the leading edge, the ribs taper to a point. The hinge-member consists of a 1¼-in. steel tube, and the maximum depth of the elevator at this point is about 2½ ins. Being double-surfaced, that is to say, having a fabric covering top and bottom, the ribs

and the hinge are entirely enclosed. The elevator is virtually cambered by its arched upper surface; the bottom surface is approximately flat.

The operation of the elevator is carried out by means of a connecting-rod attached to the steering-wheel spindle. This latter member is mounted so that it can slide in its bearings, and the pilot is thus able to set the elevator by pushing and pulling the steering-wheel bodily to and fro.

#### The Rudder.

The rudder resembles the elevator in form and construction. It is situated between the decks and the tail, being mounted upon a vertical hinge pivoted upon the rear transverse spars of the tail decks. Owing to the tail itself having a flexible trailing edge most of the rudder lies wholly within the tail, only about 1 ft. 3 ins. of its chord projecting in the normal position. The hinge of the rudder is about 18 ft. 4. ins. behind the rear edges of the main decks.

The operation of the rudder is effected by wires, which pass round a wooden drum on the steering spindle.

(To be concluded.)

#### Farman Wins the "Professor Prize."

THE prize of 1,000 francs offered through the Ligue Nationale by M. A. C. Saint-Macary for the professor who produced the most promising pupil has been won by Henry Farman. The conditions stipulated that the pupil must fly round a course of one kilometre three times on one day, and this M. Sommer had little difficulty in doing, and so winning the prize for his tutor.

#### Wright Bros.' next Visit to Europe.

FROM Odessa it is announced that a contract has been made by the Aero Club there with Wilbur Wright, under which the latter will make some flights during October next in Odessa.

On Tuesday Orville Wright, accompanied by his sister, left New York for Europe on the "Kronprinzessin Cecilie." He will first visit England, going to Messrs. Short's factory at Shellbeach in order to test the Wright

machines which have been built by them. Afterwards he will go to Berlin to carry out the flights which were arranged to be made on Aug. 20th. We also refer to this on page 493.

#### Laffan's Plain "Closed" to Experimenters.

A CORRESPONDENT writes complaining that permission has been refused him to use Laffan's Plain for experimenting with his motor-driven aeroplane, and he also mentions that other suitable places, like Wormwood Scrubbs, Hackney Marshes, and Wimbledon Common, are closed to flyers, even though none of those places are much frequented during the greater number of hours of daytime. It appears that in response to his application he has been recommended to Salisbury Plain. He very naturally feels aggrieved that any difficulties should be put in the way of British experimenters, particularly now that so much leeway has to be made up in this country.

# THE VOISIN BIPLANE, 1908-9 TYPE.

A DETAILED DESCRIPTION OF MR. MOORE-BRABAZON'S "BIRD OF PASSAGE."

(Concluded from page 488.)

### Side-Curtains.

ANOTHER feature which characterises the Voisin flyer is the presence of side-curtains between the main decks and also between the decks of the tail, these members being thereby converted into a kind of box-kite construction. Between the main decks there are four side-curtains, one at each end and another between the vertical struts adjacent to those at each end. They consist of sheets of the same surface material as is employed for the decks, and are stiffened by flat ribs enclosed in pockets. To a certain extent they may also receive support from the diagonal wire-ties which lie adjacent to them.

The real utility of side-curtains has been questioned by some aviators, and M. Delagrangé has flown a Voisin machine without them. Leaving aside all considerations affecting those employed between the main decks, it appears to us that the possible influence on the effectiveness of the rudder, of those in the tail, ought certainly to be taken into consideration. We have already pointed out that the rudder is almost entirely enclosed within the tail, and it is difficult to believe that the side curtains do not effect its action.

The part played by the side-curtains between the main decks is not altogether too well defined. They afford a

considerable extent of cutwater, which doubtless assists the machine in turning, and it is possible that they also tend to minimise the direct effect of side gusts suddenly striking the machine obliquely.

