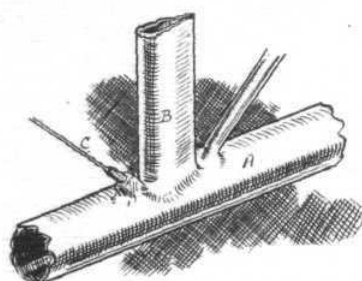


MAY 15, 1909.

JOINTS AND FASTENINGS.

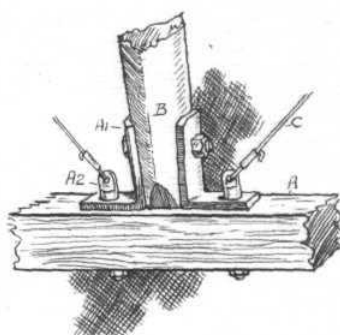
EXAMPLES OF SOME INTERESTING LITTLE CONSTRUCTIVE DETAILS WHICH MAY BE SEEN ON AEROPLANES.

To those unacquainted with actual workshop practice, the construction of a machine like an aeroplane may seem straightforward enough, and it is probable that many casual observers have far too little appreciation for the ingenuity displayed in the design of their details. Yet, in practice, it is precisely the details which take the time. One piece has to be fastened to another, and the question at once arises how the joint can be best effected in the easiest and cheapest way.



"Flight" Copyright.
Welded joint on Howard-Wright biplane.

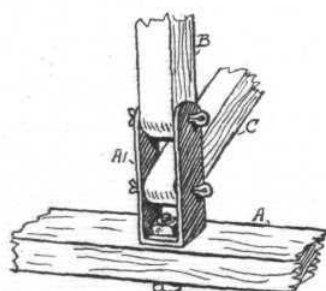
At the same time a decision has to be arrived at as to whether the joint in question must be essentially strong, or whether



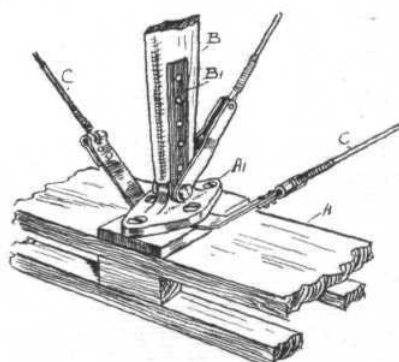
"Flight" Copyright.
T-joint in Capt. Windham's Pischoff.

perchance the attachment may be regarded as something of a casual nature. In engineering pure and simple, it is, perhaps, needless to say, joints of this latter character are unknown in principle, and are happily seldom to be observed in practice; in aeroplane construction it is more than likely that the same state of affairs will ultimately evolve, but at present it is only fair to remark that not everyone acts up to this principle at the present day.

In the accompanying sketches will be found examples of a few details which serve very well as a



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Lamplough's flexible fastening.

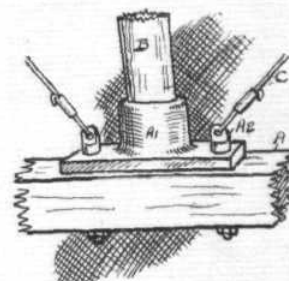


"Flight" Copyright.
Short's flexible fastening.

basis of comparing present day methods. For the most part the illustrations represents joints between vertical struts and horizontal spars, the former being principally employed in the separation of the two main planes of a biplane, and the latter constituting either of the main-transverse members which run through the planes in question. For the most part, as our readers are aware, wood is used as the material of which these members are made, an interesting exception being the case of the Howard-Wright biplane, in which tubular steel work is used throughout. As our sketch of the joint on this latter machine shows, the tubes, A and B, are welded together, and not only so but the eye-pieces for the attachment of

the tension wires, C, are also fastened solid into the same joint. Properly executed, such construction is, of course, simple and strong, and the joint itself is characterised by great rigidity.

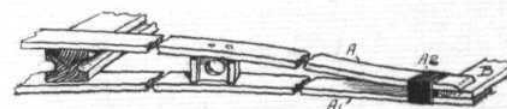
When considering the other examples afforded by the accompanying sketches, it is necessary to make a preliminary classification of great importance. Some makers, it will be found, purposely design such joints so that they are naturally flexible, while others make them so that they are essentially rigid. It is to the former class that the Wright flyer belongs, and British-made machines which follow the same principle include the



"Flight" Copyright.
Rigid socket-joint on the Voisin flyer.

Short and the Lamplough. The Voisin flyer has rigidly-attached struts, and in Captain Windham's Pischoff the intention is also apparently to give a rigid effect, although the detail of the joint in question is not such as to make this quality inherent to the same degree.

The joint on the Short flyer is particularly interesting for the evidence of careful thought which has been given to its design. The main horizontal-member, A, to which the strut, B, is attached, is fitted with an aluminium lug, A¹, screwed in place by four wood screws, and it will be noticed that the flange of this lug has been employed as a clamp for fastening a light steel strap to which the diagonal tie-wires, C, are secured. Inserted in the faces of the strut, B, are a pair of steel fitch-plates, B¹, which project beyond the extremity of the wood, and themselves serve to



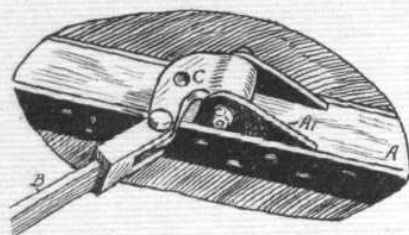
"Flight" Copyright.
Short's flexible rib.

form the hinged joint with the lug, A¹. The pin which completes this joint also serves, it will be noticed, as an anchorage for a third diagonal tie-wire.

Another example of flexible construction is that afforded by the Lamplough machine, in which a vertical wood strut, B, and also another wooden member, C, placed diagonally, are required to be attached to a main-spar, A. In this case it will be noticed that a steel U-piece, A¹, has been bolted to the spar, A, and that the other members, B and C, are fastened to this steel stirrup by means of split-pins. Subjected, as it probably would be, to a racking strain, owing to the exigencies of experimental work, it would conceivably enhance the

longevity of a joint of this description had the members, B and C, been themselves faced with steel so to prevent the split-pin cutting into the wood.

In the Voisin flyer, which is an example of rigid construction, the attachment of the vertical-strut, B, to the horizontal-spar, A, is accomplished by means of an

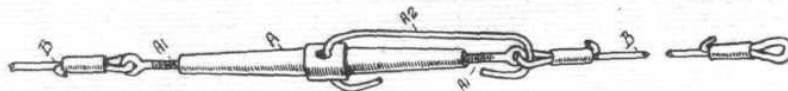


"Flight" Copyright.

A detail on the Rep monoplane.

aluminium socket, A¹, which is fastened to the spar itself by two bolts, A². The heads of these bolts, it will be noticed, are used as eye-pieces for the attachment of the diagonal stay-wires, C, which, by the way, would seem to be in a position to exert an appreciable leverage upon the bolt-heads. On Captain Windham's Pischoff, the socket is replaced by a pair of angle-brackets, A¹, which are similarly fastened to the main-spar, A, but have, of course, to be bolted to the vertical strut, B, in addition. As a result, it is not so simple a job to make a really rigid connection, although the method doubtless lends itself to cheap construction.

Some other details not related to the particular type of joint which we have just discussed, are also included among the accompanying sketches, one of which, for instance, shows a little detail in the construction of the Rep monoplane. It illustrates a connection between a rectangular steel tie-rod, B, and a main spar, A, which is carried out by means of a swivel, C, carried on a bracket, A¹, formed by steel fitch-plates screwed to the main spar itself. This particular joint is one used in connection with the warpings of the wings, but as a detail of construction it is, of course, not limited to this particular application.



"Flight" Copyright.

Adjustment for tightening stay-wires.

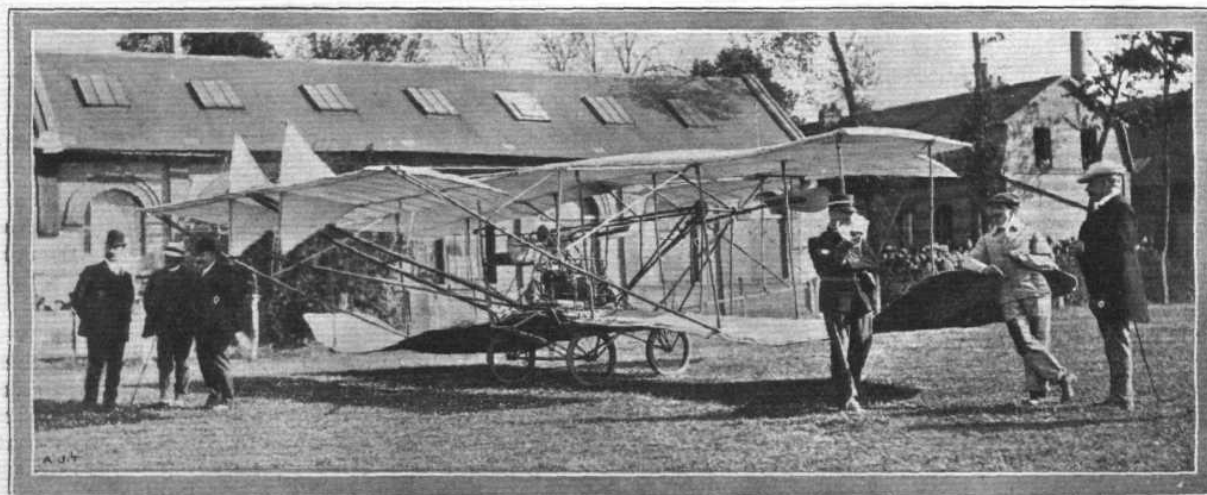
form the rib, are caused to grip the transverse-lath, B, which forms the trailing edge of the lip in question, by means of a light steel band, A². This is so arranged that when the lip is flexed up or down the laths can accommodate themselves by sliding into their natural positions without in any way disturbing their joint with the rear edge.

Mention has already been made of the fact that while some constructors believe in tight bracing, others use comparatively slack wires. In the former case it is commonly considered desirable to afford some means of keeping the wires taut, and of readily adjusting them. The device for doing this is in most cases a simple barrel nut, such as that illustrated, in which the wire, B, is divided and attached to a pair of right and left-handed steel screws, A¹, which engage with the nut barrel, A. Through the centre of the nut a hole is drilled so that it can be conveniently turned by the use of a "tommy-bar," and the same hole serves for locking the nut by means of a piece of wire, A², arranged as shown in the sketch.

"Army Dirigible II."

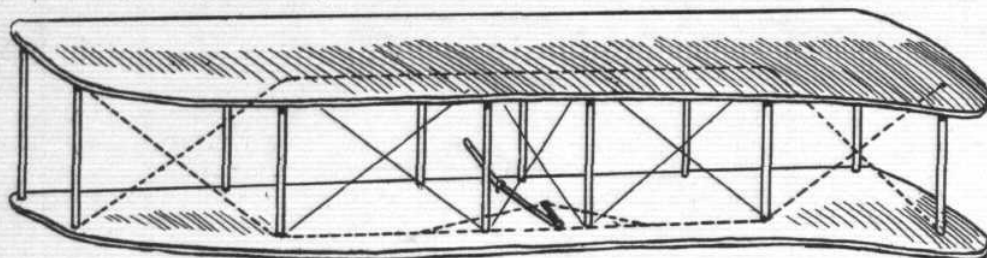
TRIALS were made at Farnborough on Tuesday and Wednesday last with the new Army dirigible. Only short flights were made, that on the first day lasting for about

an hour, but on the second day it was noticed that a steadying sail had been fitted beneath the balloon. As far as could be judged the trials were satisfactory, although no information was divulged officially.



Latest form of the Robart biplane which is fitted with an 8-cyl, 50-h.p. Antoinette motor, chain transmission and two propellers. It has a span of 12 metres, and a plane surface of 52 sq. metres. The feature of this aeroplane is the pronounced curvature of the lower plane.

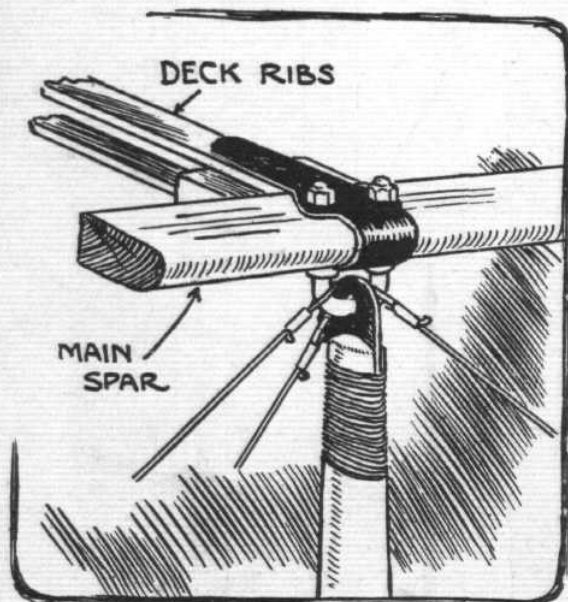
tion in the first instance, but for our own part we favour the other aspect of the case for the two points which it has in its favour, the first being that the better a machine is made the less liable is it to give trouble any way, and the second being that when it does get smashed a well-made article is always more easily and satisfactorily repaired than one which is half a wreck to start with. Moreover, there is always the consideration that a



"Flight" Copyright.

Diagrammatic sketch of main planes, showing the arrangement of warping-wires (in dotted line), and the manner in which the rear edges of the planes are flexed. It is important to note that the front or entering edges are unaffected by this movement, remaining always perfectly straight.

certain amount of risk attaches to flight, which it is gratuitous to exaggerate by neglecting any reasonable proportions such as using a decently built machine to fly on, and although, of course, a well-made glider will probably cost more than one on which less care has been spent, there is no reason why the old adage should not apply, "the best is cheapest in the long run."



"Flight" Copyright.

Sketch of the flexible-joint connecting the vertical struts to the main decks. A slight notch is made at the lower end of the U bolt to keep the eye of the strut central.

Timber and Fabric.

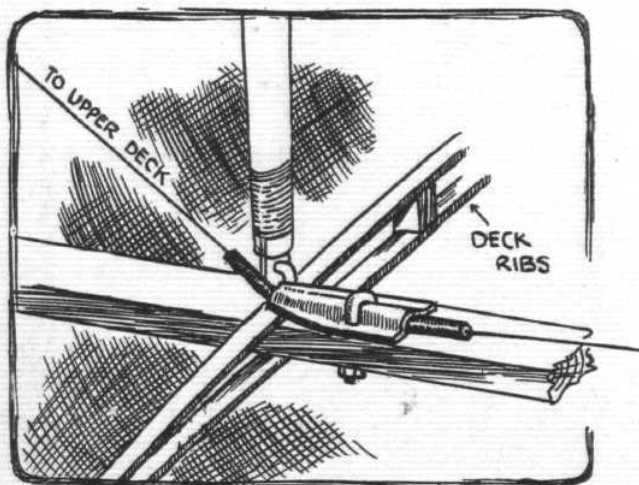
The material from which Messrs. Clarke have constructed the glider is for the most part silver spruce, a timber which, we understand, they are able to procure in 20 ft. lengths without a flaw. In one or two places where bent woodwork is required—as, for instance, the extension of the runners which carry the elevator, and the extremities of the main decks—American elm is used. The decks are double-surfaced with a special fabric of British make, which Messrs. T. W. K. Clarke

supply; it has a weight of 36 sq. ft. to the lb., and the waterproofing is done by a celluloid treatment. The seams in the complete covering are diagonal, and each half of a deck, from an extremity to the centre, is practically enclosed with a kind of fabric bag, the edges of adjacent bags are laced together in the centre, while at intervals the fabric is tacked down to the supporting ribs. In order to prevent the fabric being torn, a thin strip of wood is placed between the fabric and the heads of the nails.

Main Decks.

The skeleton framework on which the surfaces are stretched consists, for each deck, of a pair of transverse spars having a section 1 in. deep by $1\frac{1}{2}$ ins. At the extremities these spruce spars are joined together by a piece of bent elm, a scarf joint being made between the two timbers.

At intervals of 1 ft., light ribs pass fore and aft between the spars and overlap the rear spar to give a flexible trailing edge extending rearwards about 15 ins. The ribs consist of two small strips of rectangular section wood separated by distance pieces at intervals. Each rib as it is built up is curved to a template so as to give a camber to the decks of 3 ins. at the maximum versine. The method of fastening the ribs to the front spar, which by the way is rounded off to form a blunt cutting edge, is to secure the last distance piece to the spar by screws so that it virtually belongs to that member and, as it



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Instead of pulleys where the warping-wires leave the decks, short lengths of Bowden wire sheath are used clamped to the rear spars, as shown above.

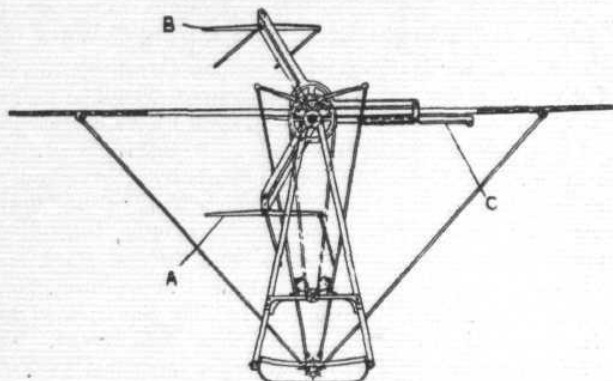
were, forms a supporting tongue for the top and bottom members of the rib proper. The connection is then further strengthened by putting a light strap of metal round the spar and tacking the ends to the rib.

Considered as a unit, the framework of the two decks, taken together, forms an example of the usual lattice girder work which has been commonly adopted on biplanes. In accordance with the Wright system, the machine built by Messrs. Clarke further belongs to the flexible type, that is to say, non-rigid joints are employed

INVENTORS' IDEAS.

FEATHERING PADDLE-WHEELS.

THIS describes an arrangement of eccentrics for feathering a paddle-wheel for lifting aeroplanes. The blades, A, have just reached the



end of their working stroke; the blades, B, are feathering, while those at C are at the middle of the downward stroke.—E. E. Lindkvist, 16,941 of 1908.



CORRESPONDENCE.

. The name and address of the writer (not necessarily for publication) MUST in all cases accompany letters intended for insertion, or containing queries.

PROPELLER ADVERTISEMENTS.

To the Editor of FLIGHT.

SIR,—Until the Watford Engineering Co. produces a 14½-in. "Beedle" propeller which will lift 2 lbs. dead weight at any speed under 1,580 r.p.m. on less than .75 amps at 200 volts, they cannot justly claim not to have been beaten by the "Cochrane."

Yours faithfully,

WILLIAM COCHRANE.

PROPELLER THRUST.

To the Editor of FLIGHT.

SIR,—Can you tell me what is the utmost thrust per horse-power that can be got from a perfect propeller?

Quoting from the lift and drift experiments given in the issue of February 6th, 1909, the best curvature gives a ratio of lift to drift of 15 to 1, so that in the propellers so far evolved there appears to be a great loss of power.

Will you or some kind reader of your excellent paper please enlighten me?

Marple.

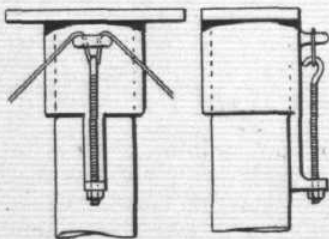
Yours respectfully,

H. G. DAWSON.

INGENIOUS FITMENTS.

To the Editor of FLIGHT.

SIR,—I trust this sketch of a combined strut-socket and wire-strainer will be of sufficient interest to readers of FLIGHT to warrant reproduction. The idea is so simple that it will be unnecessary for me to explain the illustration, but the following are the advantages claimed for the device:—Extreme lightness, as it takes the place of two turnbuckles, and in some instances dispenses with six wire-attachment eyes. For the same reasons it is cheap, and the wire is attached much more easily and quickly than by other methods. It offers no head resistance, being immediately behind the socket and strut, and it has no left-hand screws, which are often difficult to replace in case of loss. Patents are pending which cover several variations of this arrangement, and I shall be pleased to send



further particulars to prospective users. I may mention that Messrs. Handley Page, Ltd., are taking up the manufacture of same, and can give early deliveries. Wishing FLIGHT continued popularity and success,

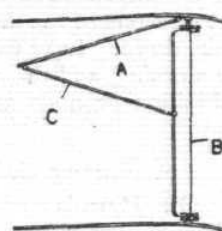
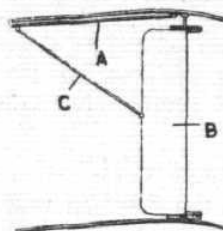
Elland.

I am, yours faithfully,

F. BROCKWAY.

INTERCONNECTED RUDDERS.

THIS patent describes the use of interconnected vertical and horizontal rudders. The horizontal steering-plane, A, is connected



to the vertical rudder, B, by a rod, C, and any movement of B will be accompanied by a corresponding change in the position of A. The claims also cover the use of a pair of rudders so connected that they move towards or away from each other.—H. C. Lobnitz, 9,235 of 1909.



BASIC FORMULÆ.

To the Editor of FLIGHT.

SIR,—The conquest of the air is still proceeding at a rapid pace, and the cross-Channel flight of M. Bleriot marks a new era. One of the most important signs of its coming within thoroughly practical regions is the production of formulæ bearing upon it. Major Squier, of the Signal Corps of the U.S. Army, who, I understand, has been recently appointed by the U.S. Government as head of their newly-created Aviation Department, read a paper a short time since, on "The Present Status of Military Aeronautics," in which he went very carefully into the principles governing the construction and flight of aeroplanes. He gives the formula for a single plane surface, $P = 2 k \sigma A V^2 \sin \alpha$, where P is the pressure supporting the plane, and causing it to rise, k is a constant, σ the density of the air, A the area of the plane, V the relative velocity of translation of the plane through the air, and α the angle of flight. Transposing, he gives the equation

$$A V^2 = \frac{P}{2 k \sigma \sin \alpha}$$

He then points out that, if the pressure and the angle of flight are maintained constant, in, of course, a constant medium, the equation assumes the form, $A V^2 = \text{constant}$, or the area of the surfaces required to support an aeroplane is inversely as the velocity at which it is driven. At 40 miles per hour, the supporting area measures 500 sq. ft. If the speed were increased to 60 miles per hour, the supporting plane need only be 222 sq. ft.; at 80 miles per hour it would be reduced to 125 sq. ft.; and at 100 miles per hour 80 sq. ft. would be sufficient. These figures, I think, are of very great importance, showing, as they do, the great value of the speed at which the aeroplane is driven. If an aeroplane is to be of any value for attack, it must be made as small as possible, or in other words, the speed must be raised as much as possible. On the other hand, Major Squier also gives formulæ for the power required to drive an aeroplane. Without going very much into the details of the calculation, it may be mentioned that he gives the power required, as proportional to the cube of the speed. All of these formulæ will be recognised as very similar to those that rule in all engineering problems, where fluids are dealt with. In ventilation, and compressed air problems, it will be remembered that the resistance opposed to the passage of the air varies as the square of the velocity, and the power required to move the air varies as the cube of the velocity. Moving an aeroplane, or any airship through the air, is in fact the converse of moving air through any duct or gallery, or mine passage. Major Squier points out also how important the question of skin-friction is. Of course, skin-friction increases with the area of the supporting planes. Skin-friction must be a very large item in the resistance offered to the passage of dirigible balloons through the air. Skin-friction again is the important item in the problem of moving air through ducts, &c., and in moving ships through the water. It is the rapid increase of the skin-friction, with the velocity, which causes the great increase of power required to drive the great ocean liners, and the large battleships, through the water.

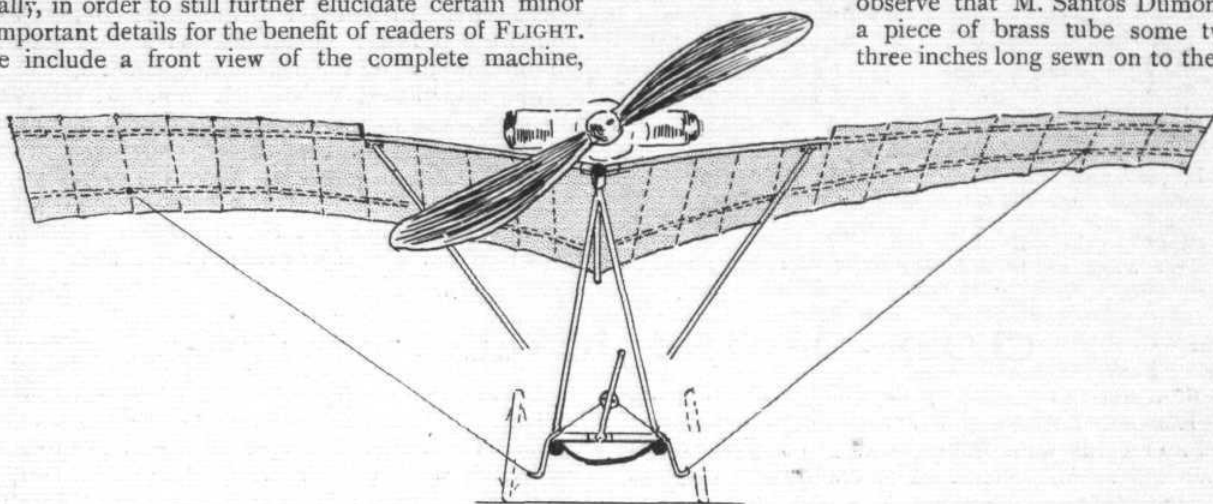
W. WINDHAM.

* This Paper was reproduced in full in FLIGHT over a series of issues commencing February 27th, 1909.

FURTHER DETAILS OF SANTOS DUMONT'S No. 20

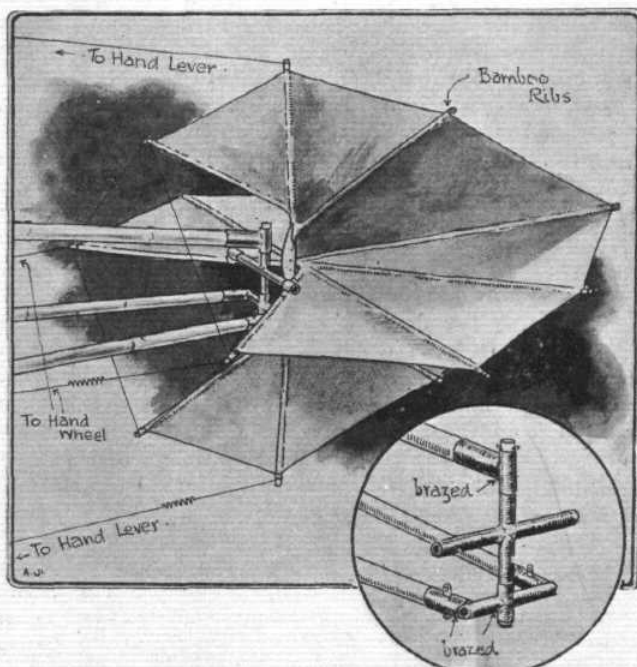
SUPPLEMENTING the very full illustrated description which we gave last week of the "Demoiselle," we now reproduce four further sketches which we have made specially, in order to still further elucidate certain minor but important details for the benefit of readers of FLIGHT. These include a front view of the complete machine,

side of the aviator's seat. The centrally placed lever which lies behind the back of the pilot operates the wings as described last week, but it is interesting to observe that M. Santos Dumont has a piece of brass tube some two or three inches long sewn on to the back



Front view of the "Demoiselle," showing the main stays for the leading edge of the wings as well as the warping wires passing from the seat.

another showing the tail with its universal-joint, a third illustrating special fittings adopted for the tubular struts for the main girder, and the remaining sketch relating to the system of lacing adopted for the trailing edge of the main plane.

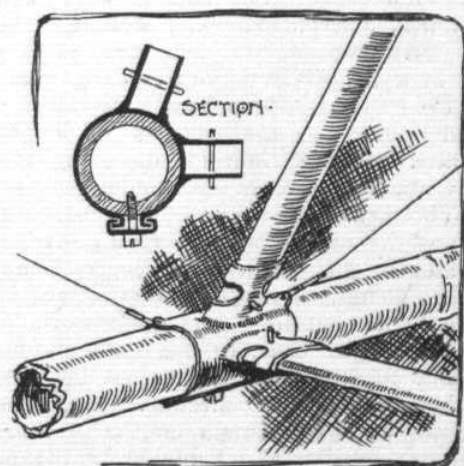


View of the complete tail, which is moved bodily upwards and downwards as well as sideways, about the special swivel-joint shown in greater detail in the inset.

In the first of these illustrations two important points are brought out with special prominence. Firstly, the tubular stays which form the chief supports for the leading edge of the main planes, and secondly, the precise manner in which the operating-wires for warping the wings are run through small guide-tubes on either

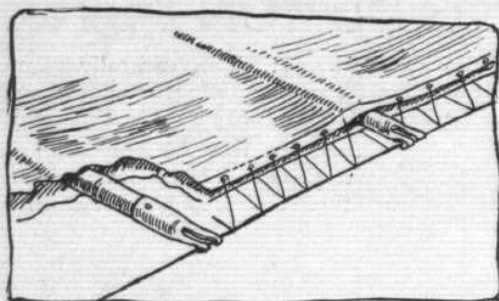
of his jacket, so that when he is seated in place the tube slips over the lever in question and enables him to rely upon a positive action when he leans over to the right or left. In the same sketch, too, may be observed the position occupied by the two chassis wheels.

As regards the tail, this in itself is constructed with a bamboo rim as mentioned last week, but the universal swivel is formed entirely of pieces of tube, in the use of which the inventor is very clever. The intermediate T-piece has one vertical arm that swivels in the braced



Tubular struts of oval section fit into sockets braced on to thin metal collars in order to stiffen the main girder-frame. As will be observed above, these collars are rendered rigid with the main bamboos by means of small clamping plates and screws.

sockets which couple up the main bamboos together, and the tail itself swivels upon the horizontal arm of the T-piece. Our sketch also shows the connecting-wires that pass to the hand-lever on the right and the hand-wheel on the left for elevating and for steering respectively, and also denotes the presence of the small helical springs



In the above sketch is shown the lacing by means of which the rear edge of the main planes is held taut about a strong wire, which is itself clipped to the ends of the ribs. The surfaces of the wings are in this way stretched tightly.



CLOSE OF THE BERLIN MEETING.

ALTHOUGH during the last four days of the Berlin flying week Rougier, Latham and Farman each made long flights, no records were broken, and so the proceedings became rather monotonous. The unfortunate disputes over money matters did not improve affairs. The semi-official announcement that the Bleriot monoplane was "seized" was subsequently officially denied, and, as a matter of fact, the machine was sent on to Cologne on the 30th ult. The poor organisation was, however, responsible for two further disputes on the penultimate day, when the aeroplanes of Senors Sanchez Besa and Edwards were detained, as it was alleged they had not fulfilled their contracts.

Taking up the story of the actual flying from where we had to break off last week, at the conclusion of Wednesday's proceedings, on Thursday, the 30th ult., the hero of the day was Latham, for he succeeded in improving upon Rougier's record for the distance prize, flying 33 rounds of the course—82.5 kiloms.—in 1 hr. 22 mins., and only stopping because of the falling darkness. An amusing incident arose out of this. Latham, in trying to land in the dark, was unable to quite clear a lamp-post, and when he did reach earth he found himself in the clutches of a policeman, who wanted to arrest him for damaging the lamp-post. Eventually, however, the committee set matters right. Those German polizei are real humorists. Rougier was the only other one to do anything noteworthy, and he flew with a passenger—Duray—to a height of 70 metres. Both Baron de Caters and Leblanc also made flights, but they were quite short. The following day Rougier came to the front, and his trip of 130 kiloms. for the distance was not improved upon before the end of the meeting. His time was 2h. 41m. 50s. and like Latham on the previous day he was only prevented from continuing by the gathering darkness. Farman also made an attempt for the distance prize, but he could only manage 33 laps, or 82.5 kiloms. in 1 hr. 30 mins. De Caters also made a dozen turns round the course, his time for the 30 kiloms. being 33 mins. 30 secs. At one time all these three flyers were in the air together, and the spectacle had all the appearance of a real race, as the machines were of similar type.

On Saturday last Farman made another attempt for the Distance Prize, but was unfortunate. After flying steadily for 1 hr. 3 mins. motor troubles began to develop, and he had to come down. Other than this the afternoon crowd had very little to see except a couple of short flights by de Caters and Molon. Rougier had dismantled his

that automatically take up any slack or allow for any contractions in the operating-wires.

It will be remembered that we spoke last week of the ignition-switch that is fitted into the steering-lever for enabling the engine to be stopped at a moment's notice if necessary. In addition to the three controls for the monoplane proper, it should also have been stated that the throttle-valve on the engine is coupled up to a pedal conveniently placed for the left foot. In this way the two engine-controls can be manipulated, although the operator's hands need never leave the even more important lever and wheel on which the evolutions of his flyer depend so greatly. Our other illustrations with their inscriptions readily speak for themselves, and hence no further reference need be made to them here.

engine in order to make some adjustments, and it was well after five o'clock before he was ready to take the air again. Then, after a couple of trial flights to see that everything was in order, he went up with Duray and made five circuits of the track, 13.75 kiloms. in 17 mins. 27 secs. He afterwards took up Col. Pellé, one of the military attaches to the French Embassy, and flew with him once round the track. Very little out of the ordinary was done on the last Sunday, and although Latham hoped to be able to retrieve his misfortunes, he was doomed to disappointment. For some reason the motor on his machine could not be got to work properly until ten minutes after the closing time, when he flew to a height of 178 metres, but it was too late. Rougier made his try for the height prize earlier, and attained an altitude of 158 metres, sufficient to give him the first prize. He also made a splendid flight accompanied by M. Georges Prade, during which he rose to a height of 70 metres and completed a dozen circuits, or about 30 kiloms., in 36 mins. Farman made a gallant attempt in the distance contest, and kept going for two hours, but owing to one of the wings touching the ground after the first twenty minutes, the time officially recorded was not sufficient to improve his position. He also had a try for the passenger prize, but only completed one of the four laps.

Altogether the meeting was not quite the success it might have been, a result largely due to the want of proper organisation. One of the chief complaints levelled against the management was the long distance of the ground from the railway station, while the cheap seats were so far away from the grand stand that it was only possible to tell what was going on by the aid of glasses.

RESULTS.

Distance Prize.

1. Rougier (Voisin). Berlin Cup and 40,000 marks (£2,000) ... 130 kiloms.
2. H. Latham (Antoinette). 15,000 marks (£750) ... 82.5 "
3. H. Farman (Farman). 5,000 marks (£250) ... 82.09 "

If he had not touched ground at the 30th kilom. in his long flight, Farman's record would have been 110 kiloms.

Speed Prize (20 kiloms.).

1. H. Latham (Antoinette). 8,000 marks (£400) ... 18m. 46½s.
2. H. Farman (Farman). 2,000 marks (£100) ... 22m. 20s.
3. De Caters (Voisin) ... 22m. 47½s.

Altitude Prize.

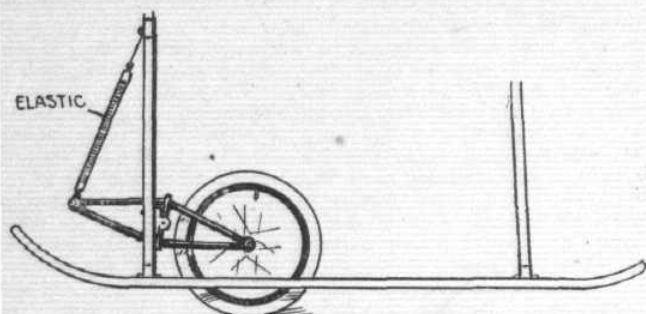
1. Rougier (Voisin). 10,000 marks (£500) ... 158 metres.
2. Latham (Antoinette). 5,000 marks (£250) ... 85 "

After the close of this event Latham flew to a height of 178 m.

Passenger Prize (10 kiloms.).

1. Rougier (Voisin). 10,000 marks (£500).

and seems to be a very good solution of a particular difficulty which has to be overcome. Wheels are necessary for running along the ground when starting, but skis are better suited to withstand the shock of landing. In those devices which combine both members, the wheels are mounted so that they are normally some six or eight inches below the level of the runners. They are suspended



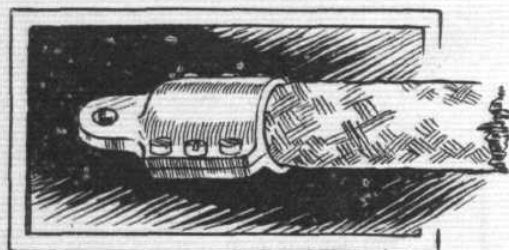
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PARIS FLIGHT SHOW.—Sketch illustrating the use of wheels in conjunction with ski for the chassis of an aeroplane.

in such a manner as to be capable of taking the dead weight of the machine, but on sudden impact with the ground the wheels rise and the runners take the load, thus preventing damage to the wheel-mounting which is otherwise liable to take place. Even on a so-called smooth flying ground a chassis wheel gets quite an amount of bumping about; in fact, it is rather remarkable that more accidents have not happened with this member.

Elastic Springs.

The suspension at present employed almost invariably includes the use of elastic springs. These springs are built up out of innumerable fine strands of elastic until they form a cable which averages from an inch to an inch and a quarter in diameter, according to the load. The cable is covered with a woven cotton fabric and is fitted with a



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PARIS FLIGHT SHOW.—Portion of an elastic spring, showing the brass ferrule which is clamped to its extremity to provide a means of attachment to the machine.

clamp at each end, so that it can conveniently be attached to its anchorages. The price which the accessory dealers are asking for these elastic springs suggests a very keen eye to the main chance, in spite of the present cost of rubber; for a single "spring" about 12 ins. in length 35 frs. was demanded.

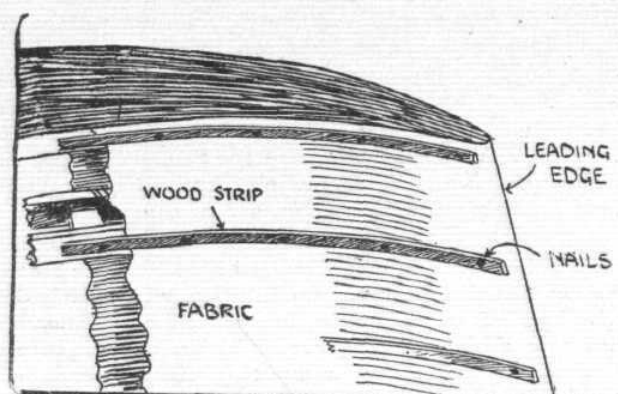
Timber and Steel.

Turning to the materials used for the construction of aeroplanes, timber is unquestionably still more popular than steel, although there are not wanting prominent designers, like M. Esnault-Pelterie, who use steelwork very largely in their machines. Spruce for spars and other fairly bulky members, and ash for the lighter pieces, especially those which are curved, are the most common woods employed. Tubular steelwork for the chassis is, of course, frequently to be seen.

Deck Surfaces.

The surfacing of the decks or wings is in most cases carried out with rubber-proofed fabric, although in a few instances fine untreated canvas is considered adequate. From the many letters we have received on the subject, we are led to suppose that the method of fastening the surface material to the skeleton framework of the deck presents points of special difficulty to our readers, but in reality there

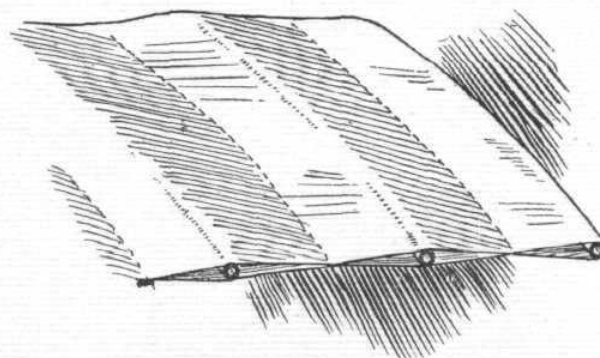
is not a great deal in this matter which calls for special comment as the result of an examination of the actual machines. Sometimes the fabric is hardly fastened down at all, at others it is stuck down with cement or tacked down with nails to occasional ribs. A pre-



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PARIS FLIGHT SHOW.—Sketch illustrating how the surface fabric may be protected from the nails which secure it to the rib by the use of rib laths. The above sketch illustrates a portion of a wing tip seen from beneath.

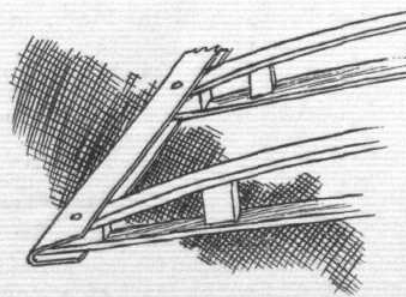
caution which some builders take in the latter case is to place a thin strip of wood outside the fabric to prevent the nail heads from tearing through. The method adopted by Santos Dumont of sewing the upper and lower surfaces together between the ribs is interesting and uncommon. Many firms are using strips of aluminium



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PARIS FLIGHT SHOW.—Sketch illustrating Santos Dumont's method of fastening the fabric by sewing the upper and lower surfaces together between the ribs.

bent into C section for the leading edges of the decks, as it is light, and gives a smooth continuous front. A method of finishing off the trailing edge, which is at once effective and neat, is to run a steel wire through a pocket which can be conveniently made by turning back the fabric. Incisions in the cloth expose the wires at intervals coinciding with ribs of the framework, over the ends of which it can



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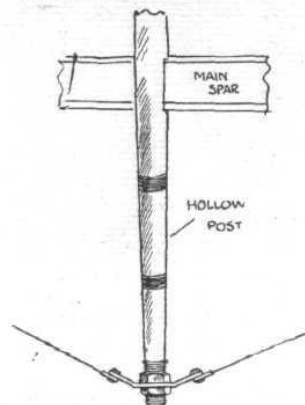
PARIS FLIGHT SHOW.—Sketch illustrating the use of sheet aluminium for the leading edge of the main decks.

THE ANTOINETTE MONOPLANE.

(Concluded from page 662.)

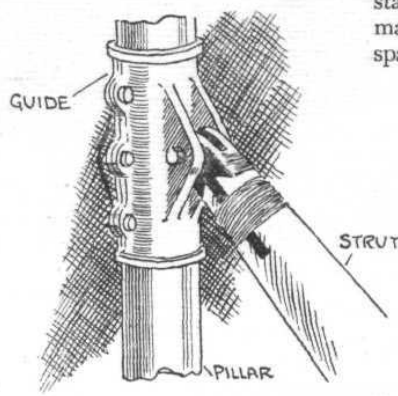
Thick Wings and their Buoyancy.

THE thickness of the wings already mentioned is a result of adopting a system of construction designed to secure a maximum of strength with a minimum of weight, but it may be remarked *en passant* that the volumetric capacity which this thickness confers on the wings showed itself to be of more than incidental advantage



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The Antoinette Flyer.—Sketch showing how the main spars in the wings are trussed by hollow posts and diagonal wires.

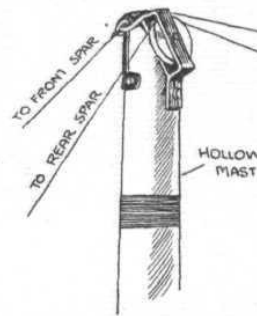


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The Antoinette Flyer.—Sketch showing the attachment of the axle-strut to the sliding-guide on the vertical pillar. The strut is of hollow wood, and has a steel end-piece.

kept exceptionally taut by the large number of ribs that go to make up the wing framework.

The outstretched wings form a pair of cantilevers, of which the main transverse spars are the principal members. Each spar is constructed on the lattice-girder principle, and tapers in depth towards the extremity. At its inner end it is mounted in a substantial bracket, which is attached to the body of the machine. This bracket, in the case of the rear pair of spars, is pivoted, as shown in an accompanying sketch, so that it can rock bodily when the wings are warped.



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The Antoinette Flyer.—Sketch showing how the stay-wires for the wings are attached to the mast.

In addition to these main transverse spars there are other transverse members unattached to the body of the machine, but serving, nevertheless, to give strength to the wing framework. Across these spars pass the curved main ribs, which are spaced at intervals of about 18 ins.; they are also built up lattice-girder fashion. Between the main ribs light open ribs, constructed without the lattice bracing, are provided for the additional support of the surface fabric. Near the body of the machine these latter members have a spacing of only about 2 ins., but elsewhere their distance apart is twice as much. As the result of this very carefully thought-out system of construction, the manufacturers claim that their wing framework for wings of 15 to 25 square metres in surface can be produced as light as 1 kilog. per square metre, not including the fabric.

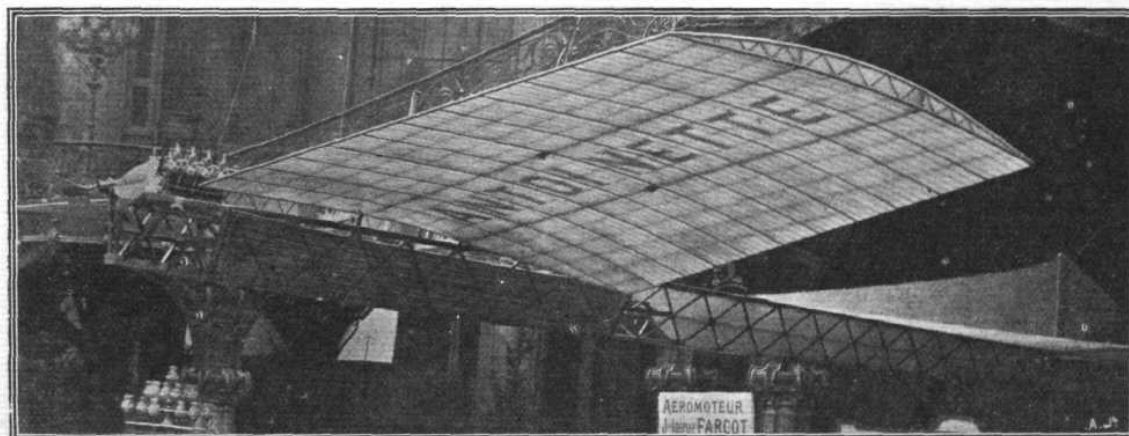
In addition to their mounting on the body of the machine, to which reference has already been made, the wings are further supported by wires, which radiate from a central wooden mast projecting above the body. These wires are attached to the main transverse spars about the centre of their length, and each spar is itself

in the matter of buoyancy when Mr. Latham so unfortunately had to alight on the sea in his cross-Channel flights.

Of the other special features, it is necessary only to mention the boat-like body and the distance of the tail behind the main planes, which distinctly seems to be relatively greater than on other machines.

Wing Construction.

The wings are built up upon two transverse main spars, neither of which, however, forms the edge of the wing, as is so commonly the case in the decks of biplanes. Both the leading and trailing edges of the Antoinette wings are sharp, and their upper and lower surfaces (made of Michelin rubber-proofed fabric) are



THE ANTOINETTE FLYER.—In the above illustration of an early Antoinette monoplane the arrangement of the spars and ribs and the framework of the wing can be seen through the surface material. The above view also shows the lattice-girder main frame, which in the latest machines is covered in.

independently trussed by a vertical post and diagonal wires. The posts used for this purpose are, like the main-mast, of hollow construction, and each is one continuous member from top to bottom. It is placed a little to the side of the main-spar which it trusses, being notched to receive that member.

This arrangement avoids the necessity of dividing the post at the centre. Each end of the post is fitted with a steel ferrule, on the outside of which is a screw thread. A suitable attachment for the stay-wires is provided by a light steel plate threaded over the ferrule, and clamped between two nuts.

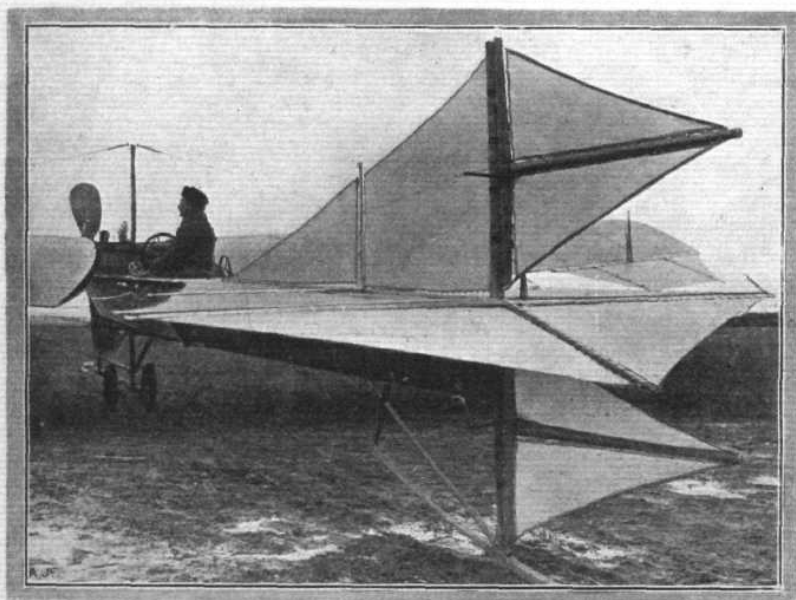
The Body and Chassis.