### Engine and Propeller.

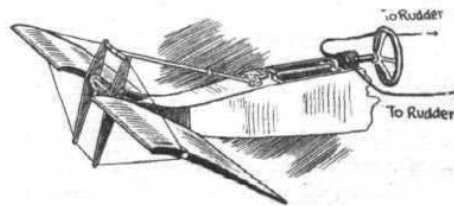
After trying various different engines, Mr. Moore-Brabazon finally selected an E.N.V.\* motor of 50-h.p. It is an engine of the 8-cyl. "V" type, and of very substantial construction, although specially designed for flight.

The propeller is mounted direct on an extension of the crank-shaft, and is a two-bladed construction in steel. The blades are riveted to detachable arms, which are bolted to a separate boss in a manner which is clearly illustrated in an accompanying sketch. Some observations on the pitch and efficiency of the Voisin propulsion will be found in *FLIGHT*, vol. 1, p. 16. In front of the engine, and immediately behind the pilot's seat, is a large honeycomb radiator.

The engine is mounted on a light girder framework of steel, an arrangement which is well illustrated in the accompanying photographs.

### Control.

The control of the Voisin flyer is carried out entirely



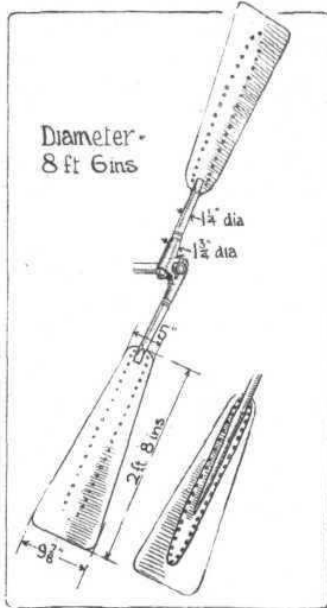
"Flight" Copyright.

Sketch of the steering wheel control on the Voisin biplane, showing the connection between the spindle and the elevator.

by the aid of the elevator and the rudder, the former being operated by pushing and pulling the steering wheel bodily to and fro, and the latter by turning the wheel upon its axis. The steering

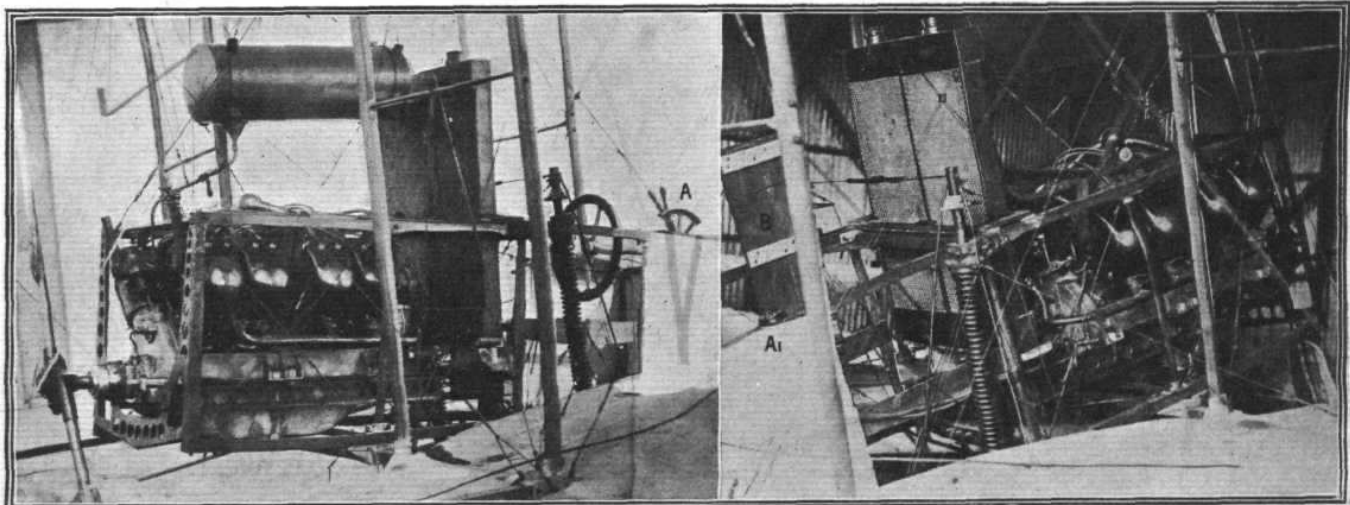
follows the same direction as on a motor car; pulling the steering wheel tilts the front edge of

\* See *FLIGHT*, vol. 1, pages 48, 193, 206.



"Flight" Copyright.

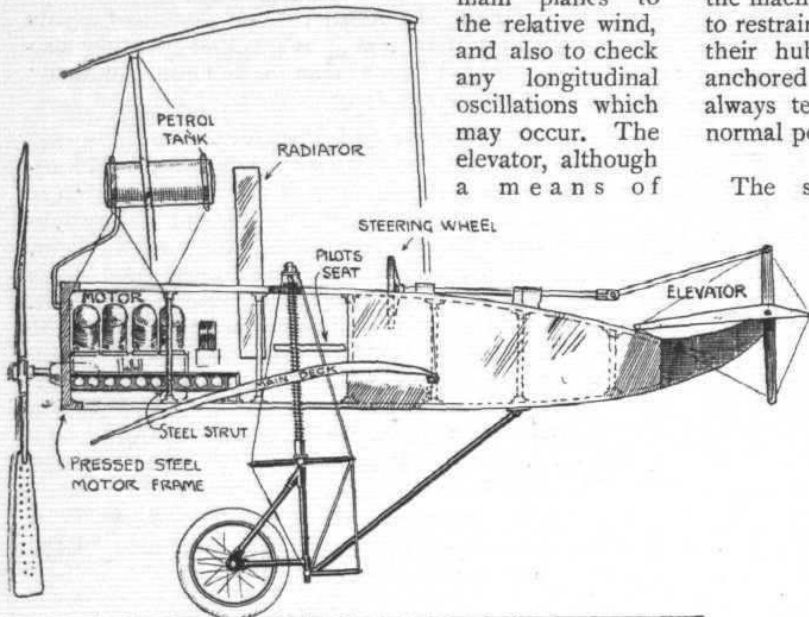
Sketch of the two-bladed propeller on Mr. J. T. C. Moore-Brabazon's "Bird of Passage." The inset drawing shows how the blade is riveted to its arm.



"Flight" Copyright Photo.

Two views of the engine on the Voisin biplane; also showing the pilot's seat and the control. In the right-hand view the seat itself, B, has been turned up into a vertical position. The timing and throttle-levers, A, and also the switch, A<sup>1</sup>, are to be seen in the centre of the above illustration.

the elevator for temporary ascents. The purpose of the elevator is to produce temporary ascents or jumps by altering the angle of incidence of the main planes to the relative wind, and also to check any longitudinal oscillations which may occur. The elevator, although a means of



can swing, together, to one side or the other of their normal position, like the castors of a chair, a feature which is essential in order to preserve the equilibrium of the machine when it runs along the ground. In order to restrain these movements on the part of the wheels, their hubs, which are joined by a hinged axle, are anchored to the chassis frame by tension springs, which always tend to draw the wheels back again to their normal positions.

### Suspension.

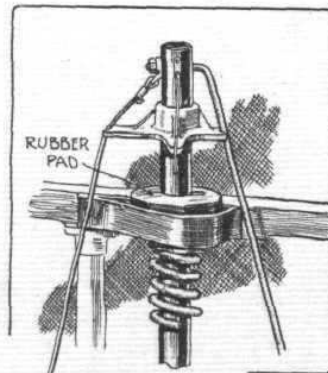
The suspension of the flyer upon the chassis is effected by a pair of long helical springs. Each spring is mounted about a steel column which extends upwards from the chassis and passes through a bracket attached to the girder frame which carries the engine. This bracket serves as an abutment to the upper end of the spring, and it also carries a rubber pad to cushion the effect of the recoil. This point forms one of the attachments of the chassis to the frame, the other attachment being formed by a radius-rod which is hinged directly to the frame at a point further in front. When the springs compress, the effect of these radius-rods is to cant the uprights about which the springs are mounted, a point which should be borne in mind when considering the stresses to which the supporting brackets are liable to be subjected.