The body of the machine consists of a hollow V-section lattice girder, the fore part of which is encased with a veneer of cedar,



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THE ANTOINETTE FLYER.—View of the latest model, showing the cedar hull. The framework under the surface is illustrated in another view, showing an earlier type.



THE ANTOINETTE FLYER.—In the above view of the tail the triangular horizontal plane which forms the elevator is shown depressed for descent, while the two triangular rudders are shown set over for turning to the right.

and pointed like the bows of a boat. Further aft the cedar gives place to a covering of rubber-proofed fabric, and this material is also carried over the top side of the frame, thus forming a kind of deck. An open cockpit is provided for the accommodation of the pilot's seat.

The machine is supported on the ground by a pair of small pneumatic shod wheels, attached to an axle which is provided with pneumatic suspension. This latter is obtained by means of a plunger in a steel tube; the tube is a downward continuation of the main-mast already mentioned. The bracing of the axle to a sliding collar which rides on the outside of the stationary tube, and thereby prevents the axle from tilting, is effected by hollow wood struts fitted with steel forks spliced in their extremities.

An ash skid is provided in front of the machine to prevent the propeller from hitting the ground, and there

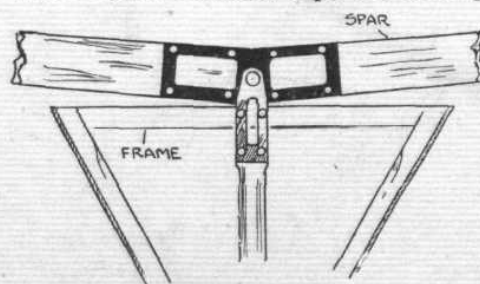
is a very light skid at the rear to protect the rudder. The forward skid is made of ash, and has a maximum square section of about $2\frac{1}{4}$ ins. Its extremity is laminated and curved upwards, the tip being protected by a steel plate.

The Tail.

At the rear of the body is the tail, consisting of two fixed planes, and three movable planes. The fixed members include a vertical and a horizontal plane arranged like the feathers on the shaft of an arrow, and their object is to fulfil much the same purpose in respect to the flight of the machine. The movable members are virtually extensions of these planes; the continuation of the horizontal plane forming an elevator, while the continuation of the vertical plane makes a rudder. An additional rudder working in unison with the first is provided beneath the elevator.

Control.

The control of the machine is effected by means of two hand wheels and a pedal. The wheels are placed vertically on each side of the pilot's seat, and lie just outside the body of the machine. That on the right when moved forwards dips the trailing edge of the



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The Antoinette Flyer.—Sketch showing how the rear spars in the wings are pivoted to the frame to facilitate warping.

elevator. A similar movement of the left-hand wheel warps the trailing edge of the right-hand main-wing downwards. Pressing forward the right foot puts the trailing edge of the rudder

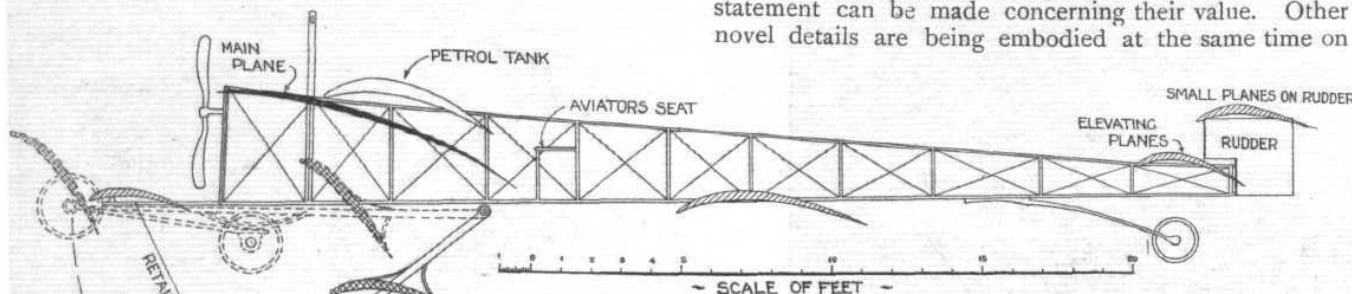
ORIGINALITY IN MONOPLANE DESIGN.

AN EXPERIMENTAL MACHINE NOW BUILDING IN LONDON.

VARIOUS unusual features have been embodied in the monoplane of which we reproduce a side elevation herewith, and which is being constructed by the Aerial Manufacturing Co. of Great Britain and Ireland for a

the leaf springs absorb shocks due to any roughness of the ground.

Needless to say both the above-mentioned systems need to be given a practical trial before any conclusive statement can be made concerning their value. Other novel details are being embodied at the same time on

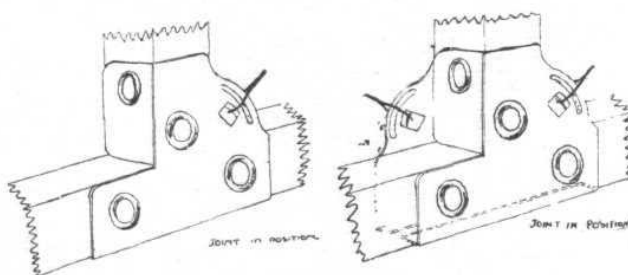


client of theirs. First and foremost it will be observed that various subsidiary planes are introduced locally at different spots with the object of assisting in the distribution of strains within the machine itself, while even the petrol tank is shaped similarly, although it is only the width of the main framework. For

this particular monoplane, and hence future experiments with it will be watched with considerable interest. The machine itself is of quite large dimensions, as may be judged from the scale on the drawing, the length overall being no less than 44 ft., and the span being also 44 ft. from tip to tip of the wings. An engine of novel design, developing about 50-h.p., is moreover, we understand, to be employed in conjunction with a 10-foot 4-bladed propeller. In due course, too, it is hoped that the machine will be placed on view in London, but the makers are unable to allow it to be seen in their works at the present time as they are also carrying out other commissions there, in connection with which they are pledged to secrecy.

convenience of reference, the main plane is shown in black, the small supplementary planes, including the elevator, are cross-hatched, and the petrol tank is merely shown in outline in the drawing.

Hardly less noticeable is the curious double-hinged framework, with its wheels in front, that is intended to facilitate starting and alighting. In the position indicated by the full lines, the two small planes carried by it (double cross-hatched) serve to assist in lifting the machine, while since the lower wheel leaves the ground last, the full weight is only taken after a fair altitude has been attained. The further object of the arrangement is to cushion the descent by allowing the lower wheel to reach the ground some time prior to arrival of the complete machine, and then, as the hinges allow the framework to fold up into the position indicated by the dotted lines, to cause the small planes to act as brakes, retarding further forward progress, at the same time that



Sketch of a bracket for joints of framework of aeroplanes which is being manufactured by the Aerial Manufacturing Company of Great Britain and Ireland, of Upper Charles Street, Finsbury. Great rigidity and lightness are claimed for these, whilst the price is quite small, we understand. The sketch shows a single bracket, and also one each side of a joint, making a very rigid fixture, with wiring connection included.

An Aviation Catalogue.

A REMINDER that flight is rapidly attaining a commercial position is to hand in the shape of a catalogue issued by the Richelieu-Automobiles, Paris. It contains particulars and prices of Bleriot, Antoinette, Wright, Voisin, and R.E.P. aeroplanes, and dirigibles of the Astra, Lebaudy and Zodiac types, as well as various motors specially adapted for flying machines. In this connection special illustrated prominence is given to the Wolseley 8-cyl. V motor, and the prices quoted for the various aeroplanes are given either without motor, with ordinary motor, or with Wolseley motor, a striking compliment to the British product. The catalogue also contains particulars of hangars of various sizes, and prices of many accessories used by aviators.

Flying at the Antarctic.

IN view of the several proposals with regard to the use of airships and aeroplanes in connection with the exploration of Polar regions, it is interesting to note that in the course of his remarks at the R.A.C. recently anent his experiences in the Antarctic seas, Sir E. H. Shackleton, C.V.O., explained that it was almost impossible for any work to be done by flyers in the Far South regions. There was always a very strong wind blowing across the plateau, so that aeroplanes were out of the question, while balloons would be of no use, as at a height of 700 feet the gas would contract, and the valve once opened would not again close properly. Thus, Antarctic research was narrowed down to a question of men, dogs, and motor cars.

German Airship Manœuvres.

DURING the latter end of last week the four German military dirigibles continued their manœuvres at Cologne, and on the 4th inst. a series of altitude trials were carried out. "Parseval III" rose to a height of 800 metres, while the "Gross II" and "Parseval I" went up as high as 1,200 metres; but the "Zeppelin II" was unable to take part, owing to some motor defect. Just before midnight on Tuesday week the airships, with the exception of "Parseval I," set out for a night cruise, and carried out a series of imaginary attacks on the fortress of Coblenz. They all remained in the air for the stipulated time of eight hours. On Saturday the manœuvres came to an end, when the four airships sailed in procession over the city, passing round the double tower of the famous Cathedral.

Armament For and Against Dirigibles.

FROM Austria comes a little information regarding two inventions which are at present receiving the attention of the Ministry of War of that country. One, the idea of Louis Bertuch, is for a torpedo, which could be fired

from the ordinary Army rifle and yet would effectively disable the largest airships at a height of 1,000 feet. The second idea, evolved by an engineer named Gratz, consists of a projectile which could be discharged from an altitude of more than 1,400 feet from a dirigible of any size.

An American Balloon Record.

IN connection with the "Centennial" Races held at St. Louis, Missouri, on October 4th, 1909, Mr. Clifford B. Harman, an Ae.C.A. pilot, in the balloon "New York" (80,000 c.f.) set up a new American endurance record of 48 hours. The balloon, which was built of vulcanized rubber material made in America, left the Aero Club Park at St. Louis at 5.15 p.m. on October 4th, and landed at 5.41 p.m. on October 6th at Edina, Missouri. The distance between these points was 150 miles, but a much greater distance was really traversed, as the winds were extremely variable, and the balloon kept travelling in a circuitous direction. The highest altitude reached was 24,200 ft., and the temperature varied from 90° F. to 39° F.



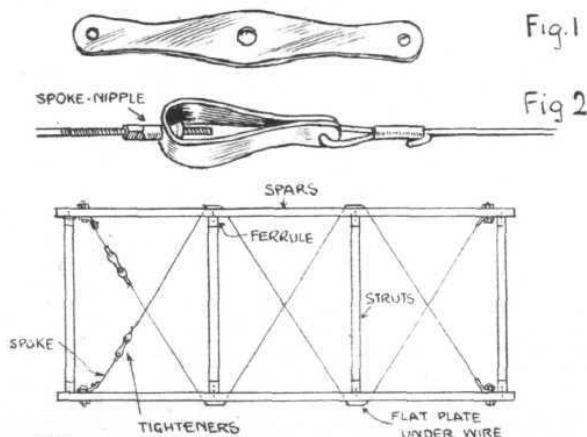
CORRESPONDENCE.

* * The name and address of the writer (not necessarily for publication) MUST in all cases accompany letters intended for insertion, or containing queries.

WIRE BRACING.

To the Editor of FLIGHT.

SIR,—I have no doubt that a number of readers of FLIGHT who are building aeroplanes have a great difficulty in bracing up their machines. I am building a biplane, and am using the system of which I have enclosed a rough sketch, and find it works most satisfactorily either for the planes or outriggers or any other part. It



is what I call continuous bracing; the wire is fitted with a bolt at one end, goes under one strut and over the other, and is pulled taut with an adjuster made of a spoke and nipple and a bent plate.

This makes a good, sound job, and I trust it may be of some use to the readers of FLIGHT.

Wandsworth.

Yours truly,
WALTER YEATMAN.

A QUESTION OF WEIGHT.

To the Editor of FLIGHT.

SIR,—I am making a model monoplane with a total area of 7½ sq. ft. Will you or one of your readers of your excellent paper let me know what the maximum weight of the model should be with engine complete, i.e., to obtain good results; also what h.p. and dimensions of propellers. Wishing your paper every success,

Yours faithfully,
M. M. W.

A DEFINITION OF "V²."

To the Editor of FLIGHT.

SIR,—Referring to the account of the Wright Bros.' early experiences (by Wilbur Wright), I note that the curve for the decks is given as having been originated by them, whereas I have always been under the impression that it was the strict and ideal Lilienthal curve.

Did then Lilienthal use a plane with just an ordinary semi-circular curve?

I shall esteem it a favour if you can enlighten me on this point, and give me a definition of V² at the same time, as I continually stumble upon it in the columns of your valuable paper.

Yours faithfully,

Chiswick.

WALTER E. FOX.

[The tables compiled by Lilienthal relating to the lift of aerofoils were based on his experiments with cambered surfaces having the curvature of an arc of a circle. There is not, so far as we know, any record of Lilienthal having moved the maximum versine of the camber nearer the leading edge, nor have we found any record of any experimenter having done so prior to the Brothers Wright.

The symbol V², which is so commonly used in articles on flight, should be read "square of the speed." It implies a value obtained by multiplying the speed by itself. Thus, if the speed is actually 10 miles an hour, then V² equals 100. Air resistance is proportional to V². That is to say, the ratio of two resistances, one being at 10 miles an hour and the other at 20 miles an hour, will be represented, not by the figures 10 and 20 themselves, but by their squares, which are 100 and 400 respectively. It will be noticed that the greater resistance is thereby four times instead of only twice as great as the smaller.—ED.]

BROOKLANDS AND FLIGHT.

To the Editor of FLIGHT.

SIR,—Having in view the great interest which the original use of Brooklands as an aviation ground has aroused, it might interest you to see and possibly to publish the enclosed letter, which I have forwarded to the many applicants we have had for sheds and accommodation at Brooklands.

Yours faithfully,

F. LINDSAY LLOYD, Clerk of the Course.

[Enclosure.]

"With reference to your application for facilities for exercising an aeroplane at Brooklands, I beg to inform you that we are proposing to proceed on the following lines:—

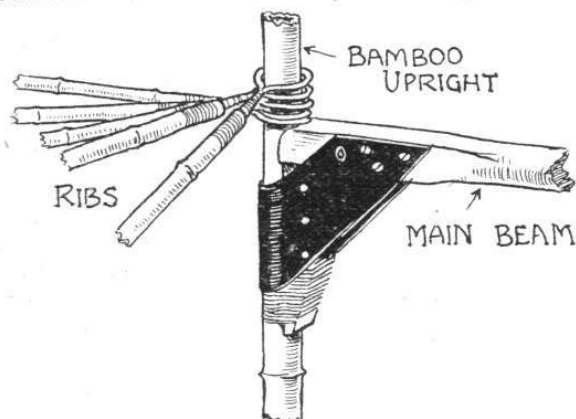
"We will erect and maintain a suitable shed for each tenant, and let same for the rents mentioned below. For these payments the

THE LILIENTHAL AND PILCHER GLIDERS COMPARED.

(Concluded from page 8.)

Willow and Bamboo.

THERE is a subtle difference in the construction of these two gliders, otherwise so much alike, which is directly attributable to the difference in the materials employed, for where Lilienthal used willow sticks, Pilcher adopted bamboo. Both had, it will be seen, sufficiently awkward materials to deal with, but Pilcher, it must be



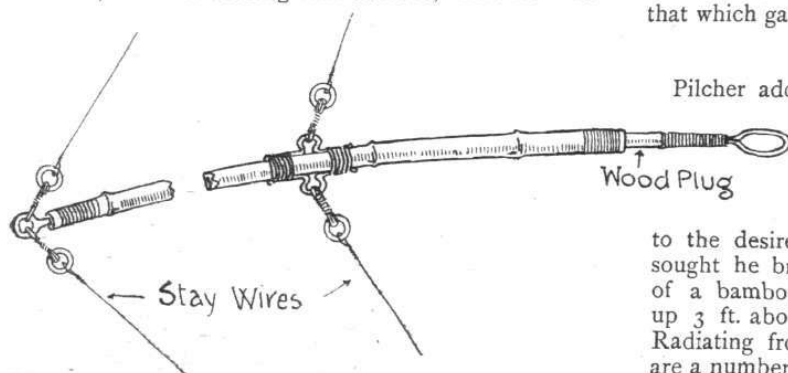
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Method of attaching the ribs to the wing standards on the Pilcher glider.

confessed, made a far more engineering-looking job of his work than Lilienthal, whose constructive methods are somehow reminiscent of bent-wood furniture. Both designers embodied the principle of folding-wings in their machines, and thus both were under the same necessity of adapting their construction to suit the special requirements imposed by this important condition. At the same time, however, both had to provide their wings when finished with an artificial camber, and it is particularly interesting to compare the two methods by which these details were accomplished.

The Folding of the Wings.

Pilcher, who was working with bamboo, fitted the inner



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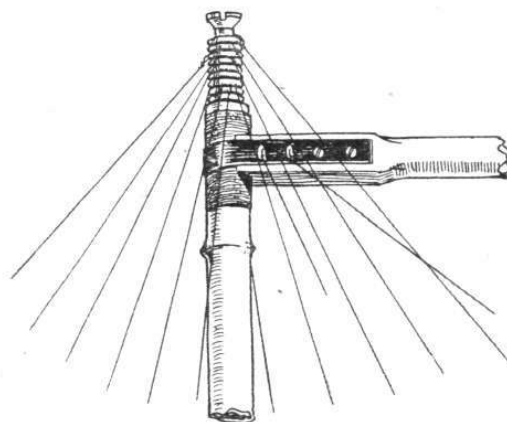
One of the ribs of the Pilcher glider.

extremities of the ribs of his wings with wooden plugs, to which he lashed a loop of iron wire so as to form a ring. These rings he subsequently strung over the central standard, around which each wing spread out like an

open umbrella. In order to close the wings, it was only necessary to unlash the attachment between the front edge and the main frame, when the ribs would then all swing round one above the other into any convenient position.

Lilienthal obtained much the same effect, but in his case the ribs folded up side by side, being hinged to a central bracket into which their wedge extremities normally fitted like the spokes of a wheel.

In this machine the hinge centres are 6 ft. apart, and in the Pilcher machine the same points are separated by a distance of 7 ft. 6 ins. In both cases the hinges are joined by a wooden beam, but whereas in the Pilcher glider this member consists of a simple rectangular piece of wood, in the Lilienthal machine it is a built-up structure in the form of the letter X; which system was



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Head of a wing standard on the Pilcher glider, showing radiating tie-wires.

adopted in order to enable the staying of the wings to be conveniently accomplished. It would doubtless have been better had Pilcher attached more importance to the strains on the main beam of his machine, because it was that which gave way during his last glide.

Pilcher and His Wire.

Pilcher adopted a very different method of bracing his wings to that employed by Lilienthal, in fact, it is in this respect that the two machines are most unlike. He relied entirely upon the use of piano-wire for cambering the surfaces of his wings to the desired shape, and in order to get the effect sought he braced each to a central hinge pin consisting of a bamboo pole some 6 ft. in height, which stood up 3 ft. above the deck and projected 3 ft. beneath it. Radiating from the top and bottom ends of this pole are a number of wires, for the most part there are three wires attached above and beneath each rib, only the two front ribs in each wing having less than this number. There are nine ribs in each wing, and altogether 50 wires were required to stay them.

How Pilcher managed to retain all these wires properly taut is a matter for conjecture, but he must have been a man of great patience if he really gave proper attention

to each of the 100 wires on which the camber of his surfaces depended. It is no easy matter to adjust wires used for such a purpose, as no sooner is a slack wire tightened up a little too much, than it relieves the strain upon two or three other wires, which become slack in turn. And Pilcher, it must be remembered, worked before the days of those very pretty little wire strainers which commonly form a feature in the bracing of modern flyers, and his method of adjustment must have been as tedious as it was effective. Each of his wires he fitted with a curtain-ring—Pilcher was very fond of curtain-rings—and on the rib he fastened a wire eye. The wires were cut to a fixed length in advance, and calculated to allow about an inch between the ring and the eye when in place. This gap was filled up by a piece of string, passed several times through each member to give the required strength, and by pulling on one end of the string a very minute adjustment could be made in the tension. More curtain-rings were employed for fastening the other ends of the wires to the vertical bamboo poles, so that the wings could be folded without twisting the wires.

Another little device for which Pilcher's construction is peculiar is his method of plugging his bamboo rods with wood. The wood plugs were glued into the hollow ends of the bamboo, which were then carefully lashed with string. Pilcher was very careful about lashing the ends of his bamboo poles as he evidently fully appreciated their liability to split. His use of wire eyes as lugs is another neat detail well worthy of attention, and these little fittings he would also lash in place.

Lilienthal's Stiffening Ribs.

Lilienthal, who very possibly had a natural objection to the use of a lot of wires, hit upon a very ingenious method of doing away with some of them, for he maintained the camber of his wings by the use of detachable supplementary ribs, of which there were four placed fore and aft above the deck. These ribs were strips of wood having an inverted T section, and they were cut to shape so as to serve as templates. As their permanence would have interfered with the

could slide. As the wings were naturally flexible there was no difficulty in sliding the curved templates in place from one end, and once in position these members were fastened by little clips. Their purpose was primarily to give the wings the desired camber, although they would of course tend to increase the rigidity of the structure; by their use, the necessity for employing a large number of wires was obviated, in fact, there were only two tie-wires radiating from each of the vertical posts mounted above the hinge plates. Beneath the wings, however, there was a wire to every rib, but even in this respect Lilienthal contrived to do without some 78 wires which Pilcher found necessary.

Relative Cambering.

It may be remarked that the number of ribs in each of the two machines is identical, viz., 18, but the camber and arching of the wings themselves is distinctly different in the two cases. Pilcher employed an umbrella-like form, in which the camber may be described as being of a uniform character. Lilienthal, on the other hand, flattened the extremities of his wings to such an extent that the curvature of some of the ribs was virtually reversed. The maximum camber on the Lilienthal glider, as on the Pilcher machines, occurs at the hinge of the wing, which on the former is situated 18 ins., and on the latter 2 ft. 6 ins. behind the leading edge. At this point the camber is deeper on the Lilienthal than on the Pilcher glider, but on the Lilienthal machine the camber is almost confined to this point alone, and is far more concentrated, if the term may be used, than in Pilcher's construction.

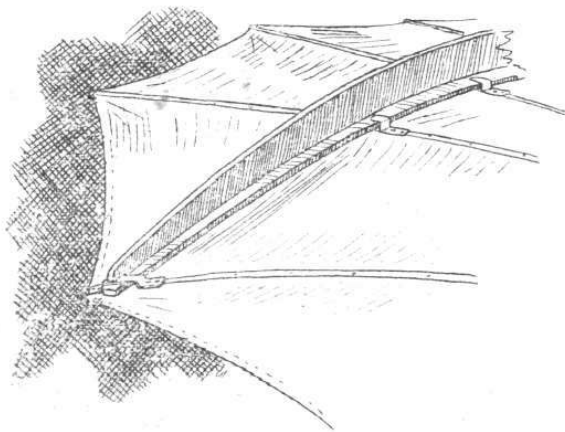
It is known that Lilienthal experimented with cambers of considerable height in proportion to the chord, and he has stated that the maximum versine (camber) of the wing curvature should be less than $\frac{1}{12}$ of the chord, and preferably only $\frac{1}{18}$ to $\frac{1}{25}$ for considerations of stability.

Both machines had the surface material attached above the ribs.

The Framework.

Having compared the wings and supplementary surfaces, it is of interest to consider the main frames of the two machines, by which we imply that central structure to which the whole is braced, and on which the pilot supports his weight. In the Lilienthal glider this member is of somewhat peculiar form, and is best observed by reference to the accompanying plan; it bears in a marked degree that bent-wood furniture appearance to which we have already drawn attention. One of the principal members is an approximately circular hoop of willow, across which pass in a fore and aft direction two willow rods that ultimately converge at a point where the bamboo tail rod emerges from the wing surface. Transversely across the hoop passes the main beam to which reference has already been made, and immediately behind this an orifice is provided in the surface to accommodate the upper part of the pilot's body. Two small bolsters attached to the frame rest under the pilot's shoulders, and the pilot's arms pass through rests provided for them in the corners of the X-shaped main beam. Just in front of this beam is another transverse rod which the pilot can grip with his hands, and in front of the main hoop member is another bent-wood construction lashed in place with wicker, the object of this device being to act as a fender in the event of collision.

On Pilcher's glider the main frame consists of two bamboo rods spaced 18 inches apart above the main



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Method of attaching the supplementary stiffening ribs on the Lilienthal glider.

folding of the wings, they were fitted in such a manner as to be detachable, and the method of doing this was to fasten small steel clamps on to the primary ribs of the wings, through which the flange of the template

CORRESPONDENCE.

* * The name and address of the writer (not necessarily for publication) MUST in all cases accompany letters intended for insertion, or containing queries.

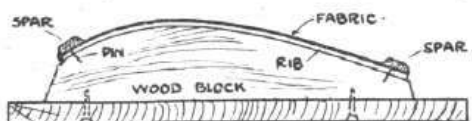
Correspondents asking questions relating to articles which they have read in FLIGHT, would much facilitate our work of reference by kindly indicating the volume and page in their letters.

NOTE.—Owing to the great mass of valuable and interesting correspondence which we receive, immediate publication is impossible, but each letter will appear practically in sequence and at the earliest possible moment.

SURFACING.

[284] In answer to your correspondent, re-surfacing, I thought the method I adopted might be useful. I made a number of wood blocks the shape of the curved ribs, and fastened them in position on a board thus, with pins, with the heads cut off to keep in position.

Having stuck one of the main spars to the fabric, I fastened it to one edge of the ribs, covered the ribs with adhesive, brought the



fabric over, and fastened the other spar down, and left until quite dry; carefully removed them from the blocks by raising them with a chisel, and screwed the webs on to the main spar from beneath. I found this quite satisfactory, and the planes kept in position without any tendency to curl. Of course the webs were already steamed and bent.

Bedford.

L. HALSEY.

LARGE ELASTIC MOTORS.

[285] Would you or one of your correspondents say whether it is possible to drive a 6 ft. 2 in. spread biplane (with tail) of Voisin type by an elastic motor? I propose taking off the front elevator and using the tail for that purpose, so as to make it possible.

Doncaster.

C. G. H. WILKINSON.

[A supplementary question arising out of our correspondent's letter seems to be, what is the largest size elastic motor which has been tried? F. W. Lanchester, in his early experiments, built a high-speed monoplane, 7 ft. in length, driven by twin screws under the action of two skeins of rubber, weighing together nearly $\frac{7}{8}$ lb. The energy of propulsion stored in the two skeins when fully wound up amounted in all to about 1,000 ft.-lbs.; the total number of propeller revolutions available was 500. Probably not more than 50 per cent. of the energy was usefully employed in the propulsion. The propellers were $17\frac{1}{2}$ ins. in diameter, and had a pitch of approximately 20 ins. The total weight of the machine, which was of very light construction, was only 2 $\frac{1}{2}$ lbs.

Perhaps some of our readers will give particulars of their own best efforts in this direction.—E.D.]

DETAILS OF CONSTRUCTION.

[286] As many readers of FLIGHT have lately brought forward practical improvements in aeroplane and glider construction, I beg to submit a few details that, I hope, may be of use to those engaged in practical aeronautics.

In the first place, constructors will find that a large amount of timber, especially spruce, has to be thrown away owing to knots being found on the surface of long narrow scantlings, such as used for the transverse rails and tail outriggers, &c. In my case, about half the wood has been wasted on this account alone, but I have resorted to a method which has obviated the necessity of throwing away, to a great extent, an otherwise good piece of wood.

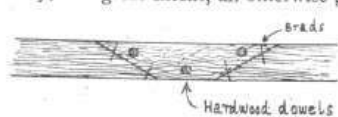


Fig 1

As shown in Fig. 1, the knot, if near the surface, is cut out and replaced by an inserted piece of hardwood cut on the skew, so that the joint does not cut the wood abruptly and weaken it.

This is then dowelled and bradded in whilst the wood is being pressed

downwards in the direction of the arrows; this has the effect of opening the joint, allowing the spliced piece to go further in, and when released, automatically tightening up the joint.

A simple method of attaching the vertical and horizontal stays to the tail outrigger or fuselage of an aeroplane or glider is shown in Fig. 2.

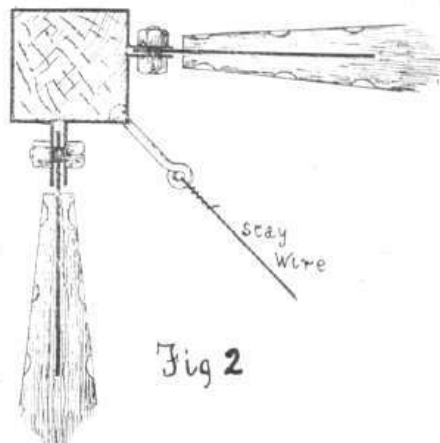


Fig 2

A couple of steel strips are bent round the outrigger as per sketch, their ends brought together over steel strips fitted into the stays; a hole is then run through the three which, when tightened, should draw the whole together.

The diagonal stay wire is attached to a stiff wire eyelet inserted in the angle of the inner steel strip.

In Fig. 3 is shown a neat and strong rocker arm for controlling the elevator, rudder, or other moving aerofoil. This can be made

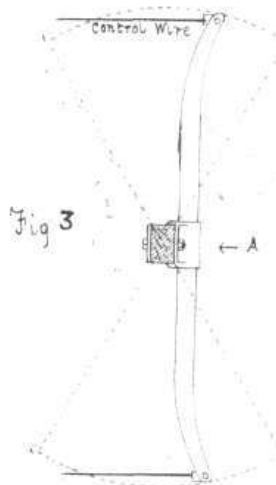


Fig 3

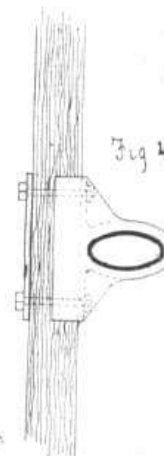


Fig 4

Plan enlarged of casting A

with two tapered oval cycle forks brazed with their butt ends together into a light malleable iron casting, which bolts on to the pivoted transverse rail.

These tapered fork tubes can also be made good use of where a light and strong lever is required for purposes of control, and many methods of utilising them will suggest themselves to the thinking constructor.

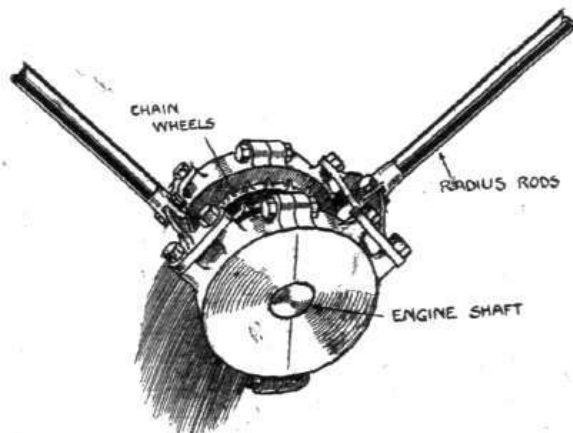
Sheffield.

MACHELL MORTIMER.

TRIAL GROUND WANTED.

[287] It is my intention to try an entirely new idea in aeroplanes early this year, but being only a visitor to your country I am at a

The term elevator that has been applied to this device must not be supposed to suggest that it is capable of lifting the machine as a whole. Its elevating power is sufficient only to tilt the machine either for the purpose of restoring equilibrium or for the purpose of inclining the attitude of flight. Actual ascent can only be effected as the result of developing an excess of power over and above that required for horizontal flight, hence the engine must be considerably larger than considerations of horizontal flight alone demand. Owing to the fact that an aeroplane does not develop the reaction necessary for its support unless it is travelling at a certain speed, it is, unfortunately, impossible to compensate for ascent by travelling more slowly through the air in order to economise power. Ascent automatically results from an increase of velocity through the air, and descent similarly results from a decrease in the velocity through the air, unless provision is made for altering the angle of incidence (*i.e.*, the angle made by the chord to the relative wind), so as in the first place to reduce the lift for a given velocity, or, in the second place, to increase the lift for a given velocity. It would seem that the



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Sketch showing how the radius-rods that form struts between the chain-brackets on the Wright biplane are supported by ball-bearings on the crank-shaft of the engine.

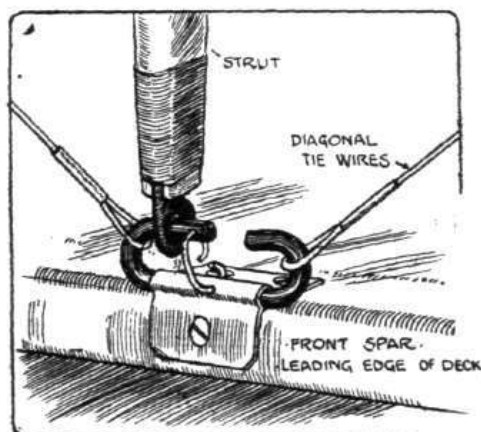
limits within which any such alteration is possible in machines with rigid planes is very limited in amount.

So far, we have considered only the longitudinal stability of the machine as it is determined by the operation of the elevator; an equally important matter is the transverse equilibrium and steering that are under control through the agency of the lever in the pilot's left hand. This lever is mounted on a universal pivot so that it can move sideways, or to and fro. When moved to and fro it operates the rudder at the rear of the machine and steers in the same way as a boat. If moved sideways it causes the extremities of the decks to warp in such a manner that the trailing edge at one end is depressed while that at the other end is raised.

This at once affects the camber of the decks and consequently the angle of incidence, so that, for a given velocity, one side of the machine exerts a greater lifting effect than the other. Should the machine be accidentally canted by a wind gust, warping thus affords a means of restoring balance. It is important, however, to bear in mind in connection with this system that any alteration in the angle of incidence likewise involves an alteration in the resistance of such a character as to make the

machine swerve from its path. This tendency can be neutralised by a suitable use of the rudder, which, as we have explained, is controlled by the same lever, and it is, in fact, the great feature of the Wright control that the warping of the wings and the moving of the rudder can be simultaneously accomplished in this manner.

When steering, the warping and rudder movements are both brought into play. Flying over a curved path causes the outer extremity of the aeroplane to have a higher relative velocity than the inner extremity, and this in turn causes the outer extremity to exert a relatively greater lift so that the machine cants over. A certain amount of canting is obviously advantageous, in the same way that a banked road is advantageous when going round a curve on a motor car, but if the canting becomes excessive the machine might capsize, and in order to check this, the warping of the wings may be brought into action. If thought desirable the warping of the wings may, of course, be employed to give an initial cant to the machine; in fact any combination of rudder and warping movements may be employed as may seem to be best suited to particular requirements.



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Sketch showing how the vertical struts between the main decks of the Wright biplane are attached to the main spars.

The Wright biplane is, as has been described, supported upon a pair of skis. It is not provided with any wheels for running along the ground, and, in order to be launched in flight, it has to be mounted on a light detachable trolley that is constructed to run upon a single rail previously laid down for that purpose. The initial acceleration is obtained by the use of a falling weight dropped from a tower and coupled up to the machine by a rope, but if the conditions are suited to the use of a longer rail, the machine may be started by the thrust of its own propellers alone. The trolley is, of course, left behind when the launching has been accomplished. If it is necessary to push the machine about over the ground another pair of light single wheeled trolleys are employed.

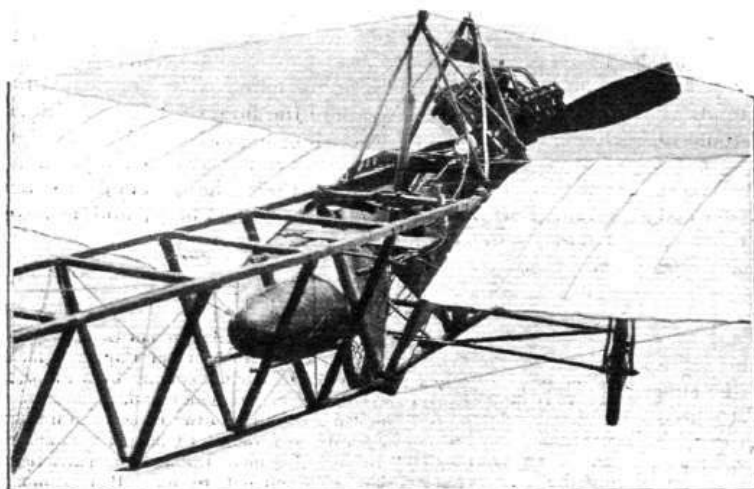
It is sometimes urged by those who take a pessimistic view of the future of aviation that this characteristic of the Wright flyer constitutes a permanent disability in machines of this type, and it should therefore be pointed out that there is no reason why the skis should not be fitted with wheels like the machines of Farman and others. The problem of making a re-ascent from any spot upon which the machine might happen to land as the result of a breakdown during an attempted cross-country flight is

THE MACFIE BRITISH AEROPLANE.

(Concluded from page 154.)

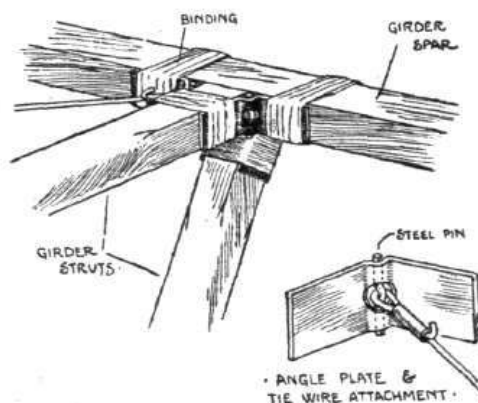
THE skid was specially designed for use on the sand over which the first experimental trials were carried out. It is very light and is provided with a combination of elastic and steel springs, as shown in one of the accom-

panying sketches. The shoe itself is pivoted to a vertical wood column that is free to rotate in its supporting brackets, being rigidly bolted to the frame of the machine, while those behind are each so fastened by a single bolt that they possess a certain amount of hinge action, which is employed for purposes of warping. The details of the attachment of the rear spars to the main frame of the machine is shown in one of the accompanying sketches.



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View of the Macfie monoplaner, showing the position of the pilot's seat and the overhead frame used in the trussing of the main wings.



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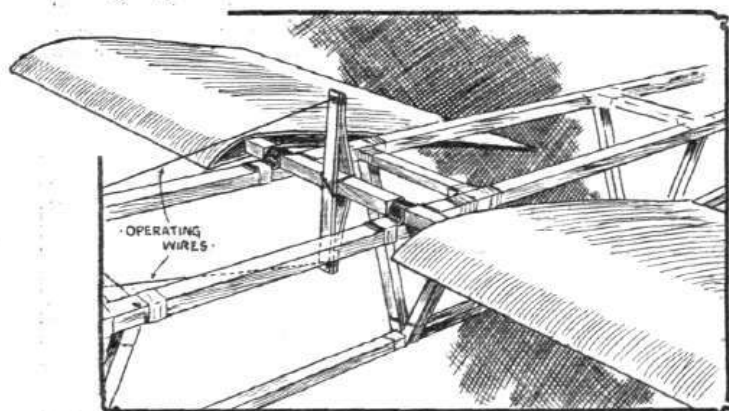
Sketch showing how the joints are made on the Macfie monoplaner.

panying sketches. The shoe itself is pivoted to a vertical wood column that is free to rotate in its supporting brackets.

The Wings, Elevator and Rudder.

The wings of the Macfie monoplaner have a span of 28 ft. 6 ins., and a chord of 6 ft. 6 ins., which gives an aspect ratio of 4'4. They are set at a dihedral angle and are double surfaced. A feature in connection with their plan form is the removal of their trailing corners for a distance of about 3 ft. from the extremities along the trailing edge.

The ribs are spaced along the spars at intervals of about twelve inches, and each rib consists of a built-up member representing the camber of the wing section. The details of this construction are also shown in an accompanying sketch, where the principal dimensions of the rib are given and also the method by which it has been made as light as possible. Further light is also thrown on these details of construction by an accompanying photograph, which



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Sketch showing the mounting of the elevator on the Macfie monoplaner.



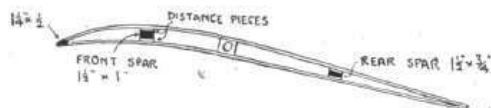
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View showing a portion of the skeleton framework of the elevator on the Macfie monoplaner.

The surface material, for which Continental fabric No. 100 B has been used, is laid on a skeleton framework consisting of two main spars and a set of shaped ribs in each wing. The main spars are of I-section, those in front

shows a portion of the skeleton framework of the elevator tail. There are some differences between the actual details of this member and of the main frame, but the same system is followed in both cases. The ribs, it will

secured by bolts to the engine frame. Wooden spars are employed of the dimensions given in our separate sketch, and it will be observed that distance pieces are fitted between the ribs and the spars in order to give the latter a greater depth where the ribs are attached, and thus to prevent the fabric from sagging down between the ribs

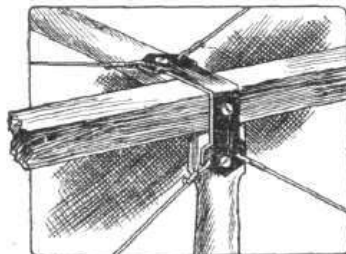


Section through one of the main planes, indicating the dimensions of the wooden spars.

and assuming an ugly shape by resting on the spars. The arrangement of the thin webs between the two surfaces will also be noted, and, of course, it will be understood that a double fabric surface is obtained. Incidentally, we are told that a good deal of trouble was experienced with this particular fabric, owing to its

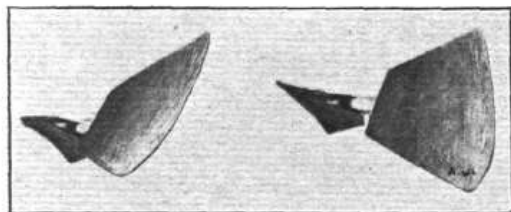
tendency to contract in damp weather, even to the extent of distorting the planes, and to hang in festoons when the atmosphere was dry.

Eight pairs of vertical struts are arranged between the upper and the lower main planes, the distance between these planes being 6 feet, as may be observed from the drawing.



Sketch showing the neat strut joint for the main girder.

Also it may be added that the leading edge of the lower plane stands about 4 feet from the ground under normal conditions. As regards the wing tips on the upper planes, the plane which we give shows precisely the manner in which these are hinged, so as to be operated from the pedals that are situated in front of the pilot's seat.



Two views of the Havilland adjustable propeller, indicating the extent to which the pitch and the twist of the blades can be changed to suit requirements.

Elevator, Rudder, and Tail.

Each of these three members—the elevator, the rudder, and the tail—is formed with spars of steel tubing. The area and shape of each is clearly marked on the drawings, and it will be observed, moreover, that provision is made whereby the angle of the tail can be altered if necessary. For controlling the machine the elevator is coupled up to a hand lever on the left, while the rudder can be actuated from a lever on the right.

The Chassis.

Normally when the machine is resting upon the ground or is running along, it rests upon the three spring-suspended wheels that are anchored to the main frame by guide-rods and by forwardly mounted radius-rods.

The two front wheels are, of course, arranged together in a kind of tubular frame of their own, and it is they that take the bulk of the weight initially. The details of this chassis are likely to be altered very considerably indeed in Mr. de Havilland's next machine, for he found the present scheme of arranging clumsy and otherwise unsatisfactory. We have already mentioned the additional front wheel and the supplementary side skids that are used.

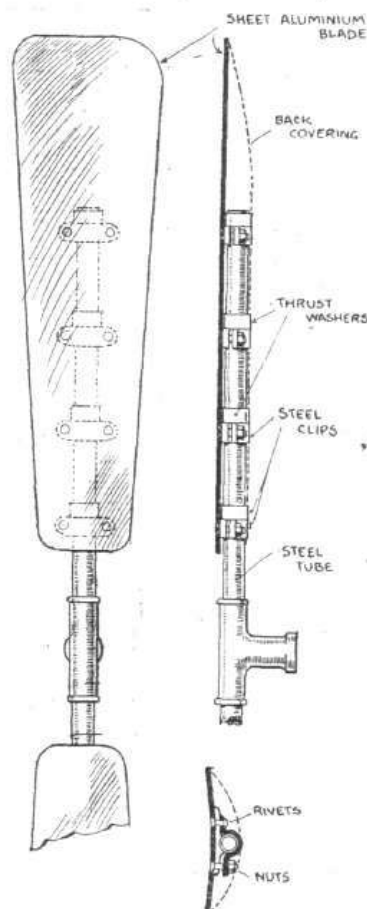
The Propelling Mechanism.

Details of the engine will be found in a separate article, for which we hope to find room in FLIGHT very shortly; but it must suffice here to say that it weighs about 250 lbs., and that its four $4\frac{1}{2}$ in. bore by $4\frac{3}{4}$ in. stroke cylinders develop about 45-h.p. at 1,500 revs. per min. We are told that it ran with an entirely satisfactory absence of vibration on the "Havilland No. 1" and in fact that it, with the whole propeller drive, fully came up to all expectations. In the machine a radiator built up of $\frac{3}{4}$ in. tubes was fixed at an angle of 1 in 6 between and beneath the two parts of the upper main plane, and natural circulation took place through large aluminium pipes coupling it up with the jackets.

Concerning the propellers, our illustrations show very clearly how four clips are used for securing each of the sheet aluminium blades to the single steel tube which passes unbroken right through the T-shaped hub, and it will readily

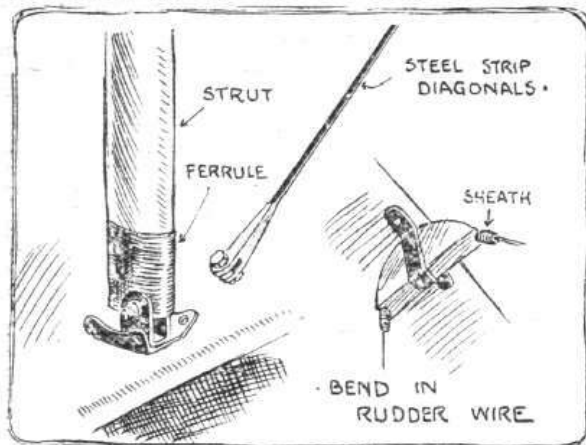
be understood how these clips permit the angle of the blade with the tube to be adjusted at each of those four points, and thus permits the twist as well as the pitch to be varied. Centrifugal force is guarded against by the thrust washers, and the whole of the back of the blade is neatly covered in with a stiff millboard casing in order to provide a smooth rear surface.

One advantage of this form of propeller construction is that a considerable amount of strength is ensured at the root of each blade where it passes into the hub. This is so not only because the steel tube is continuous from end to end, but also because its central portion is wood filled. On "Havilland No. 1" the two-bladed propellers have a diameter of 7 ft. 4 in., and each propeller weighs about 14 lbs.



Sketches showing details of the Havilland propeller.

steel instead of wire. These ties are set edge on to the direction of flight. The main planes have been surfaced with a rubber-proofed Japanese silk, which Sir Hiram Maxim had specially woven for the purpose. It is exceedingly light and very strong for its weight.



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Sketches showing details of the strut-joints, tie-strips, and wire guides on the Maxim biplane.

It is stretched very tightly over the framework of the main planes, and in order to maintain uniform curvature of surface under varying conditions of pressure, the lower surface of each deck is provided with a vent hole so located as to maintain equilibrium of the static pressures inside and outside the deck. The exact position of this air vent has an important bearing on its utility; for the particular camber employed on this machine the



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Sectional sketch of a rib in the main decks of the Maxim biplane.

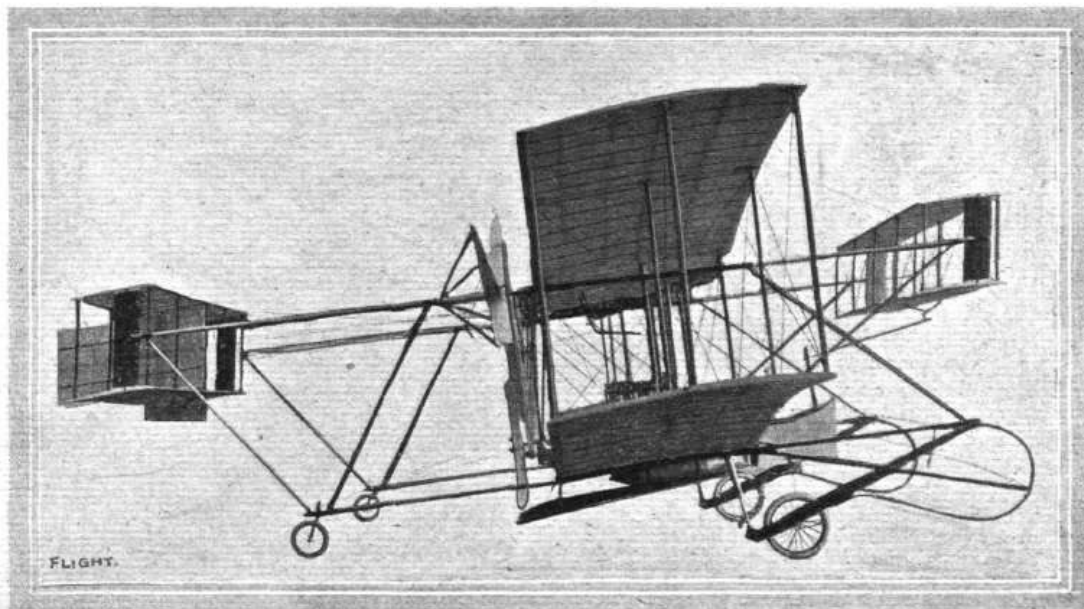


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Photograph of Sir Hiram Maxim at the wheel of his biplane, illustrating the control mechanism.

vents are situated about a quarter of the chord from the trailing edge. The vent holes are about 2 ins. in diameter, and have been covered with fine gauze in order to prevent flies being blown into the cavity.

(To be concluded.)



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Side view of the Maxim biplane, showing very clearly the arrangement of the two principal fore and aft spars that carry the elevator, tail and propellers.

very simple calculation would suffice to show how little lifting effect would be available from the internal capacity of the wings of an ordinary monoplane or biplane.—ED.]

BLÉRIOT CONSTRUCTION.

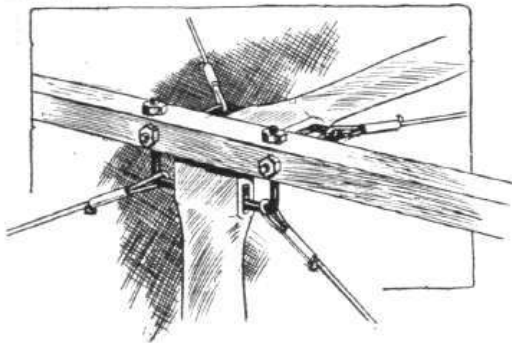
[550] Could you insert in your valuable paper a sketch of the Blériot pattern wire clamps application. I do not quite gather from Capt. Windham's explanation on p. 548 of FLIGHT for Sept. 4th, 1909, how it works.

I am indebted greatly to you for many constructive details of great value.

Delhi, India.

JAC.

[The accompanying sketch illustrates very clearly the particulars asked for by our correspondent. The U bolts are of steel, and vary



in size from a diameter of $\frac{1}{8}$ in. to $\frac{3}{8}$ in., the larger size being used for the front end of the girder. The vertical struts are placed slightly in advance of the horizontal struts to enable the U bolts to clear each other.—ED.]

THE CYCLOPLANE.

[551] On looking at an old number of FLIGHT the other day, I noticed a letter, No. 442, written by a Mr. Gaunt, of the Cycloplane Works, Gargrave. As I have not heard of any cycloplane actually in flight, I should like to ask Mr. Gaunt, through your valuable paper, of the results he has obtained with his machines.

At the Olympia Exhibition there was a cycloplane with this notice affixed to it: "If this machine fails to fly at the Crystal Palace before the end of the month, all orders for it will be automatically cancelled." The inventor of it told me that an attempt was to be made the following Thursday. I could find nothing about it, however, in Friday's papers. I should very much like to know if any news has reached you about this machine.

Gerrard's Cross.

O. D. A.

LOADING OF GLIDERS.

[552] May I offer a few words of friendly criticism upon the suggestions in the letter from Miss Lilian E. Bland (538), in which she states, *inter alia*, that a well-designed glider should carry a load of $1\frac{1}{2}$ lbs. to the square foot.

It would do so, of course, at a comparatively large gliding angle and high air speed, both elements attended with risk to machine and pilot. I have followed Miss Bland's accounts of her experiments with the greatest interest, but cannot recollect particulars of free flights made by the glider with pilot on board from which the really useful data can be obtained. When Miss Bland states that her glider will support a load of 2 lbs. per sq. ft., I understand she refers to the machine flown as a kite, which is a somewhat different matter. In this case I believe the load should be supported with the machine in its soaring position with the cords from the leading edge vertical upon a hill representing its gliding angle.

Is Miss Bland quite sure also of her wind speeds? A breeze of 30 m.p.h. has more than twice the lift of a breeze of 20 m.p.h., according to the tables of Mr. Lanchester, and the practical experience of Mr. Wilbur Wright (FLIGHT, October 9th, 1909). In the same series of articles Mr. Wright also describes how, having on one occasion started gliding experiments in a breeze of something over 20 m.p.h., they stopped to take an anemometer reading and found their wind to be over 37 m.p.h., which seems to suggest that a very considerable increase in wind speed is not so noticeable as one would imagine.

In my own elementary experiments I have found that the machine when flown in soaring flights, kite-fashion, with long cords, seems to have a considerably greater lifting efficiency than when held breast high, and I imagine this to be due to the fact that the breeze has an increased speed when well away from the ground.

Miss Bland's tables are always interesting, but upon turning up my FLIGHTS I find the following dimensions given in two, which I have open before me at the moment of writing:—

Lilienthal's monoplane glider 140 sq. ft. (FLIGHT, January 1st, 1910).

Pilcher's monoplane glider 180 sq. ft. (FLIGHT, January 8th, 1910).

Both machines weigh about 50 lbs. each, and allowing the construction as suitable for a 150 lb. pilot, we have:—

Lilienthal's machine built to carry 1.42 lbs. to the sq. ft.

Pilcher's machine built to carry 1.1 lbs. to the sq. ft.

Both figures unfortunately differ from those quoted by Miss Bland, but are the only two I can turn up at the moment.

I see from the description of Miss Bland's machine (FLIGHT, February 19th, 1910), that the supporting surface is 260 sq. ft., with a somewhat excessive weight of 200 lbs.

If I may be so bold as to estimate the weight of the pilot at 110 lbs., the machine is apparently constructed to carry about 1.2 lbs. to the sq. ft.

Now I am chiefly interested in the sporting and practical side of gliding rather than its mathematical, but if I can rightly apply Mr. Lanchester's tables (FLIGHT, May 22nd, 1909), I should make the following comparisons and deductions in respect to the above gliders.

The resistance efficiency of Lilienthal's and Pilcher's machines must have had a high value owing to their simple monoplane construction, but the low aspect-ratio, about 3 in both cases, gave a comparatively low lifting efficiency.

I should deduce, therefore, that the air speeds for their natural gliding angles were: Lilienthal's glider about 32 m.p.h.; Pilcher's glider about 28 m.p.h. With the absence of means for proper control of the machines, both speeds are impracticable from the point of view of those wishing to enjoy gliding as a sport, and both the landing and launching difficulties must have been highly hazardous.

In Miss Bland's machine, the lifting efficiency is considerably higher with the aspect-ratio 5.5 for each plane, but as a biplane, with its necessary stanchions, outriggers, wiring, &c., the proportionate resistance is much increased.

I should expect upon an incline of 1 in 10 or so to find an air-speed necessary of about 24 m.p.h., which is, in my opinion, rather too high for sporting purposes, necessitating a breeze stronger than one can ordinarily find blowing steadily, and presenting many difficulties in launching.

I have ventured to suggest $\frac{3}{4}$ lb. per sq. ft. as a load which will allow gliding to be enjoyed upon ordinary sloping downs with a mild breeze of 15 m.p.h., and anything under this speed with the aid of the starting rail and pylone.

I should much like to read an account from Miss Bland of any free flight experiments with her glider, and a photo of the machine in mid-air during a 300 yds. gliding flight would be most interesting and instructive. From the illustrations it seems fully capable of this, and Miss Bland is much to be congratulated upon her design and enterprise.

I feel upon reading through what I have written that my broad deductions are open to considerable criticism, possibly on account of lack of space to add the often necessary qualifications, but I must really not encroach further upon the hospitality of your columns.

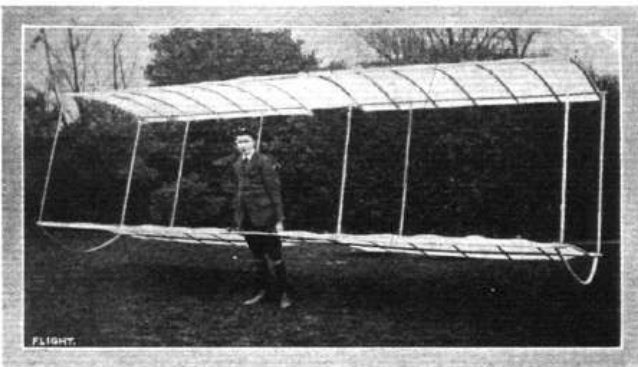
Sutton.

HORACE W. H. VAUGHAN.

THE RIDLEY GLIDER.

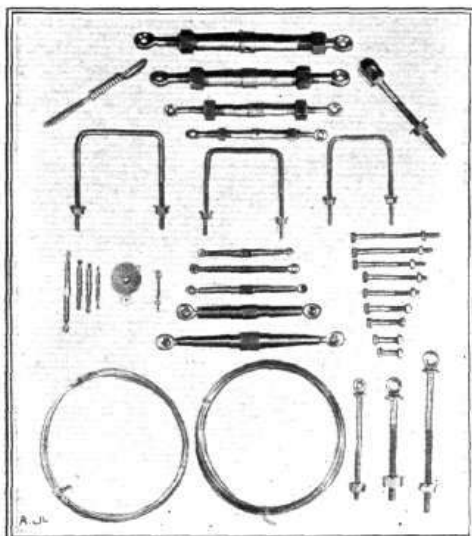
[553] In reply to Mr. J. W. Dewar's letter (527), May 21st, I have pleasure in stating that:—

1. The dihedral angle of the main plane is 165° .



SOME AEROPLANE FITTINGS BY WHITEMAN AND MOSS.

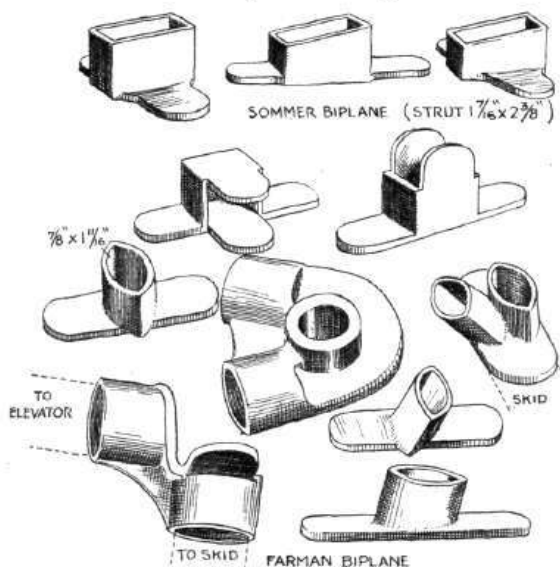
ALUMINIUM lugs and sockets already form quite an important section of the articles included under aeroplane accessories, and no firm has specialised more extensively in their production than



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Some wire-tighteners, eye-bolts, wire clamps, &c., manufactured by Whiteman and Moss, Ltd. At the top are four Blériot type wire-tighteners with lock-nuts, and underneath there are three Blériot type wire-clamps.

Whiteman and Moss, a selection of whose British made aluminium castings are illustrated by the accompanying sketches. To the general reader the mere variety of shape should be a source of interest, if not of instruction in the amount of detail that is involved in the manufacture of a modern flying machine; to the builder, the illustrations should be an inspiration in design as well as an index



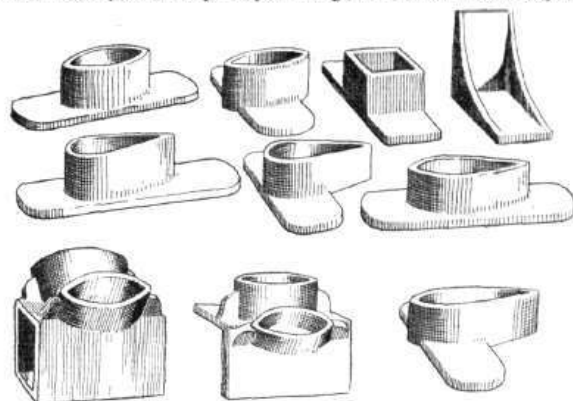
"Flight" Copyright.

In the above sketch will be seen some of the special sockets used in the construction of the Sommer and Henry Farman biplanes. The casting in the centre is the elevator fitting.

to a good market where he can obtain the articles ready made. The sketch of standard sorts includes three types of strut sections—the oval or torpedo-shaped, and the ichthyoid or fish-shaped, the latter being subdivided into two classes, of which one represents struts having a blunt leading edge, while the other includes those

having a sharp leading edge. The illustrations of special sockets relate principally to the types employed for the Sommer and Henry Farman biplanes, and as these machines have an especial vogue at the present moment, the sockets in question are in great demand.

It is worth remarking that Messrs. Whiteman and Moss are prepared to supply all the principal fittings for Farman machines, and



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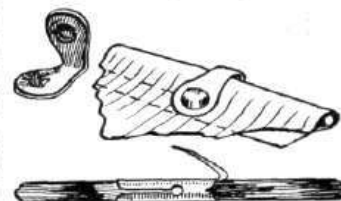
The aluminium lugs and sockets shown in the above sketch are some of the standard types for ordinary work made by Whiteman and Moss, Ltd.

they also supply wire and bolts of every description, some of the principal accessories in this category being illustrated by an accompanying photograph. There are two kinds of wire tighteners, both of the barrel-nut pattern, but one having clamping nuts for gripping the thread. "U" bolts are provided in various sizes as also are eye bolts and ordinary hexagon-headed bolts. These latter are made with various length of shank, all of which are cut with a considerable length of screw thread, which is always a great convenience in bolts used for experimental purposes.

PORCUPINE QUILLS FOR MODELS.

WE have received from J. O. Lea and Co. a variety of useful and uncommon materials for model aeroplane making, amongst them being some porcupine quills of various sizes, with metal sockets for making joints. These quills should prove to be useful for several parts of a model, as they are light and strong.

Other materials consist of whalebone in strips, broad and narrow, and in rods of about $\frac{1}{4}$ in. square, small fabric fasteners, and samples of fabric. There is also a special preparation called "Transpormoid" for proofing fabric, that can be obtained in bottles for home treatment. The accompanying sketch shows the method of using the fabric fasteners, and also the socket for joining the quills.



British-Built Farman-type Biplanes.

A WEEK or so ago we mentioned that Messrs. A. V. Roe and Co., Manchester, had received orders for a couple of Farmans. We hear that these are now almost complete. A Farman in a fortnight is a pretty good record, as all the work is excellent, with no signs of being rushed. One is being fitted with a 40-h.p. "Avro" motor, the other a 60-h.p. E.N.V.

THE Aerial Manufacturing Co. of Great Britain and Ireland, Ltd., 26, Shaftesbury Avenue, W., ask Mr. Gerald N. J. Carr to send his address so that they may send on a copy of their Catalogue, for which he has sent a P.O. for 1s., but omitted his address.

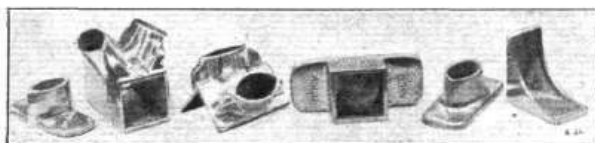
MESSRS. NORMAN AND M'KNIGHT, of 145, Argyle Street, Glasgow, inform us that they have been appointed official aeronautical and repairing engineers to the Scottish International Aviation Meeting at Lanark. The firm are erecting an up-to-date workshop on the course, equipped with plant and machinery, whilst a staff of trained builders and mechanics will be always in attendance, ready to execute renewals and repairs to all types of machines. They will also have on hand a large selection of spare parts for all types, together with special timber, wheels, and all conceivable accessories.

SOME FLIGHT ACCESSORIES—continued.

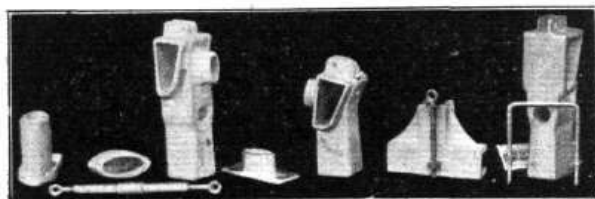
LUBRICANTS AND FUELS.

S. Bowley and Son.—Special fuels for aeroplanes known as "Bomo" and "Express," are supplied by the above firm, also all descriptions of lubricating oils and greases.

W. G. Nixey.—W. G. Nixey and Co. make a graphite grease for aero engines, also a graphite lubricant for chains.



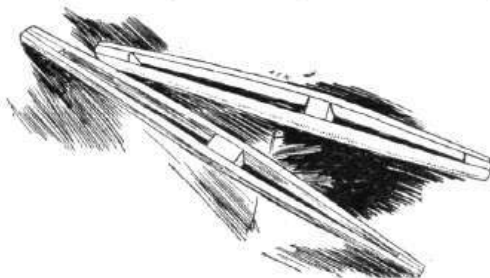
A group of "Asco" aluminium socket-brackets made by the Aeroplane Supply Co.



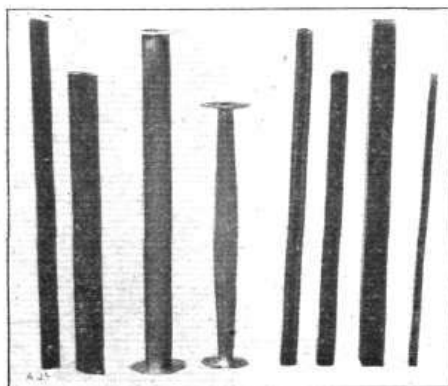
A group of aluminium socket-brackets and wire strainers made by Handley Page, Ltd.

RUB METAL.

Rub metal is a patented material having a rubber base amalgamated with a combination of metallic salts and gum and is claimed to be unaffected by acids or grease. It may be used for making con-

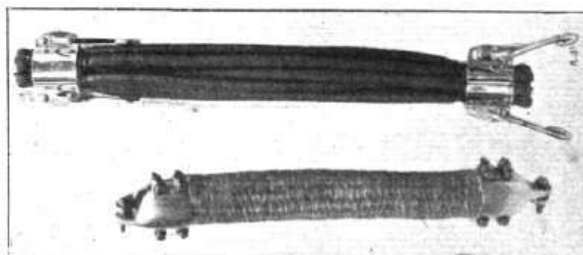


Samples of built-up struts made by the Aeroplane Supply Co. These struts are made of silver spruce.

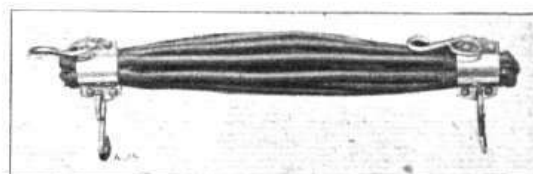


Examples of tubular steel work by Rubery, Owen and Co. The tubular steel struts shown in the centre are pressed in halves, and joined together by oxy-acetylene welding.

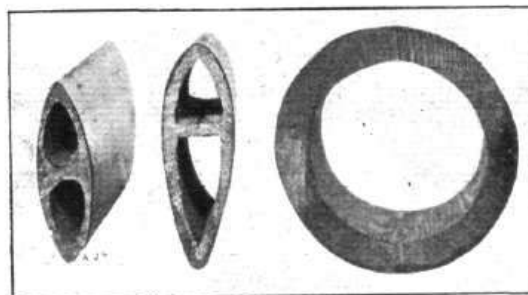
nections in petrol pipes or oil pipes without deteriorating. It is supplied by the New Motor and General Rubber Co., in the form of tyres.



Two elastic shock-absorbers by the Aeroplane Supply Co.



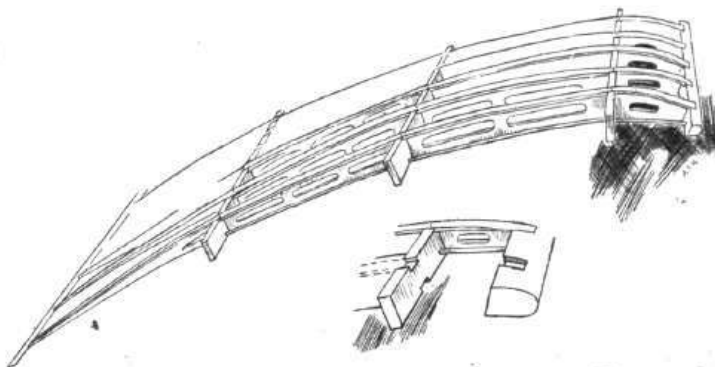
An elastic spring made by Handley Page, Ltd.



Three examples of hollow spars by T. W. K. Clarke and Co. The oval sections, it will be noticed, have a web down the centre. These spars are made in halves, and the wood is silver spruce.

SHEDS.

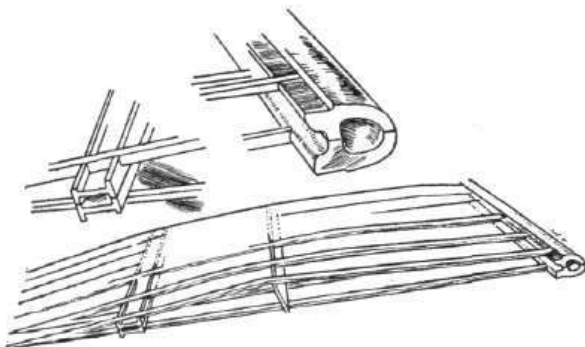
The Aerial Manufacturing Co. of Great Britain and Ireland undertake the construction of special sheds of their own design, which are made more or less portable, if required.



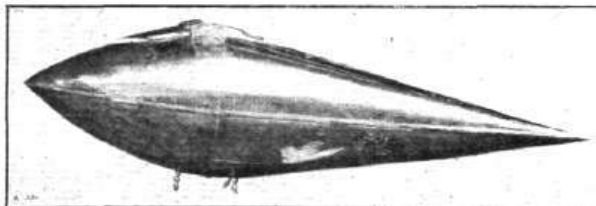
Example of wing construction by Holland and Holland. The ribs are built up, the flanges are continuous, but the webs are in separate lengths.

SOCKETS

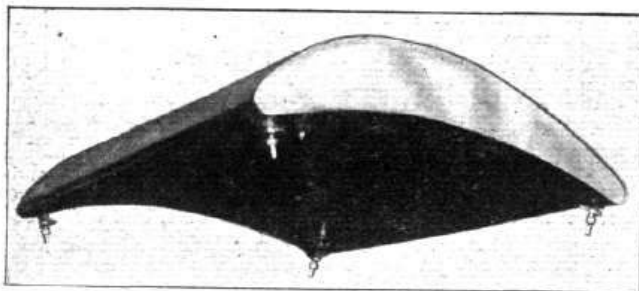
Aluminium lugs and sockets in a variety of shapes, polished or plain, are supplied by the Aeroplane Supply Co., Handley Page, Ltd., Gratz, Ltd., and Messrs. Harris and Samuels.



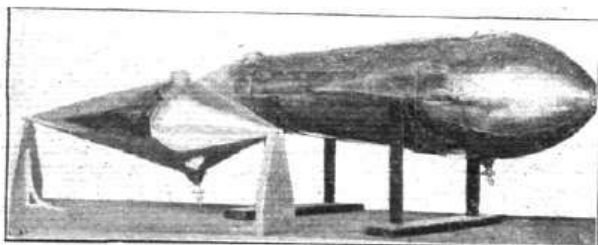
Sketches showing examples of wing construction by T. W. K. Clarke and Co. The spars are made of silver spruce, and are built up in halves.



A "stream-line form" petrol tank constructed by the Phoenix Radial Rotary Motor Co.



An interesting petrol tank, manufactured by the Aerial Manufacturing Co. of Great Britain and Ireland, Ltd. It is made in the shape of a plane, having a dipping edge, and is intended to lift its own weight.

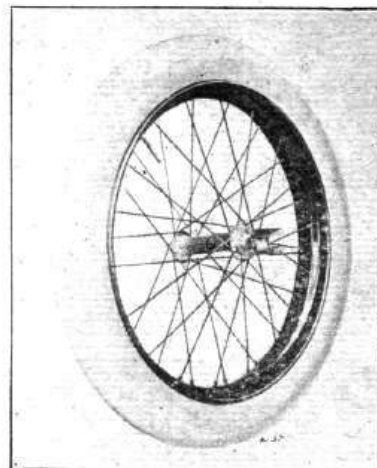


The above tanks, constructed by the Spiral Tube and Components Co., are designed with a stream line contour to give least resistance while passing through the air. The larger tank is divided into two compartments for petrol and lubricating oil.

SPRINGS.

Elastic.—Elastic springs having the rubber strands so arranged in detachable units that the strength can be varied to suit different requirements, form a speciality with the Aeroplane Supply Co., Messrs. Handley Page, Ltd., and Messrs. Harris and Samuels (Eyquem's Patents).

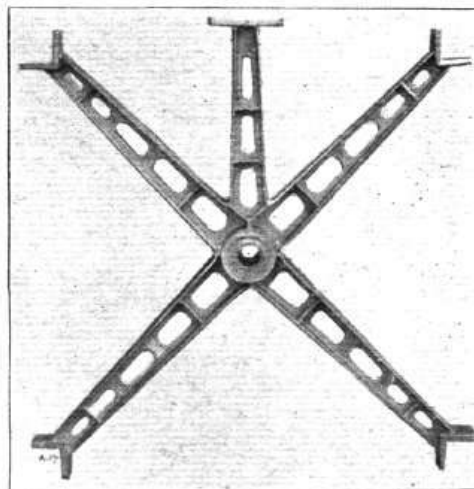
Lever.—The Lever Spring Suspension Co. have adapted their device, which has already been applied to automobiles, to the chassis of aeroplanes. The central principle of the system is the interposing of a spiral spring operated by a lever between the main spring and its hinge. The lever spring is for the purpose of absorbing minor vibrations.



A wire wheel for aeroplanes by Harris and Samuels—Eyquem's patents—which weighs 11 lbs., and is 28 ins. in diameter.

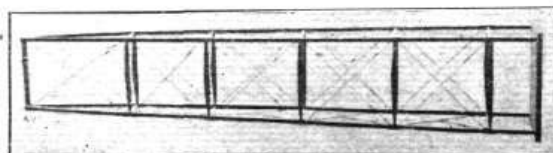
STRUTS.

Steel.—Hollow tubular steel struts are made by Rubery, Owen and Co. in any shape or section desired. One form of strut that this firm has made has a tapering oval section, and is flanged at each end. Struts of this kind are pressed in halves and oxy-acetylene welded.



A cast magnalium bracket, constructed by the Phoenix Radial Rotary Motor Co., for the support of their engines in aeroplanes.

Timber.—Hollow spars and struts made of timber are constructed of various shapes and sections by T. W. K. Clarke and Co. Struts of this kind are made in halves, and can be webbed down the centre if desired. Silver spruce is the principal wood used by this firm.



Portion of a fuselage, or lattice box-girder frame, constructed by the Motor Accessories Co., and embodying their new system of wire straining.

PARIS-BORDEAUX.



Bielovucic, who has just flown from Paris to Bordeaux, at the wheel of his Voisin biplane.

TRULY rapid fame, almost unequalled in the annals of the world, is being attained by means of aviation. Day by day some new flyer whose name has hardly appeared in print, becomes one of the leading lights of the universe by reason of some extraordinary feat, either novel in itself or surpassing previous exploits of a similar character. In this category must almost be included Bielovucic, for although he has been known in certain circles in the flying world, until the last few weeks his name was practically unknown to the general public. And yet, with little preliminary fuss last week,

and mainly in order to avoid the very heavy expense entailed in transporting his Voisin machine to Bordeaux from Paris, where he proposes to fly at the big aviation meeting, he determined to take the air for the entire journey, merely descending for necessary replenishment stops and rest. Without a suspicion of serious delay he has succeeded magnificently, and once more the tablets of history must receive an addition by the inscription of his name for this fine work. The total distance between the two points is 540 kiloms., and this Bielovucic covered in three successive days with three landings, in the total flying time of 6 hrs. 15 mins. The longest stage was between Orleans and Chatellerault, this totalling to 170 kiloms., the shortest being the first stage, starting from Issy, between Paris and Orleans, with 110 kiloms. The various stages, with times, are as follows:—

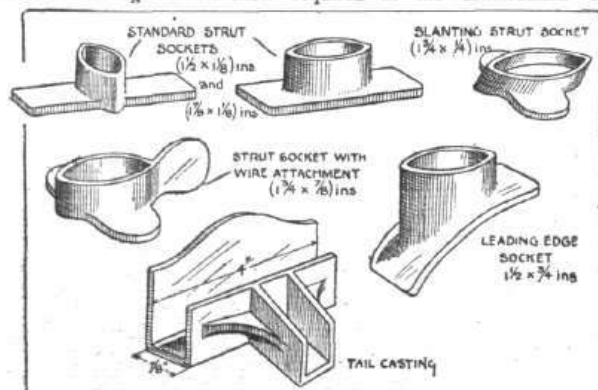
		Start.	Arrival.	Time.
	kiloms.			h. m.
Paris-Orleans ...	110	6.5	7.15	1 10
Orleans-Chatellerault ...	170	9.35	11.20	1 45
Chatellerault-Angoulême ...	135	3.30	5.15	1 45
Angoulême-Bordeaux ...	125	10.48	12.25	1 37

Total for the 540 kiloms. ... 6 15

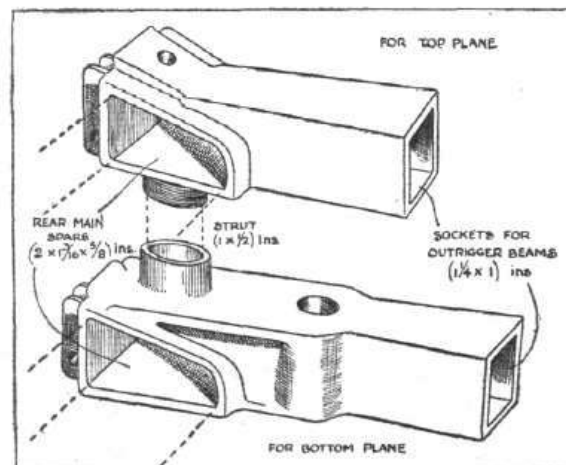
In the first stage he travelled over Montrouge, D'Arpajon and Etampes, before alighting at Orleans. Rising from the military field of manoeuvres at Grouves before actually making a start for the second stage, Bielovucic made a trip round the plain four times in spite of a very bad fog prevailing at the time. Later, when the sun had dissipated the thick mist at 9.35, he rose from the ground for his second stage. During this journey the route took him over Blois and Tours, he passing over the latter town at three minutes past eleven, and at 11.20 he descended at Chatellerault for *déjeuner*. Restarting at 3.30, he was speeding over Poitiers at 3.45, Couhé-Verac at 4.10, and descended at Angoulême for the night at 5.15. The next morning the completion of the journey to Bordeaux was successfully accomplished with a start at 10.48, he was sighted over Libourne at 12 noon, where he had to rise to about 1,000 metres in consequence of some violent wind eddies met with. Bordeaux was reached at 12.25, although Bielovucic did not actually finish his journey at the Beau Desert Aerodrome until 10 minutes later, during which interval he passed over the Cathedral at a height of 1,600 ft., and the Grand Theatre, where the streets were positively black with the populace who had sallied forth *en masse* to welcome the popular aviator. And so, what will presently become hardly a matter for unusual comment, this further remarkable step in the history of aviation ended, with the material reward to the hero of a gold medal which is to be presented to him by the Bordeaux Departmental Assembly in recognition of the first man to fly from Paris to Bordeaux. As a preliminary to the Bordeaux aviation meeting, the promoters have assuredly reaped a magnificent advertisement for their project, which starts on Sunday next.

SOME LUGS AND SOCKETS BY HANDLEY PAGE, LTD.

As there is practically no end to the various shapes and sizes of aluminium lugs and sockets required in the construction of



Some of the standard type aluminium lugs and sockets supplied by Handley Page, Ltd.

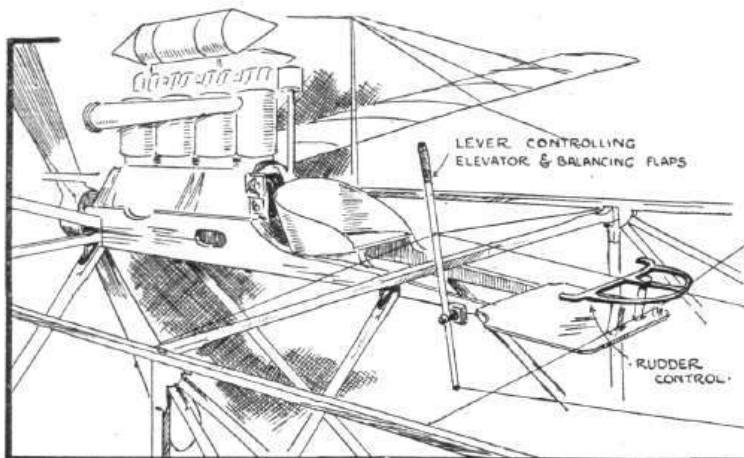


Two special compound castings for carrying the outrigger beams and the main spars of a biplane.

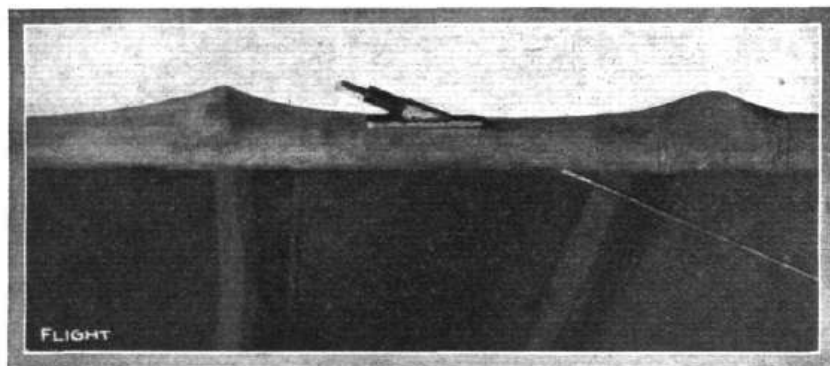
somewhat reminiscent of the original Short biplane, and is in some respects the most important feature of the machine, for coupled as it is with the absence of a tail, the principle involved results in a most important reduction in the overall length. "Valkyrie I," which is shown in the accompanying illustration, measures only 22 ft. from stem to stern, although it has a span of 34 ft. Experiments were originally carried out with the independent operation of the rudder-planes, but the interconnection of these members has been found preferable, and the steering effect is the same, in principle, as that of a rudder carried on the extremity of an outrigger. The absence of leverage, which would ordinarily be provided by the distance of the outrigger from the main planes, is in this case seemingly made up by the increased influence of the slip of the propeller on the particular rudder-plane that happens to be turned into the wash. It will be observed that the rudders are situated one on either side of the slip-stream from the propeller. These rudders are not especially large; indeed, they have actually less area than those on the Wright biplane, with which machine the Valkyrie, although a monoplane, is almost unconsciously compared.

In this comparison, moreover, it is interesting to note that although the leading plane of the Valkyrie seems to be an unusually long way in front of the main planes it is actually scarcely more than a foot further off than the elevator on the Wright biplane, and the dimension is identical with the corresponding measurement on the Curtiss biplane of last year. Regarding dimensions, an out-

Special aluminium sockets are employed in many places on the Valkyrie, and especially should their use be noted as abutment



"VALKYRIE I."—Sketch illustrating the position of the pilot's seat and the arrangement of the control.



Detail view showing the method of attaching the tie wires for bracing the spars of the main planes.

standing feature of the Valkyrie is that it provides over 140 sq. ft. of supporting surface for a total weight of 520 lbs. This weight is approximately that of the Blériot monoplane, but the Valkyrie is a machine of much wider span, and much greater area. Such lightness is due entirely to detail design, for the machine carries a standard Green engine of 30-h.p., and a glance at the accompanying illustrations, particularly the drawings, is sufficient to show that, with the exception of the tail outrigger, it has the usual number of principal members. Perhaps the most important constructional feature of the machine from the point of view of detail is the use of a single-surfaced main plane, which is considerably lighter than a double-surfaced member, firstly owing to the smaller quantity of fabric, and secondly owing to the lighter character of the cambered ribs.

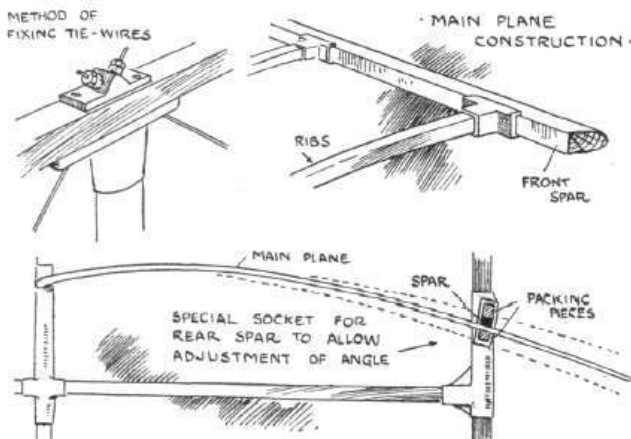
In connection with the attachment of these latter to the transverse main spar forming the leading edge of the plane, there is an interesting detail that is illustrated in one of the accompanying sketches. It will be observed that in order to avoid weakening the main spar by making mortice joints, the ribs are held in aluminium sockets fastened to the back edge of the spar by screws. These sockets are also flanged, and the flange is grooved so that it overlaps the edge of the spar and thereby obtains great rigidity of support without cutting the wood. The ribs themselves have a slightly triangular section, this shape having been found to give the greatest ratio of lateral stiffness to weight of any simple form of construction.

The main plane of the Valkyrie is built in three sections, and special aluminium sockets have been designed to facilitate an adjustment of the angle of incidence of the main plane by raising or lowering the rear transverse main spar during erection. The central portion of the main plane has a shorter chord than the extremities, and is also adjusted to a smaller angle of incidence owing to its presence in the slip stream of the propeller.

pieces in connection with the method of anchoring the tie wires on this machine. Not one of the important wires used in bracing the Valkyrie is either fitted with a strainer or bent over at the ends. The method of attachment adopted avoids the necessity of doing either, and thus simultaneously saves the weight of a wire strainer, and likewise overcomes any objection that there may be to bending.

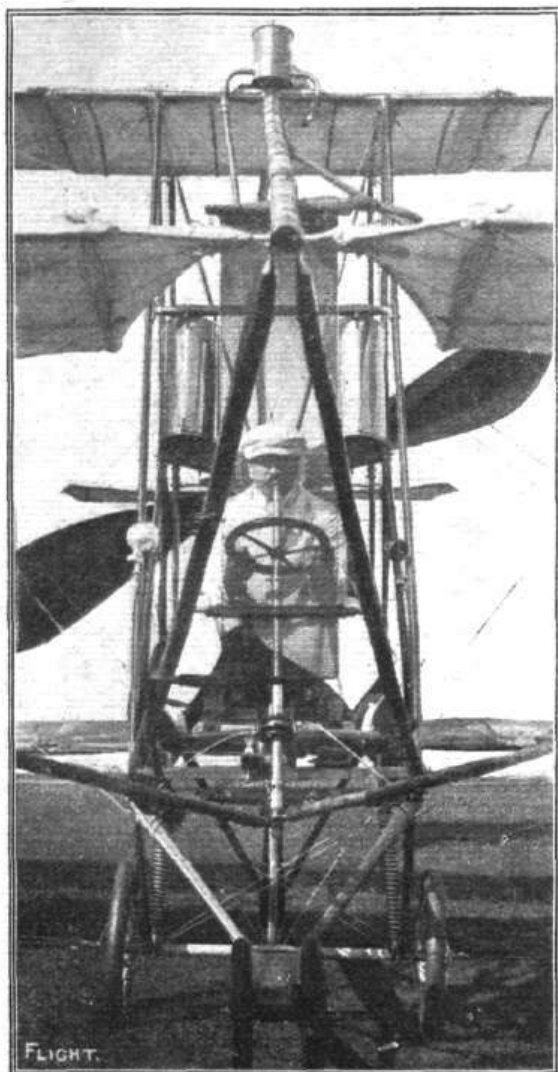
The wires used are of larger gauge than ordinary, and it has been found preferable to employ wire that does not exceed 110 tons tensile strength owing to the liability to brittleness of the higher grade steel. All the wires are cut approximately to the desired length, and then have a screw thread chased upon their extremities so as to take an ordinary nut. The wires are threaded through the lugs at the points of attachment to the frame, and the nuts are fastened down against the special aluminium brackets provided for their abutment. One such bracket is shown in an accompanying sketch, and another is illustrated in a detail photograph, which

shows how the tie wires are fastened to the main spars of the main plane. As a practical flying machine, the designers of the Valkyrie lay emphasis on the advantages associated with the position in which



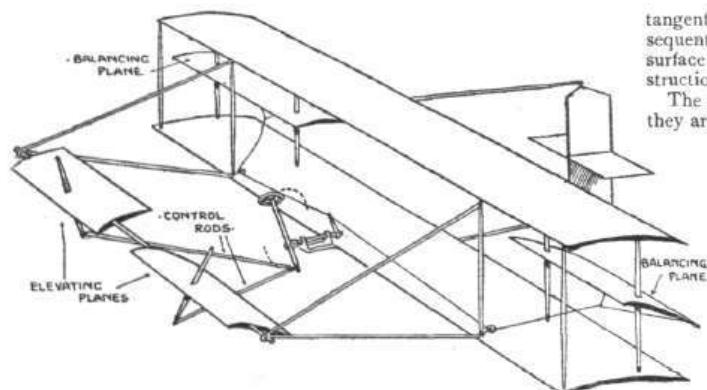
"VALKYRIE I."—Sketches illustrating various special features of construction.

they place the pilot. He is situated in front of the engine away from the exhaust and the draught of the propeller, and he has an



"Flight" Copyright.

Front view of the pilot's seat on the Cody biplane, showing Mr. Cody at the wheel. This photograph is taken through the radiator, which protects the pilot to a certain extent in cold weather. That the radiator is no obstruction to the view in this position may be judged from the above picture.



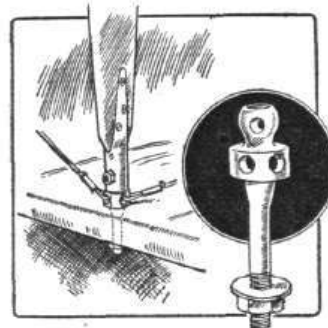
"Flight" Copyright.

Diagrammatic sketch illustrating the use of the elevators as balancers on the Cody biplane, and also the simultaneous action of one of the main balancing planes.

control; the other balancer, although it may be dipped by the action of the spring, cannot exert a downward thrust, by virtue of this attitude, of a greater magnitude than the springs themselves can support. Interconnected with the balancer mechanism is the rudder—which, as already explained, is capable of independent operation by turning the steering-wheel—and this member is likewise put over in synchronism with the balancing movements. It will be observed, as an outstanding feature of the Cody control, that the balancing forces are brought to bear upon the machine at several points, and it can be readily appreciated that in large aeroplanes of this kind such a feature may be very desirable in order to guard against failure through undue local stress. With the exception of the rather small horizontal tail plane, which is quite flat—and can really almost be regarded more as a member for trussing the rudder, to which it is permanently fixed, than as a factor of great importance in the stability of the machine—all the planes on the Cody biplane are cambered to carry load. And, in connection with the camber of the main planes, there is another original feature which it is only fair to designate as the "Cody curve."

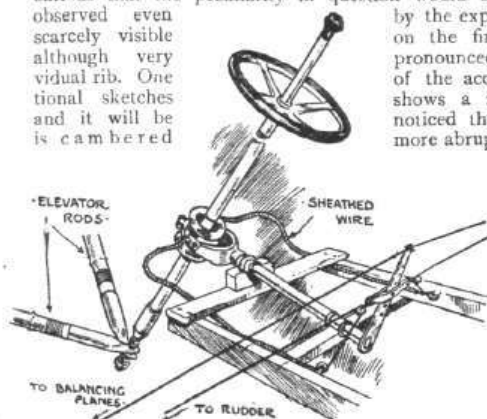
The section of the main planes is very peculiar, and it is rather curious that the peculiarity in question would scarcely ever be observed even on the finished machine, pronounced in an individual of the accompanying sketches and it will be by the expert eye, for it is on the underside more abruptly than the top side, so that the two laths of which the rib is built up touch one another at a point about one-third of the chord from the leading edge. The attitude of the main planes in respect to the normal axis of flight is such that the upper surface is practically tangential to the line of flight in the vicinity of the leading edge, consequently the lower surface has a dipping front edge and the upper surface has not. Mr. Cody claims for this particular system of construction that it produces the most efficient plane that he has ever tried.

The main planes are built up in sections of 8 ft. span each, and they are divisible into these sections when the machine is dismantled



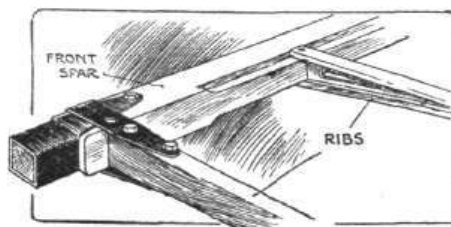
"Flight" Copyright.

Sketch illustrating how the vertical struts are fastened by a ball-socket joint to the main spars in the Cody biplane. Inset is an illustration of the bolt.



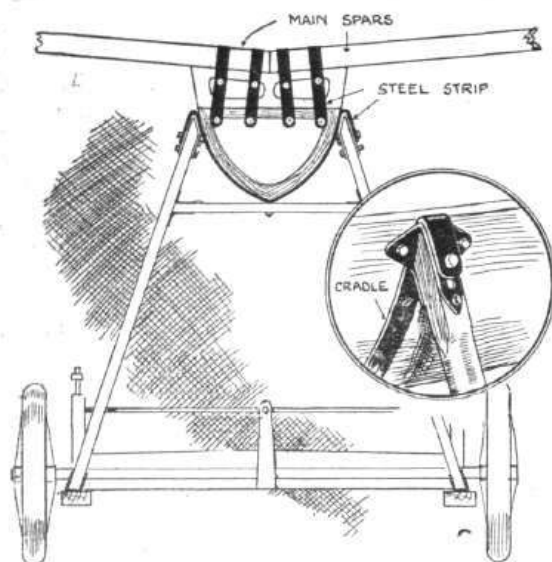
"Flight" Copyright.

Sketch illustrating how the steering-column simultaneously operates the balancing-planes and the rudder when moved sideways.



"Flight" Copyright.

Sketch illustrating how the main ribs are fastened to the main spars by a steel strap on the Cody biplane.



"Flight" Copyright.

Sketch illustrating the attachment of the front spars to the body of the Hanriot monoplane and the method of carrying the body itself in a cradle of steel straps.

Now it is Settled!

No doubt the heart of the staunchest supporter of aviation will flag when he hears that at last week's meeting of the City of London College Debating Society a resolution to the effect "That this Society is unable to see that any real benefit to mankind is likely to result from the development of aviation," was passed by a substantial majority. The mover of the resolution, Mr. S. S. Hosking, although he very graciously thought man's desire to fly a reasonable one, doubted whether the risk and expense were likely to result in a corresponding benefit to mankind. The value of the aeroplane in war might be great, but for the purpose of commerce it would never be of much use. Amongst those who assisted at this merciless annihilation of aviation were: Mr. H. Owen, Mr. G. P. Ridley, Mr. M. F. Cahill, Mr. T. G. Harper, B.A., Mr. A. G. Dryden, Mr. P. R. Higgins, Mr. G. L. Precious, Mr. C. L. Cocks, and Mr. W. J. Spray.

This controls the rudder, which is mounted between the halves of the elevator. The fixed tail-plane on the Hanriot monoplane is quite flat, and consists of a sheet of fabric tightly stretched by the aid of a couple of transverse spars. The rear portion of the tail plane is deflected a little below the line of the leading portion, to which it has a relative, although small, angle of incidence.