### Pilot's Seat.

The pilot's seat in the Voisin flyer is situated about a third of the chord behind the leading edge of the main plane, and is contained within the girder frame which carries the engine and the elevator. On Mr. Moore-Brabazon's machine the seat consists of a simple board, hinged so that it can be raised for access to the starting-handle of the engine, which lies almost immediately beneath it. The relative position of the seat to the other principal members is clearly shown by an accompanying sketch.

### Girder Work.

From a constructional point of view a flyer presents a series of special problems in girder work, and it is therefore always instructive to consider the design on this basis. The main planes of the Voisin machine constitute together a kind of lattice girder, in which vertical wood struts alternate with diagonal piano-wire ties. Here and there extra struts and tie-wires have been introduced in the manner illustrated by an accompanying diagram which shows the staying of the main spars forming the leading edges of the decks.



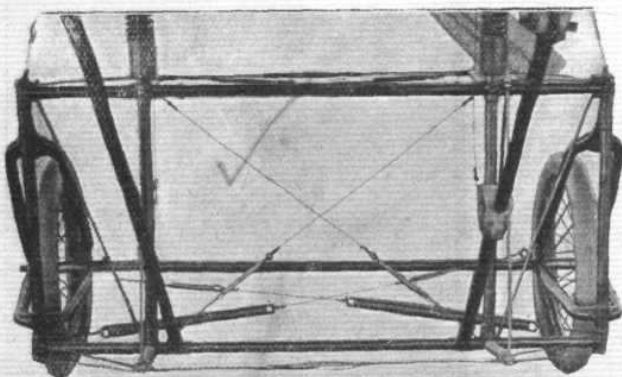
"Flight" Copyright.

The entire weight of the main decks, engine and pilot on the Voisin biplane, carried on a pair of helical springs abutting against manganese steel brackets, arranged as shown in the above sketch.

beginning an ascent, is not itself endowed with any capacity for causing ascent to be maintained, that alone can result from an increase in the engine power beyond what is necessary to sustain horizontal flight. Lateral stability is maintained by suitably steering the machine, so as to give the depressed wing tip such an increased relative velocity to the air as will cause it to have a greater lift.

### The Chassis.

The weight of the machine, with the exception of that part represented by the tail, which is independently supported by a pair of small wheels, rests upon two bicycle wheels shod with 650 by 65 mm. tyres. These wheels are mounted upon a tubular framework, and have a track of 4 ft. 8½ ins. They are so arranged that they



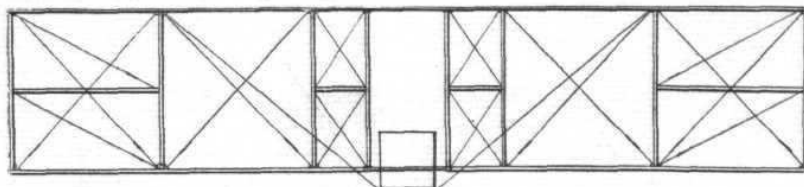
"Flight" Copyright Photo.

Detailed view of the chassis on the Voisin biplane, showing how the wheel axle is anchored to the chassis frame by springs.

A point which is always of considerable importance to observe in this connection, is the continuity or otherwise of

of the girder from end to end, and special attention should therefore be paid to the manner in which the lower spars of the main decks are carried across through the supplementary frame used for the engine. In the

tie-wires have tighteners fitted to them, so that they can always be kept taut. On the contrary, the Wright flyer has hook-and-eye joints between the struts and the spars, and the tie-wires are not specially stretched in place; the whole machine is, in fact, built so as to be slack, and therefore able to give when strained.



"Flight" Copyright.

Diagram of the bracing of the main spars constituting the leading edges of the decks on the Voisin biplane. The square member in the centre is the girder which carries the engine and the pilot's seat.

**Materials.**

Ash is used throughout in the construction of the machine, with the exception of the steel tube work employed in the chassis. As timber, ash is characterised by its flexibility, and on the Voisin machine it must be confessed that there is not lacking evidence of its capacity in this respect, many of the struts and spars being very much inclined to bend under the load imposed upon them. In flying machine design every effort is, of course, made to keep down the weight, and sections have to be reduced to a minimum in consequence.