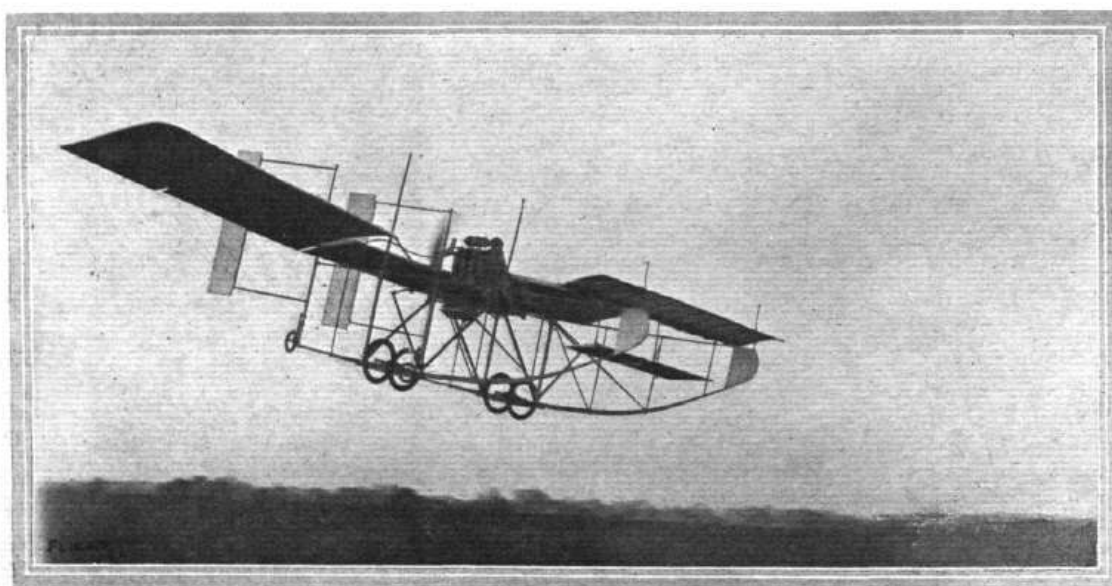
Well forward of the main planes is the engine, which on this machine is an 8-cyl. 40-h.p. E.N.V. This is mounted in the bows of the boat body, and is also partly supported by the struts of the "A" frame, a pair of which are situated immediately beneath the motor. The tractor-screw, which is direct-driven by the engine, is 2.1 metres in diameter, and 1.2 metres in pitch. When at rest on the ground, the machine is carried by a pair of pneumatic-tyred wheels in front and by a light trailing-skid behind. The wheels are mounted on a steel axle that is reinforced by a wood batten and mounted in vertical guides, so that it has a considerable upward travel. Suspension is effected by elastic springs anchored to the main skids and attached to the upper end of a column that rests upon the axle itself.

The construction of the axle is shown very clearly in one of our photographs, in which it will be observed that the system represents a very strong but rather rigid form of construction; rigid, that is to say, so far as lateral stiffness is concerned, for the vertical play permitted by the guides is considerably in excess of that usually obtained with the ordinary rubber attachment of the axle to the skids. The clearance is enough, in fact, to enable the wheels to rise up so high as to enable the weight to be taken directly on the skids in the event of a very severe bump. Like everything else in the Hanriot design, solidity seems to be the keynote of its construction.

It is with a machine of this type that some very satisfactory flights have been made at Brooklands recently.

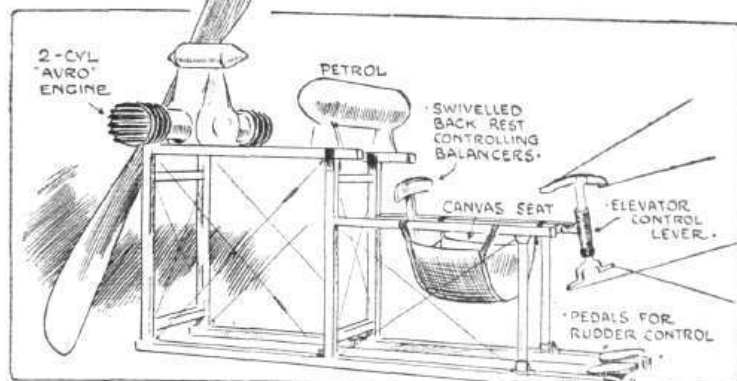
Kern Rivalry between Aviatresses.

DURING the current month there is likely to be some keen competition between Mdlle. Marvingt and Mdlle. Dutrieu, both of whom have set their hearts upon the Coupe Femina offered by the Parisian ladies' paper for the best flight by a lady flyer before the end of the year. On Sunday afternoon Mdlle. Marvingt rose on her Antoinette monoplane at Mourmelon, and keeping at a height of about 40 metres she circled round and round the ground for 53 mins., thus easily beating the duration record which had been held up to then by Mme. de la Roche. The cold was intense, but the intrepid lady was well protected by furs, and although the gusty wind was a little troublesome at times the monoplane kept on its course very regularly, the turns being taken very wide, which accounts for the fact that the distance completed was only recorded as 35 kiloms. Having obtained her pilot's certificate, Mdlle. Dutrieu has decided to try and better this record, and with this end in view has taken up her quarters at Etampes, where she is daily practising.



"Valkyrie II," the three-seater machine, during one of its long flights at the London Aerodrome on Sunday week, referred to in last week's FLIGHT.

When the engine starts, the draught from the propeller lifts the tail and the tip of the skids off the ground, and the machine balances on the two wheels; the third wheel in front only comes into action over rough ground, and is to prevent the going on to her nose; it answers admirably, as my practice ground is ridge and furrow, which on hunting

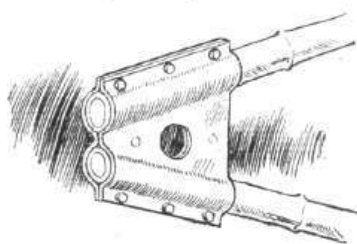


THE "MAYFLY."—Sketch showing the general arrangements of the detachable framework containing the power plant, &c.

principles I take at a slant. I have wasted much time in trying to run the machine on ball-bearing wheels and spindles, fitted with various springs, rubber bands, &c., none of which were satisfactory. The spindles were always bending or breaking, and the wheels are now rebuilt on to 7 in. hubs, which run on the axle. The axle is clipped to the skids, and the only spring is that afforded by the Palmer tyres.

The construction of the machine is more or less of the usual type, but the trailing edge and wing tips are more flexible. Originally steamed ribs were used, but were later discarded, as they did not keep their proper curve; the present ribs are cut out solid to the correct curve for the lower surface of the rib, and are given a flatter curve on the top, while they are bored out for the sake of lightness.

The double surface of fabric is laced on, a method which allows one to make any alterations without spoiling the fabric, and also it can be tightened up when it stretches.



The "Mayfly."—Detailed sketch of the outrigger pivot.

The machine was out for four months in the open, including the wettest August we have had for years, and the fabric is still waterproof, and except that it looks very dirty, is as good as when it was put on. The machine was tethered with three ropes fore and aft, from the main spars, and with her back to the south, and the west wind blowing along the span, she rode out several gales in safety.

I should not advise any amateurs to commence

building aeroplanes unless they have plenty of spare time and money, but there are nevertheless many people who like myself have the time, but lack the necessary £5. d.

As the result of my experience I am certain that the only way to build an aeroplane cheaply is to put the best or everything into it. Eyebolts, I think, should be hand turned with good solid heads, and, needless to add, wire-strainer eyes should be strong, and the threads properly cut. Castle nuts or patent locking washers of some kind should be used to prevent the nuts working loose with the vibration. I may say that I got all my wire, bolts, &c., from Messrs. A. V. Roe and Co., and was very well satisfied. The actual cost of a biplane is not very serious, as sufficient good wood (in the rough) costs about £3 or £4. With regard to the fabric, I now use unbleached calico, which is 6 ft. wide and costs 9d. a yard. The running gear will cost anything from £6 upwards. The engine, as everyone knows, is the most serious item. My own machine has a 20-h.p. engine, and the expenses have not yet amounted to £200, although the machine has been practically rebuilt, has had two propellers, several pairs of skids, three different tails, &c. It should be borne in mind, how-

ever, that this means doing all the work oneself, which is not altogether a disadvantage.

My first propeller was broken by some wires snapping from the vibration of the engine, and when the second propeller had had some narrow shaves from the same cause I tied all the wires back, so that when it snapped it could do no further harm; the break was always at the bend on the loop. Unless the wire is silver plated it

has to be continually cleaned to keep it free from rust, and as many wires are difficult to get at to clean it is a good plan to paint them. I use a good black enamel for all the clips. All the woodwork is copal varnished to protect it.

Bamboos should be carefully selected, the section of the cane being thick and round, and one generally has to sort through 20 or more canes to find one good one. The bamboos also get a coat of varnish, the ends have an air hole drilled, before the plug is driven in. A piece of cycle tube with one end flattened to make the necessary clip, is slipped over the bamboo, and riveted on. The other clips, &c., are made of different gauges of hoop iron or steel.

The tank and carburettor float are placed across the span of the machine, so that the fore and aft tilt does not interfere with the petrol supply when the tank is getting empty; tanks are made now with two cocks leading to the tube, which gets over this difficulty where the fuel is fed by gravity.

As to the actual flying of a machine, I am not a good enough pilot yet to give much advice, and my own machine is the only one I have been on. She rolls considerably until she gets up speed, and I imagine all machines do the same. As this is the natural action of the beast when one sits still, it is not necessary to try and balance the roll. If the balancing planes fail to right the machine quick enough, the vertical rudder can always be relied on to do so. One can learn a great deal by watching good pilots. Unfortunately there are none in Ireland at present, but I have been fortunate in seeing Farman, Paulhan, and Latham, all masters of the art.

Certainly it is the finest sport in the world, and well worth all the hard work, but there is still plenty of room for improvement both in the aeroplanes, engines, and propellers. I imagine one of the best types of aeroplane would be a tandem monoplane, in which the wings would be used for balancing and elevation.

To sum up the various points one has to settle before starting the construction of a machine:—

Firstly.—A place to fly in. Bad ground is waste of time and takes much longer to learn on.

Secondly.—The engine, if of low h.p., the aeroplane must be light and have large area to weight.

Thirdly.—The placing of engine and pilot, and whether main planes will carry all the weight, &c.

Fourthly.—To draw out every detail to scale, and if trying an original design, to make a good-sized model, and see if any new point in controls or design is going to work as it is intended.

Fifthly.—Design the machine so that it can be easily taken to pieces for transport, &c. (by turning the skids round, my machine will wheel along any road when the outriggers are taken off).

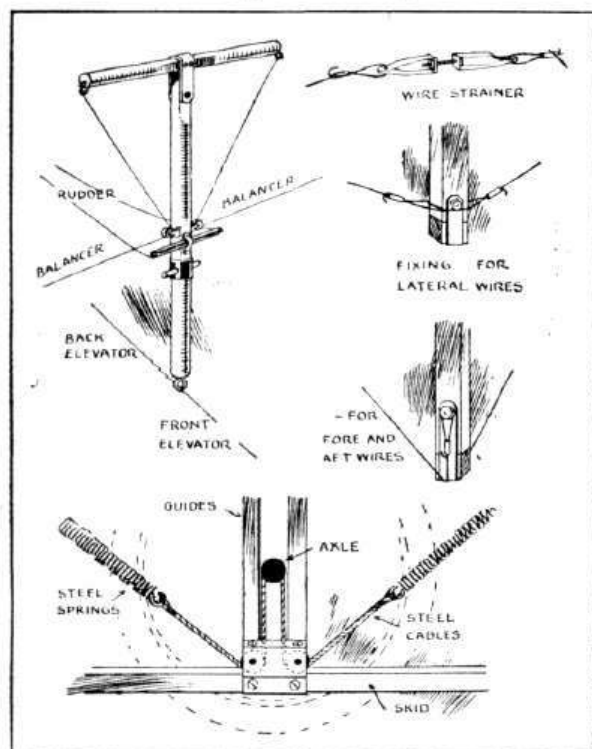
In conclusion, I should be glad to get orders either for gliders or full-sized machines, and provided I can use my own designs, I will guarantee that the machines will glide or fly, that the work and quality will be of the best, but the engine and propeller must be reasonably efficient, otherwise it is only waste of time.



The "Mayfly" in its original form as a glider, soaring in a 12-m.p.h. breeze.

pair of grips. Total cost, about 13d. As there are some four dozen wire strainers in the machine, this means a considerable saving for the cheapest articles that can be bought are about 6d. each.

Figs. 3 and 4 show the strut fixing, each strut being held to the spar by a clip of 1-in 22 gauge strip steel. The bolt holding this serves also to hold the straining wires in place, each wire going right round the strut and clip under the bolt, and the fore and aft



wires going round the head of the bolt and under the spar where it is protected by the clip. A small bracket of the same steel screwed on to the spar, stops all lateral movement.

The wheels, Fig. 5, are simply bicycle wheels both on one axle, the ends of the axle running between two guides. A clip over the axle end holds a steel cable, which, passing over two pulleys at the foot, is attached at each end to a pair of steel tension springs. Each spring is capable of holding 56 lbs., with a stretch of 10 inches, so the four of them at that length support 2 cwt. The skids do not touch the ground until the springs have stretched 11 inches. The price of these springs is 15. each; the price of rubber ones is 7s. each.

The dimensions of the machine are: span 27 ft., front to back 30 ft., chord 5 ft., camber 2 in., weight about 130 lbs. The whole machine can be lifted from any of its extremities and the planes have been tested by standing a 12-stone club member on each end of the wing.

The second photo shows the Society's gliding hill with the trolley half way up the cables. When the biplane has been tested for balance, lifting power, speed, &c., it is proposed to start it off by placing it on the trolley. This is then pulled up to the top of the mast, and the pilot by snicking the rope lets go. The whole business glides down the cables with accelerating speed. The sag in the cables allows the machine to keep at a negative angle of incidence for the first part of the journey. At about half way the speed is estimated to be 35 m.h.p., and the angle of incidence becomes positive. The pilot may then raise his elevator, in which he is assisted by the slope of the cables, and the machine answering, lifts off the trolley and glides to earth from a height of about ten feet. The trolley swoops down the rest of the cables and is stopped by the spring board and bridle arrangement at the bottom. This idea is intended to take the place of a sloping field which is so difficult to find near London, and the structure being simple and very strong can be put up anywhere, so that gliding may be practised on any ground where there is room for a run.

The photo also shows the Society's aeroplane shed in the background. The shed is big enough to house both the biplane and the monoplane now almost completed, and it was built entirely by the members. The biplane is shown just being taken inside.

A Model Club for Willesden.

A NUMBER of persons interested in flying matters having suggested the formation of a club in Willesden, Mr. Claude Dudgeon of 108, Church Road, Willesden, is taking the initiative, and anyone who wishes to have further particulars of the proposed club is asked to communicate with him, when steps will be taken for calling a meeting.

Conisborough and District Model Ae. Soc. (18, CHURCH ST.).

MEMBERS are reminded of the entertainment which will be given in the Church Hall, Conisborough, on Thursday next. The programme will consist of a musical and dramatic entertainment, concluding with a lecture on aviation by the Secretary, illustrated by a magic lantern. The tickets are 6d. and 1s. each, and the proceeds will be devoted to the funds of the Society.

Clapham Aero Club.

THE first competition of the above club was held on Saturday, January 28th, and passed off very successfully. The prize was offered for the best all round model. To decide this, a number of marks were given for each event, i.e., stability, control, altitude, &c. The winner was Mr. W. E. Thorpe, with his "Type No. 6 Albatroplane." This model is a really beautiful flyer, its stability, both laterally and longitudinally, being practically perfect.

Competitions are for our members only, and professionals are not admitted as members of this club.

The Secretary will be pleased to receive catalogues, &c., from the various accessory dealers, &c.

Manchester Aero Club (22, BOOTH STREET).

ON Friday, January 20th, a lecture on the "Conquest of the Air" was delivered by Mr. A. E. Berriman before the members of the club, and a considerable attendance of the general public, at the Municipal School of Technology. The meeting was to have been presided over by the Lord Mayor, but ill-health prevented his presence, and the Principal of the School, Mr. J. H. Reynolds, consented to take the chair.

Mr. Berriman divided his lecture into two principal sections, one dealing with the work of pioneers, the other with the technology of modern flight. In the former he traced, as briefly as possible, the conquest of the air from the earliest periods of concrete thought on aviation, showing by means of a variety of illustrations the different ideas of such pioneers as Da Vinci, Lana, Cayley, Montgolfier and others. Particularly interesting were his remarks relating to the discovery of the hot air balloon and the subsequent substitution of hydrogen for Mr. Montgolfier's gas.

Another suggestive reference was that made when discussing the subject wherein Mr. Berriman remarked on what might have been the present state of the art of flight had the present race been practised in gliding from childhood and by custom throughout preceding generations. Gliding, as the lecturer pointed out, might have been introduced years before Lilienthal invented it and it might have come to be looked upon as a not less unnatural art than swimming.

One phase of gliding flight was illustrated by the use of a variety of paper models of all kinds and shapes, and the construction of such instructive toys to the rising generation was recommended. He also put forward a suggestion that the encouragement of gliding might be included among the activities of the Manchester Aero Club when they acquire the new aerodrome that they hope to possess.

The concluding part of the lecture was devoted to stability, and a demonstration was given of certain phenomena associated with the action of a gyroscope.

Sheffield & District Ae.C. (22, MOUNT PLEASANT RD., SHARROW

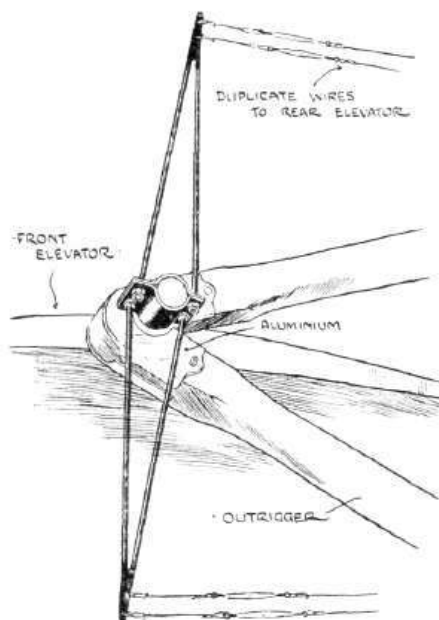
THE club will hold a special general meeting on the evening of Monday next, 6th inst., at 8.15 sharp, at the Wentworth Cafe, Penstone Street, City. Important business will be reported by the Committee, and a discussion will take place. Every member is requested to attend this meeting without fail. The secretary also has a quantity of literature awaiting disposal among the club members.

Sheffield Model Aero Club (35, PENRHYN ROAD).

A MEETING of the above club will be held at Staniland's Restaurant, West Street (opposite Carver Street), on Wednesday, February 3th, at 8 p.m. All those interested and wishing to become members should attend as there is some very important business to discuss. Messrs. Blake Bros., West Street, will be pleased at any time to give further particulars to interested enthusiasts and also to receive all contributions. The club will be pleased to receive show cards and catalogues.

connected with the rear elevator, which forms an extension of the tail. One of the accompanying sketches shows an interesting constructional detail in connection with the front elevator, which is rocked on its trunnions by a light steel lever, coupled up at each extremity to the control lever by wires in duplicate.

The other sketches also show several interesting constructional features of this machine, notably the method of supporting the extensions to the upper main plane, which form the characteristic feature of the military model. These extension planes are braced by diagonal tubular steel struts which are anchored to the lower main planes by attachment to the sockets of the vertical struts. The steel tube is capable of taking tension and compression stresses, but a safety tension wire has also been introduced, on the principle of duplicating such members, which is characteristic of the design of this machine. It will be noticed that all the control wires, for instance, are in duplicate. Another little detail about the wires on this machine which is worth observing is that those in the vicinity of the propeller are bound with whipcord, so that should they break they will be less likely to fly about and get caught in the propeller. Two other interesting constructional details are shown in the illustration that includes a sketch of the whipcord winding round the wire. One is the extra strong end rib employed in the construction of the framework of the main planes, the other is the very neat hinge by which the rudder is mounted on the tail strut. As may be seen from the photograph, four such hinges are employed for the support of each of the three rudder planes. Before leaving the consideration of this machine reference should be made to the fact that, as set out below, the British Government have ordered four to be delivered next month.



"Flight" Copyright.

Sketch illustrating the lever attached to the elevator on the Bristol military type biplane.

THE ARMY AND AERONAUTICS.

FOLLOWING upon the information given last week by Mr. Haldane, the statement in connection with the Army Estimates made by the Secretary for War in the House of Commons on Tuesday night is of a somewhat reassuring nature, that aviation in the future is to be considered of some account in the affairs of the nation.

Mr. Haldane said: "The total provision in the Army Estimates this year is £133,300. In addition to that there is the money spent on the Teddington Special Committee, under Lord Rayleigh, which comes under the Civil Service Estimates. We have added about £50,000 this year on the whole. Under the new Army Order for the Air Battalion, officers will be appointed for a period of four years, if found suitable after a probationary period of three to six months. Of the officers appointed two are under probation, four have obtained pilot's certificates, and six other officers on the active list are also certified pilots. The non-commissioned officers and men will be Royal Engineers.

"Besides the present dirigibles the 'Beta' and 'Gamma,' in the present financial year a new dirigible, the 'Delta,' has been under construction, and will be completed at the end of April. The design was prepared in the balloon factory after considerable experiment and research to fulfil tests for the Lebaudy airship ordered by the *Morning Post*. The materials are of British manufacture, and the capacity of the gasbag is 140,000 cubic feet, sufficient to carry five persons in addition to wireless equipment. I am told that the speed is 42 miles an hour. It is a very modern dirigible.

"Then I come to the French machines. The Lebaudy, the gift of the *Morning Post*, has been repaired, and is now ready for inflation and trial. The Clement-Bayard is about to receive a new gasbag, and we are providing shed accommodation for it. I think we have as many dirigibles as we can handle in the state of instruction of our corps.

"Now I come to aeroplanes. We have purchased five, which are available for practical instruction. Three are of the latest pattern, the Farman, Pashan, and Havilland. Besides that we have just completed the purchase of four additional biplanes from Sir George White, of Bristol, of the British and Colonial Aeroplane Co. They are to be delivered in April, and Sir George White has got an establishment of skilled pilots with whom we hope to work on Salisbury Plain. We shall probably make use not only of these biplanes, but of others which he has for enabling our people to practise observation and piloting. We have bought four, and that will give us nine aeroplanes altogether. We intend to buy more as soon as we get on, but it is no use having more than our people can work. We have a new full-sized shed at Farnborough and a portable shed. Then we have made three sheds for aeroplanes on Salisbury Plain besides a portable shed.

"As soon as the new dirigible 'Delta' has been tested another new

dirigible is to be put in hand embodying all improvements. Later on there will be still another put in hand, and we hope to build two new dirigibles as we gain experience in the next financial year.

"The balloon factory, really the dirigible factory, has been completely reorganised, and has got a very efficient civilian staff of experts under a gentleman well known in aeronautics. Considerable changes have been made and new machinery introduced, by which three times the output of hydrogen will be obtained. In solving the various problems in connection with the construction of these dirigibles and in designing and equipment of the sheds we have received very valuable assistance from the Advisory Committee under Lord Rayleigh. The Committee is not there to invent or design, but to solve problems, and I have a confident feeling that this highly-equipped Committee is ahead of the rest of the world in this field of scientific knowledge. At any rate it is producing material which is most valuable for us at this stage.

"In addition to the regular corps we are forming a technical reserve, and we are also proposing to form a Territorial section. There are a large number of men in the Territorial Force with extraordinary technical skill. We have got a place for them, and we shall be able to put a dirigible and an aeroplane at their disposal.

"There is a committee sitting to organise the technical reserve, and on it are Mr. Grahame-White, Mr. Roger Wallace, Dr. Glazebrook, and other well-known experts. I hope the pains we have taken to organise this will result in some very substantial fruit."

The Army Aeroplanes.

In a printed reply to a question in the House of Commons by Mr. Lonsdale, Mr. Haldane last week stated that the Army aeroplane which was wrecked has been repaired, and is now serviceable. Two of the Army machines are not up-to-date, and the improvement of one is under consideration. Both machines, however, are available for instruction. The provision of additional machines of modern type is in hand.

The Air Battalion.

In answer to a further question by Mr. Lonsdale, the Secretary for War pointed out that the restriction that men joining the Air Battalion must have a minimum of two years' service was made because it was clearly desirable that officers should not have to learn the rudiments of military training after joining the battalion. It was also clearly desirable that an officer joining should be young, not too heavy, and of rank junior to those under whose orders he would serve. Officers having special qualifications could be specially considered if they did not in all respects comply with the conditions.



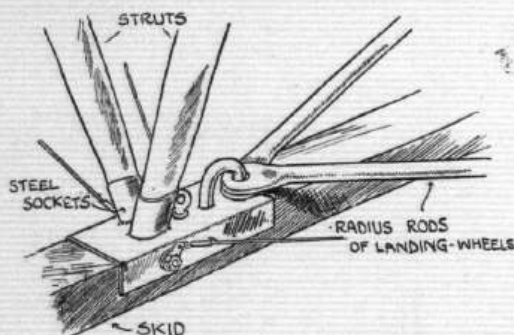
Rear view of the Grahame-White "New Baby" biplane.

"Flight" Copyright.

occupies a position midway in the gap. A very neat sloping frame supports the engine and the pilot's seat.

Among constructional details, the most interesting feature of this Grahame-White biplane is the use of steel fittings throughout, instead of the aluminium sockets and lugs that are commonly employed in aeroplane construction. Some examples of these steel fittings are illustrated in the accompanying sketches; and one that is of particular interest,

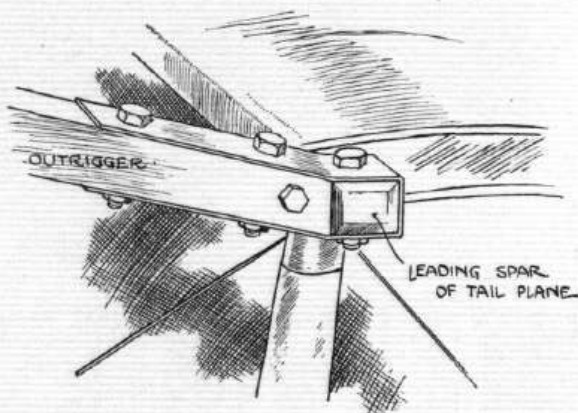
used is for the attachment of the leading spar of the tail plane to the outrigger, and this also is shown in one of the illustrations. The method of hinging the rudder plane to the tail strut is likewise shown in detail in a similar manner, as also



"Flight" Copyright.

Sketch illustrating one of the steel sockets which are such a characteristic feature of the Grahame-White "New Baby" biplane.

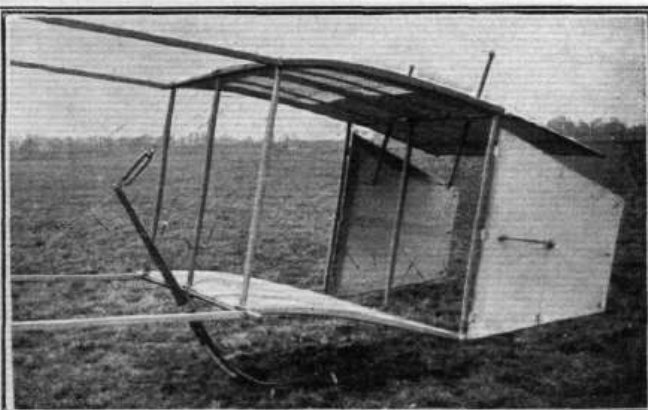
inasmuch as it is called upon to withstand very severe shocks, is that forming the sockets that carry the struts supporting the machine upon the skids. The sketch itself gives a very good idea of the neatness and lightness which is so characteristic of the actual appearance of these details on the machine itself. Another place in which a steel bracket



"Flight" Copyright.

Sketch illustrating the attachment of the tail to the outrigger by means of steel sockets on the Grahame-White "New Baby" biplane.

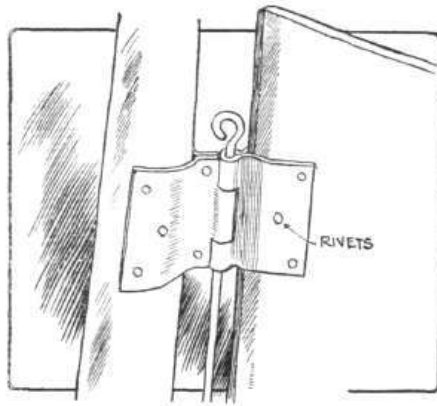
is the safety wiring by means of which the guy-wires in the vicinity of the propeller are prevented from fouling the propeller blades should one of them accidentally break. Experience has taught that some precaution of this sort is eminently desirable, not because breakages are frequent but because the consequences of one are so very unpleasant



Views of the engine and the tail on the Grahame-White "New Baby" biplane.

"Flight" Copyright.

if the wire gets tangled up in the propeller. Moreover, the propeller is not the least expensive part of the machine, and there is also the engine to be considered. On one occasion on which we witnessed a rather indifferent

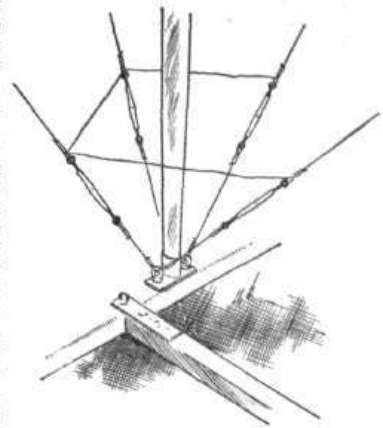


"Flight" Copyright.

Sketch illustrating the steel rudder hinge on the Grahame-White "New Baby" biplane.

although apparently of such a minor character. The system of control on the Grahame-White model is the standard system, but the arrangement of the control-lever is uncommon and

interesting. The lever is duplicated so that one lever is fitted on the left and another on the right of the pilot's seat. These levers are coupled together by a cross-bar, which can be hinged out of the way whilst the pilot is mounting to his seat. In flight the pilot has the cross-bar immediately in front of him, and can thus use either or both hands in the control; the movements themselves, however, are of course of the usual kind, and the cross-bar, being pivoted at both ends, interferes no more with the side-ways balancing movement than it does with the to-and-fro operation of the elevator. In connection with this detail, again, the use of steel sockets constitutes a prominent feature, and although the design has incorporated an additional member, nevertheless the characteristic lightness and neatness in appearance has been retained.



"Flight" Copyright.

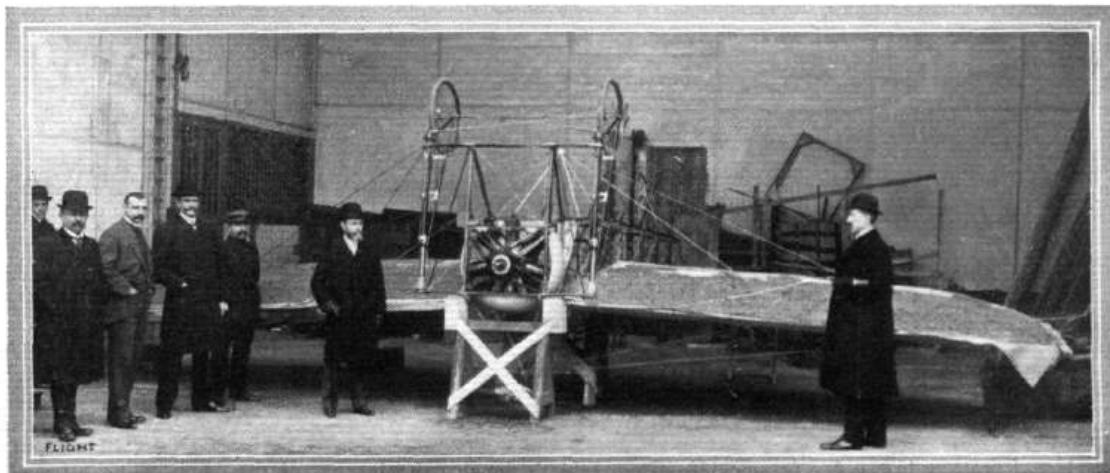
Sketch illustrating how some of the guy-wires in the vicinity of the propeller are anchored to one another for safety, in case either breaks, on the Grahame-White "New Baby" biplane.

OLYMPIA SHOW, 1911.

LIST OF AEROPLANE AND AERO ACCESSORY EXHIBITORS.

The figures after the names denote the Stand No.

A.A. and M.U., 9	Burroughes, Wellcome & Co., 7	Humber, Ltd., 44	Polysulphur Co., Ltd., 72
Aerial Engineering Works, 3	Car & General Insurance Corp., 27	Imperial Motor Ind., Ltd., 15	Renault Frères, 39
Aeronautical Society of G.B., 21	Clarke, T. W. K., & Co., 17	Isaacson Radial Engine Co., 22	Ripault, Leo, & Co., 36
Aeronautical Synd., Ltd., 69	Cole, W., & Co., 74	Knight, A., & Co., 33	Roe, A. V., & Co., 29
"Aeronautics," 16	Ding, Sayers & Co., 6	Lamplough & Sons, 28	Royal Aero Club, 82 to 86
Aeroplane Supply Co., 2, 77	Ducrocq, Maurice, 80	Leo Ripault & Co., 36	Rubery Owen & Co., 40
All-British Engine Co., 10	Dunlop Rubber Co., 56	Mallinson & Son, 4	Sanders Biplane, 75
Allen Knight & Co., Ltd., 33	Dunne Aeroplane, 81	McLean, McLean & Co., 13	Simms Magneto Co., Ltd., 38
Almagam, 37	FLIGHT, 1	Melhuish, Richard, 41	Smith, S., & Son, 98
Basset-Lowke & Co., 5	General Aviation Contract Co., 19	Motor Boats, 48 to 64	Spencer & Son, 25
Blackburn Aeroplane Co., 45	Goodchild, G. W., 32	Motor Radiator Mfg. Co., 8	Spiral Tube & Components Ltd., 30
Blair-Atholl Aeroplane Synd., Ltd., 81	Grahame-White, C., & Co., Ltd., 14, 42	Mossley Hill Motor Works, 12	Stern, Sonneborn & Co., 35
Blériot, L., 43	Green's Motor Pats. Synd., Ltd., 31	Mulliner, Ltd., Long Acre, 46	Trier & Martin, 70
Bowley and Sons, 88	Handley Page, Ltd., 73	New Engine Co., Ltd., 65	Valkyrie Aeroplane, 69
Breguet, L., 76	Harris and Samuels, 34	New Motor & General Rubber Co., 37	Warwick Wright, Ltd., 68
British & Colonial Aeroplane Co., 47	Hayes, F., 11	North British Rubber Co., Ltd., 26	Weston, Hurlin & Co., 24
Brown Brothers, Ltd., 18	Howard Wright, 68	Piggott Brothers, 71	Wolsley Tool & Motor Co., 51
	Hughes, Henry, & Co.		



TESTING THE WINGS OF A BLÉRIOT MONOPLANE WITH SAND LOAD.—Standing on the left are Mr. Grahame-White, M. Blériot, Col. Bouttiaux, General Roques, &c.

H.P. propeller, direct-coupled to engine. Weight without pilot, 420 lbs.

Control.—Upright steering wheel on top of lever. Movement left and right warps wings. Movement backwards and forwards elevates or depresses. Rotation of wheel steers.

Remarks.—Shock-absorbing device consists of spring axle with central skid. For transport purposes the wings fit on side of body, tail fits inside the body. Price, £450. Tuition free to purchasers.

Humber, Ltd. (STAND 44).—One Humber biplane. This machine is not yet complete, but it has a special interest in that it is exactly similar to the Humber biplane that has been used for the first aerial post at Allahabad, India.

Mulliner Monoplane (STAND 46).—It will be remembered that Messrs. Mulliner, of London and Northampton, exhibited a monoplane at the last Olympia Aero Show that attracted considerable attention from visitors by reason of its light appearance and the good workmanship bestowed upon it. This year they are also exhibiting, and again it is a monoplane, but this machine differs greatly from that of last year, although we have no doubt that this difference will not be found in the workmanship.

The machine, which is known as the "Kny-plane," is a monoplane having a span of 39 ft. and an overall length of 36 ft. The weight of the machine complete with aviator and in flying order is 1,250 lbs., with an actual lifting surface of 300 sq. ft. The wings are controllable, and by means of a simple steering device, similar to that used in motor car construction, it becomes possible to increase or decrease the angle of incidence and the camber synchronously or independently. The body is torpedo shaped. The power-plant, which is entirely enclosed, consists of a 60-80-h.p. E.N.V. engine with dual ignition, and drives, through a fly-wheel and a specially-designed clutch, a Normale tractor-screw. The chassis embodies some unique features, one of which, it is claimed, enables the machine to start on any railway if the ground is in any way unsuitable. This should be worthy of consideration for military requirements. It also claimed that the body of the machine always remains horizontal in flight.

Piggott Bros. and Co., Ltd. (STAND 71).—Monoplane of unusual design and so constructed that the pilot, passengers, engine, controls, &c., are all enclosed within a streamline form.

Main dimensions:—Length, 24 ft. 6 ins. Span, 30 ft. 6 ins. Net weight, 850 lbs. Maximum chord of wings, 6 ft. 6 ins. Aspect ratio, 4:5. Fitted with 80-h.p. engine.

Control.—The controls are all from a central pillar and double wires are largely used in order to minimise any risk of accident.

Remarks.—The tractor-screw is placed in front and the stream line body is carried beyond the front of the propeller, thus cutting out the boss and the non-effective portions of the blades. The wheels and landing chassis are of the Farman type, with shock-absorbers and radius-rods. Long skates are provided carried high up in front, the wheels being set well forward of the centre of gravity.

Trier and Martin, Ltd. (STAND 70).—Martin-Handasyde monoplane, two-seater.

Dimensions:—Span, 37 ft. Chord, 6 ft. (average). Area, 240 sq. ft. Length 33 ft. Weight, unloaded, 800 lbs.

Remarks.—Fitted with 50-h.p. Gnome engine. M.H. fabric, treated with M.H. wing proofing. The body is of

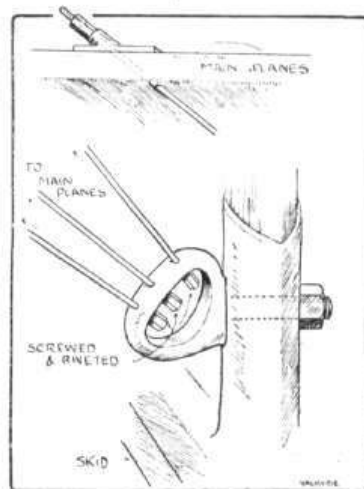
special triangular section. Seats placed in tandem. [Panelled in three-ply. The general design of the machine follows that of the single-seater now in commission at Brooklands.

Alfred Turner and Co., Ltd. (STAND 76).—Breguet biplane, three-seater "Cruiser" type. The frame of this machine is built almost entirely of steel. The wings are of the usual Breguet construction, namely, what is known as the "Supple" or "Flexible" type, and it is to this that it owes its automatic stability. The engine is a 60-h.p. Renault, running at 1,600 r.p.m., with a two-bladed wooden propeller running at half the speed. Immediately behind the engine is the assistant pilot's seat, with a supplementary control fitted. Behind this, somewhat raised, is the observer's seat, and a short distance back is the pilot's position.

There are only four steel struts between the two main wings, and the angle of incidence is very easily varied. There are no pedals, the whole of the machine being controlled by a wheel mounted on a pivoted lever. This operates the elevator and rudder and warps the upper planes. The tail is of the cruciform type, also mounted on a steel frame. The landing wheels are fitted with patent "Oleo-pneumatic" brake suspension, which gives a smooth and safe landing, even on comparatively rough ground. As on all other Breguet machines, the main planes can be folded. The total length is 8'400 m., the span of the planes 14'200 m., and when folded the width is 3'600 m. The weight of the whole machine is about 520 kilogs.; speed, with total load aboard, 85 kiloms. per hour; and the total useful weight-carrying, that is to say, passengers and fuel, is 300 kilogs. Its radius of action is about 500 kiloms.

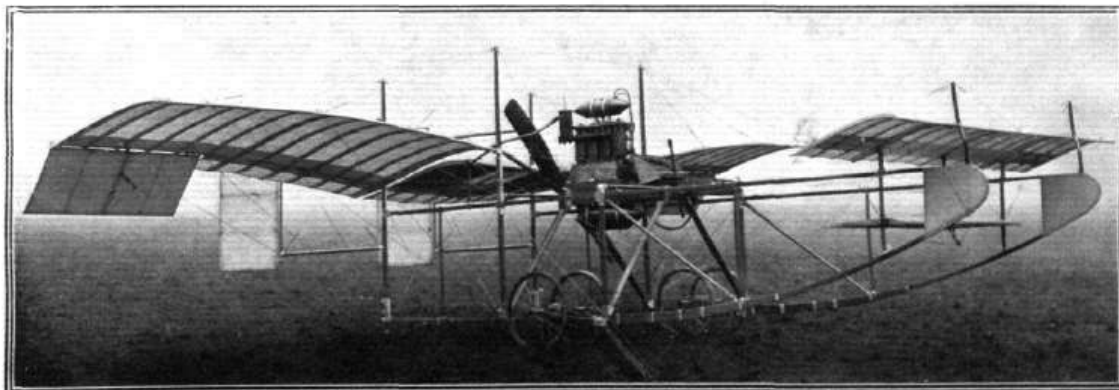
Valkyrie (THE AERONAUTICAL SYND., LTD.) (STAND 69).—The latest Valkyrie monoplanes

differ somewhat in appearance from their prototype in being lower in overall height. The general design and construction, however, remain much the same and they are still of the tail first type and of distinctly British design and construction. Among the interesting minor constructional features is the method of bracing by wire without bending the wire at the extremities.

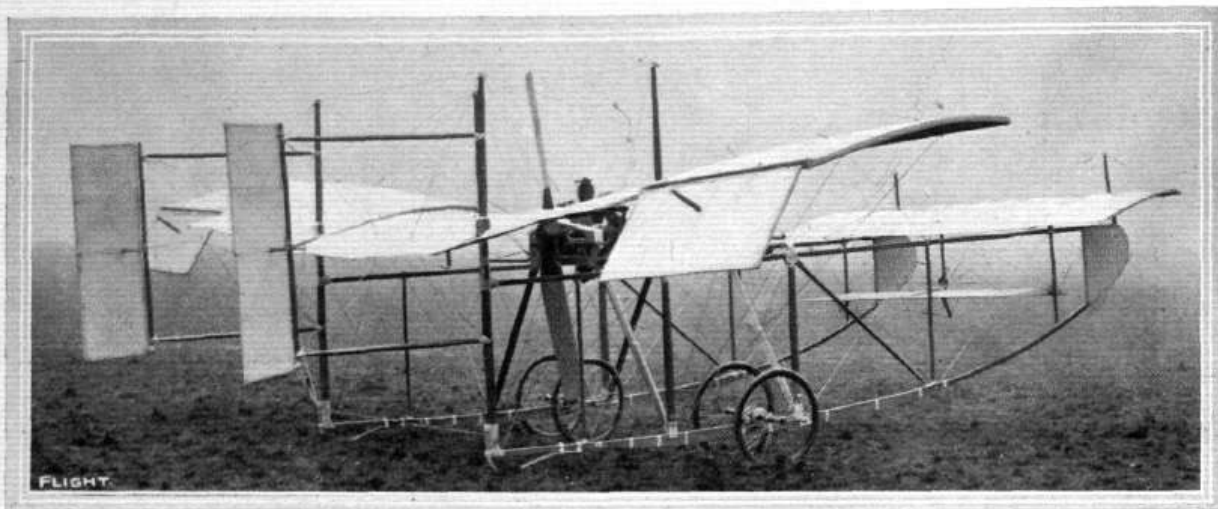


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An interesting constructional detail on the latest Valkyrie, showing how the main wing guy-wires are anchored to a solid steel forging that can be detached as one piece from the principal strut. It is a feature of the Valkyrie design that none of the guy-wires are bent at the point of fastening.



The latest Valkyrie monoplane, with Green engine, at Olympia.

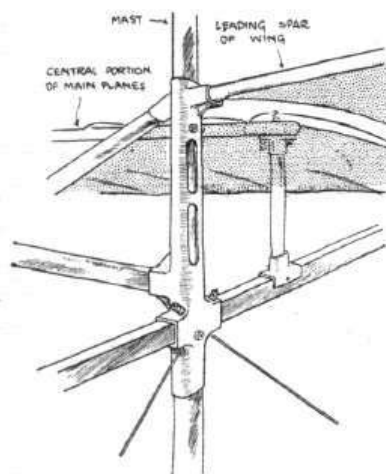


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View of the Valkyrie monoplane racer, showing the hinged balancing-planes and the outriggered rudders.

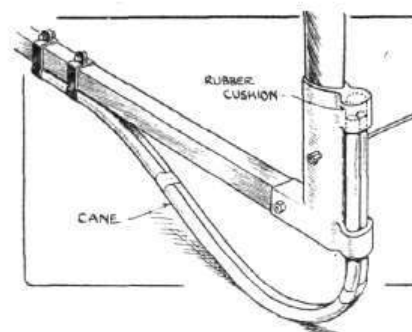
and general balance of the machine. Beneath this leading plane and a little to the rear thereof is the movable elevator, which on this machine is characterised by a slightly upturned trailing edge. Balancing planes are let into the trailing extremities of the wings, and rudder planes are mounted on two outriggers that form extensions to the under-carriage, but are raised to the level of the main plane.

A characteristic feature in the construction of the Valkyrie monoplane is the use of guy wires of large section, which are screwed at their extremities and fastened and adjusted by nuts so as to avoid bending the wires for this purpose. On the present machine a Gnome rotary engine is fitted, which contributes considerably to the neatness of the design, because constructional considerations make it necessary to have the engine in the centre, and on a one man machine the pilot has to sit in front of the engine. Any saving of length is, therefore, an advantage, inasmuch as it facilitates the concentration of the principal masses about the actual centre of gravity. The control of the machine may be described as arranged on the Farman



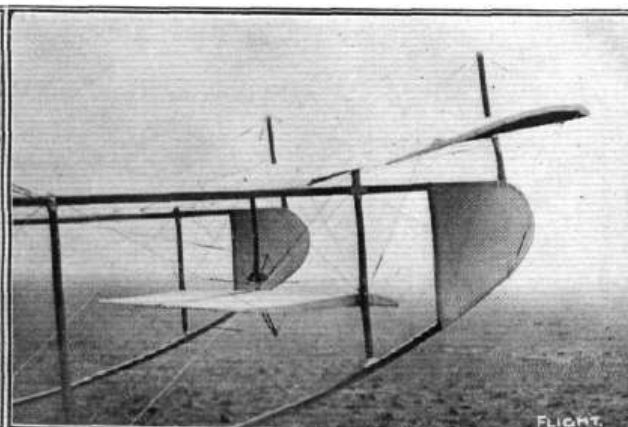
Sketch of the aluminium sockets as used for the attachment of the wings.

principle, for the elevator and balancers are operated by the universal motion of a pivoted upright lever conveniently situated for the pilot's right hand, and the rudder planes are controlled by a pivoted foot-rest. A minor feature that affects the external



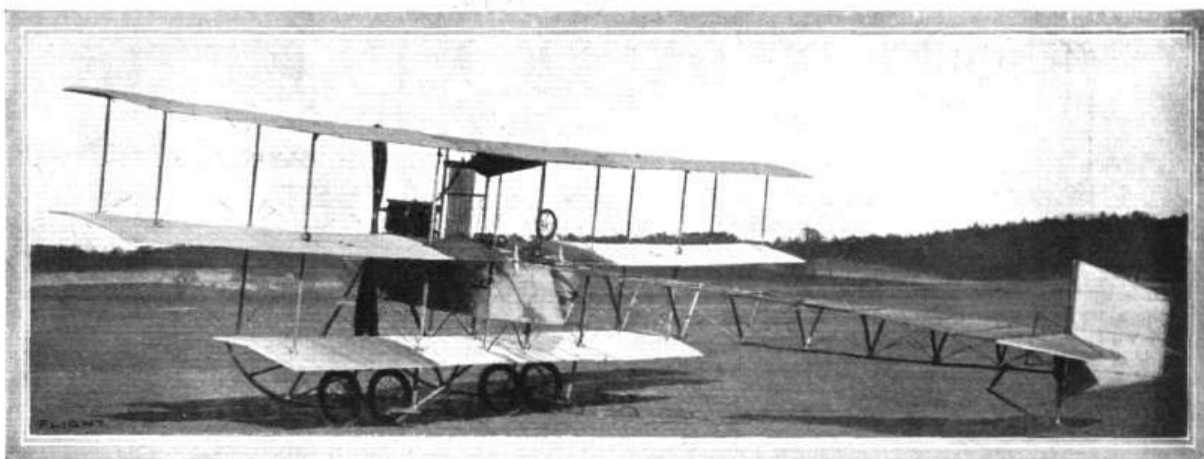
Sketch illustrating the cane fender under the rear end of the skid of the Valkyrie racer.

appearance of the machine is a very neat saddle tank surrounding the engine. This tank is of horseshoe shape, and contains compartments for petrol and oil. It is mounted rigidly on the engine frame.



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Detail views of the Valkyrie monoplane racer, showing (on the left) the pilot's seat and mounting of the Gnome engine. The right-hand view shows the two small "prows" under the fixed front plane.



General view of the Roe triplane from behind.

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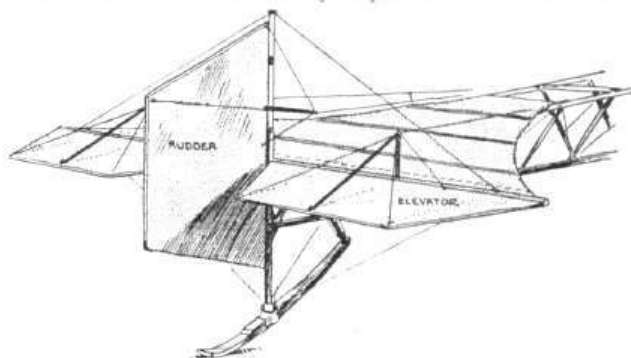
will be observed that in the latest machine the lowest of the three planes has less span than the others, and it is only the latter that are influenced by the warping movement.

The body of the machine is an open triangular section girder made of ash and trussed with wires. It is situated just beneath the level of the middle plane, and its fore part is cased in from the engine to the pilot's seat. The engine itself, as may be observed from the illustrations, is mounted high up in the bows, and the direct driven propeller is some little distance in front of the leading edge of the planes. A simple undercarriage, supported on the Farman principle by four wheels mounted independently in pairs on the two skids, serves to support the entire weight of the front part of the machine, while the tail is kept clear of the ground by a rocking skid anchored to the frame by a piece of elastic.

A minor detail of construction indicative of thoughtfulness in design can be seen in the sketch of the mounting of this tail skid, which shows how it has been provided with a special rocker-shaped surface where it takes abutment against the base of the rudder post. Some other interesting constructional details are also illustrated in the sketches, which show the method of fitting the end struts of the main planes loosely into their sockets, and taking the tension by auxiliary tie-wires in order to facilitate the warping of the wings. Another detail illustrated by a sketch is the method of anchoring the diagonal tie-wires to thin steel plates that are clipped against the spars of the body by the principal aluminium brackets.

A characteristic feature of the Roe machine, considered as a triplane, is, of course, the relatively high aspect ratio of its planes. Owing to the fact that it has three planes, the same equivalent surface is available from a given span with a considerably reduced chord, and consequently the ratio of span to chord in each plane, which is termed the aspect ratio, has a higher value than is ordinarily to be found in biplane construction. In the machine illustrated a span

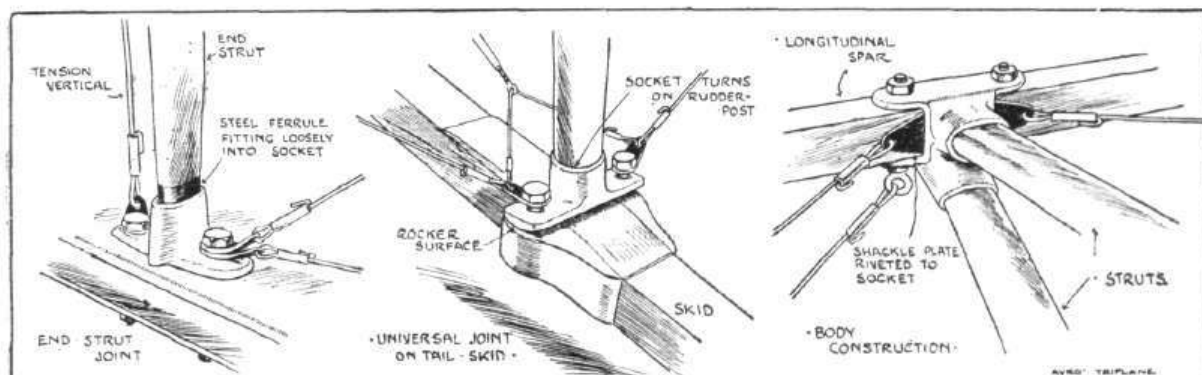
of 32 ft. is accompanied by a chord of 3 ft. 6 ins., which corresponds to an aspect ratio of over nine. In most biplanes the same factor seldom exceeds six, and in monoplanes it is still less likely to be as high. The advantage of a high aspect ratio is fundamental in character, and has been substantiated in such laboratory experiments as have been



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Sketch of the tail on the Roe triplane.

conducted. It is concerned with the leakage of air over the extremities, which leakage bears a smaller percentage of the total volume of air dealt with as the aspect ratio increases for a given area of plane. Fundamentally, therefore, the triplane is potentially a more efficient combination than the biplane—provided always that other practical considerations do not interfere with the realisation of this feature—and it is at least to Mr. Roe's credit that he has flown with less power than anyone.



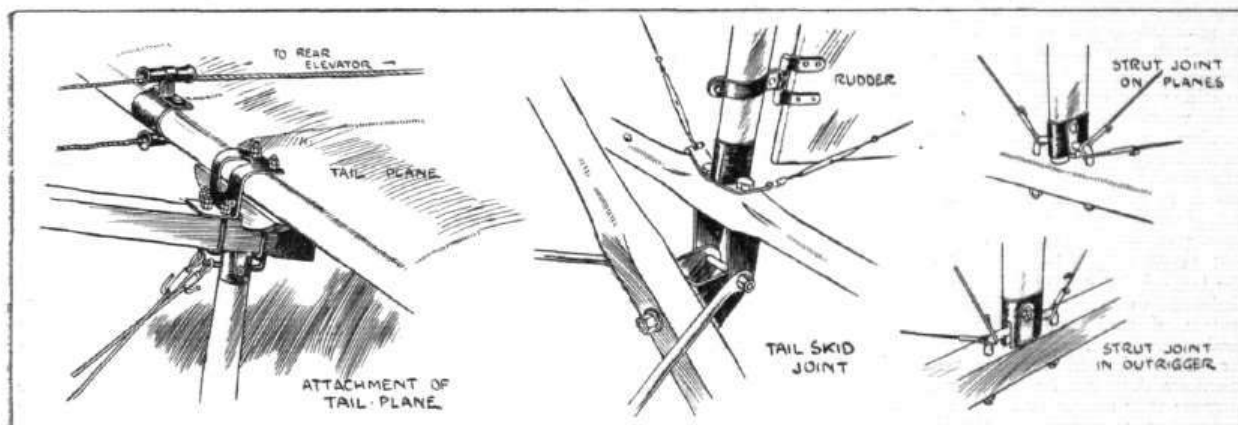
Sketches illustrating some constructional details on the Roe triplane.

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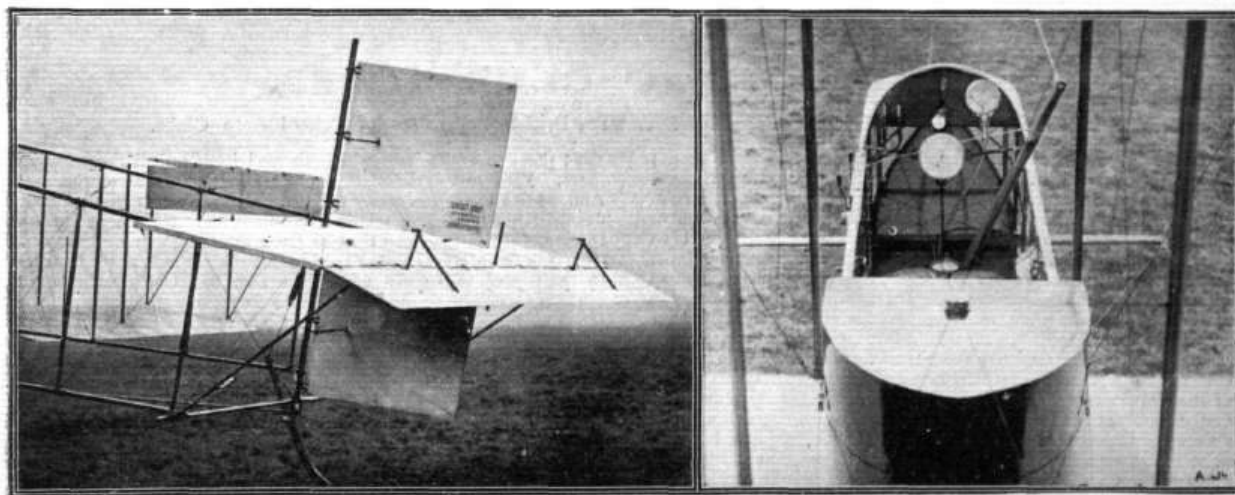
Side view of the latest Short biplane, showing the enclosed car for the pilot and passenger. The horizontal rib in the extremities of the main planes, which are cambered elsewhere, is a curious feature of interest.

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Sketches illustrating some of the joints on the latest Short biplane.

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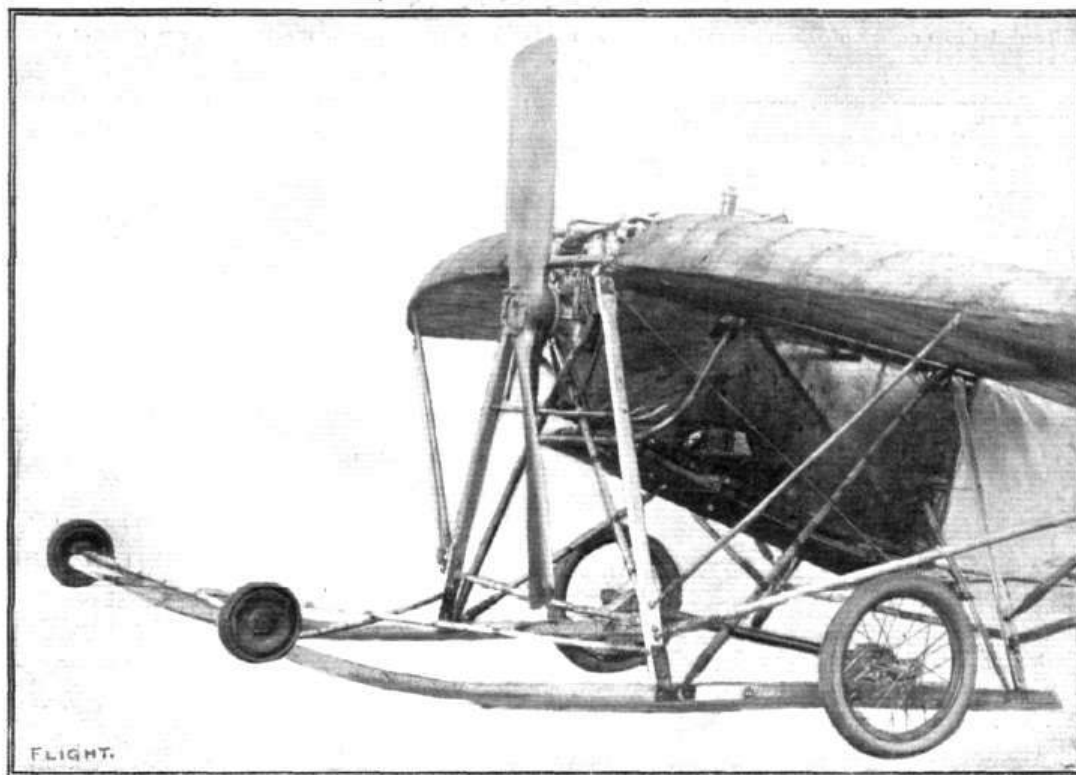


Views of the tail and the pilot's car on the latest Short biplane. In the view of the tail one of the balancers on the extremities of the upper main planes appears rather like a vertical keel in front of the rudder, due to an absence of proper perspective in the photograph.

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of both upper and lower main planes. The former struts join the points of intersection of the diagonal tie wires with the rear spar of the lower main plane, and their purpose is

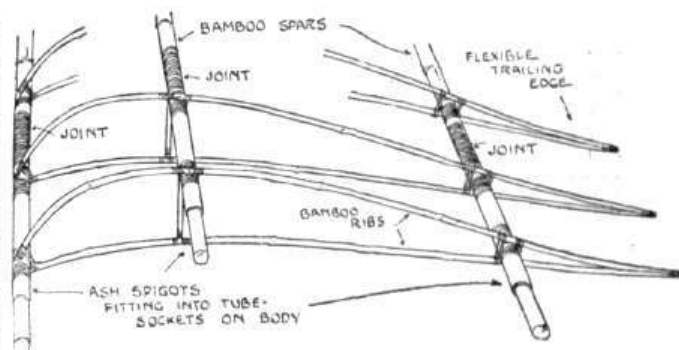
to add stiffness by resisting the bending that is apt to take place at this point when the machine lands. The nature of the stress induced is illustrated by one of the accompanying



View of the front portion of the Weiss monoplane, showing the carriage.

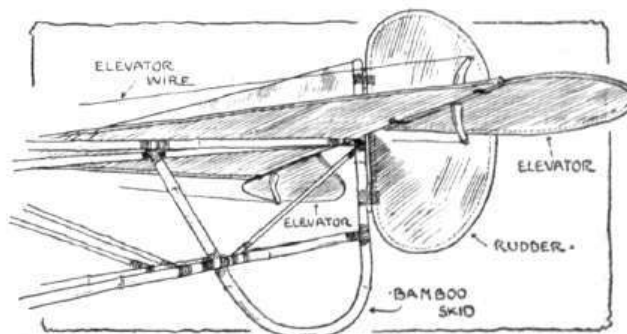
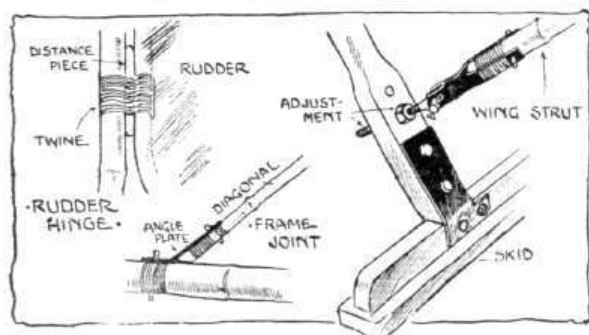
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the balance of the machine as a whole. Equilibrium is the coincidence of the centre of pressure with the vertical axis through the centre of gravity; natural stability is the quality of maintaining equilibrium under disturbing influences, and it is the function of the peculiar shape of the wings on the Weiss monoplane to confer natural stability in flight. These wings and the balance of the machine are the result of the innumerable aforementioned experiments. The wings themselves are characterised by a marked change of angle and attitude from shoulder to tip. Near the body they have a very steep camber and an attitude represented by a positive angle of incidence of about 5° . At the extremities they are flexible and flat and their tips are upturned in such a way that the attitude hereabouts presents a distinct negative angle of incidence. In addition, the entering edge of each wing slopes back from the shoulder to the tip, where it joins the trailing edge. Only 4 ft. behind the trailing edge is the commencement of the tail, which is a squat arrangement of two triangular planes, horizontal and vertical, with hinged extensions forming an elevator and rudder. These latter members are operated by a lever and pedal-bar respectively;



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Sketch illustrating the wing framework on the Weiss monoplane.

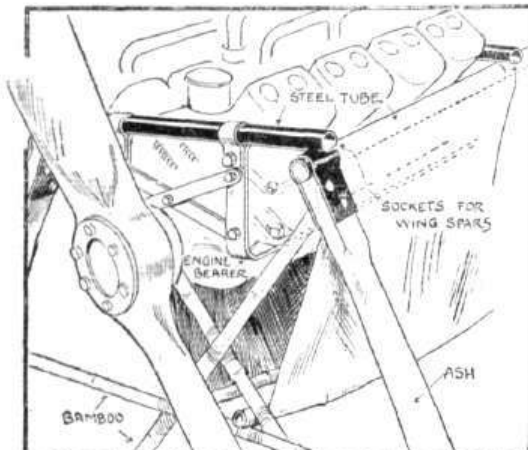


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Sketches illustrating some lashed joints used in the construction of the Weiss monoplane. The lashing is coated with tyre cement.

they are intended to be organs of direction and not organs of control in the sense of balance, and it is, of course, a feature of the Weiss monoplane that there is no provision for mechanically correcting lateral disturbance by the use of wing-warping or balancing planes.

Constructionally, the Weiss monoplane is as interesting as it is in design, for almost the entire machine is built of

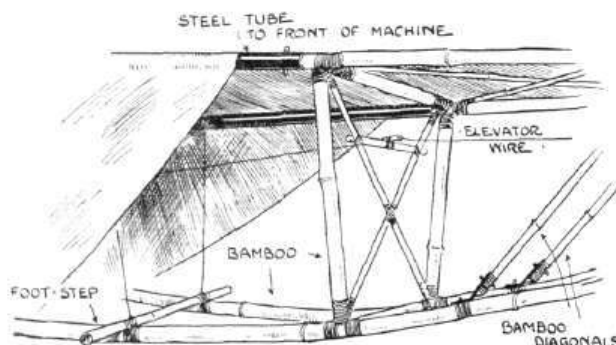


Sketch illustrating how the engine is carried in the Weiss monoplane.

bamboo and the joints are for the most part only lashed with twine, although the bamboo diagonals, which are used as struts, have a steel angle-plate joint introduced into the lashing in a manner that is illustrated by one of the accompanying sketches. It will be observed in this detail illustration of the frame-joint that the diagonals are lashed and pegged to the angle-plate, which thus forms the actual connection between the two members. A modification of this system of construction may be observed in the sketch illustrating how the bamboo diagonals that truss the wing-spars to the under-carriage are attached by ferrule-plates, lashed and pegged in place and provided with a hinged adjustment bolt. The mounting of the rudder also affords an interesting example of lashing, and an ingenious detail that will be observed in this case is the introduction of a smooth distance-piece of wood between the two bamboo members. This distance-piece holds the two pieces of bamboo sufficiently far apart

so that the knots in the bamboo are clear of one another. As the rudder turns on this hinge it rolls over on the distance-piece and the lashing remains taut in all positions, because during the movement it merely unwinds off one member on to the other.

Not only the body, but also the spars of the wings are made of bamboo on this machine and the manner in which the of bamboo ribs are attached to the spars is illustrated in detail in one of the accompanying sketches. It will be observed that the wings have three spars in each and that the ribs are so deep in the centre that the lower rib member has to be specially struttled at this point in order to enable the



Sketch illustrating the body construction of the Weiss monoplane. Spars and diagonals are made of bamboo.

central main spar to afford it any support. The main spar themselves are attached to the body by ash spigots that are fastened into the bamboo and engage with the tubular steel transverse members that form the front of the body, and also serve as a support for the 8-cyl. E.N.V. engine with which this machine is equipped. The engine, as may also be observed from one of the accompanying sketches, is carried in a steel cradle slung from the same transverse steel tubes that support the wings. The body itself is mounted on an A type carriage, of which the principal members are constructed of ash; its diagonals, however, are made of bamboo. The skids of the under-carriage are suspended to a steel axle, supported on two wire wheels by elastic springs. Between the under-carriage and the engine, fastened to the bottom of the body, is the radiator, which may be seen in the photograph showing the front of the machine.

THE AEROPLANE IN MILITARY WARFARE.

By O. D. ATKINSON.

THE student of military history will perhaps remember Col. Hamley's comment on the campaign of 1706 in Germany, in "The Operations of War." To quote Col. Hamley:—

"It seems that for two armies to operate against a combined enemy by lines where, from distance or want of concert, they are independent of each other, is to confer on the enemy an advantage . . . which will compensate for considerable inferiority in numbers."

To state briefly the facts of the case: Jourdan and Moreau having been separated through carelessness and the nature of the roads, the Arch-Duke Charles seized the opportunity to interpose his army between them, thus cutting their intercommunications. He then detailed a smaller force to keep Moreau at bay, and attacking Jourdan himself with infinitely superior numbers, he drove him back to Kehl.

Moreau, through lack of communication with Jourdan, was unable to ascertain the exact circumstances of the case, and therefore advanced towards Vienna, thus widening the gap between the French armies, and giving the Arch-Duke an easy double victory. Had the communication between Moreau and Jourdan been better, the former would have turned instead of going on towards Vienna, and pursued the Arch-Duke, who would thus have been caught between two fires.

Now this is but one of one thousand similar cases in which campaigns have been lost by lack of efficient communication between the several parts of an army, and it is in this respect, as a means of

carrying dispatches, that the aeroplane is bound to make so radical a change in the principles of modern strategy.

I have no doubt that it was hard enough for the Arch-Duke to intercept the dispatches on land, but in the air, where there is a third direction in which the aeroplane can move, had Moreau possessed one, it would have been well-nigh impossible to do so.

Even if the intervening space were patrolled by the aeroplanes of the interposed army, it would only be a matter of a few extra hours for a machine belonging to part of the separated force to fly round in a large circle to its destination.

Even more wide than in strategy are the possibilities of the aeroplane in tactics. I do not propose to enter into a lengthy discussion here as to its value for scouting and for carrying staff officers, as this has already been proved in practice by the French at Grandvilliers. It is worth mention, however, though obvious, that its capabilities for scouting purposes in wooded countries are limited.

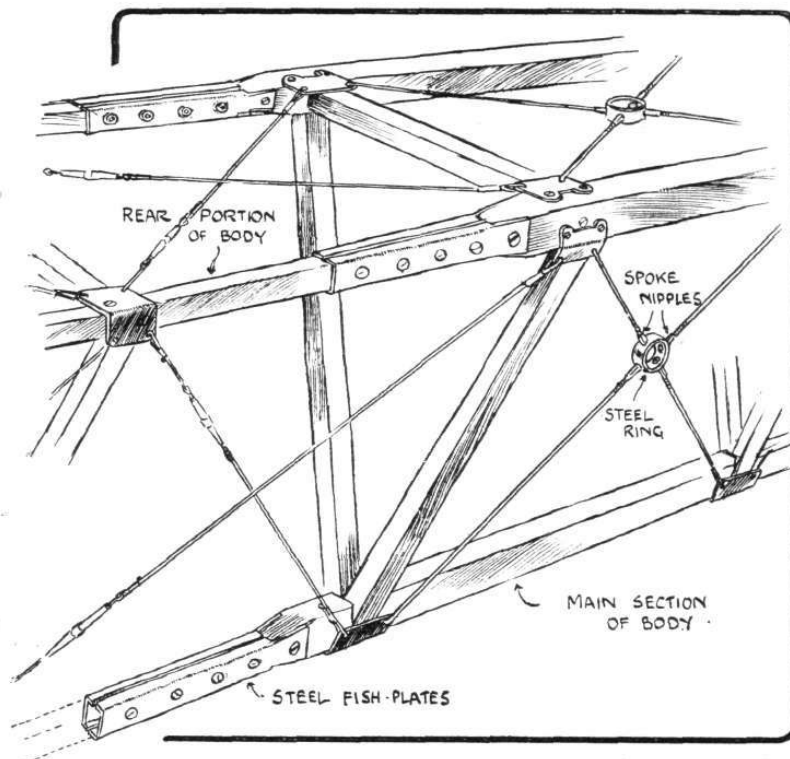
For dropping bombs, the method proposed by Capt. Piumatti and described in a recent number of FLIGHT, might be employed, but it seems to me that this throws an undue amount of calculation on the "bomb-dropper," considering the short time he has at his disposal, to be of much use over land.

For this reason, I have suggested the apparatus in the diagram, which in reality is merely a variation of the theodolite. It consists of a vertical tube through which the bomb can be dropped, and is attached to a half-quadrant. A telescope is hinged at the upper end and can move through the half-quadrant. An anemometer will be

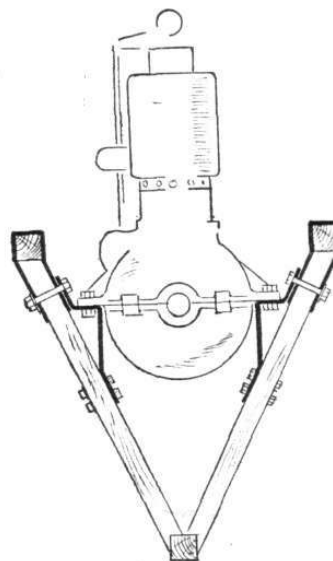
dihedral angle, are rather unusual in that they are not solid, but are built up of two lengths of American white wood placed one over the other and separated by a few inches. On the inner end of the leading spar an aluminium socket is fitted, which receives and is bolted to a rectangular lug of the same metal attached to the main girder. The rear spar

admit the triangular fore parts of the diamond-shaped elevating planes. The arrangement of these planes in this way is presumably intended to place the members in question more or less in equilibrium about their axes of support. It would be interesting, however, to know something more of the effect of an entering edge of this form and also of the effect of the orifice in the tail plane through which the air deflected by the fore part of the elevator necessarily has to flow.

The control system of the machine is, as may be observed from one of our sketches, commendably free from complication; a lever is pivoted on the lower member of the body im-



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Sketch illustrating the joint in the main frame on the Star monoplane, and also the system of wire bracing.

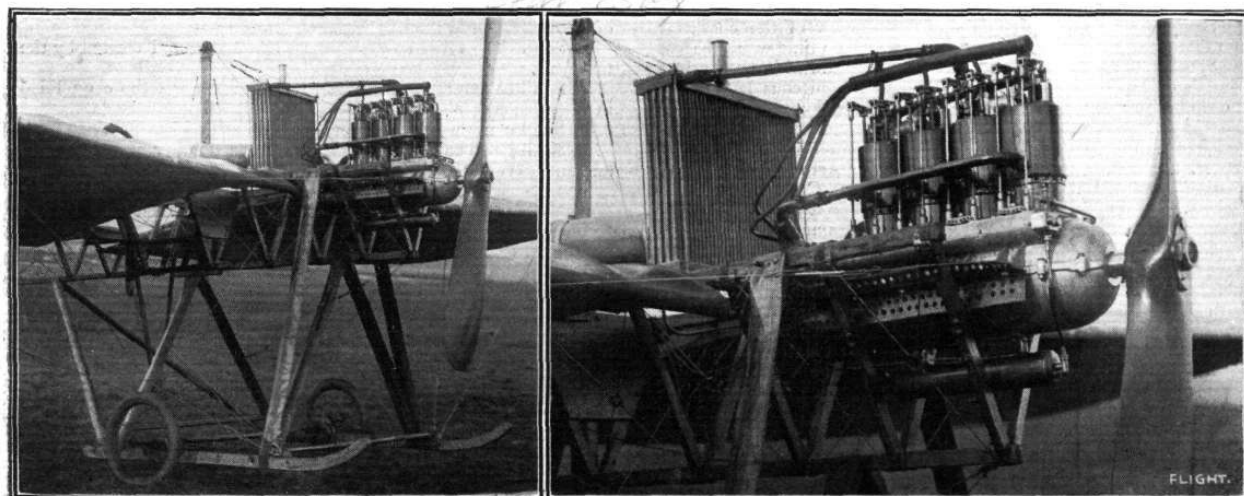


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Sketch illustrating the steel engine bearers on the Star monoplane.

is hinged to a strong steel channel, which being fixed at both ends to the body, incidentally contributes to its rigidity.

The main planes are double-surfaced and in plane form resemble those of the Blériot. Their span is 37 ft. and their maximum camber approximately 5 ins. The span of the tail is 7 ft. 4 ins. across the maximum dimension, and is of the flat non-lifting type. It will be noticed, on reference to the plan of the machine, that the tail plane is recessed to

mediately in front of the pilot's seat. At its upper end this lever carries a hand-wheel, by rotating which the wings may be warped through the agency of a small sprocket-wheel, chain, and suitably arranged wires. Moving the control-lever as a whole forwards or backwards operates the elevator. There is no sideways movement to this lever, the operation of the rudder being obtained by the control of a pivoted cross bar supporting the pilot's seat.

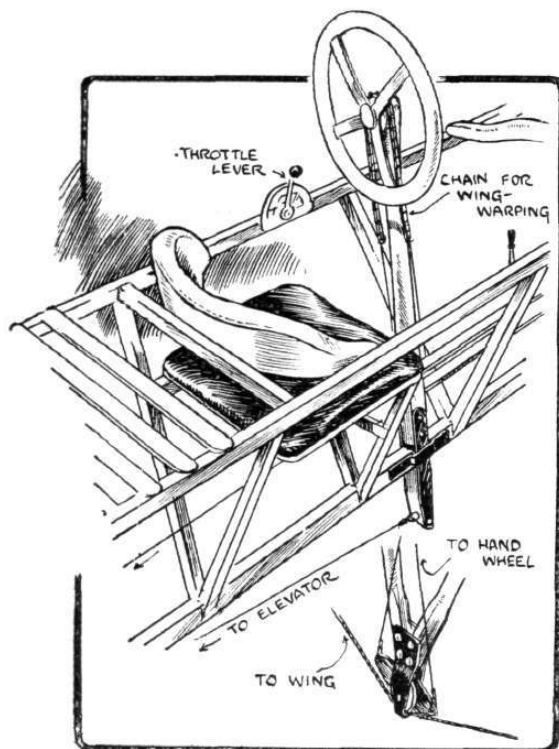


Views illustrating the engine and carriage of the Star monoplane.

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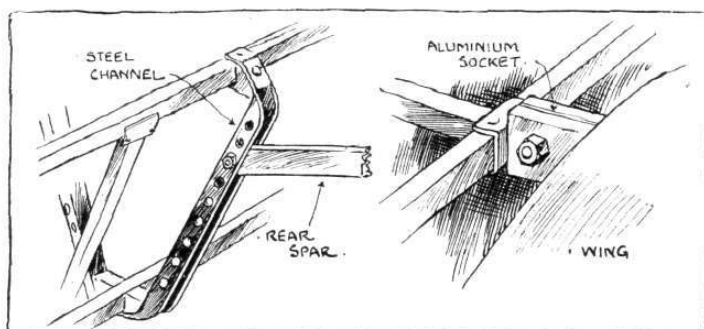
A 4-cyl. 40-h.p. Star engine, weighing 182 lbs., and driving a 6 ft. 8 in. Clarke propeller, constitutes the power plant. Pressed steel bearers of a special channel section support the engine and are bolted to the forward struts of the body. The consequent strain on these members, however, is con-

the A principle and is a very rigid construction. It carries a light axle, by means of which the machine is supported on two pneumatic-shod wheels. The ends of the skids of the under-carriage are laminated to give greater flexibility in the event of an awkward landing. The axle itself is attached



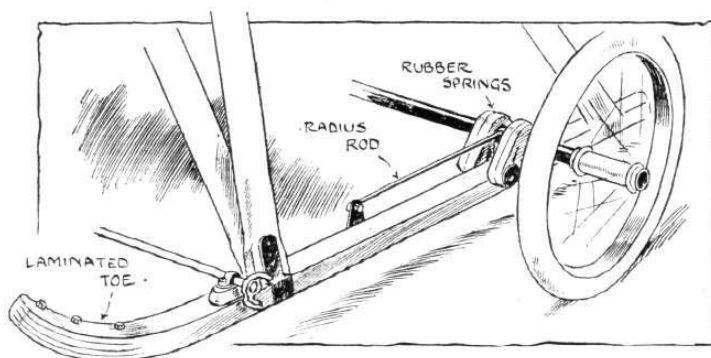
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Sketch illustrating the control on the Star monoplane.



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Sketches illustrating the wing attachment on the Star monoplane.



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Sketch illustrating one of the skids on the carriage of the Star monoplane.

siderably reduced by an ingeniously arranged series of small clips embracing the upper spars at the strut joints. Reference to an accompanying sketch will show how these clips really constitute a sling-mounting of considerable strength, but very small weight. The ash under-carriage is built up on

to the skids by rubber springs and light steel tubular radius-rods. At the base of the rudder-post a short length of flat steel spring is fitted to form a simple tail skid. It is pivoted so as to facilitate the tail movement when manœuvring the machine on the ground.

THE AERONAUTICAL SOCIETY—

A NEW ERA IN SIGHT.

At the end of our report of the recent meeting of the members of the Society, we ventured the opinion that in view of the character of the meeting and its indeterminate ending, no time would be lost in adjusting the technical difficulties of procedure which had arisen—and so it has proved to be. Replying to a courteous letter from the Committee of Inquiry, in which was enclosed for consideration the Committee's report and memorandum, and suggesting a small conference to discuss any differences of opinion arising out of the report, the members of the Council of the Aeronautical Society at once appointed three of their number, viz., Col. J. E. Capper, Col. J. D. Fullerton, and Major Baden-Powell, to meet three members of the Committee of Inquiry. At the same time the Council tendered their thanks to the Committee for the great trouble they have taken in the preparation of their report. This is a very healthy step in the right direction, and there should be no difficulty whatever, with this spirit in the air, in all working together with but one object in view—the placing of the Society upon a sound basis, with the power and sinews of war to carry out a strong campaign for the furtherance of the scientific side of aviation.

Indeed no time has been lost, for the Conference duly took place on Monday, June 26th, when we learn that an agreement was obtained on practically every point at issue. The policy of give and take resulted in the amendment there and then of the memorandum of suggested by-laws that accompanied the report of the Committee of Inquiry, without, however, affecting any of the vital principles on which it is based.

These principles, which were accepted by the last general meeting of members, are to the effect that the Society—

1. Shall be governed by a Council nominated and elected by the members.
2. Shall have a technical side, to which none but those qualified in the science of aeronautics shall be admitted.
3. Shall continue to encourage the support of lay members.
4. Shall be so constituted as to limit the liability of members to amounts covered by their subscriptions.

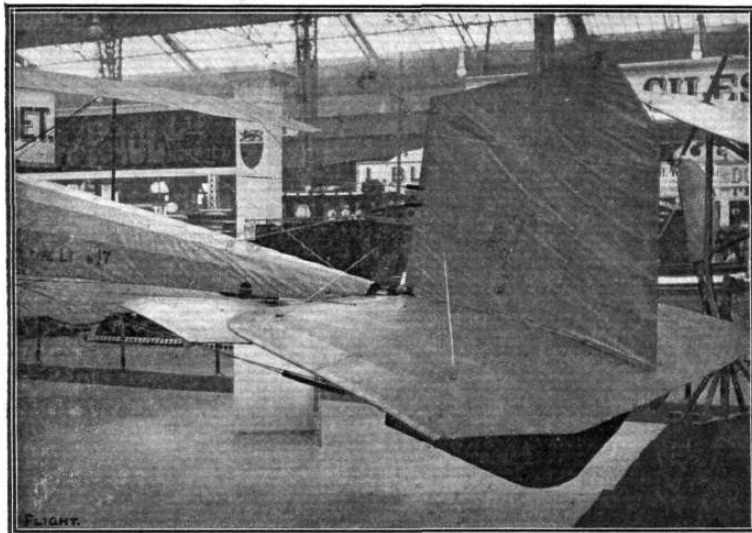
The by-laws suggested by the Committee of Inquiry provide for the election of Fellows, Associate Fellows, and students on the technical side, and also provide for the extension of the lay membership to include Associate Members having limited privileges at a reduced subscription. Now that the existing Council and Committee of Inquiry are thoroughly in accord on the matter, it only remains to put the machinery in motion for giving effect to the intended reform in the proper legal way. This will almost necessarily involve a few weeks' delay, and in the interim those interested cannot do better than make up their minds to join the Society forthwith, for there is likely to be a considerable pecuniary benefit to those on the Society's roll at the time of the inauguration of the new régime. It is, moreover, only proper that all those interested in aeronautics should join the Aeronautical Society, for it is officially recognised, under agreement with the Royal Aero Club, as the "paramount scientific authority on aeronautical matters." The Secretary's offices are at 53, Victoria Street, S.W.

THE BREGUET AEROPLANE.

(Concluded from page 625)

WHEN at rest the planes have an angle of incidence of about 11° , and the strength of the construction is such that under test a load of

with its wings thus folded. When we speak of a single row of struts it is necessary to observe that even this single row



Tail of the Breguet biplane.

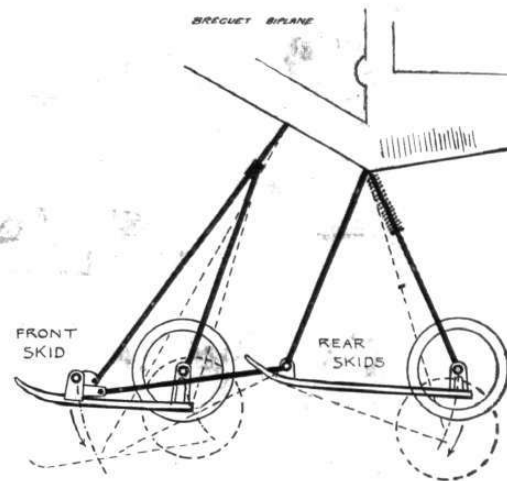
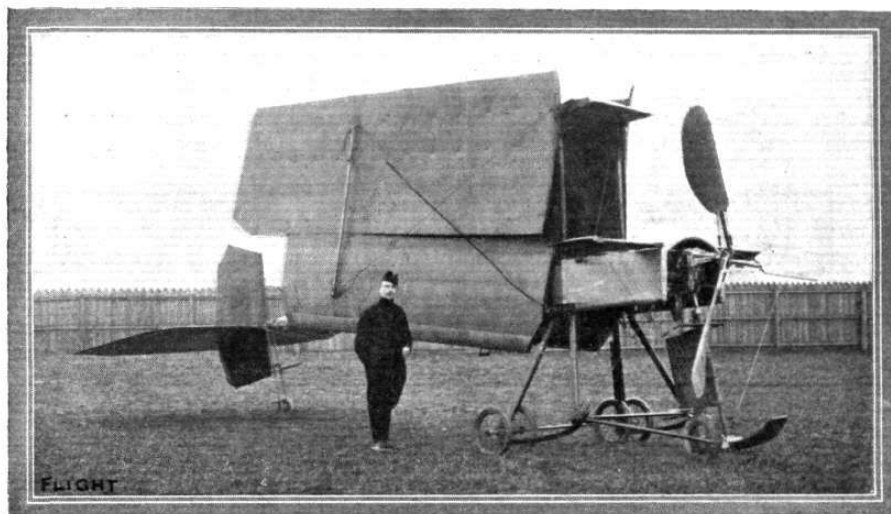


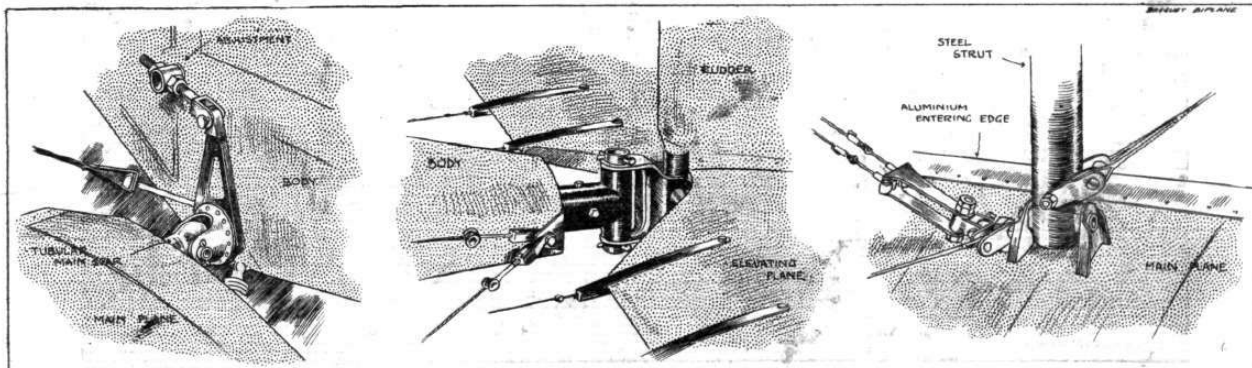
Diagram illustrating the suspension of the under-carriage on the Breguet biplane.

20 lbs. per sq. ft. reduces the angle of incidence to about 2° without permanently distorting any of the constructive details. Tests made by loading the wings with sand have been conducted officially at the Douai works. Of the importance of a variable angle of incidence in connection with the problem of variable speed our readers are already acquainted through our discussion of the subject in a series of articles entitled "Can we fly faster for less Power," which appeared in FLIGHT recently.

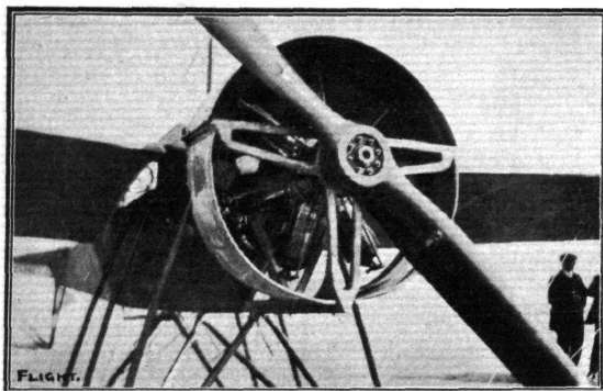
An important outcome of the use of but one row of struts between the main planes is that provision can be made for folding the wings against the body of the machine as a means of reducing the bulk for transport. The manner in which this is done on the Breguet aeroplane is very clearly illustrated by the accompanying illustrations, one of which is a photograph of the machine



The Breguet biplane with its wings folded for transport.



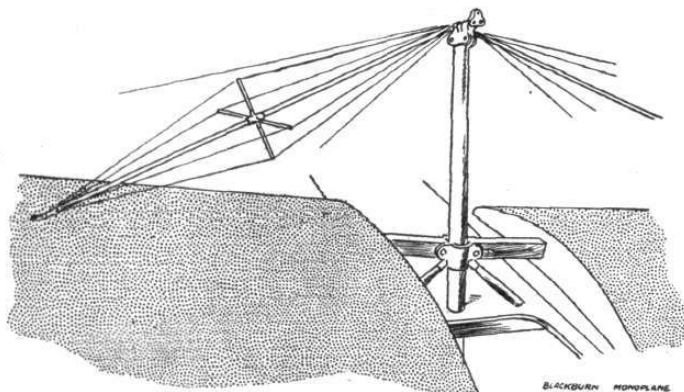
On the left is a view of the knuckle-joint attachment of the wings to the body; in the centre is the universal-joint supporting the tail, and on the right is shown the method of anchoring the tie-wires to the base of a strut on the main plane.



THE BLACKBURN MONOPLANE.—View showing the method of mounting and encasing a Gnome rotary engine, when this type of motor is employed.

Ash spars are also used in the wings, and these are grooved to an I section so as to combine lightness with strength. The ribs are very carefully built about the spars, and a certain amount of lattice girder work is also introduced into the construction of the wing so as to increase its rigidity. The front main spars are rigidly fixed to the body, but those behind are hinged in order to facilitate wing warping.

The control of the Blackburn monoplane is one of the special features of its design, a universal mechanism being employed which differs, however, from the usual types. Immediately in front of the pilot, who occupies a seat in line with the trailing edges of the wings, is a steering-wheel placed in a vertical plane on a longitudinal shaft. This shaft terminates in a universal-joint, the forward portion of which is itself mounted in bearings on a bracket that is attached to a hollow transverse-shaft carried in supports projecting above the body of the machine. This transverse-shaft is divided at the centre in order to accommodate the aforementioned bracket, which is itself



Sketch illustrating the mast and special arrangement of guy wires for the support of the main wings on the Blackburn monoplane.

cut away so as to give room for a small winding-drum that is attached to the forward extremities of the universally-jointed shaft.

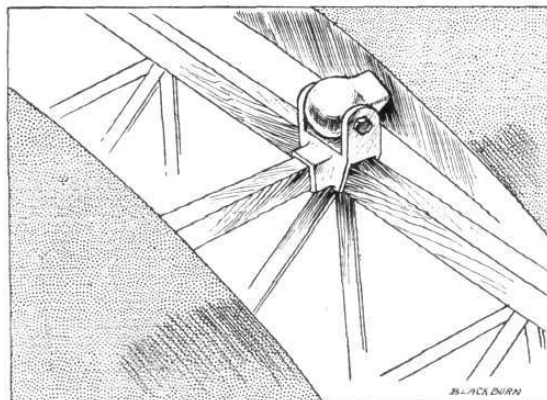
When the hand wheel is rotated, this winding drum operates a cord passing through the hollow transverse-shaft over pulleys to a lever that controls a longitudinal rock-shaft situated immediately under the body of the machine. From the forward end of this underneath rock-shaft other cords pass to the rear spars of the wings, for the purpose of warping. Turning the wheel is, therefore, employed for the purpose of balancing the machine by wing-warping.

Between the hand-wheel and the universal-joint, the first-mentioned shaft carries a fixed collar from which radiate four wires. Two pass over pulleys mounted on the tops of the brackets that support the transverse rock-shaft. The other two are connected in such a way that an up and down movement of the wheel causes the transverse-shaft already mentioned to rock. On the transverse-shaft is a lever from the extremities of which wires pass to the elevator. Raising and lowering the hand-wheel is thus employed for controlling the attitude of the machine in flight by means of the elevator, which consists of a hinged extension to the fixed horizontal tail plane.

When the hand-wheel is moved bodily sideways, the other wires, already described, operate the rudder, which consists of two triangular planes situated above and below the elevator. The special shape of these rudder planes is, of course, to enable the elevator to move up and down to the required extent.

The tail portion of the machine is supported above the ground by a simple skid that is trussed by the rudder post. Similar skids may also be observed on the extremities of the main wings, where they act as fenders should the machine accidentally heel over while running along the ground.

By no means the least interesting point in connection with the development of the Blackburn aeroplane is the fact that this Company have from the first been firm supporters of the Isaacson radial stationary engine. As our readers are already familiar with the features of this motor, it is, however, unnecessary to do more than merely refer to its three outstanding peculiarities, the first of which is that although radial the engine does not revolve; the second being that while stationary the engine is, nevertheless, air cooled, while the third feature is that, while the propeller is mounted concentrically about the crank-shaft it is, nevertheless, driven at half engine speed.



Sketch illustrating the hinged attachment of the rear spar in the main wings to the body of the Blackburn monoplane.

Trial with the Airship "Le Temps."

THE Zodiac Vedette airship has been kept very busy during the past week or so. On the 25th ult. it was out for 2½ hrs. about the Villepreux Plain, while in the afternoon, during a voyage of three-quarters of an hour, it carried two Japanese naval officers. The following day it was up for 2½ hrs., and on the 27th, with four persons on board, it started from St. Cyr and cruised over Guyancourt, Toussus, St. Aubin, Montléry, and Brétigny, returning to its headquarters via Bures, Saclay, Jouy-en-Josas, and Versailles, the round trip occupying 3½ hrs. In the afternoon the airship was out for an hour.

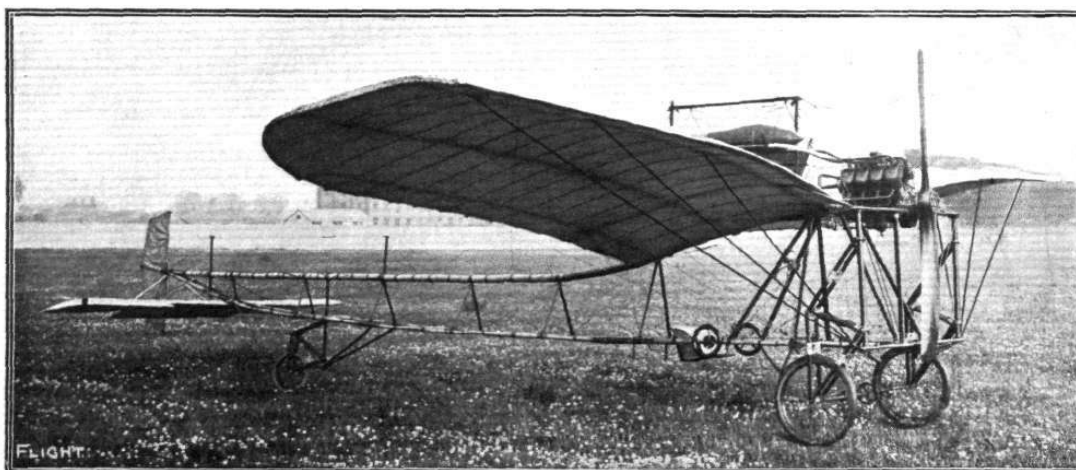
A Long Flight by "Parseval VI."

LEAVING Hamburg at 9 o'clock in the morning on the 10th ult., the dirigible "Parseval VI" arrived at Essen at 4 o'clock. The next day the journey was continued to Leichlingen, where

after an hour and three quarters the dirigible landed, and was placed in the shed built for the Erbsloh airship. In the afternoon, with twelve passengers on board, the airship went for a voyage over Düsseldorf, Crefeld, and Elberfeld. The airship remained at Leichlingen for a week.

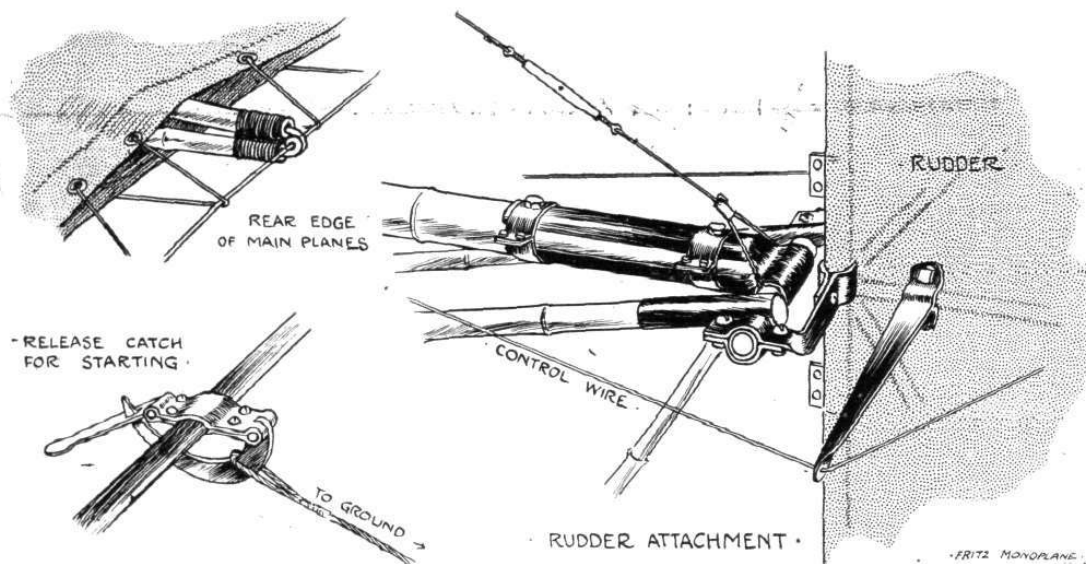
Three Airships at French Review.