Voisin construction the front spar is divided at this point and fastened to the engine girder by a bracket, an intermediate member belonging to the girder bridging the gap.

For the small fittings such as the socket-brackets for the struts, aluminium is employed, and this metal was also used for the main supporting brackets above the springs, until it gave way during a rough landing. Messrs. Short Brothers then introduced a pair of manganese steel brackets when making the repair, and as these members are in any case not large, the increase in weight is in no way comparable with the value of the additional strength thus obtained for such an important member

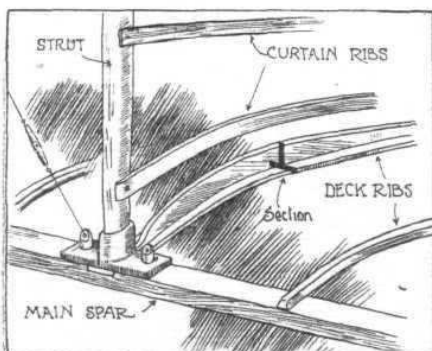
Another example of girder work in the Voisin flyer is the outrigger carrying the tail, but this consists of four rectangular spars attached by brackets to the rear transverse spars of the main decks. Each pair of spars in a vertical plane constitutes a lattice girder, and is braced in a similar manner to the spars in the main decks. There is no bracing, however, between the spars in a horizontal plane, other than that afforded at each end by the tail and the main decks respectively.

The fabric used for covering the decks is Continental rubber-proofed material.

The girder, to which the chassis is attached, which carries the engine, the pilot's seat, and the elevator, is a semi-elliptic construction formed by four longitudinal spars braced together by wood struts and diagonal wire-ties. In the vicinity of the engine tubular steel struts are used instead of ash, and the blank end of the girder is finished off with a pressed steel member, which braces three sides simultaneously.

**Dimensions.**

Most of the important dimensions likely to be of primary interest to the reader are given on the full-page plan and elevation. There are a few others, however, which it may be of interest to summarise here. The spacing of the ribs in the main decks is approximately 1 ft. 3 ins.; their camber is given by an accompanying diagram. The main transverse spars in the decks are 1 1/2 ins. fore and aft and 3/4 in. deep, but the section is not symmetrical, being cut away to sharpen the leading edge. The ordinary ribs have a section of about 1/8 in. by 3/4 in., while the main ribs of the section are 1 1/2 ins. wide at the base. The struts have a maximum width of 1 1/2 ins. and a maximum depth of 2 ins. They taper slightly towards the extremities, and have a sharp-pointed elliptic section. The longitudinal spars forming the outrigger which carries the tail have a mean section of 1 1/2 x 1 x 1 1/4 ins., while the main spars in the central girder which carries the engine and elevator have a section 1 1/8 ins. square. The ribs in the elevator are spaced 1 ft. 4 1/2 ins. apart.



"Flight" Copyright.

Sketch showing the skeleton framework forming the deck of the Voisin biplane.

**Constructive Detail.**

Considerable attention has already been given to the joints and fastenings of the Voisin flyer in other issues of FLIGHT, so that our readers are

already familiar with the aluminium socket-brackets by means of which the struts of the machine are fastened to the spars. This in itself is a feature of the Voisin construction not alone as a detail but also because of the rigid system which it represents. The joints in the Voisin flyer are designed to be quite rigid throughout, and the

The smallest wire used has a diameter of about 1/8 in., but their size varies in different places and is much larger where it is employed for staying the chassis. The tubular steel work of the chassis is mostly 1 1/4 ins. in diameter. The helical springs used in the suspension are 3 ft. long, 2 ins. mean diameter, and of 3/4 in. circular section.



**Blackpool and Fylde District Aero Club.**

SUCH is the new title of that very active organisation which was founded some time ago as a model aero club. M. Bleriot has just accepted the first Vice-Presidency of the Club, and, under the guidance of Mr. Jack Kemp,

the energetic Hon. Secretary, a period of activity is promised. Councillor Parkinson has promised to take his Bleriot monoplane to Blackpool, and the Club hopes to have its full-sized glider ready very shortly now.