DURING the review of the troops at Longchamps on the 14th ult., three airships were seen overhead. These were the "Adjutant Vincenot" (née "Clement-Bayard IV"), the Zodiac "Le Temps," and the "Astra-Torres." The Zodiac dirigible had come over from St. Cyr, while the other two airships started from Issy. Last Saturday morning, General Roques went for a trip in the "Astra-Torres," and he was to have taken a cruise in the Clement-Bayard airship in the afternoon, but it was decided to postpone this, after the accident to Brindejonc des Moulinais.



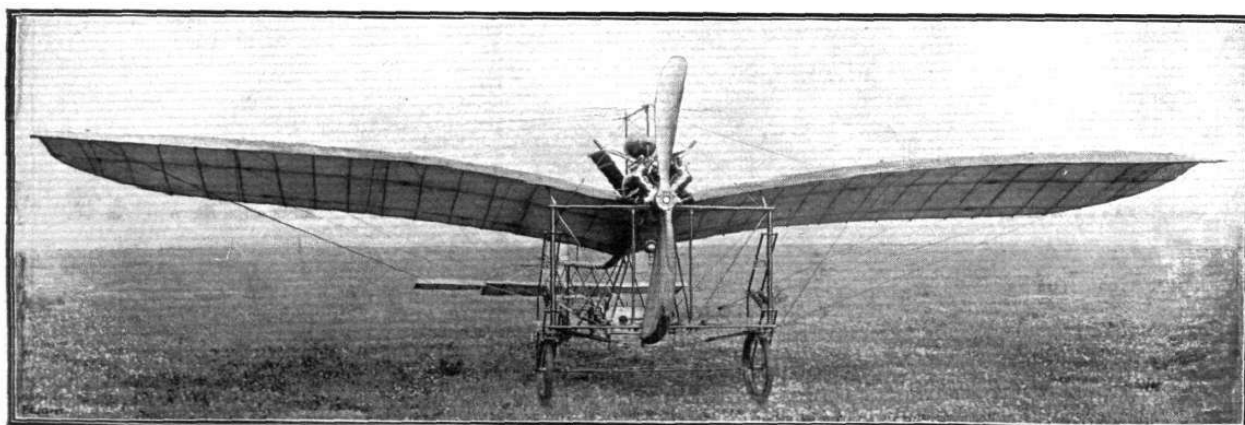
Side view of the Fritz monoplane.

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Sketches illustrating some constructional details of the Fritz monoplane. Above, on the left, is seen the method of lacing the Pegamoid fabric to the trailing edge of the wings. Beneath is a little releasing catch intended to enable the pilot to dispense with assistance when starting. On the right is shown the method of mounting the rudder to the tail end of the bamboo frame.

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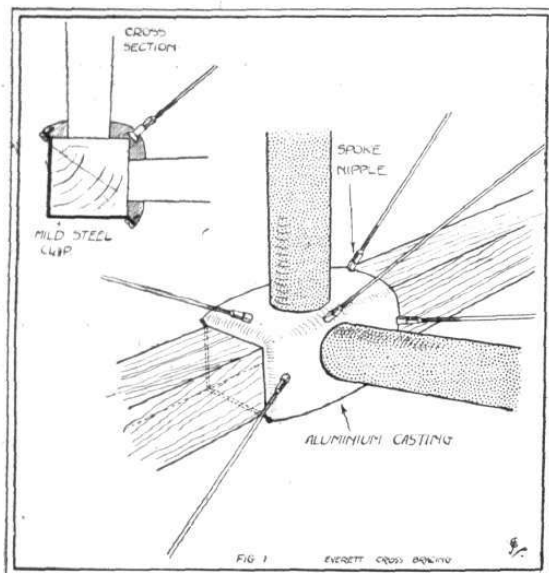
Front view of the Fritz monoplane, built by Messrs. Oylers, Ltd.

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"FLIGHT" TECHNOLOGY.

TWO INTERESTING METHODS OF CROSS-BRACING.

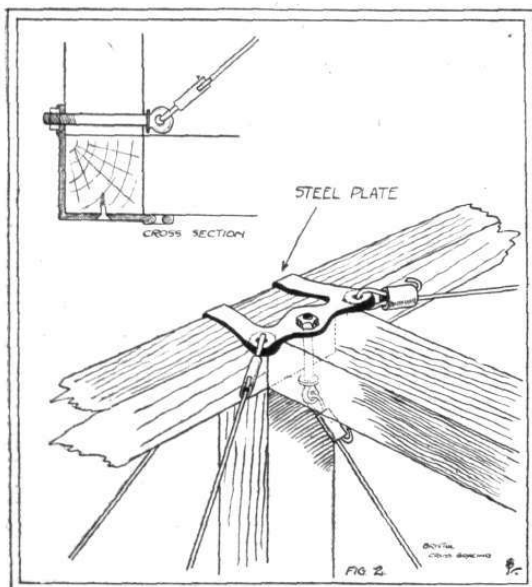
IN connection with aeroplane bodies built on the box girder principle, the method of attaching and straining the cross-bracing wires forms a most interesting problem. Every constructor has his own pet idea



in this regard, and it is curious to note that methods involving piercing of the longitudinal members are much in the majority.

Naturally the *longerons* are considerably weakened if many holes pierce them and to ensure the maximum factor of safety, it is in their interests to devise some scheme whereby such drilling is eliminated.

Of the two accompanying sketches the first illustrates a method



which fulfils these conditions, and the second shows a scheme which only falls short to the extent of a small wood screw.

Fig. 1 represents the method that is employed on the Everett monoplane. An aluminium casting is clipped to the longitudinal member by means of a steel angle-plate. Two large elliptical holes in the casting accommodate the transversal struts, and five smaller ones, countersunk, receive the five spoke-nipples, which serve both to anchor and to tighten the bracing-wires. The wires

are cut to the correct length and threaded at each end. Straining is effected by a simple key that engages on the square sectional part of the nipple.

Fig. 2 illustrates the cross-bracing of the new Bristol monoplane. A mild-steel right-angle lug serves as an anchorage to the longitudinal spars, and its position is "centered" by a small wood screw that is not intended to take any strain. The four wires from each plate that truss the sides of the girder are attached to reinforced eyes provided for the purpose.

These wires are carefully bent to the right length, and fixed in position without any provision for adjustment of the tension.

The diagonal wires are anchored to eye-bolts passing through the transverse struts, which is a convenient method, as not only does it allow of adjustment to these wires, but serves to keep the struts in position.

ABOUT CASTOR OIL.

WHY is castor oil used so extensively for lubricating aeroplane engines? The demand for castor oil as a lubricant in aeroplane work was created by the advent of the air-cooled rotary engine, and even though it has succeeded in serving its purpose more or less satisfactorily it is curious that it has not yet been superseded by an oil that would lubricate much more effectively.

The purest castor oil is a vegetable product obtained by pressing the seeds of the castor-oil plant in hempen bags by means of hydraulic or screw presses, after they have been subjected to a crushing process between heavy rollers. The crude oil thus obtained is refined by being digested with water at boiling point, an operation that separates out the albumen and other impurities by coagulation.

Highest-grade oil is prepared in this way, and possesses a light yellowish colour. Secondary grades are obtained by steaming the seeds and then subjecting them to a further pressing. Pure castor oil is completely soluble in its own volume of absolute alcohol which test should prove useful to those aviators who doubt the purity of their lubricant.

The advantage that castor oil possesses as a lubricant for rotary engines is due to its volatility, for before it has time to accumulate on such vital parts as the sparking-plug points, it evaporates and the hard flake-like deposit it leaves behind is blown out by the scavenging action of the exhaust. If ordinary motor oil were used the electrodes would soon become flooded and misfiring would result. Although castor oil is so volatile, it is doubtful if the heat caused by the explosion of the mixture is sufficient to effect the complete evaporation of the oil film on the cylinder walls, for otherwise how would one account for the oil saturated condition of those surfaces in the wake of the exhaust. It is clear that quite a considerable portion of the lubricant exudes in the form of spray.

If castor oil is subjected to a constant heat for a considerable time, roughly 50 per cent. of its volume is driven off in the form of vapour and what is left is a hard brownish-coloured transparent cake of solid matter that can be chipped with a hammer. From experiment readers can draw their own conclusions as to the true value of castor oil as a lubricant pure and simple.



A Memorial to the Hon. C. S. Rolls.

THERE was a good gathering of people to witness the unveiling by Lord Raglan of the Bronze Monument which has been erected in Agincourt Square, Monmouth, to the memory of the late Hon. C. S. Rolls. The statue, which is the work of Sir W. Goscombe John, R.A., shows Mr. Rolls in his flying costume looking at a model of his aeroplane, and three plaques on the sides of the plinth represent Mr. Rolls motoring, ballooning and flying respectively. Among those present at the ceremony were the late aviator's parents, Lord and Lady Llangattock, Lady Hood of Avalon, Sir John and Lady Shelley, the Hon. J. M. Rolls, and the Mayor and Mayoress of Monmouth.

The Wright Glider Experiments.

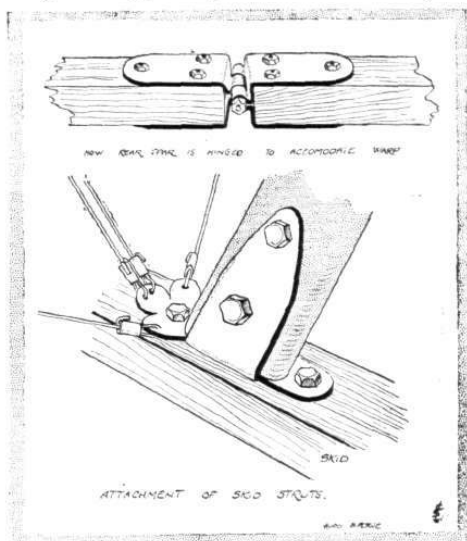
EXTRAORDINARY results are being obtained by Messrs. Orville and Lorin Wright and Alec Ogilvie in their glider experiments at the Killdevil Hills, North Carolina. On Thursday of last week Mr. Orville Wright succeeded in gliding for 1 min. 15 secs. In the course of one glide he was able to keep the glider motionless for five seconds at a height of 125 feet, and in another test he kept it still for a similar period at 60 feet high. A bit of a spill at the finish fortunately resulted in nothing worse than a good shake-up so far as the aviator was concerned. Mr. Orville Wright is said to have expressed the opinion that they will succeed in making glides of a mile or more and be able to poise in the air for five minutes or longer, all of which we sincerely hope will come true. Experiments are also being carried out with the automatic stabilising apparatus which was described in these columns some time ago when the patent covering it was issued.

THE AVRO BIPLANE.

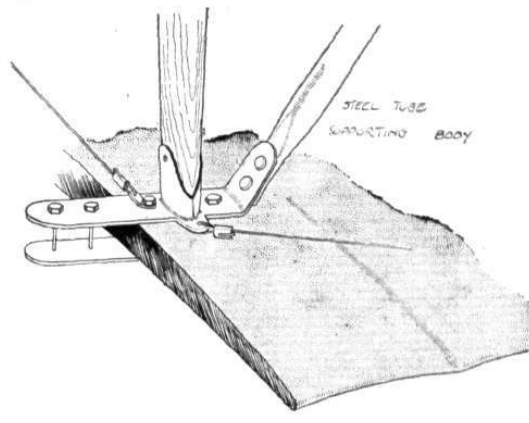
THREE things at least stand to the credit of A. V. Roe, the development of the first successful triplane, the application of the monoplane type body on multiplane machines, and the construction of commercial aeroplanes for men of moderate means. Aeroplaning is considered the sport of the few, but all along it has apparently been A. V. Roe's object to make

has been made at remedying the unwieldiness and awkwardness of transport that has so long characterised machines of cellular construction. To effect this, the main supporting surfaces are constructed in sections that are readily attachable and detachable by means of the simple clip illustrated.

A subsidiary advantage that this method of construction possesses is the ease with which the wing can be repaired by merely replacing a damaged section. This feature alone should place the Avro design in favour with those who have experienced the tedious stripping, boom-grafting, rib-refitting and recovering process associated with the general run of such machines. The planes are covered



Constructional details of the Avro biplane.

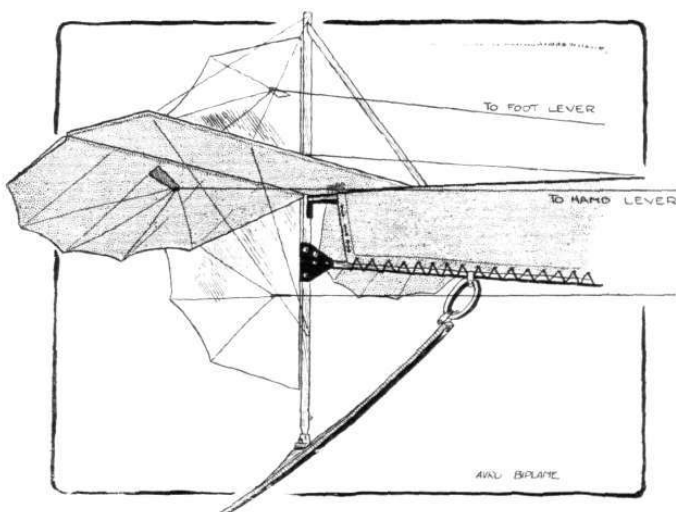


The method employed on the Avro biplane of assembling the wing sections.

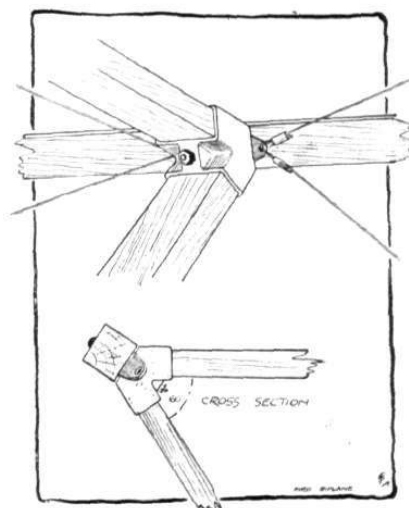
it the pastime of the many, for it has been his ambition to build machines that are inexpensive in initial cost and reasonable in upkeep.

Regarded purely from the technical standpoint, the design of the Avro biplane is characterised by its slender gracefulness, which is perhaps less appreciated by those inartistic souls who regard extreme robustness as the first principle

on both sides with cotton fabric, which is sized and varnished after being stretched in position over the wooden wing skeleton. Warping is utilised to preserve lateral balance, the end sections of the planes being flexed much after the manner adopted by the Wright Brothers. To accommodate the warping movement the rear boom of each end section is hinged to its rigidly-braced continuation in the inner wing



Arrangement of the tail unit of the Avro biplane.



The Avro method of cross-bracing the main body.

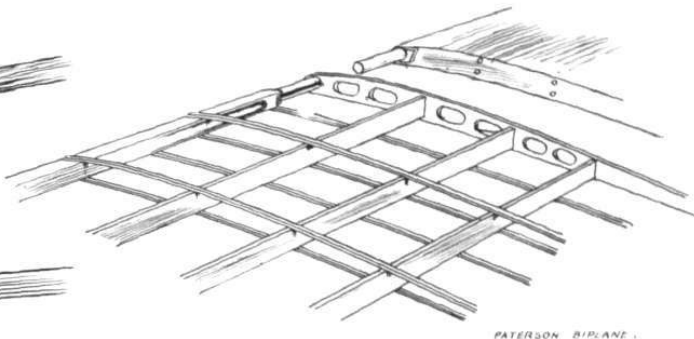
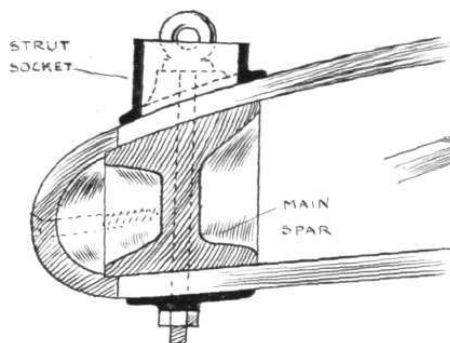
in construction. Nevertheless, the designer seeks to acquire more than mere pleasing lines, for efficiency has ever been one of the principal objects that this pioneer constructor has sought to obtain with his machine. In his present model not only has the attribute of efficiency been combined with symmetry of outline and the safety of the pilot obtained by the monoplane type body construction, but a real attempt

sections by the simple hinge shown in the accompanying sketch, so that in the process of wing flexing that portion of the rear boom moves helically. The compression struts that brace the main planes are held in position by welded steel sockets and ears, to which the bracing wires are attached, and are formed integrally with the base of each socket—a really neat method.

THE PATERSON BIPLANE.

LOOKING back over the general run of biplanes, particularly those of the cellular type, constructed during the past three years, one cannot help being struck with the lack of *finesse* in design that most of them display, probably on account

necting twelve stay wires and the cable operating the *ailerons*. So easy is the whole operation that either end section can be removed by three men within 2½ minutes, and within double that time the biplane, of 32 feet span, can be got



Details of the wing construction of the Paterson Biplane.—The sketch on the left illustrates the application of the strut sockets to the built-up front spar.

of the ease of construction that characterises that class of machine.

Mr. Compton-Paterson cannot be accused of erring in this respect, for, as a pilot who prefers the biplane as a mount, he has attacked the problem of construction with a view to eliminating as far as possible the shortcomings of that type. Undoubtedly the most evident bugbear of the cellular bi-

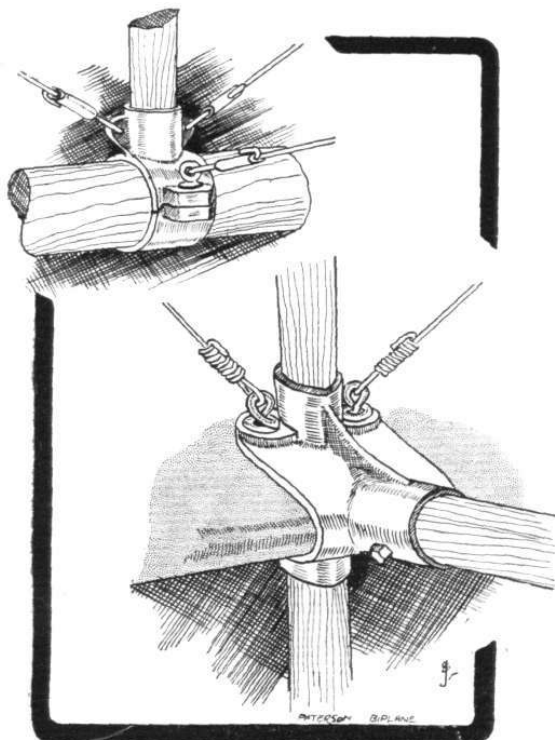
plane is its unwieldiness in transport, and to remedy this failing the *cellule* of the Paterson biplane is constructed in three sections, each of the two outer units being easily detachable from the central one by the simple process of discon-

necting twelve stay wires and the cable operating the *ailerons*. So easy is the whole operation that either end section can be removed by three men within 2½ minutes, and within double that time the biplane, of 32 feet span, can be got

ready to pass through a 10-foot gateway by the removal of both end portions. The advantages of this feature will be easily apparent to those who have had any dealings with the transport of machines of this type, and although it may seem to some an innovation, it must be said to Paterson's credit that he adopted the same system in the autumn of 1909 in the construction of the Anzani-engined Curtiss-type on which he carried out his initial experiments.

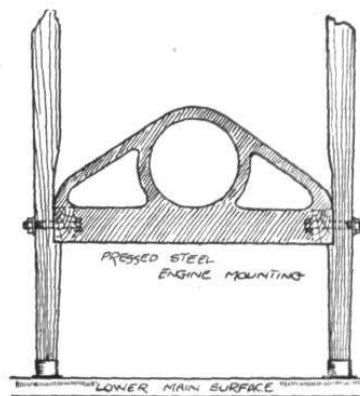
The internal construction of the planes is of considerable interest, as they are double-surfaced, the fabric being supported by a well-conceived wooden skeleton, after the manner adopted in monoplane practice.

Both front and rear spars are cut from best English ash and are hollowed out to H section for the sake of lightness, excepting in those portions to which struts are applied and through which eye-bolts are passed. To the front spar is applied a hollow wooden strip, forming a nose piece, which not only strengthens the boom to a considerable extent but forms an efficient entering edge. Running parallel with the booms are three silver spruce stringers of rectangular section, that pass through corresponding mortises cut in the main ribs. In this manner the stringers may be considered as being interlaced through the wing structure, a more satis-

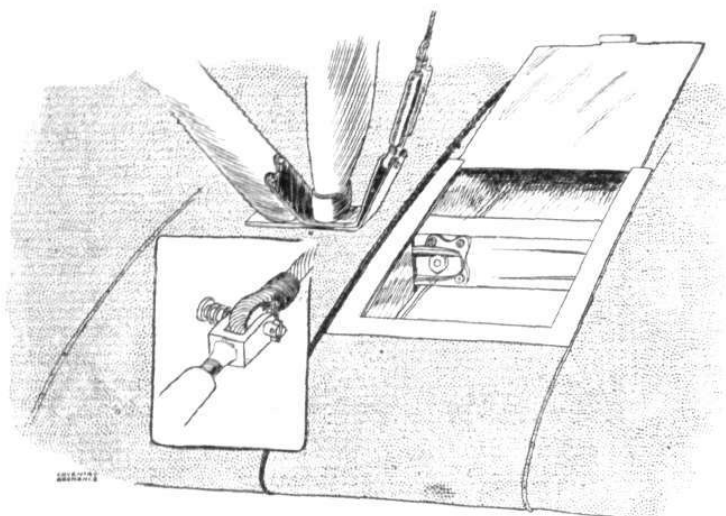


Two sketches of magnalium-bronze sockets used in the assembling of the Paterson biplane.

factory method than that of merely keeping the ribs in position by the use of a few tin tacks or perhaps wood screws. Five main ribs, shaped from ash and drilled to reduce weight, serve to give the proper curvature to each wing section and



Paterson Biplane.—Diagrammatic sketch of engine mounting.

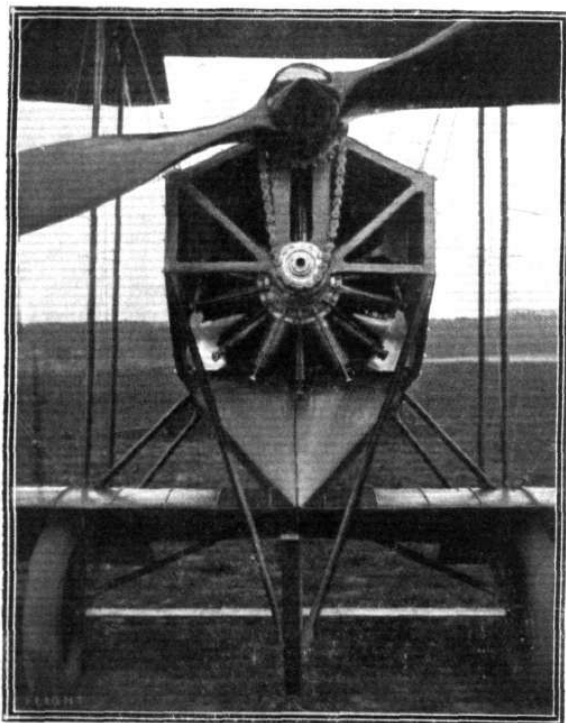


One of the aluminium inspection doors fitted to the planes of the Coventry Ordnance biplane. The sketch shows the method employed for the joining of the wing sections. Inset is the quick release pin. These are used throughout the machine to minimise the time necessary for dismantling and erection.

spruce. Although they are of a goodly size from front to back they are relatively quite thin. But this is compensated for by the fact that they are braced together in two sets of four. They fit into steel lugs where the cross-bracing cables are also assembled.

The planes are built and attached in sections, the attachments being arranged internally where they are accessible, and where they may be systematically inspected through neat aluminium sliding doors. There are eight of these—one against each strut socket.

The main body—wide enough to seat pilot and passenger side by side—is essentially a wedge-shaped box girder, flattening horizontally towards the rear. In its construction ash is employed for the main booms and spruce for the cross-members. Viewed from above its sides are parallel from stem to stern. Thus it is sufficiently wide at



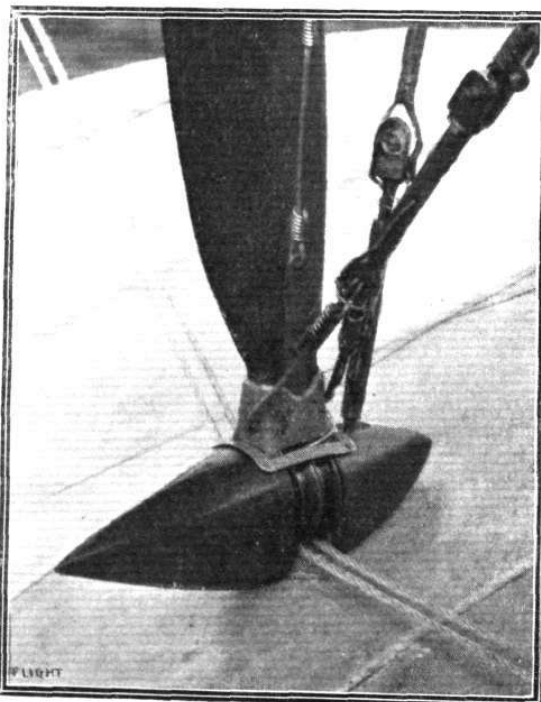
Details of the front part of the machine, showing the housing for the 100-h.p. Gnome and the chain transmission.

the tail to provide a good damping surface, a point which reduces the extra tail surface necessary. These surfaces are flat, and have a purely floating action in flight. In shape they are quarter elliptical. At the extreme rear, the sides of the fuselage extend above and below the top and bottom surfaces, forming small fins, to the back edge of which the vertical rudders are hinged. They, similarly to the elevators, are balanced in their action. A bent cane skid takes the weight of the after section of the machine when at rest on the ground. The main chassis wheels are so placed that there is only about 40 lbs. of weight at the extreme tail—a joy to its attendant mechanics—they most probably in their time have had to deal with machines tremendously tail-heavy when on the ground.

The engine mounting is decidedly interesting. The four body booms in front are assembled in a pressed steel housing, which accommodates both the motor—a 100-h.p. 14-cylinder Gnome—and the propeller shaft. The Gnome is slung low down in the housing and, keyed to its nose is a chain wheel, from which the drive is taken by a Hans-Renold chain—this alone weighs something like 25 lbs.—to the propeller shaft above. There is a reduction of 2 to 1 in the transmission. The propeller shaft is mounted, together with the engine in ball bearings, and two ball thrust washers are fitted—the larger to accommodate the propeller thrust and the smaller to take the negative thrust caused by the head resistance on the slow running or stationary propeller during a *col plane*.

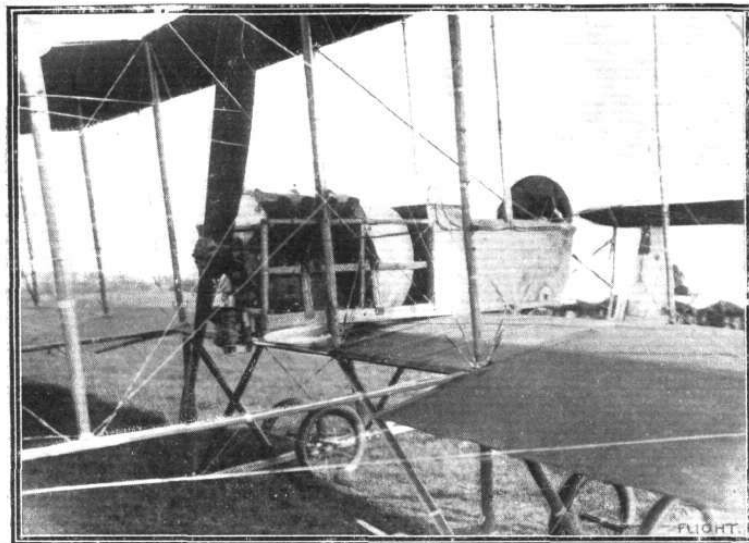
A peculiarity about the engine—we say peculiarity because we have never previously seen this system applied to a rotary motor—is that it is equipped with Bosch dual ignition, by which it may be started from the pilot's seat. Another refinement is the drip-catching funnel arranged beneath the carburettor, by which any overflow of petrol is collected and led through a copper pipe to the exterior of the body, where it is out of harm's way. A covering, similar to a Sizaire car bonnet cases in the motor and propeller-shaft housing. It is cut from sheet aluminium, and kept in place by ordinary car-hood fasteners.

The propeller is a colossal structure of teak with nine laminations. It is 11 ft. 6 ins. in diameter, and rotates at 600 revs. per minute. It is noteworthy that, from the boss to a point 18 ins. along the blade it is designed to give no thrust, but merely for that section to travel through the air, causing as little head resistance and absorbing as little power as possible. In defence of this notion the designers



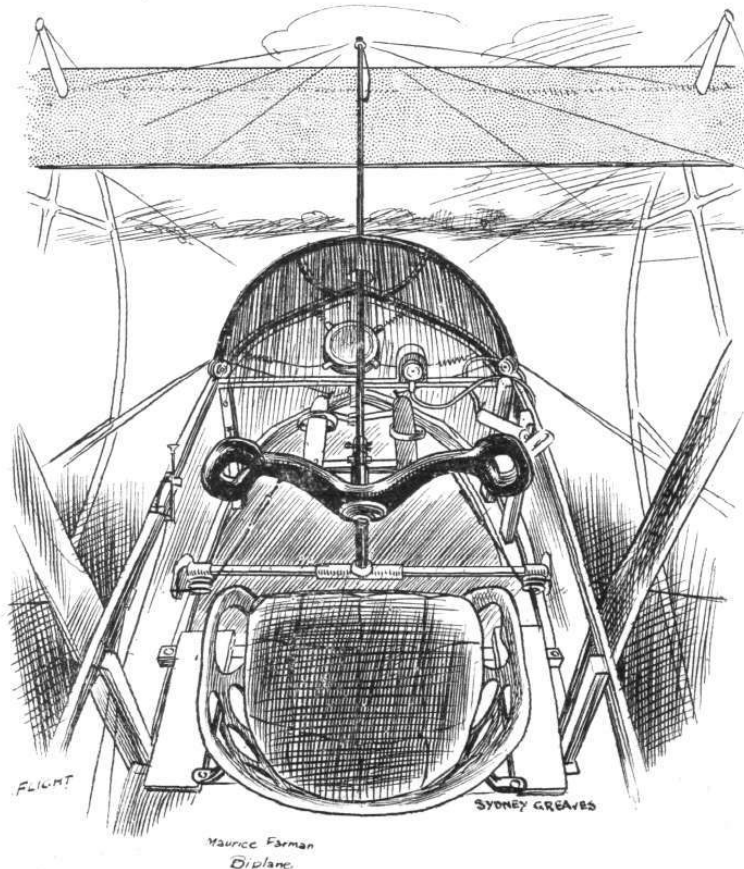
The stream-line encased warping pulley for the Coventry Ordnance biplane.

and there were only seven all told that survived—carried out the final test, weight carrying across country, loaded up with a useful weight of 990 lbs. in place of the 660 lbs. stipulated in the conditions. Even then the speeds of the machines were not very seriously reduced, for Barra covered the 300 kiloms. averaging $47\frac{1}{2}$ m.p.h., cross-country, while Fischer, on the Henry Farman, was some few miles per hour faster.



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MAURICE FARMAN BIPLANE.—Near view from behind, showing the pilot's seat, position of engine, &c.

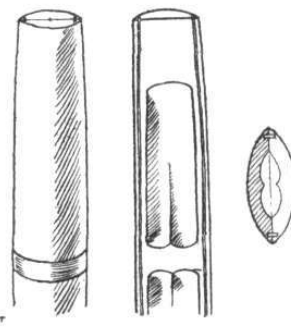
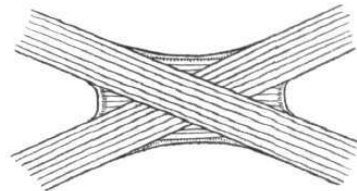


Maurice Farman
Biplane.

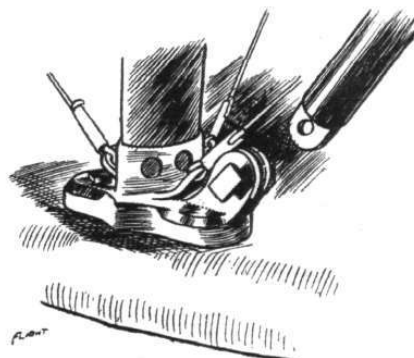
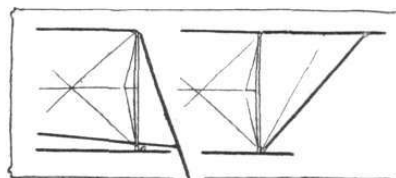
Details of the control of the Maurice Farman biplane sketched from the passenger's seat.

The points that impress themselves upon one, seeing the machine flying, are its rapidity at climbing and its remarkably fine gliding angle. Regarding the former, it has been timed, in England and quite recently, to climb, fully loaded, to 1,000 ft. inside of 5 mins. Some week or two ago, in France, Mr. Holt Thomas tells us one machine climbed to 7,000 ft. in 25 mins.

But let us review its construction, briefly—for a description of the machine has already appeared in FLIGHT. The main *cellule* is composed of two double-surfaced planes, unequal in span, braced together to form a box girder. *Ailerons* are employed for lateral balance, but they differ from those of the Henry Farman type in that they are interconnected, so that when those on one side are lowered those on the other are raised a corresponding amount. This provision does much to eliminate the necessity of using the rudder when operating them. The



Constructional details of the Maurice Farman biplane.—On top a diagrammatical sketch of a joint in the landing chassis. The two struts are half-lapped and strengthened with wooden angle-pieces; the whole is then bound securely and strengthened with steel plates. Below is a sketch of a hollow strut.



The combined steel socket and extension fitting.

struts separating the two planes are hollow, except for those immediately on either side of the engine-bed. These are of solid ash; those directly above the landing-chassis are of ash but, as we have said, hollow, and the remaining *cellule* struts are shaped from silver spruce. Indeed, most of the woodwork on the machine seems to be hollow. Even the struts supporting the machine on its chassis are fashioned on this principle to save weight.

The landing gear itself is quite characteristic. Two long skids, shaped from solid cleft ash, proceed from below the machine until they meet the front elevator. They are attached to the main frame *cellule* by a forward structure of silver spruce, and across each skid is strapped, in typical Farman fashion, a pair of landing wheels. The tail needs no description, for apart from being of a different shape and doubled surfaced it presents very little difference from the Henry Farman tails, with which all are familiar. But there is the peculiarity that the tail outriggers, of silver spruce, are hollow.

The control is, to English observers, more novel. A double hand-grip of pressed steel is mounted on a vertical column, which is arranged to swing longitudinally. Rocking it to and fro adjusts the forward elevator, by means of a steel tie-rod, for ascent or descent respectively. Lateral balance is controlled by rocking the hand-grip laterally. Two wooden pedals control the steering.

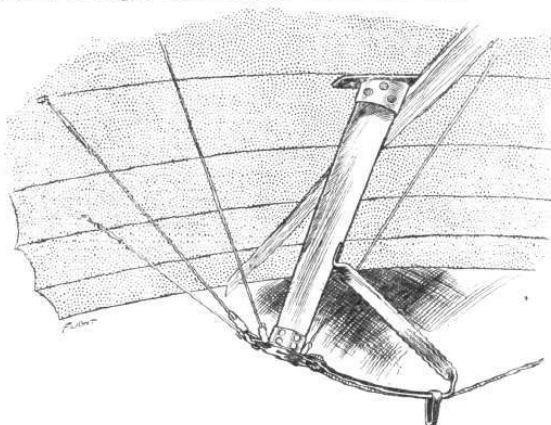
Pilot, passenger, and motor are located in a boat-shaped *fuselage*, constructed of ash and covered in with fabric.

The motor is a 70-h.p. 8-cylinder Renault, air-cooled by the customary Renault practice of forced ventilation. It drives a Chauviere propeller of 2 in 90 diameter and 1 in 90 pitch, at 900 r.p.m. The normal engine speed is 1,800 r.p.m., for the drive is taken from the reinforced cam-shaft.

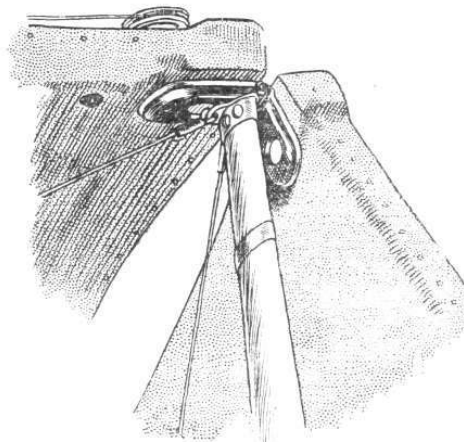
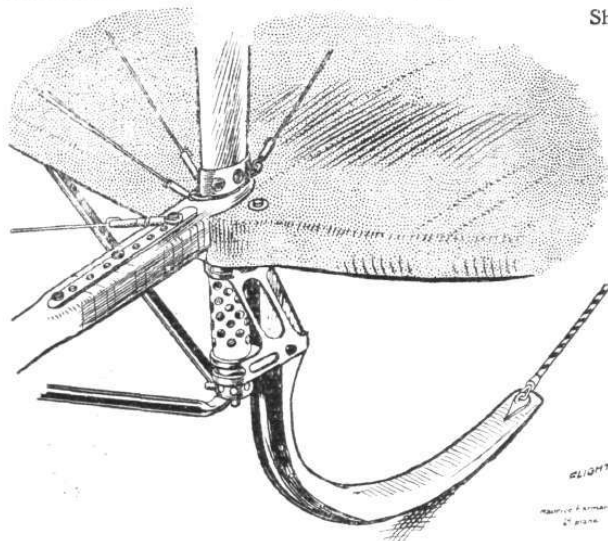
A noticeable point about the machine at present flying at Hendon

is that it has no oil-tank. All the oil necessary for a four-hours' run—some 15 litres—is stored in the engine sump, and unless longer periods of running are required there is no necessity for one to be fitted.

Now that the *real* Farman machines are about to be built extensively in this country by the Aircraft Co., we may expect to see rapid and far-reaching increase in the practical interest that English pilots have always taken in these machines, which have been so thoroughly and deservedly successful in France.



Showing how the control cord is applied to the aileron lever of the Maurice Farman biplane.



DETAILS OF THE MAURICE FARMAN BIPLANE.—On the left one of the tail skids. On the right the fitting by which the extension may be folded down to reduce overall dimensions.



MAURICE FARMAN BIPLANE.—Three-quarter view from in front.

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FLIGHT TECHNOLOGY. WIRES AND THEIR FASTENINGS.

THE stage seems to have been reached when something really serious ought to be done in the way of practical tests on wires and wire fastenings.

Machines are getting heavier, engines much more powerful and flying speed much higher every day and yet we remain, in the

in the fact that external fibres in the large wire are stressed much more (when being bent) than are the fibres in the small wire, due to the fibres in the former being much further from the neutral axis than those of the latter, and it is also quite conceivable that the small wires receive fewer gashes and bruises than do the larger and

more obstinate variety. It is a most astounding fact that the writer has seen large wires made red hot to bend them, their strength thereby being reduced to something in the nature of soft iron wire.

This type of connection seems to have been modified lately into that shown in Fig. 1 without apparently any improvement and with possibly an increase of the

personal factor. Returning to the first type of wire connection it is almost unbelievable that copper is generally used because it is less trouble to apply and more easily obtained than some stronger material.

Steel wire can be obtained now that has a breaking load of 140 tons per square inch, but the writer is of the opinion that anything over 80-ton wire should not be used, as very high tensile steel wire is weakened so much by bending, and it is quite probable that the 140-ton wire when bent is weaker than the 80-ton wire. Dealing with steel tape as a possible means of bracing, this does not on the first glance offer a satisfactory solution to the problem because it is evident that it either has to be drilled for rivets or bent in some



Fig. 1

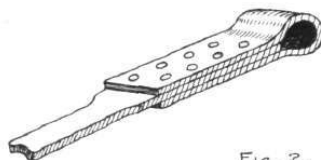


Fig. 2

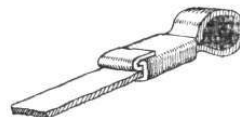


Fig. 3

matter of wing wire connections, practically where we were in the days when we were content with aerodrome flying in still air.

In fact it is really doubtful if we have anything like as great a factor of safety to-day as had the old clumsy thirty-mile-an-hour machines of two years ago. The ancient connection by means of a piece of very soft and very weak copper tube slipped over a single strand bent wire is without doubt the last word in mechanical deficiency.

In the first place, copper, if only on the score of weight efficiency should never be used in a stressed part. Secondly, the very fact of having bent the wire means that the external fibres have been stressed abnormally before any load has been applied, and thirdly,

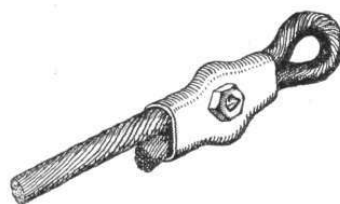


Fig. 4

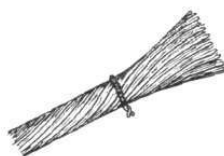


Fig. 5



Fig. 6

the personal factor plays together too important a part for the lives of our best fliers to be jeopardized by the work of any incompetent mechanic that may happen to wire up the machine.

We all know that if we put a file mark in a piece of steel wire we can break it with the greatest of ease, and yet what a common practice it is for mechanics to use a pair of pliers with sharp edged hardened steel jaws, or in the case of large wire, to hammer it over a piece of steel. The slightest mark in a wire (even a rust spot) will rob it of practically all its strength, and yet we find single strand wire fitted, and bends made in it, and cuts, and gashes, and the giant mechanic using his giant strength (which we are told is tyrannous) in his endeavours to connect a simple wire to a simple fastening.

What happens to such a wire joint when stressed is this:—The wire gradually draws itself over the bolt of the fastening, dragging with it the piece of copper tube until this latter comes into contact with the bolt itself, and after that the wire is content with cutting, in the course of time, the copper tube down one side, the wire during this process gradually lengthening itself anything from a quarter to three-quarters of an inch.

What engineer is there in existence who would build a bridge that would gradually settle down say four or five feet in the middle within about two months of its being built, and at the end of that time either be replaced or break immediately? And we adopt such a method as standard practice.

I don't altogether blame the mechanics, but what a treasure of a mechanic he would be who would treat a wire with tenderness and never persuade it with anything harder than soft copper.

Apparently the only difference between the present-day wire and fastening and the early type wire and fastening is in the increased size of the wire and copper tube, and the real irony of the thing lies

made as shown in Fig. 3, but this has no particular virtues and cannot be recommended. Taking steel tape all round it is very doubtful if it is much better than wire, its chief advantages being that it is thin and will bend without serious effect on the external fibres, it makes a wide seat on the bolt or pin it is bent round, it is not so liable to fracture through being ill-treated and it may have a better stream-line form, though this last mentioned is very doubtful as little seems to be known of stream-line and resistance of vibrating wires.

Drilling and riveting would be quite sound provided the ends were enlarged as shown in sketch Fig. 2, but otherwise this method should be avoided altogether. It is even not permissible to make the tape of such a width that, when taken at the weakest point (i.e., across the rivet holes) there is sufficient material to take the load because the weak spot is concentrated and is unable to withstand shocks due to the fact that the elastic limit is reached and the fibres are stressed and fatigued at this place before the other part has been stressed at all seriously. In other words all the "give" has to take place in the weak spot and it would add strength to cut away the tape in the centre to equal the area (or slightly less than the area) at the rivet holes.

A somewhat similar connection to the copper tube method can be

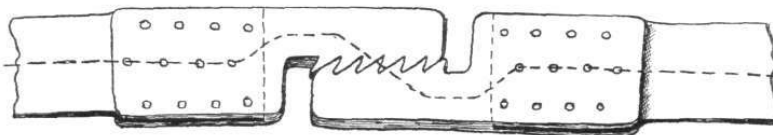


Fig. 7

made as shown in Fig. 3, but this has no particular virtues and cannot be recommended. Taking steel tape all round it is very doubtful if it is much better than wire, its chief advantages being that it is thin and will bend without serious effect on the external fibres, it makes a wide seat on the bolt or pin it is bent round, it is not so liable to fracture through being ill-treated and it may have a better stream-line form, though this last mentioned is very doubtful as little seems to be known of stream-line and resistance of vibrating wires.

MONOPLANE WING SPARS.

THE spars used in monoplane wings are, apparently, about to pass through the same changes as motor car chassis members passed through several years ago.

There were, in the beginning of motor cars, frames of wood, of armoured wood, of stout steel tubes, of lighter tubes with bracings, and eventually of pressed steel. Although one would not go so far as to say that the ultimate type of wing spar will be one of pressed steel, such as is predominant in cars to-day, it is fairly safe to say that we shall all eventually adopt one design, whatever is found best, and the sooner we find this the better.



Fig. 1.

Investigation of the points, good and bad, of present-day wing spars may help us to form our opinions as to which school of thought to follow.

Probably the commonest form of wing spar is one cut or shaped from a solid piece of ash or other wood and made of "H" or girder section. Fig. 1 shows one of this type.

At the point of attachment of wing wires, the spar is either left solid, or has pieces let in flush with the sides.

The chief stresses in a spar of this sort are those of compression, and it is a most unfortunate fact that, though ash has an average ultimate tensile strength of 19,000 lbs. per square inch, its strength in compression is seldom over 9,000 lbs. per square inch.

The serious stresses arise from compression due to wing wire pull and compression on the under side due to bending upwards.

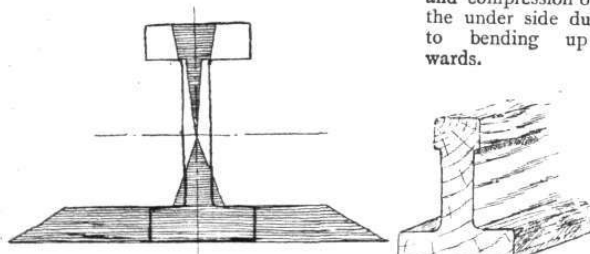


Fig. 2.

The former compression stress is spread over the whole of the area of the spar, but the latter is in the lower half of the spar only and varies in intensity from no stress in the centre to maximum stress in the lower extreme fibres of the spar. These two compression stresses, when added together, give the maximum stress the spar is subjected to in compression from these two loads.

Investigating the stresses in the upper half of the spar, we find a compression due to wing wire pull and a tension due to bending upwards, this latter reducing, of course, the compression stress in

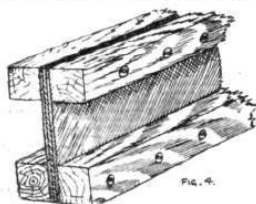


Fig. 4.

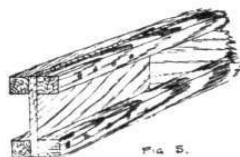


Fig. 5.

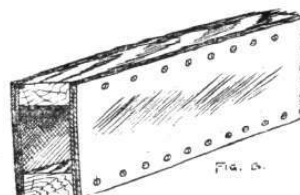


Fig. 6.

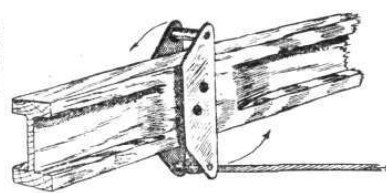


Fig. 7.

the upper half of the spar. A sectional stress diagram shown in Fig. 2 will serve to illustrate how disproportionate are the stresses in a spar with equal sectional area above and below the centre line, the area shaded showing the relative amount of compression stress.

There is still another stress which is seldom recognised when designing these spars and this is a stress on, or near, the centre line, or neutral axis of the spar. It is a stress due to shear, and is caused by the tendency of the fibres of the spar to slide on one another when the spar is deflecting under its load.

That this stress, though very low in steel girders, is of more than casual importance is shown by the fact that one spar tested by the writer fractured by shearing along the centre line before failing from compression or tension. From this it appears that the correct section of a spar between wire fastenings should be something like that shown in Fig. 3.

Another point one must not fail to consider when designing spars is the size of the bolts used to attach the wing wire plates. For instance, if we used a bolt of a diameter of one millimetre through the spars and attached our wing wires to the ends of the bolt (we know the bolt would break under the load, but let us assume for our purpose that it would not), the compression per square inch on

the wood due to wing wire pull would be too great and our one mm. bolt would tear its way along the fibres of the spar.

It looks as though many of our wing spars are fitted with bolts that are only designed to withstand the load in themselves, and no notice is taken of the load that the wood in actual contact with the bolt has to carry.

For instance, if the compression stress in the spar due to wing wire pull on any one bolt is 1,500 lbs., and we are allowed, say, a factor of safety of 6; assuming the thickness of the spar where the bolt is fitted to be 2 ins. then the diameter of the bolt to enable the wood to resist the compression must be $\frac{1}{2}$ in. although it is quite possible that a $\frac{1}{2}$ in. bolt, as far as stress in the bolt is concerned may be much too large.

Whilst on the subject of bolts fitted into woodwork, there is a method commonly used in motor body manufacture of increasing the hardness of the wood round the bolt, which method the writer has never seen in aeroplane construction. It is to drill a considerably smaller hole in the wood than is desired, and to "rub" this hole out exactly to size by means of a red-hot iron. It is sometimes done as a makeshift when proper tools are not at hand, but the makeshift in this case is often a sounder and stronger job than the proper way. After the hot iron has been used the hole can be reamed out to the exact size of the bolt, and this reaming should just remove the charred black powder.

There are various forms of built up spars, one of which is shown in Fig. 4. The method employed is to have a central piece of ash or three-ply wood with four strips of ash glued together and riveted with copper rivets and washers. If the centre piece is of three-ply there may be some slight advantage in this spar over one cut from the solid, as the resistance to shear in three-ply is somewhat greater than is the resistance to shear of ash along the grain.

If ash is used it would be a good plan to have the centre board in sections with the slope of the grain at about 30°, and alternate sections should have the grain reversed as shown in Fig. 5.

Taking this spar all round, it is very doubtful if it has any important advantages over the spar cut from the solid. The machine may have to remain out on a warm, damp night with a reduction in the strength of the glue by 50 or 60 per cent., even though the spar may have been varnished carefully to prevent this. Rivets or screws weaken the spar by the amount of sectional area of the spar that is removed and according to their distance from the neutral axis.

If the thickness of the upper flange is $\frac{3}{4}$ in. and the rivets employed are $\frac{3}{16}$ in. in diameter the strength of the spar is reduced by approximately 25 per cent.

Another spar of somewhat similar construction is shown in Fig. 6, the method employed in this case being to glue two pieces of ash and two pieces of three-ply wood together, screwed up with wood screws into the ash and varnished to prevent the glue perishing from damp.

A glued joint is about as strong as can be when well made, but there is always the remote possibility of it being badly made or of inferior glue being used or of deterioration from damp, and a designer's chief motive ought to be to remove these possibilities.

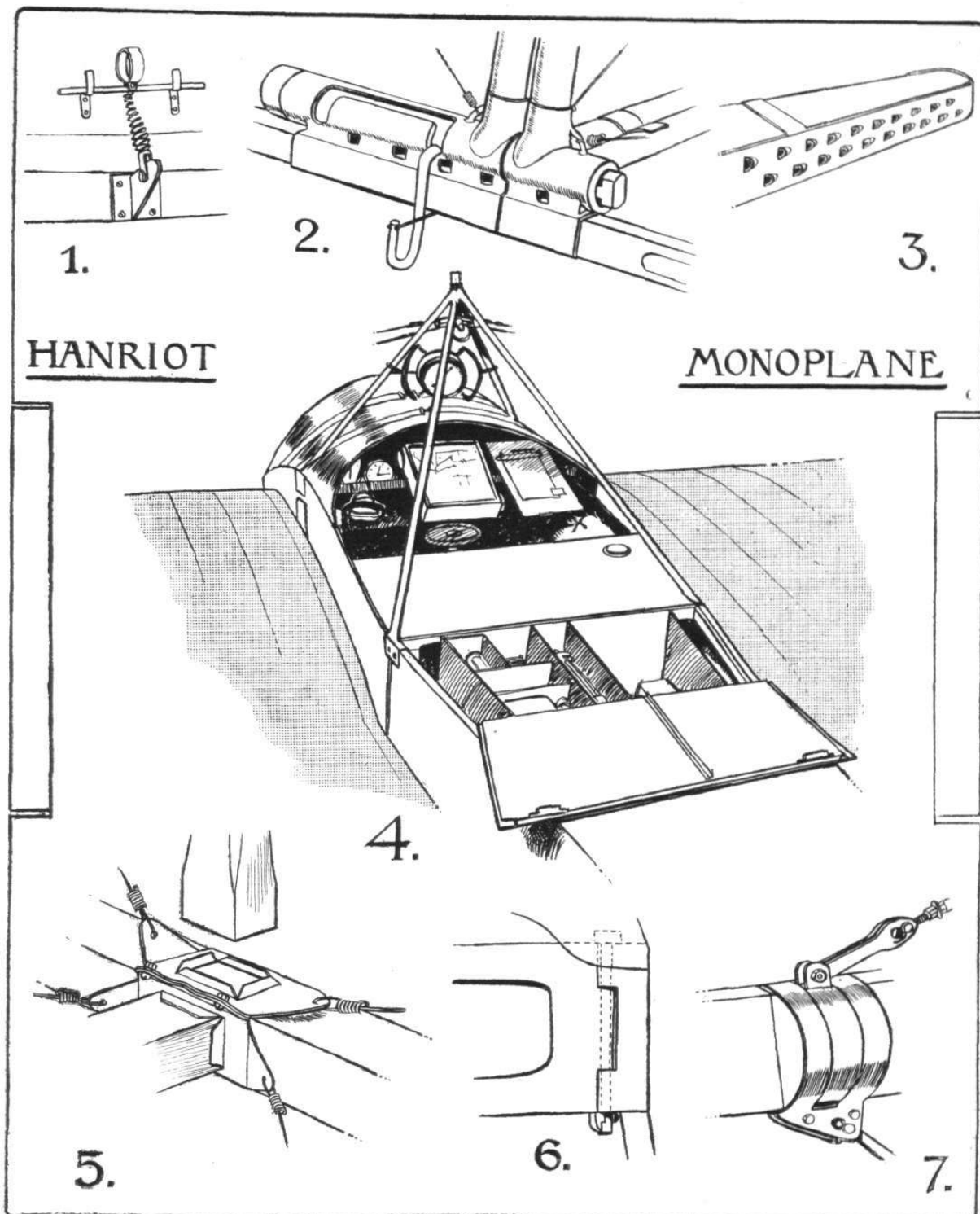
A built up spar is difficult to shape to suit the varying loads a spar has to carry, and thus one sees spars of this class with a constant taper from the fuselage to the tip. Spar sections, of course, ought to alter with the load each portion of the spar has to carry. This is done very accurately in the Nieuport wing, but then the Nieuport is mathematically designed from tip to tail, and is just one of those instances that prove the worth of design as against guesswork.

Built up spars are troublesome at the point of attachment of the wing wires, and generally have to have pieces let in, which in itself is a source of weakness. Solid spars are better in this respect.

The rear spar in a monoplane very often has greater compressional stresses to withstand than has the front spar, as the rear spar



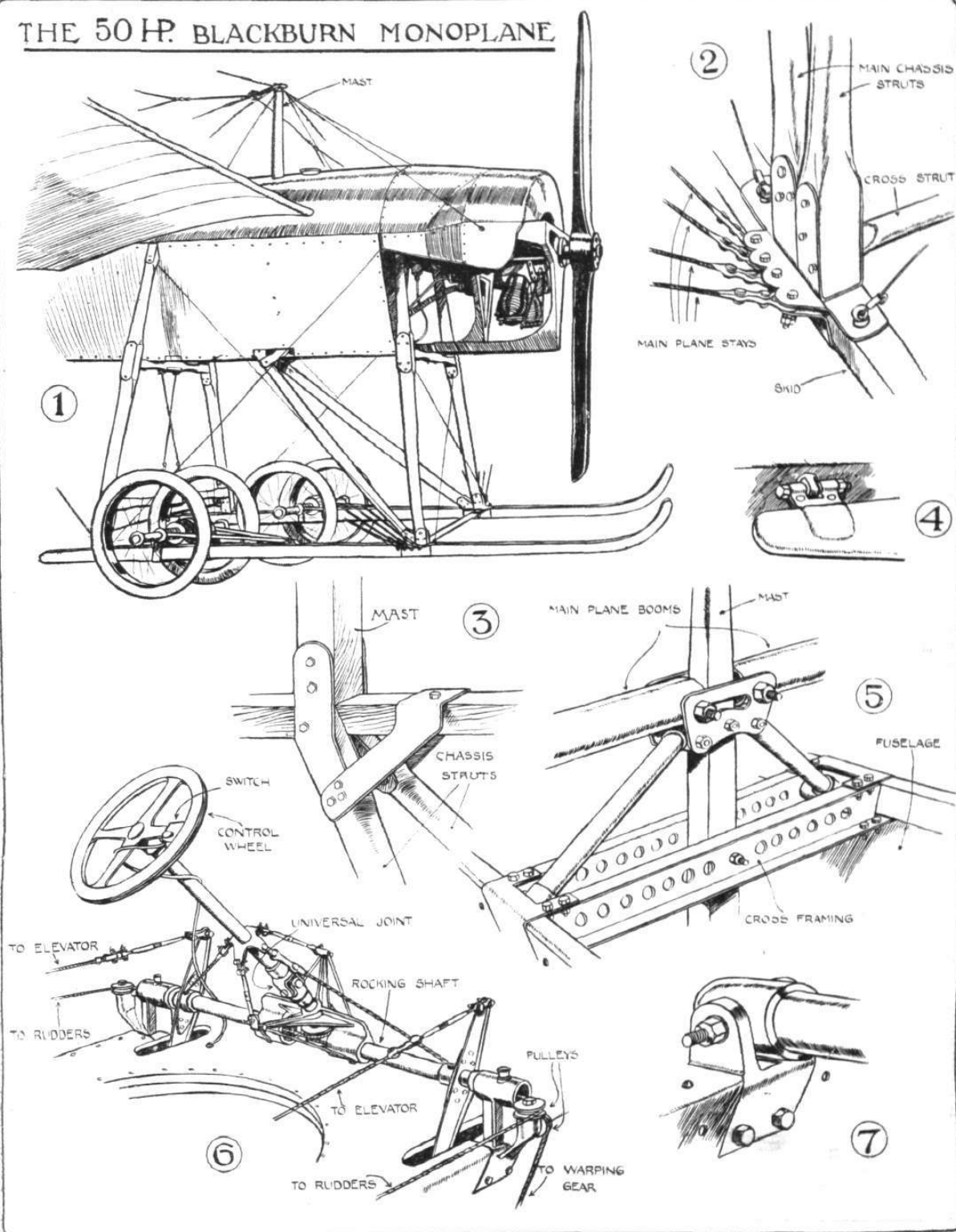
Fig. 8.



DETAILS OF THE HANRIOT MONOPLANE.—1. The fitting by which the aluminium side-plates are clipped to the fuselage. 2. An interesting fitting by which the fuselage may be divided so that it can fold in two. To dismantle or re-erect the fuselage takes no longer than the time required to operate the bolt of a rifle. 3. Showing how the rear parts of the main skids are shod with steel and punched out to act as a brake. 4. The pilot's cockpit, showing his instruments, the fuel-tank, and his chest of spare parts and fuel. 5. The cross-bracing socket, stamped from sheet steel. 6. One of the four bolts which, being removed, allow the engine, together with its carlingues, to come clear of the machine. 7. The method of attaching the wing wires to the main spars.

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THE 50 H.P. BLACKBURN MONOPLANE



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Sketches illustrating interesting constructional details in the 50-h.p. Blackburn monoplane, which is used as a practice machine at their school at the London Aerodrome. 1. The landing-chassis; also showing the mast of the cabane. 2. Joint between the front chassis-struts and the skid; the position of the joint is seen clearly in 1. 3. Joint between the base of the mast and the diagonal chassis-struts. 4. Hinge between the elevator and the backbone. 5. Details of the wing attachment to the body. 6. General view of the control system. 7. Joint of the back-wing spar to the body.

revolutions. For comparative purposes, the brake horse-powers at 1,200 revs. per minute have been tabulated and the weights given are those per b.h.p. at that speed, as it will be admitted that before any comparison as to relative lightness can be effective this important factor must receive some attention. For the same reason, the weight of the radiator, with water and piping, has been added to that of the water-cooled engines in order to obtain the weight of the complete power unit excluding fuel and oil; so far as has been possible, the additional weight has been ascertained from the

makers, otherwise it has been estimated from probable average values.

In Table III (page 1178), are the results of tests which have been made by a number of manufacturers on their engines and supplied to the author by them, but those shown in heavy type have been carried out by independent authorities. The high brake thermal efficiency attained by the 6-cyl. 70-h.p. Chenu engine should be noted, as this test was made in the laboratory of the Automobile Club of France. (To be continued).

FROM THE BRITISH FLYING GROUNDS.

Brooklands Aerodrome.

OWING to the unsuitable weather prevailing Saturday, last week, there was practically no flying, and it was not possible to hold any competitions. At noon, advantage was taken of a favourable wind and the Handley Page was flown back to Hendon, the pilot taking a passenger with him.

Mr. Handasyde was testing the engine of the latest Martin-Handasyde monoplane before handing the machine over to the War Office, and the excellence of its running augurs well for the useful work it is likely to perform as a unit of the R.F.C.

There was no flying Sunday, until the afternoon, with the exception of a test-flight of a couple of circuits by Mr. Merriam, on a Bristol biplane, who found the weather conditions too unsatisfactory.

The feature of the Bomb-Dropping and Alighting Competition was a record performance by Mr. Merriam, whose masterly handling of the Bristol biplane enabled him to land dead on the mark after shutting off his engine at a height of over 100 ft.—a performance which was warmly applauded by the crowd of spectators—thus clearly demonstrating the ability of a competent pilot to land at any given point. A little miscalculation in dropping his bomb robbed Mr. Merriam of a prize in the competition, the result being:—1st, Mr. Pashley (Sommer biplane); 2nd, Mr. Knight (Vickers-Farman biplane); 3rd, Mr. Merriam (Bristol biplane). Messrs. Bendall (Bristol) and Alcock (Farman) also competed. During the holding of the competition, Mr. Barnwell made some excellent circuits on the No. 5 Vickers monoplane, which in a few minutes climbed to an altitude of well over 3,000 ft.

Bristol School.—Merriam made a test on Monday morning last week with Lieut. Todd as passenger, but found conditions too bad for school work. Merriam again out for a test in the afternoon, taking Capt. Rickard, then up with Capt. Powell. Bendall took Lieut. Thompson, but darkness prevented further work.

On Tuesday, Bendall first made a trial, and then up with Capt. Powell and Lieut. Thompson. Lieut. Mills was out for a solo, doing excellent figures of eight and landing well. Lieut. Todd was out for a couple of circuits, Mr. Ewing doing a number of straights, as also were Lieuts. MacLean and Shekleton.

School work was resumed after breakfast, Merriam being passenger to Capt. Rickard, giving pupil landing practice. Lieut. Mills satisfactorily passed the tests for his *brevet* in excellent style, showing the making of a good pilot. Capt. Rickard again out for straights, and Mr. Featherstone for a solo, flying very well.

Merriam made a solo, Bendall took up Capt. Powell. Capt. Rickard was out for several straights with Merriam as passenger; Lieuts. Todd, MacLean and Shekleton all were out for solos; Capt. Powell was out with Merriam behind, as was Lieut. Thompson later on.

After making a trial on Wednesday, Merriam took Lieut. Thompson, who had charge of the controls. Wind and rain caused abrupt conclusion of the morning's work.

Merriam took Lieut. Thompson to test conditions in the afternoon, but found them rather unfavourable. Bendall up later on with Capt. Powell, and Merriam, a while afterwards, with Lieut. Shekleton, but weather much too bad for school work.

On Thursday Lieut. Todd made two straights, and then a good circuit after the usual trial, Mr. Featherstone following with two circuits. Bendall was testing a biplane. Capt. Powell ascending in another machine, taking Merriam as passenger. Lieuts. Shekleton and MacLean and Mr. Ewing all out for straights, but rising wind prevented further flying.

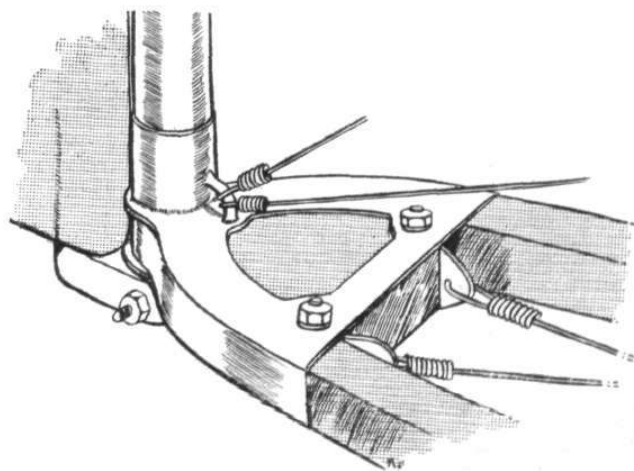
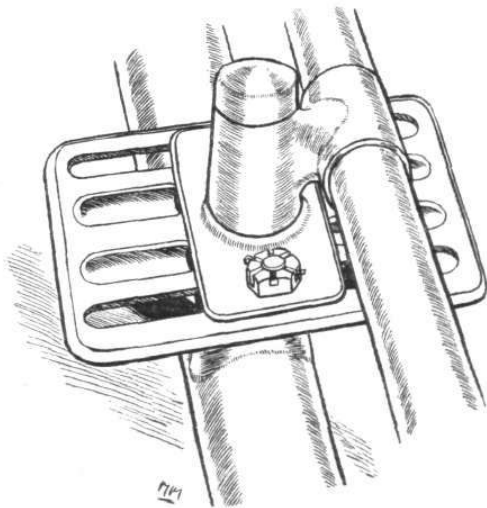
Friday and Saturday were both hopeless as regards the flying, pupils undergoing useful instruction on the machines in the hangars.

Sunday was one of the busiest days of the week, although the wind was rather rough. Merriam took Mr. Ewing for the trial, and then went up as passenger to Capt. Powell on straights.

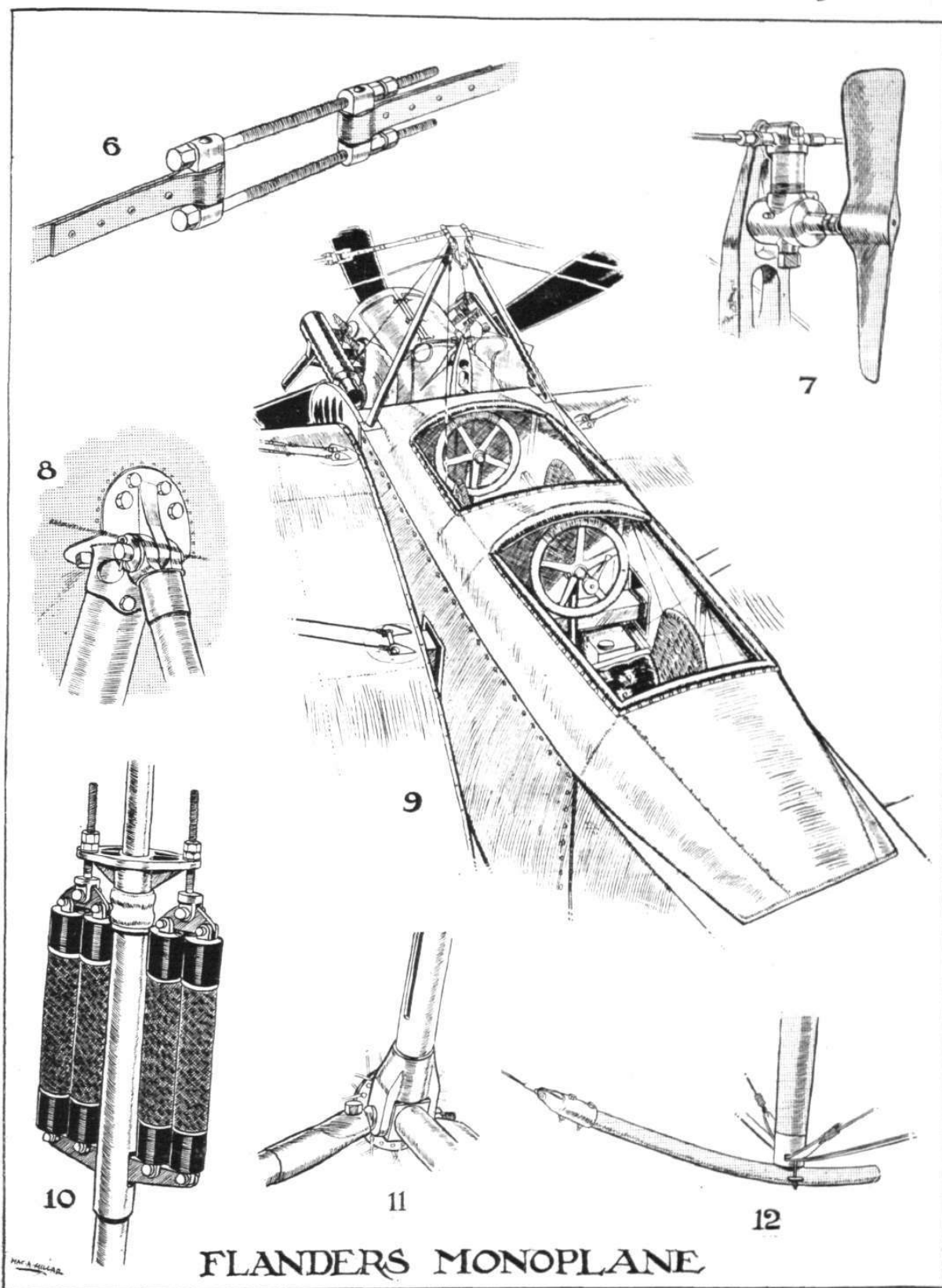
In the afternoon Merriam made a test, having Mr. Lane with him, and Bendall was up later; Lieut. Shekleton put up some very good straights considering the state of the weather. Bendall and Merriam then set out for the Bomb-dropping Competition, after which darkness prevented further work.

Ducrocq School.—Tuesday, last week, J. Alcock was making good circuits, flying very high. Also McAndrew circuits very nicely.

Alcock out Wednesday, in the evening, and Thursday doing circuits both morning and afternoon. Sunday he was out again,



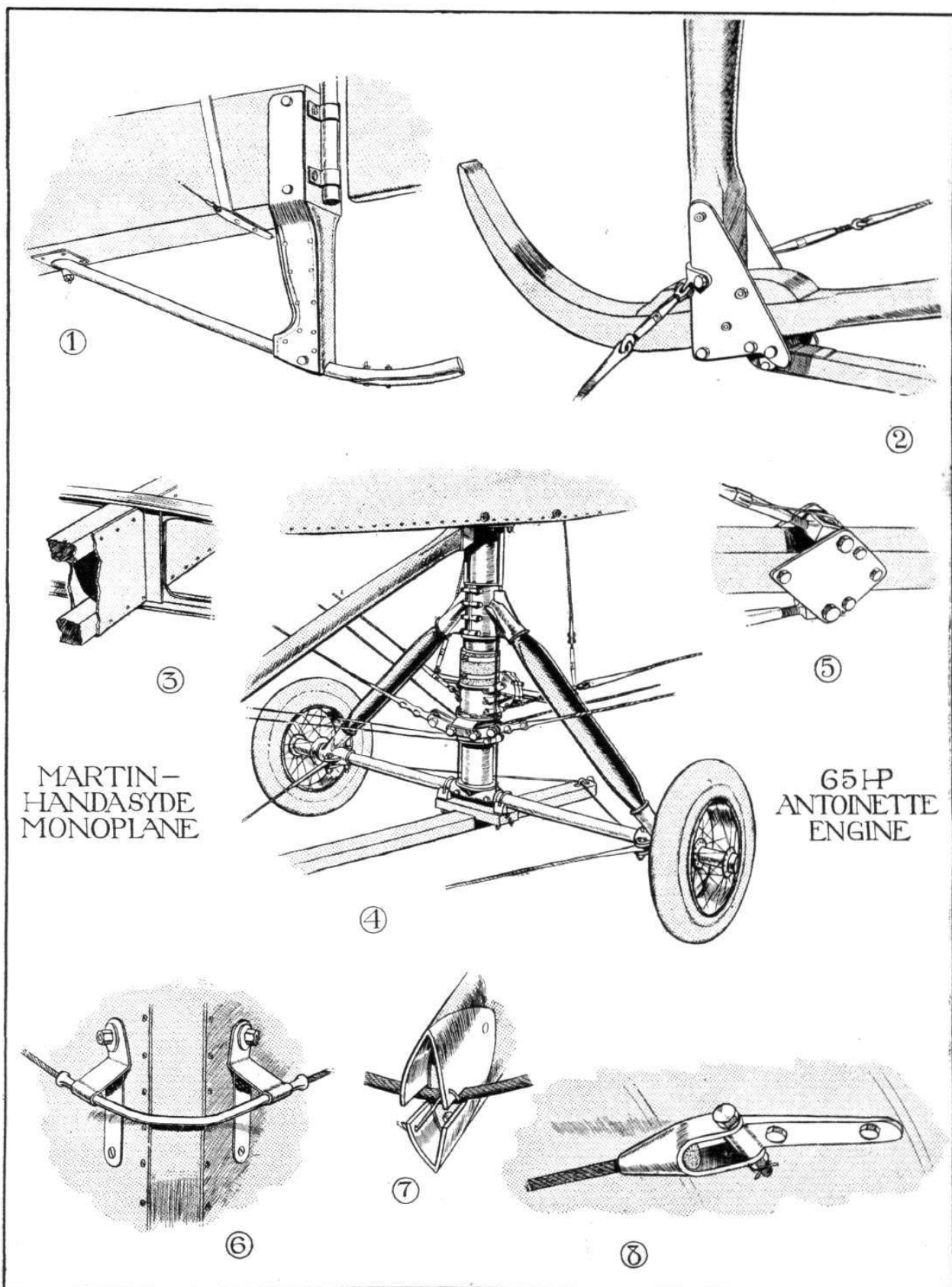
Two interesting details sketched from the Hanriot monoplanes in the course of construction at Messrs. Hewlett and Blondeau's works. On the left the clever rudder-bar fitting that may be adjusted to suit the length of the pilot's legs. On the right, the rudder post, a good example of acetylene welding.



FLANDERS MONOPLANE

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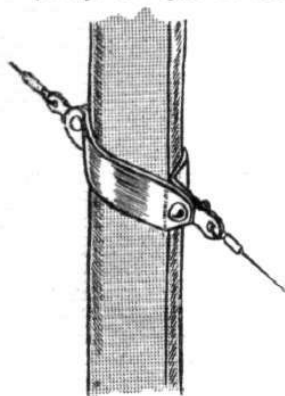
DETAILS OF THE FLANDERS MONOPLANE.—6. The Flanders steel ribbon strainer. 7. The automatic pump arranged in the slip stream of the propeller, which supplies compressed air for feeding the petrol from the main tank, low down in the fuselage, to the carburettor. 8. The fitting by which the chassis compression springs are attached to the fuselage. 9. General view from above, showing pilot and passenger's seats and double control. 10. The clever compression strut. 11. The attachment of the compression strut to the axle. 12. The neat skid that protects each rear king-post from contact with the ground.



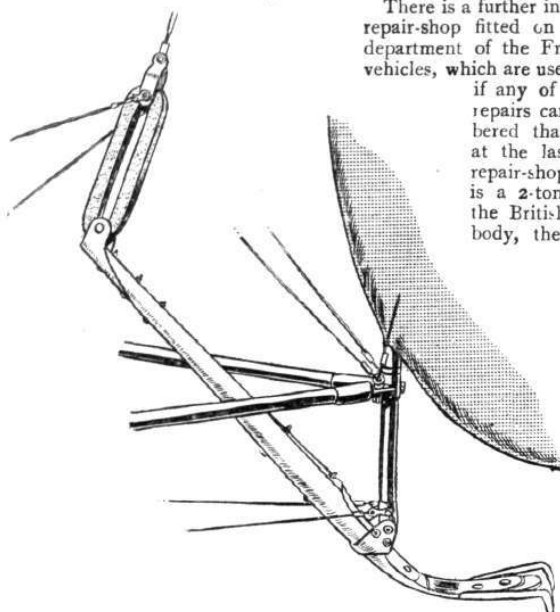
DETAILS OF THE MARTIN-HANDASYDE MONOPLANE.—(1.) The tail skid. (2.) The front skid. (3.) The construction of the wing spars. (4.) The landing gear and wing-warping mechanism. (5.) The anchorage of the chassis-staying cables. (6.) The fitting accommodating the cable which braces the wings against drift. It passes round the nose of the body. (7.) The king-post tip. (8.) One of the strong cable fastenings that are used on the cables taking the main lift.

keeping some of the draught off the occupants. This front is constructed in rather a neat manner. The skeleton of that portion is of oval section steel tubing, and the vertical members separating the top and bottom sweeps are of the same material. The joints are acetylene welded. Just behind the wind shield there is a very comfortable seat, with a high back of sheet aluminium for the pilot.

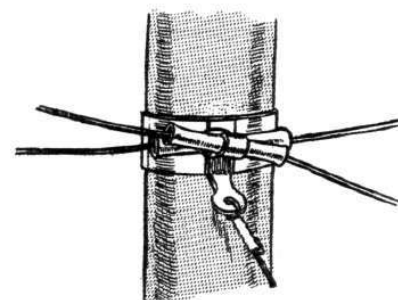
He controls the rear elevator and the compensating ailerons by means of a vertical universally jointed lever, greatly refined from the crude form of lever that was employed on the early Henry Farman biplanes. The passenger has a seat, perhaps not quite so com-



"Flight" Copyright.
How oblique stay wires are carried past struts on the H. Farman biplane.



"Flight" Copyright.
The Henry Farman tail-skid.



"Flight" Copyright.
How the tail control wires are guided at the side of a strut on the Henry Farman biplane.

fortable, just behind the pilot. The Gnome motor, at the back, is overhung. It is mounted with two flanged steel plates on one side of the crank case, and the fuselage in that vicinity is cross-braced by $\frac{3}{8}$ -in. steel tubing, to give it the necessary rigidity and strength. By the way, a new type of carburettor is fitted, whereby the engine may be made to run slowly, a condition which is difficult to obtain with the ordinary type of Gnome injector carburettor.

The tail is cambered, and is supported by outriggers which proceed from the *cellule* on either side of the engine and which meet at the rudder post. At rest, the tail is supported by a small flexibly sprung skid, which is fitted with a serrated spade, designed to dig into the ground on landing, and so bring the machine quickly to rest.

There is a further interesting exhibit on this stand—a travelling repair-shop fitted on a 28-h.p. Dennis chassis. The aviation department of the French army possess a large number of these vehicles, which are used to accompany flights of aeroplanes, so that if any of them suffered damage, quick and efficient repairs can be made on the spot. It will be remembered that quite a number of them were exhibited at the last Paris Aero Show. The chassis of the repair-shop shown on the Aircraft Company's stand is a 2-ton lorry chassis, specially designed to pass the British Government transport test. Inside the body, the sides of which are arranged to hinge

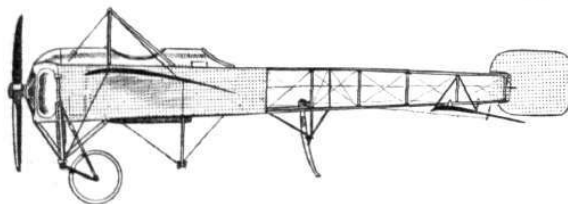
down and rest on exterior supports to give greater floor space, are a complete set of machine tools, sufficient (may be, more than sufficient) for the accomplishment of aeroplane repairs "on the road." There are installed a drilling machine and a Drummond lathe, both electrically driven by motors which obtain their current from a dynamo driven off the engine shaft. An anvil, a forge, and a convenient bench with a useful-sized vice are also carried.

L. BLÉRIOT.

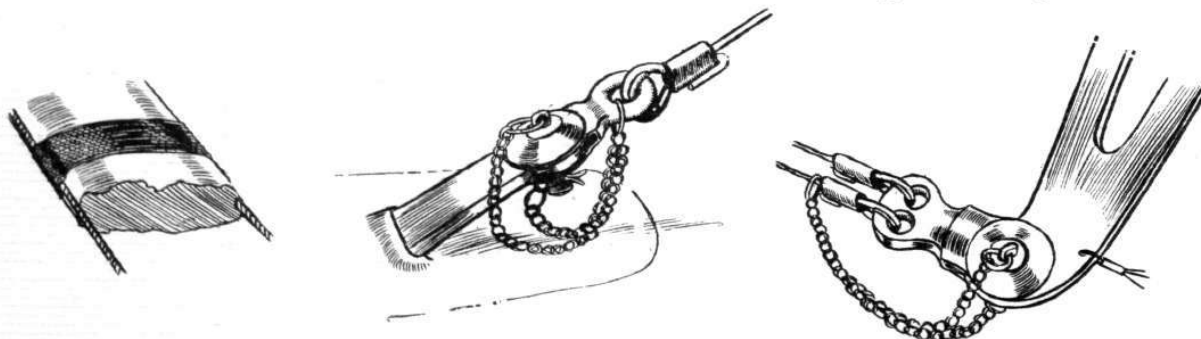
A very fine sample of an

80-h.p. Two-seater Blériot Monoplane is exhibited on their stand. To all intents and purposes the machine may be described as a 50-h.p. Gnome single-seater Blériot, enlarged up and provided with accommodation to carry a passenger. It has, as well, some few detail alterations that are not present in the 50-h.p. model. Some thirty of these machines are at the present time being put through the Blériot works at Levallois Perret, for delivery to foreign governments and private customers.

The body.—The chief point of difference that the body has, as compared with the 70-h.p. two-seater Blériot flown in this country by Hucks, is that the tail skid is sprung from the lower member of the fuselage instead of the upper. This change has been made on

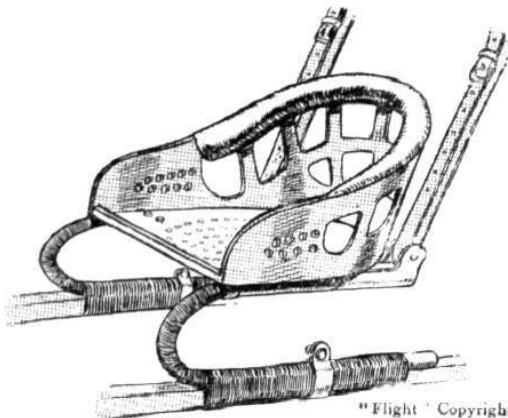


"Flight" Copyright.
The 80-h.p. Blériot tandem monoplane.



DETAILS OF THE BLÉRIOT MONOPLANE.—The sketch on the left shows the method of strengthening the bottom cross-plank of the landing chassis and the application of stranded cable. The middle sketch shows the upper wing stay-wire attachment. That on the right illustrates how the double control-wires are fastened to the rudder lever.

Particular attention has been paid to the range of the warp, and the wing tips of this machine are capable of moving up and down about 3 feet. On account of the



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The original method of cane suspension of the seats of the Bristol machine.

wing structure, which avoids putting the wing spars in torsion when the wing is warped, the wing does not tend automatically to return to its neutral position. The wing spars are, as has been mentioned, steel tubes; they are cored with wood to give them greater resistance to indentation. The wooden ribs are a free fit on the spars, and kept in position along the span by the special construction of the leading and trailing edges to which they are fastened. The trailing edges of the wings consist of three-ply wood, which is very neatly arranged and gives a well-finished edge. The general staving of the wings is very much the same as at the time of the Military Trials, the upper wires being carried over the two masts and the lower wires of the forward spars being carried forwards to the undercarriage. The lower wires of the rear spar are of course carried to the warping gear on the lower extremity of the rear mast. The innermost of the lower forward stay wires is attached to a steel strap passing under the body.

The two outer lower wires, which are attached to the forward spar and to the undercarriage, have a rake of about 45 degrees in side elevation, and their purpose is to take the drift as well as the lift. The angle is such that under all normal conditions the forward component of the lift due to the obliquity of the wires would exceed the direct drift force against the wing. The difference

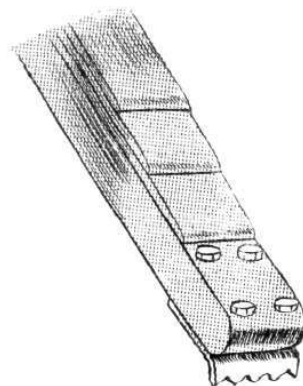
between the actual drift force at any moment and the resolved component of the lift is taken by the internal wing bracing, which is of an interesting and unusual character. Adjacent to the collars on the two spars to which the lift wires are attached, steel clips are fitted for the attachment of the internal wires. These clips embrace the tubes that are not rigidly fixed thereto. In turn, these clips are embraced by the master ribs of the wing structure. The arrangement of the clips is such that their proximity to the fixed collars on the wing spar gives them a point of abutment that otherwise would of course be lacking.

The undercarriage design of the Bristol monoplane is a striking feature of its construction, principally on

account of the very interesting and very massive looking streamline main struts by which it is attached to the body. These struts, which measure some four inches fore and aft, are hollow, and at each end are semi-circular, so that they form a knuckle-joint with the piece against which they abut. The joint is completed by a plate and a pin through the centre from which the semi-circle is described. The joint is constructed as a rigid member, but its object is to facilitate a certain amount of give in the right place so as to avoid breakage in the event of very severe shock. The general design is also such as to facilitate the replacement of these struts.

Ordinarily, the weight of the machine is carried on two wheels, which are attached by their axle to the chassis skids by means of elastic straps. Two smaller guard wheels are carried on extensions of the chassis construction, and serve to take the shock of a *piqué* landing or of any obstruction. While rolling, this portion of the chassis projects forward of the propeller, and to that extent tends to preserve it from damage.

The tail unit of the machine consists of a segmental fixed member that is non-lifting and an undivided extension thereto, which forms an elevator flap. The rudder is mounted entirely above the tail, and is pivoted so as to be approximately in balance about its swivelling axis.



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The laminated rear end of the Bristol monoplane skid.

Whitsun Work at Liverpool.

On Whit-Sunday, Mr. Birch, who had an engagement to give an exhibition at Beeston Castle on Whit-Monday, decided to make an early start to get there. After circling round in front of the hangars he headed straight for New Brighton Tower, but found the wind at 1,500 ft. so strong against him that he had only left the Mersey by about 3 miles, and had been in the air 40 mins., so wheeled round and was back at Waterloo in less than 10 mins. Later on in the day the wind subsided, and Birch made another start, but hardly had he crossed the Mersey this time before his engine showed signs of flagging, and he took advantage of the Wirral Ladies' Golf Links to come down. A telephone message to Mr. Melly at Liverpool Aviation School brought the latter across the Mersey within the hour, but as no defect could be found, after running the engine several times, it was decided to make another attempt. The engine this time gave up the ghost even sooner than before, and Birch, thinking discretion the better part of valour, executed a lovely spiral *piqué* from about a hundred feet and landed in a gorse bunker with no further damage than a strained fuselage through three wires breaking. The machine was dismantled and housed in the motor garage of Mr. H. Bickersteth, who offered the most generous help, and hospitality. The machine, which is the same machine that



Birch flew round Liverpool and Birkenhead on 2nd inst., was packed up, and on Tuesday towed home by the School car.

Mr. J. L. Hall at Debenham.

SEVERAL exhibition flights were made by Mr. J. L. Hall on his 50-h.p. Radley-Moorhouse monoplane in connection with the fête and gala at Debenham, Suffolk, on Whit-Monday. A crowd of about 8,000 people came from the surrounding villages chiefly to see the flying, as it was the first time an aeroplane had visited the district. Several flights were also made in a gusty wind towards the evening. On the termination of the flights the crowd broke through the ropes and swarmed round the machine, whereupon Mr. Moore, the chairman of the Committee, thanked Mr. Hall for his splendid display of flying, and congratulated him on his graceful landings. After the cheering ceased, Mr. Hall suitably responded, and the machine was wheeled back by the Boy Scouts.

Testing the Parsons Biplane.

SOME good flying was done at Brooklands last week with the Parsons biplane, designed and built by Mr. P. M. Muller for the purpose of testing the automatic stability device invented by Mr. J. G. Parsons. With Jack Alcock piloting, the machine was taken to 2,000 ft. during a cross-country trip on Monday week.

THE "TONG-MEI" 40-H.P. BIPLANE.

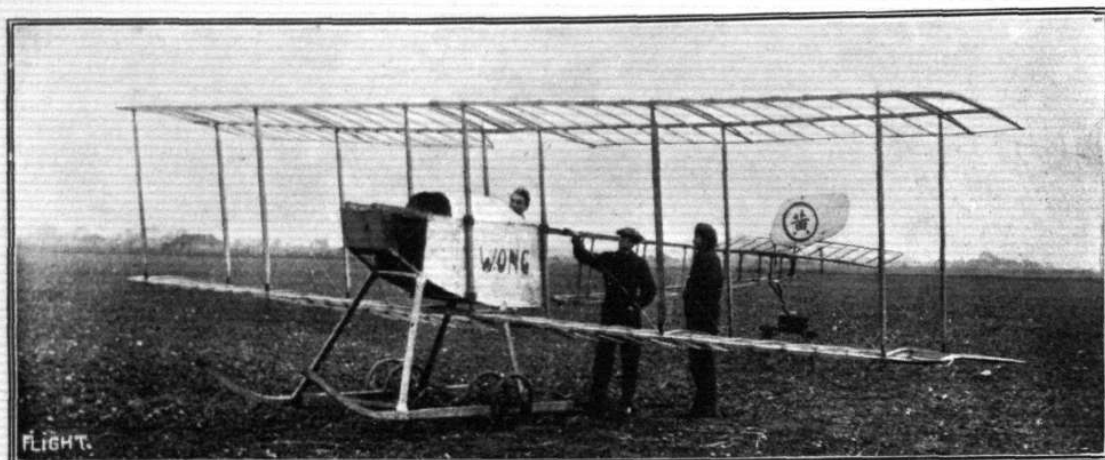
By A.E.G.

THE "Tong-mei" tractor biplane, which is now being tested at the Shoreham aerodrome, is a good example of the light single-seater aeroplane, and is somewhat reminiscent of the BE 3—the highly-staggered planes, deep fuselage and simple landing gear giving this impression.

The plane outline is not common in this country, the

The outline of the *empennage* gives a graceful effect, quite in harmony with the rest of the machine. The almost *semicircular* tail has a slightly cambered top surface. The 7-ft. 4-in. elevator is built in one piece to give high efficiency, and for a measure of safety should one control cable fail.

A detail feature of the control masts is the cable



THE "TONG-MEI" TRACTOR BIPLANE, MINUS FABRIC, IN COURSE OF ERECTION.—
Mr. Wong in pilot's seat.

trailing-edge being swept back slightly from the second rear strut to the extreme wing-tip, the idea being to gain increased warp efficiency.

A simple and neat hinge is fitted to the rear spar, to lessen fatigue.

The planes are mounted on twelve silver spruce silk-bound struts, shaped to the "Baby" section, as recommended by the National Physical Laboratory.

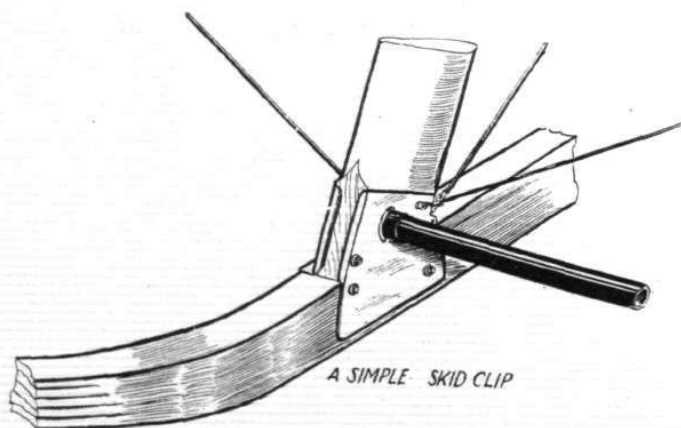
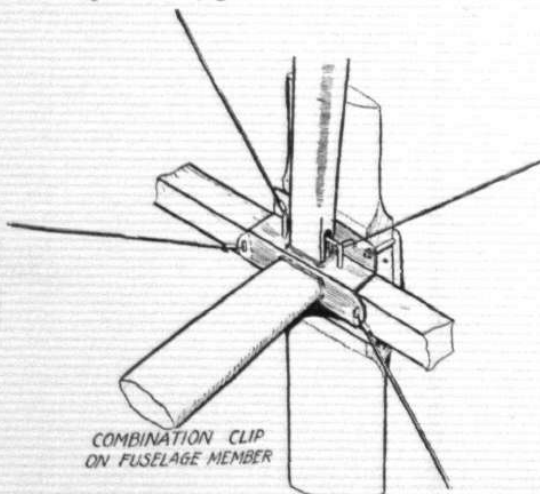
A particularly good feature is the rib construction, each

fixing, designed to retain the cable in case of failure of the bolt or its fastening.

The balanced rudder is mounted on a wood-filled steel mast, which, extended through the body, forms the support of a pivoted tail skid, in BE 3 fashion.

The landing chassis is essentially simple, being designed for use in a country where skilled assistance is difficult to obtain, each member could be replaced by almost any material that came to hand,

The steel clips fastening the struts to *fuselage* and skids are very simple, but at the same time strong pieces of platework.



rib is built up of three laminations of spruce layered together with glue and rivets on a former, the resulting curve being absolutely permanent, and the finished rib is a great deal stronger than one of the ordinary type.

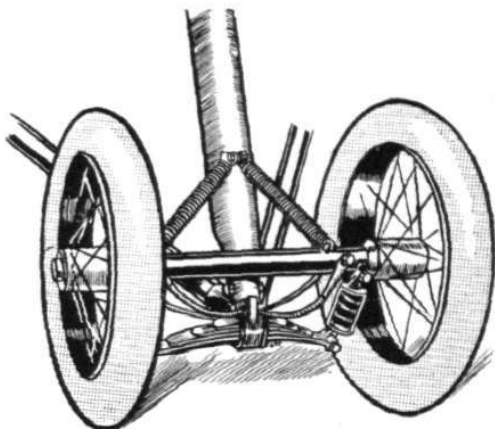
The trailing edge of the upper plane is cut away, above the body, to lessen down draught on the tail.

The comfort of the pilot has been carefully studied and he is well sheltered behind an aluminium turtle deck, which also streamlines the petrol and oil tanks. Light wood formers carry a lath and fabric combination of the streamline form behind the pilot.

The central lever utilized is practically a modified

maintenance of lateral stability is effected through stranded cables by means of two pedals.

From the pilot's seat, situated as it is well to the rear of the trailing edge of the planes, an exceptionally fine view of the country underneath is obtained, this being further facilitated by the absence of fabric in the central portion of the lower plane. Just behind the main spars, *i.e.*, approximately on the centre of pressure, is the observer's seat, formed by the front of the petrol tank, which is built into the *fuselage* between the two seats. In front of the observer is a starting handle by means of which he can start the engine without getting out of his seat.



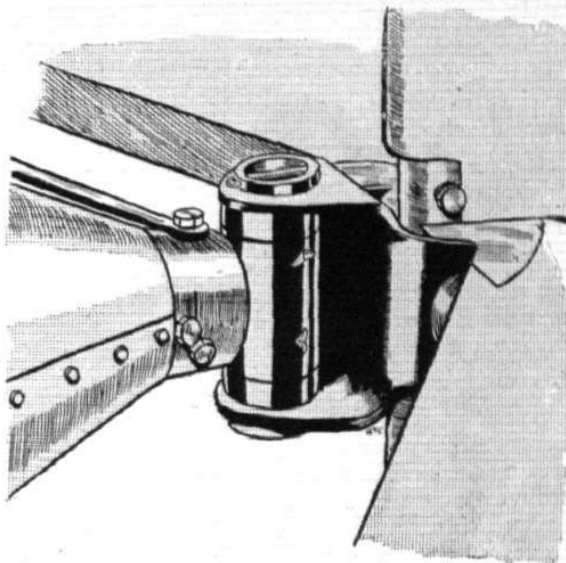
The front part of the landing chassis, showing transverse leaf-spring.

A supply of 48 gallons of petrol is carried in the main tank between the seats. A small pump of the rotary type, and driven by a miniature propeller working in the slip stream of the propeller, forces petrol from the main tank into a service tank under the cowl in front of the pilot, whence it is fed by gravity to the engine. Oil is carried in two small tanks, which have a capacity of 4 gallons each.

Mounted on strong steel bearers in the nose of the machine is the engine, which in this particular machine is a 7-cylinder radial Canton-Unné engine of 85-h.p. The fact that the engine is of the radial type allows of a very good stream-line, as only the valve rockers and tappets project outside the aluminium covering. As the engine is water-cooled it will be easily understood that there is no necessity to have the cylinders exposed

to the air, and a considerable amount of head resistance is avoided by bolting a hemispherical shield to the boss of the propeller, thus completing the stream-line form of the *fuselage*. Water-cooling is effected by means of two radiators, consisting of a series of flattened brass tubes, and secured to the two inner plane struts.

One of the most noticeable departures from the original design is the landing chassis. This structure is constructed throughout of steel tubes, which have been

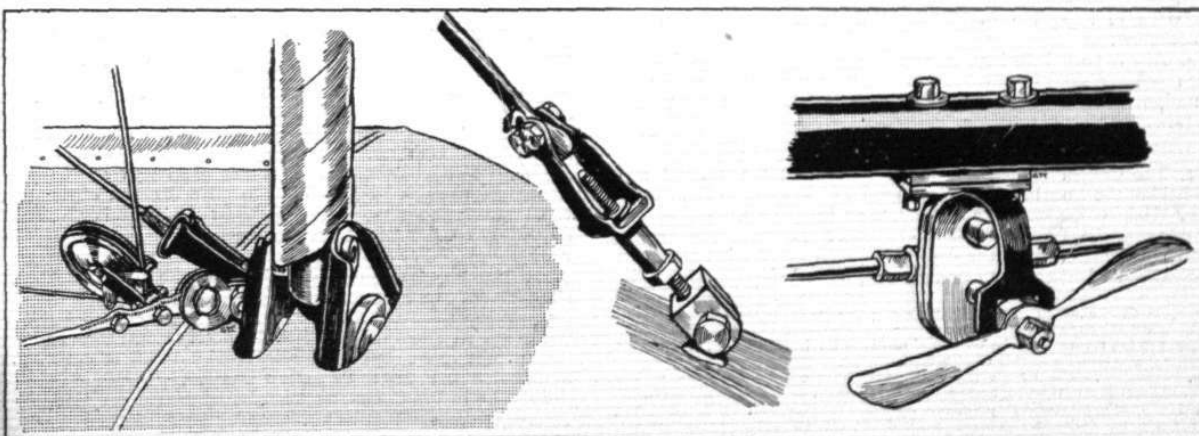


The universal tail-joint.

stream-lined with a casing of aluminium. The axle of the main wheels is supported on two telescopic tubes fitted with oleo-pneumatic springs for taking the shock in landing, while a pair of orientable wheels, sprung from the front member of the chassis, protect the propeller against contact with the ground.

A tail skid is not fitted, the rudder, as previously described, being sprung in such a manner that it performs the duty of a tail skid.

Owing to the great flexibility of the wings the machine has a large amount of natural stability, as a gust striking one wing simply raises the trailing edge without destroying the equilibrium of the machine. Another advantage of this flexible wing construction is that a very wide speed range is obtained. The weight of the machine empty is 1,550 lbs.

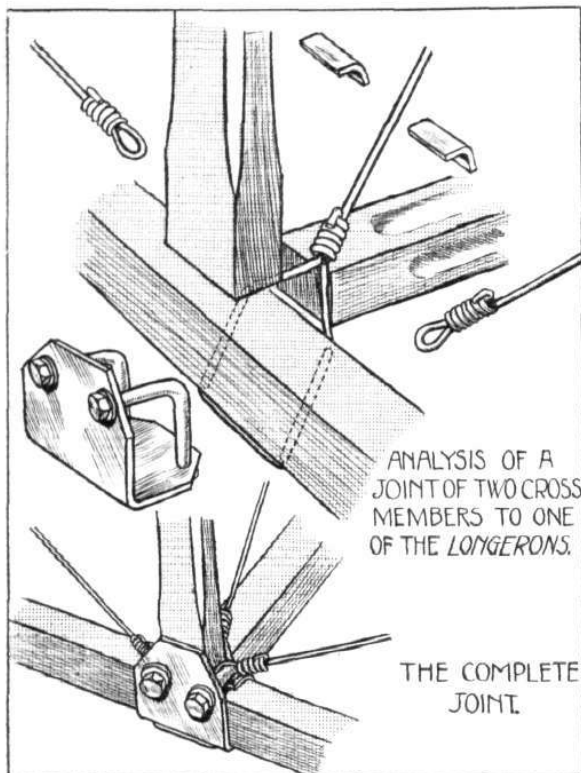


On the right, the Breguet petrol pump; in the centre, a typical strainer and its attachment to the plane. The left-hand sketch shows a flexible joint between a strut and main spar, with its adjacent fittings.

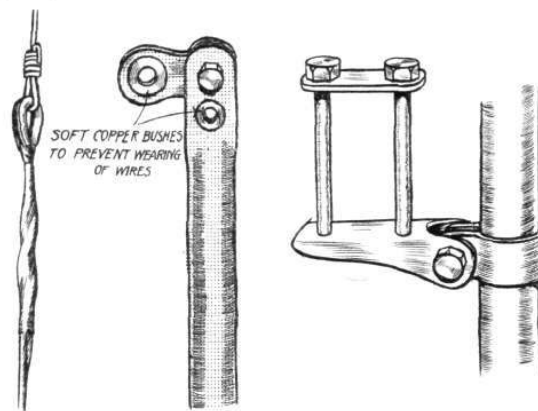
THE PARSONS BIPLANE.

QUITE apart from the interest attaching to this biplane from the fact that it is the machine on which the Parsons pendulum paddle-wheel stabilizer is going to be tried out, the Parsons biplane is in itself very interesting, as its designer and constructor, Mr. P. Muller, has managed to

that the machine is a biplane of the tractor type with a monoplane fuselage. Although the main planes resemble in their general appearance those of the Caudron biplane, with which our readers are familiar, they differ from that well-known design in several details. For instance, the planes are not warped for maintenance of lateral stability, this function being carried out by flexing the trailing edge of the outer part of the upper plane. From the rear spar to the trailing edge the ribs in that portion of the wing consist of

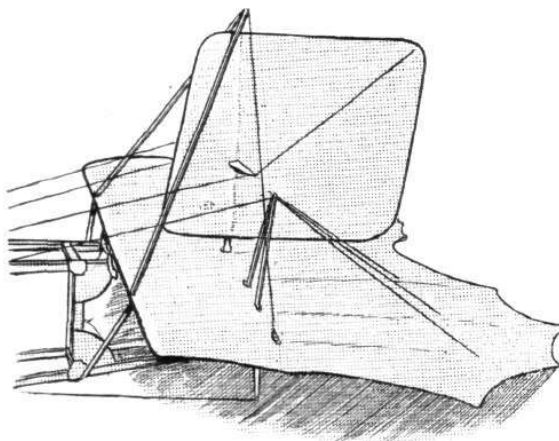
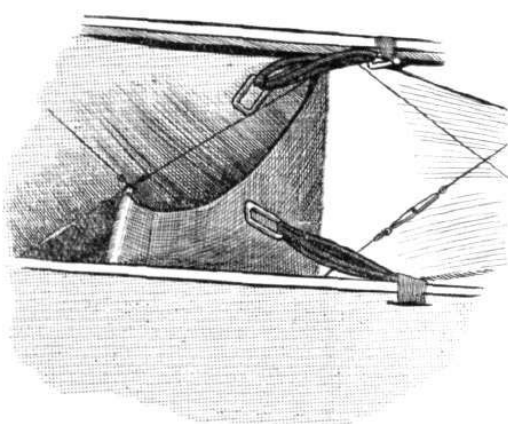


incorporate in it several new ideas. This, too, in spite of the fact that he was handicapped from the start by having to face the problem of designing a machine which could be flown with a 40 h.p. Aster car engine. To design an aeroplane that will fly with a proper aviation



On the left is shown the method of securing the strands of a control cable by soldering a long copper ferrule round them. In the centre is the top of warp operating lever, showing how wire is protected against wear by copper bushes; and on the right a sketch of the attachment of warp operating lever to rear spar.

steel tape instead of the usual wood construction, the object being to obtain greater flexibility without the risk of breakage. Running parallel to the trailing edge, and some six inches in front of it, is another steel tape, to which are secured the wires by means of which the trailing edge is flexed. These wires are attached at their other end to a tubular lever pivoted on the rear spar and operated through stranded cables from the controls. In order to obtain greater efficiency the cord of the flexing portion of the wing is made slightly wider than that of



Pilot's seat of Parsons biplane, and on the right arrangement of tail planes.

motor is, perhaps, not such a difficult matter, but to have designed a machine that flies—and flies well—with a heavy car engine is no mean achievement.

From the accompanying scale drawings it will be seen

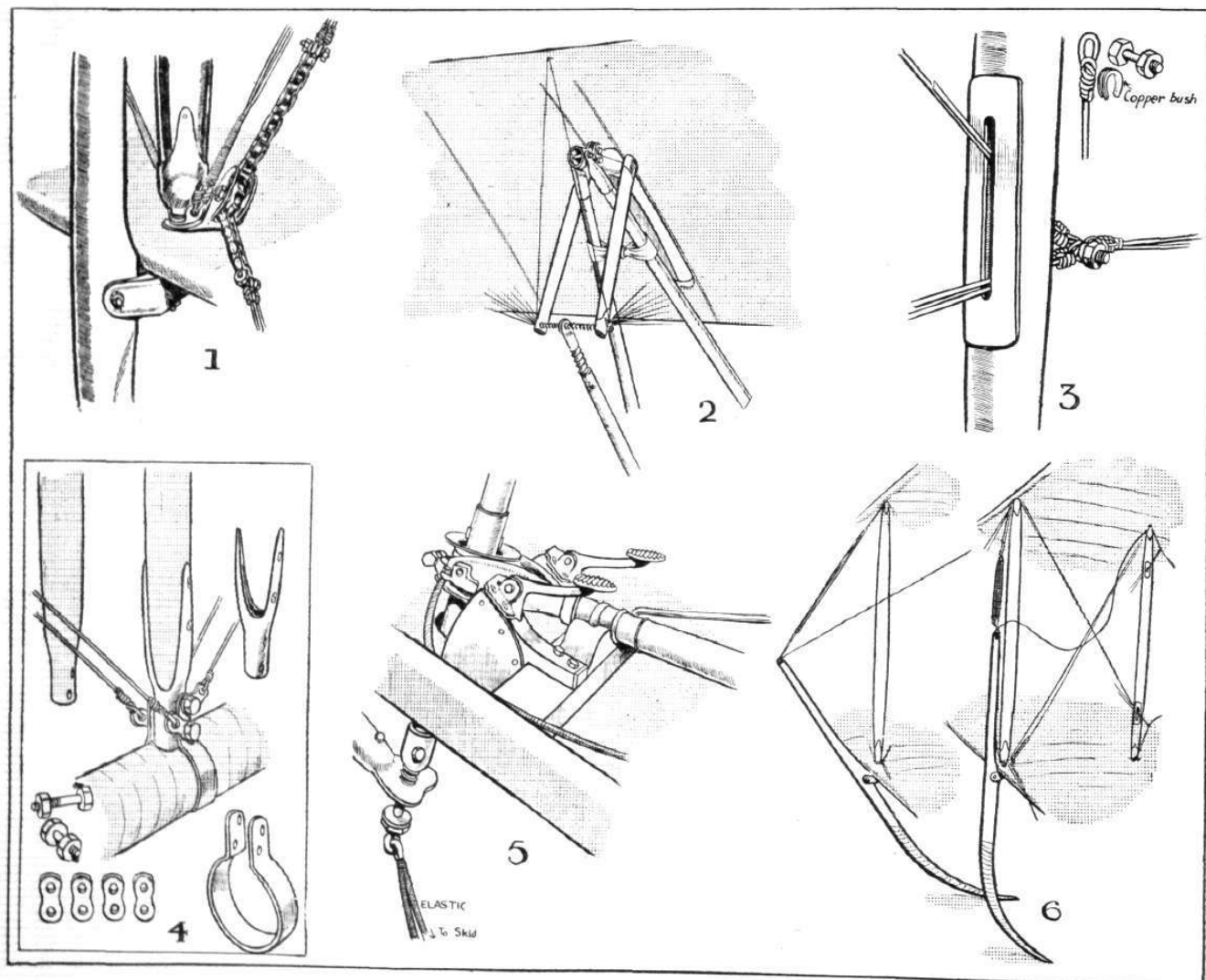
the rest of the wing. The main planes are built in three sections for ease of dismantling, and the fabric is laced together at the joints. In order to minimise stresses on the fabric the cords are passed through an aluminium

THE CODY WATERPLANE.

No doubt most of our readers will agree that in no better way could we honour the name of the great pioneer, than by publishing illustrations and particulars of the latest machine built by the late Col. S. F. Cody for the *Daily Mail* race round Britain, the machine in which he had incorporated all the improvements that his great experience and ever-alert inventive genius had suggested to him, and of which his opinion—as expressed by himself a short time before his death—was that she was “A beauty, and as steady as a rock.” We believe that the scale drawings and sketches of the Cody Waterplane, which we publish herewith, and which were made a few days before Mr. Cody's death, are the only complete drawings available of the ill-fated machine, and they should therefore be of exceptional value to all who have followed with interest the work of the great pioneer.

Size and weight have always been the characteristics of Cody machines, and it was only to be expected that for a contest like the *Daily Mail* Round Britain Race, which will impose upon both pilot and machine much more severe strains than any to which aeroplanes have hitherto

been subject that these characteristics would be retained, and as regards dimensions and weight the Cody is far in excess of any of the other machines entered. In this latest machine the span of the main planes has been considerably increased, while the overall length has been greatly reduced by bringing both the front elevator and the rudder closer in towards the main planes. It will be remembered that the machine on which Mr. Cody won first prize in the Military Competition last year had two rudders of cruciform shape. In the present machine only a single rudder is fitted, which has consequently had to be made of much larger area, situated, as it is, closer to the main planes, and therefore working on a smaller leverage. One of the features of the earlier Cody biplanes has disappeared, *i.e.*, the divided front elevator, which worked in conjunction with the main planes for maintenance of lateral stability. In its stead is fitted an elevator of more orthodox type, which has a slot cut in the centre for the accommodation of the central elevator booms. These, as well as the tail outriggers are made of bamboo bound with fabric. The



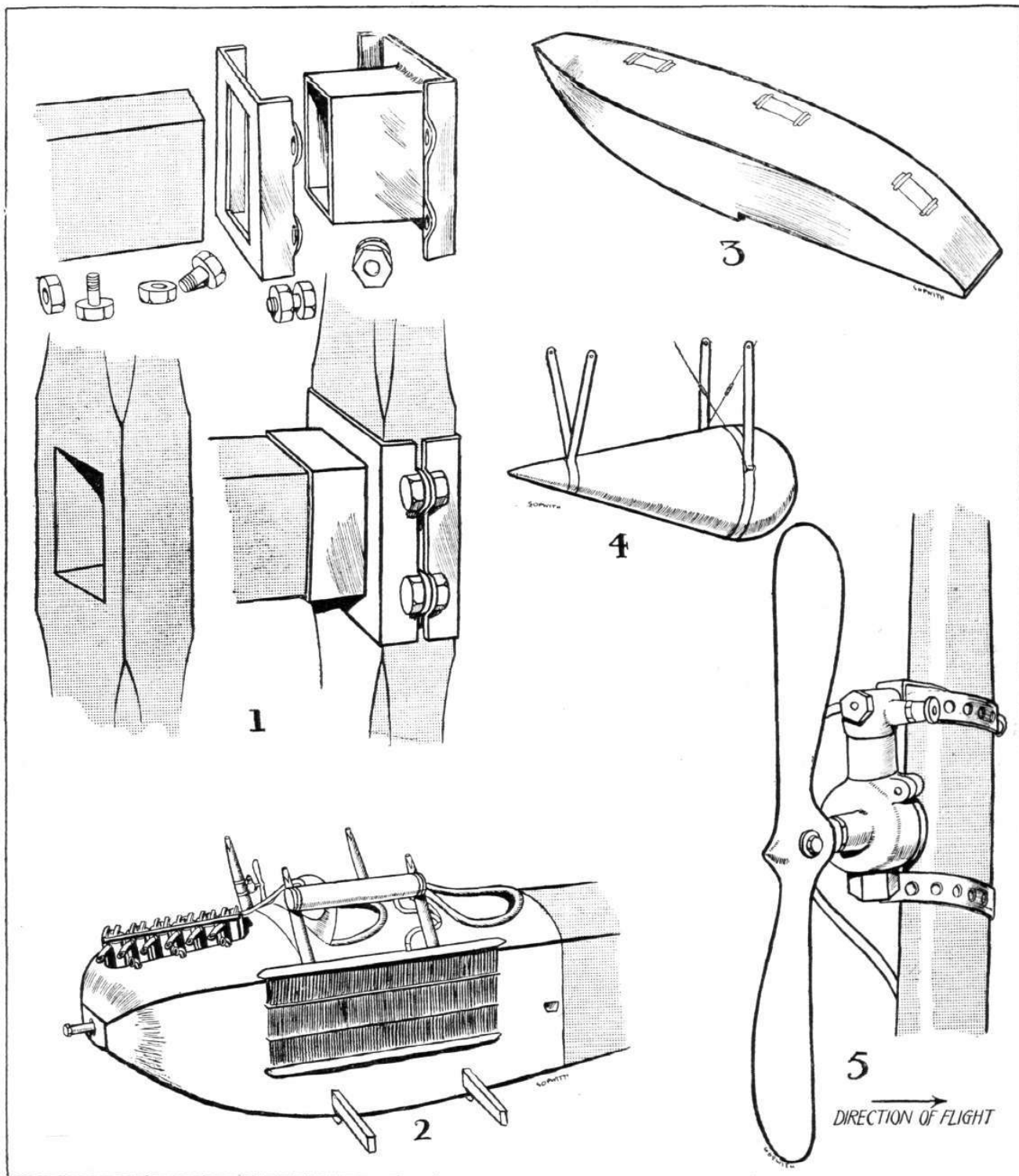
THE CODY WATERPLANE.—1. A typical strut socket and swivel joint of skid to main plane. 2. Attachment of elevator to central outriggers. 3. Sketch showing method of carrying warp wires through struts. 4. Analytical sketch of joint between tail boom and strut. 5. Universal joint and pedals operating engine controls. 6. A novel form of wing skid.

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In order to minimise end losses due to the air spewing out of the opening thus produced, what might be called baffle plates have been fitted to the inner ends of the wing.

These baffle plates have been made streamline in

section, as it was found that an ordinary thin board would bend owing to the pressure of the air trying to escape past it. With full load of fuel and passengers on board the weight of the machine is 2,400 lbs., and her flying speed is 60 to 65 m.p.h.



THE SOPWITH WATERPLANE.—1. Analytical sketch, showing method of joining engine-bearer to fuselage strut. 2. Three-quarter front view of fuselage, showing engine housing and radiators. 3. One of the main floats. 4. The tail float. 5. Petrol pump.

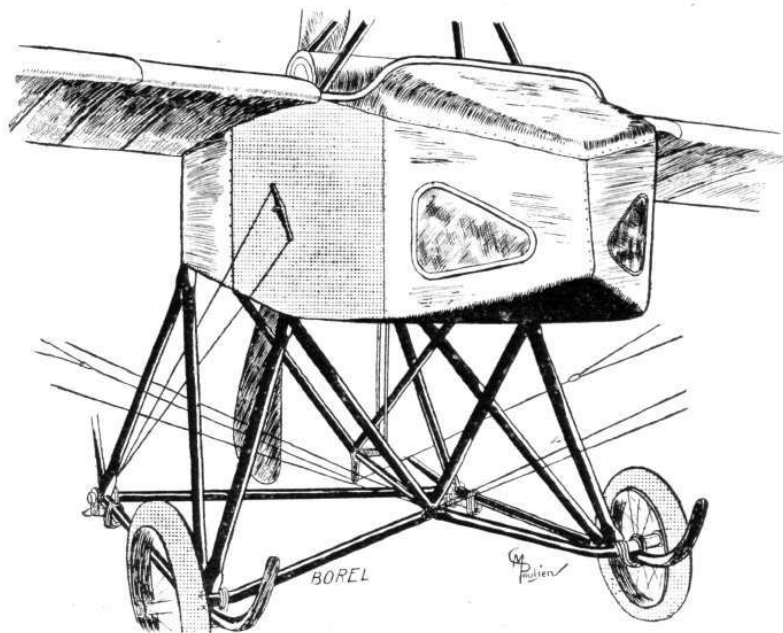
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front one of which serves at the same time as a support for the rear-wing spar and the rear members of the top pylon. The rear engine frame carries a ball-bearing, in which runs the propeller-shaft, or, more correctly speaking, the extension of the crank case on which the propeller is mounted.

In a monoplane of the engine-behind type, one of the constructional difficulties is that of suitably mounting the tail planes on an outrigger which will withstand torsional strains and at the same time allow of the propeller clearing all its members. In the Borel military mono-

carried inside the two lower tubular tail booms, so that should any one of them break there is no danger of them becoming entangled in the propeller.

It has already been said that a wireless telegraph



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The nacelle and the landing chassis of the new Borel.

plane this difficulty has been overcome by constructing the outrigger of three instead of four booms. These are in reality steel tubes, the upper one of which abuts against the boss of the propeller through the interposition of a ball-bearing. The two lower members are secured to the rear end of the chassis skids. One of our sketches shows the method of joining the struts to the tail booms, and it will be noticed that the joint is effected without piercing either boom or strut, and thereby weakening them. Another sketch shows the chassis, which impresses one as being particularly strong without affording an undue amount of head resistance. On the rear ends of the main skids will be noticed two small tusk-like extensions which are sprung in order to lessen shocks due to the tail dropping and which perform really the duties of a tail skid in the absence of a special fitting of that nature.

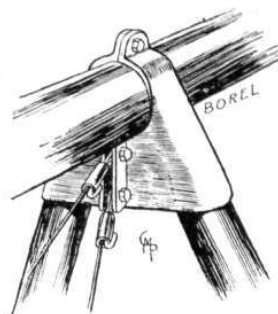
An interesting point in connection with the control of the machine is that the rudder and elevator cables are



G. M. Dyott's Ill-Luck.

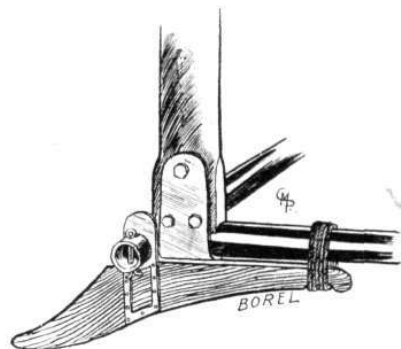
TEMPORARILY, the fates have refused to smile on G. M. Dyott, who has been doing such good work in America, but every man must expect a certain measure of misfortune, and Dyott himself is standing up manfully against his odds. On one occasion recently a terrific hurricane and a thunderstorm, which must have been almost as bad as its description in the American press, broke over the aviation ground where Dyott and several of his companions were sleeping in the tent that also covered the aeroplane.

The tent pole was shattered by lightning, and every man in the tent was momentarily stunned by the shock. The fall of one tent pole brought about the collapse of another, and the aeroplane was in imminent danger of being wrecked. Those who were less



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Sketch showing method of joining struts to tail boom of Borel without piercing either



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Small sprung rear skid on heel of Borel main skids.

apparatus is carried. This in itself can hardly be said to be a novelty, as already messages have been sent from aeroplanes in flight, but once the machines are on the ground their utility for transmission of wireless messages is greatly decreased owing to the lack of a mast on which to secure the *antennes*.

The Borel machine has been so designed that it can be made to form its own mast. By standing the machine on its nose, so that it rests on the skids and on the nose of the *fuselage*, the tail booms are inclined upwards. Another pair of tubes of smaller diameter, which during flight are enclosed in the lower tubular tail booms, now form extensions on which the *antennes* may be mounted. A small auxiliary motor is provided for the production of the necessary current.

When put through its preliminary trials by M. Daurcourt the machine behaved excellently, getting off easily with a passenger and three hours' fuel.

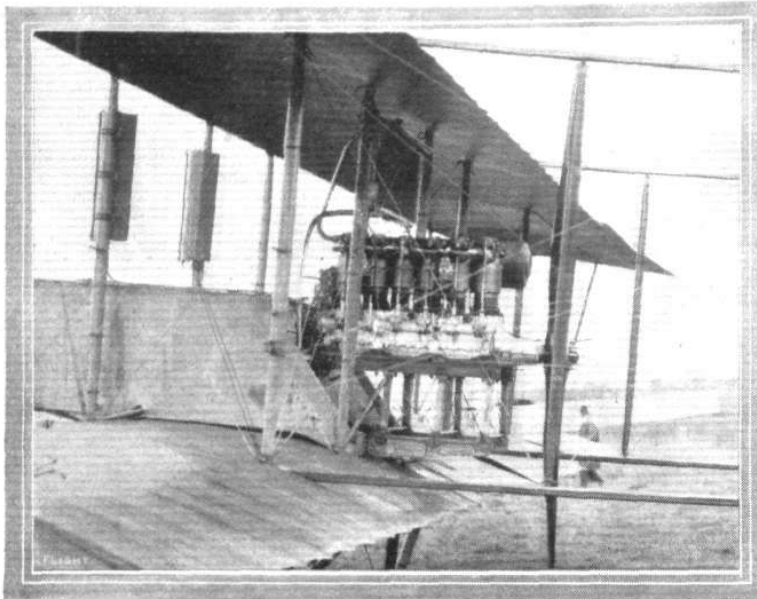


stunned than the others managed, however, to ward off a certain amount of the danger, and the fire brigade having been summoned on the misunderstanding that the whole place was ablaze, turned up at an opportune moment to render assistance.

On another occasion Dyott was returning from a flight, and about to land, when the entire crowd swept across his path, presumably under the influence of uncontrolled enthusiasm, but in any case with a total ignorance of the meaning of momentum in a moving mass. In a fraction of a second Dyott was confronted with the hideous prospect of mowing down the spectators by the score, the alternative being to elevate and fly straight at a telegraph pole. He took the latter chance, saved the crowd, wrecked his own machine, but being thrown clear himself was happily quite uninjured.

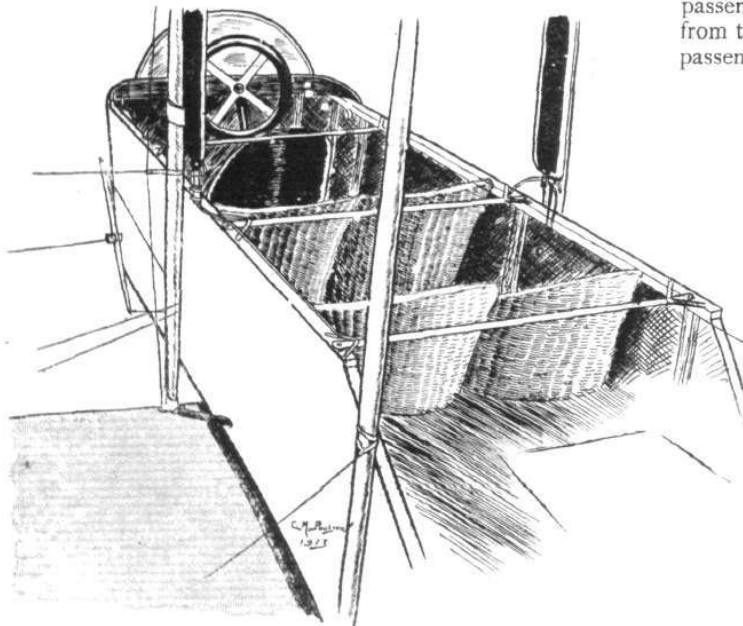
of the central column. The axle carrying the drum around which passes the warping cable, is provided with semi-thrust ball bearings in order to reduce frictional

indicator, altimetre, compass, air speed indicator, *etcetera*. The *etcetera* includes a motor horn, which creates quite a lot of amusement when sounded while the machine is



THE GRAHAME-WHITE CHAR-A-BANCS.—A view showing the mounting of the Austro-Daimler engine.

resistance, and the control wheel itself is secured on the axle by a large nut forcing it up the tapering axle in a similar manner to that employed in securing a propeller to its shaft. The cable drum is integral with



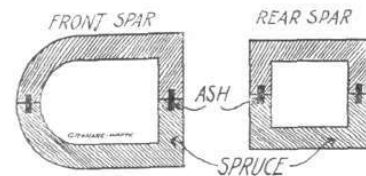
Sketch of the nacelle, showing seating accommodation for pilot and four passengers.

the axle, the whole being machined out of one solid piece of steel.

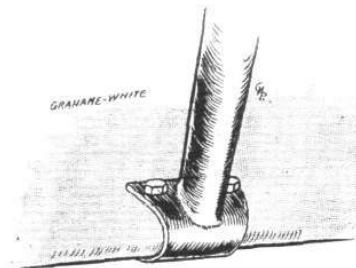
To the right and left of the pilot are mounted the various instruments, such as pressure gauge, revolution

in flight, as it can be distinctly heard above the very effectively silenced roar of the engine.

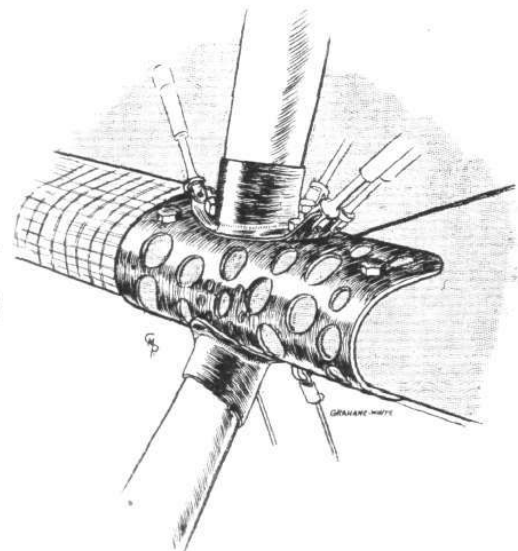
Behind the pilot are the four passengers' seats, arranged in pairs. Plenty of room is afforded so that the passengers may enjoy their flight in comfort as distinct from the more or less cramped positions occupied by the passenger in older types of machines. The *longerons* of



"Flight" Copyright.
Sections of wing spars.



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How crank-lever is attached to leading edge of aileron.

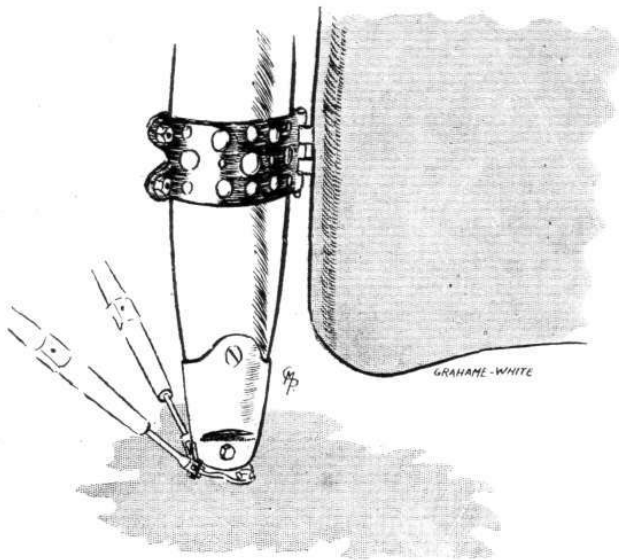


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A skid strut joint.

the *nacelle* are extended to carry the engine, a 120 h.p. Austro-Daimler, which is so rigidly mounted that hardly any vibration is felt when sitting in one of the seats. Four stout steel tubes running from the engine bed to

the front and rear spars respectively, transmit the thrust to the wings, the unit formed by the *nacelle* and engine bearers being further secured by means of steel wires taken to various points on the machine.

Slung on the cross wires of the central *cellule* is the

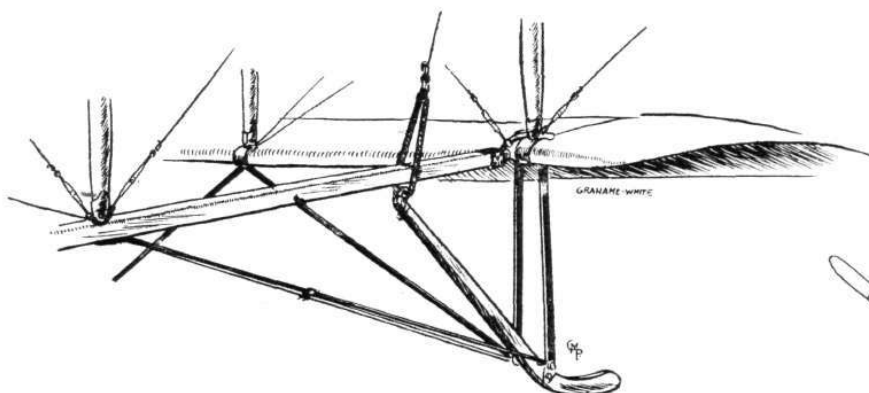


A neat rudder hinge.

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radiator, which, situated as it is right above the engine and between the main planes, receives the maximum amount of draught, thus rendering it very effective. In the bottom of the *nacelle*, and under the passengers' seats, is a large petrol tank with a capacity of 28 gallons.

From this tank petrol is forced by pressure to a service



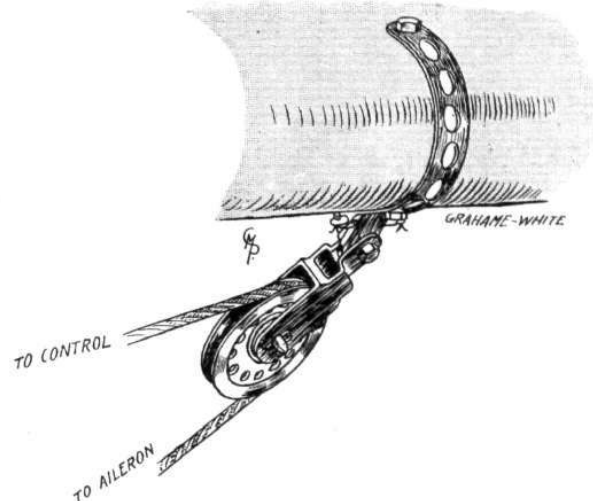
One of the tail skids.

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tank mounted on one of the inner plane struts, from whence it runs by gravity to the two carburettors. Oil is carried in a similar tank mounted on the corresponding plane strut on the other side of the *nacelle*. As we have already said, the engine is very effectively silenced by means of a silencer designed by Mr. North, and consisting of two concentric cylinders, the inner one of which is divided into 6 compartments, and perforated with small holes. After an extended run of the engine, the inner cylinder will be found to be red hot, while the outer one is barely warm. The advantage of this will be apparent

to any one who has ever experienced the sensation of carelessly resting a hand on a hot exhaust pipe.

The wings are constructed in the usual way of ribs, built over two main spars. The ribs are built up of webs of three-ply wood with flanges of spruce, while the main spars are built up of spruce hollowed out for lightness.

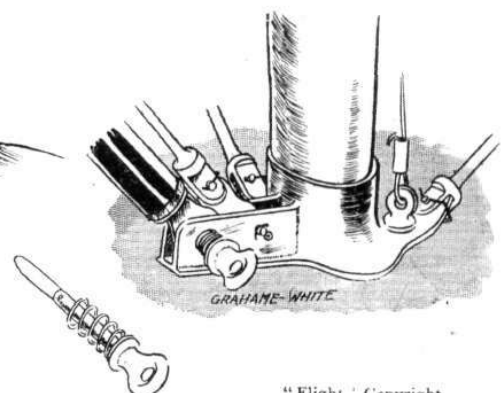


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Another neat fitting—the universally-jointed pulley for aileron cable.

In section the wings are provided with a very pronounced camber, thus rendering the machine somewhat slow; her flying speed is about 45 m.p.h.

Four tail booms of spruce, hollowed out in a similar manner to the main spars, carry at the rear the biplane tail planes. To the trailing edge of the upper tail plane is

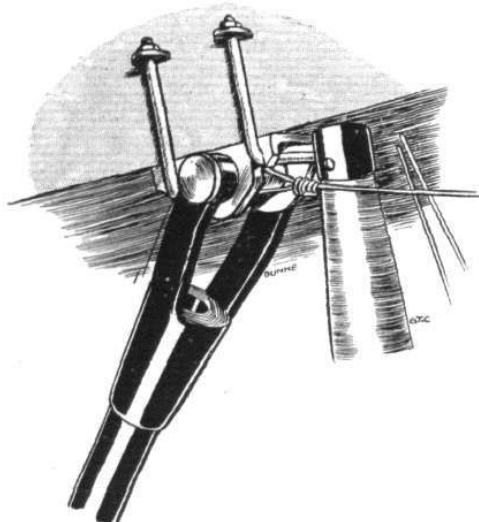


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Sketch of quickly detachable fitting of tubular extension struts to main plane struts.

hinged the elevator, while hinged to the outer tail struts are the three rudders by means of which the machine is steered. One of the accompanying sketches shows one of the two tail skids by means of which the tail is protected against contact with the ground. Hollow spruce struts are employed in the tail, outrigger and between the main planes in the outer portion, whilst the 8 inner plane struts are made of ash. A very strong landing chassis of the type usually employed in biplanes, and belonging to the wheel and skid type, supports the machine on the ground.

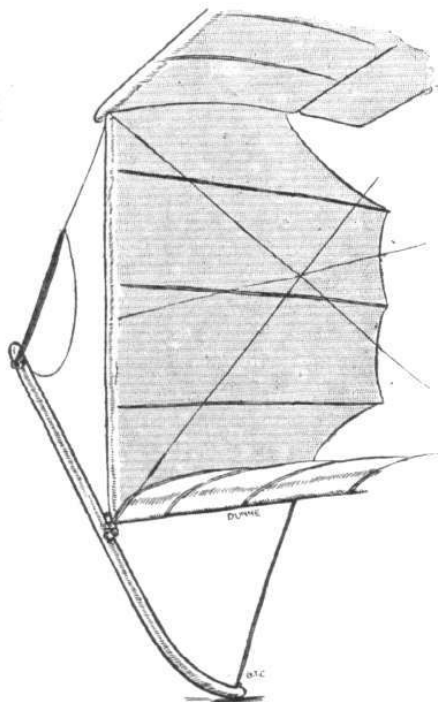
edge, are made of spruce of rectangular section, over which are built the ribs, which have flanges of spruce and webs of whitewood. As has already been said, the angle of incidence diminishes towards the tip, but another



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Shows the connection of one of the front steel tubes of the chassis to the fuselage.

point in which the Dunne differs from other machines is that the camber increases towards the tips, the centre ribs being nearly flat, while those at the tip have a very pronounced camber. The joint of the upper main planes

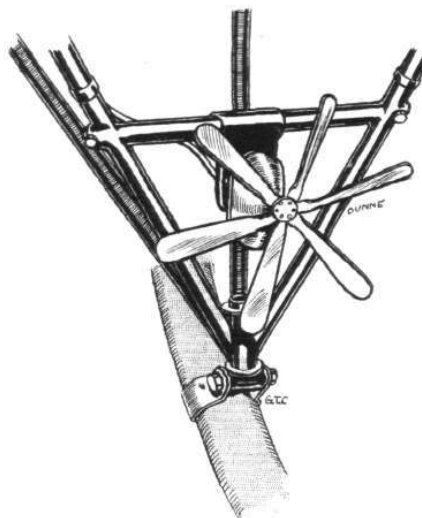


One of the side curtains and wing tip skids, and on right a closer view of the wing tip skid universal-joint.

occurs at the centre, while the lower planes butt against the sides of the nacelle.

At the extremities of the wings, and in the gap between the main planes are two side curtains, which are fixed: that is to say, they are not in any way controllable from

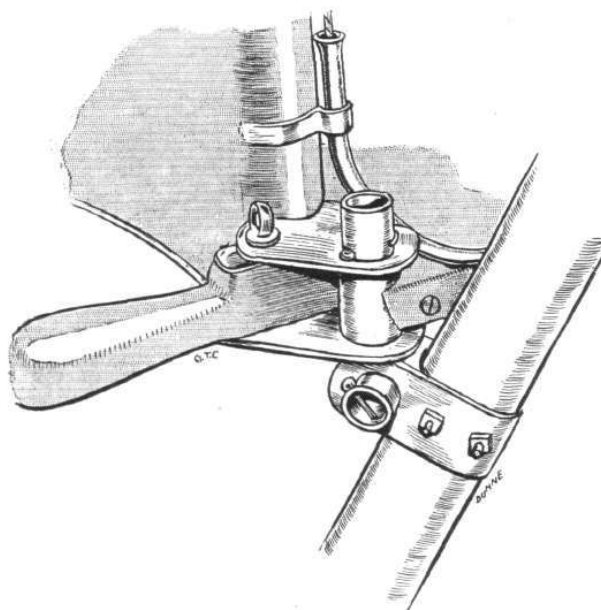
the pilot's seat. Hinged to the rear spars are four *ailerons*, which at the same time perform the functions of rudders and elevator. For climbing the *ailerons* on both sides are turned up, and the downward pressure



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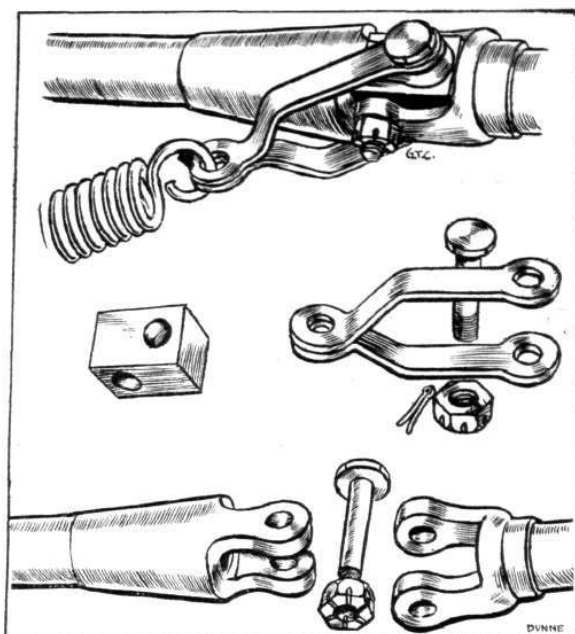
The petrol pressure-pump seen from behind.

thus caused, acting as it does on the part of the wings which lies to the rear of the centre of gravity, forces the nose of the machine upwards, or, more correctly speaking, forces the wing tips downwards, thus causing the machine to climb. For descent the reverse procedure is followed, i.e., the *ailerons* on both sides are de-



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pressed. It should be clearly understood that the right and left hand *ailerons* are worked independently, each pair being connected up to a separate lever in front of the pilot's seat. For making a turn, one lever is pulled backwards, while the

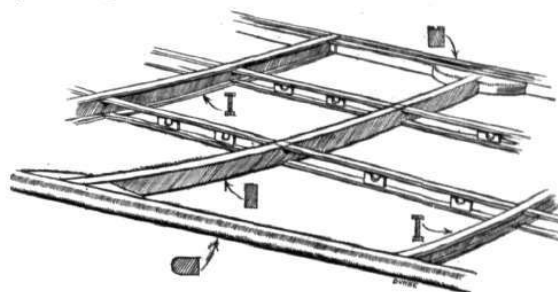


One of the universal-joints, and an analysis of same.

other is pushed forward. Thus, for making a left-hand turn the right-hand lever is pushed forward, while the left-hand one is pulled backwards. The movement is in reality the same as that of turning the steering wheel of a motor car. In the forward part of the *nacelle* is the pilot's seat, from where he has an excellent view in all directions. In front of him is a dashboard with the instruments, whilst the top of the forward part of the *nacelle* is swept upwards to form a deflector, which sweeps the air up over the pilot's head. The passenger's seat is in the rear of the *nacelle*, and situated on top of the main petrol tank. As it is well to the rear of the V formed by the trailing edges of the main planes, the passenger has also an unrestricted view in all directions. In front of the passenger are two control levers, which are interconnected with those in front of the pilot, thus affording dual control, but, while the pilot's control levers can be locked in any position required on the quadrant on which they work, the passenger's levers are always left free so that only the pilot has it in his power to lock the controls. At the rear end of the *nacelle* is the 80 h.p. Gnome engine mounted on overhung bearings, and driving directly a propeller of 8 ft. 2 ins. diameter. On the upper *longerons* of the *nacelle* are mounted the oil tank and a small petrol service tank. Petrol flows from the main tank inside the *nacelle* to a small pump mounted on the rear skid struts, and driven by a miniature propeller. The pump forces the petrol up in the small service tank, whence it runs by gravity to the engine.

The chassis is highly original, although somewhat complicated and, we should be inclined to think, offering

a considerable amount of head resistance, but Mr. Dunne finds that its excellent qualities for landing on the roughest ground more than justifies its being retained. As it is fully illustrated in the accompanying sketches, a short description will suffice. The front portion consists of three pairs of struts carrying at their lower extremities two skids, from which is sprung by means of a transverse tube and rubber shock-absorbers another universally pivoted skid which takes the weight of the front part of the machine and prevents it from standing on its nose. To the rear of this portion of the chassis are the wheels, which are also flexibly mounted so that they can "give" in any direction. Springing is effected



Sketch showing the wing construction of the Dunne biplane.

by means of very powerful coil springs and telescopic tubes. Four steel tubes forming an inverted pyramid carry at their lower extremities another skid which serves to keep the propeller from contact with the ground, whilst the wing tips are similarly protected by two skids mounted on the outer extremity of the lower main plane.

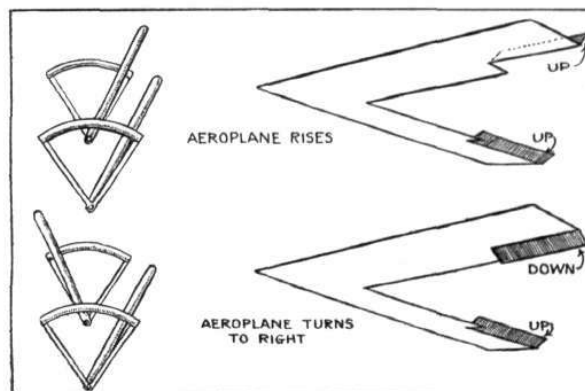


Diagram to illustrate how steering is effected.

The main petrol tank has a capacity of 22 gallons, and the small service tank holds 4 gallons, while 12 gallons of oil are carried in the oil tank on top of the *nacelle*. The weight of the machine empty is about 1,400 lbs., and her speed is in the neighbourhood of 55 m.p.h.

Carr's Fine Attempt for Michelin Cup.

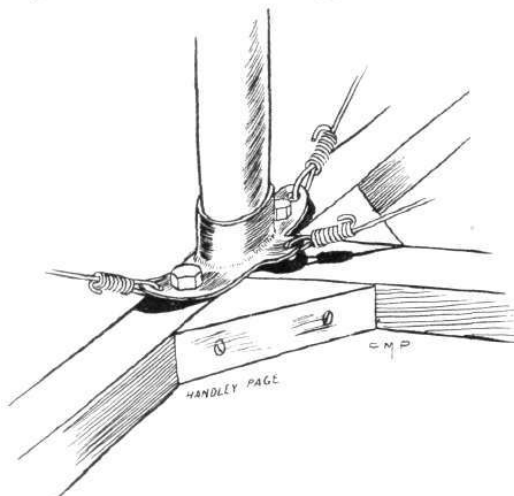
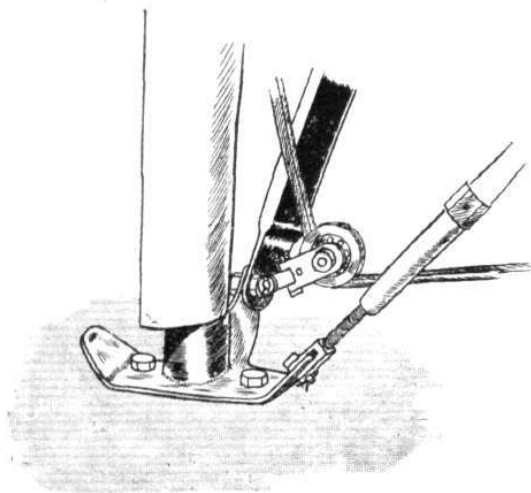
FOR the British Empire Michelin Cup, Mr. Reginald Carr, on the Grahame-White char-a-bancs on the 6th inst., made a very fine flight. Starting from Hendon at 8 a.m. he made fifteen complete circuits of the Hendon-Brooklands course, with a stop at each third round, three calls being made at Brooklands and two at

Hendon. On the sixteenth round, after leaving Brooklands, at 4.47, he ran into a thick fog at Sudbury and came down in a field. Flares were lighted at Hendon, but Carr decided to give up for the night. He had covered a distance of 315 miles. The machine is fitted with a 100 h.p. Green engine, and during this flight a passenger was carried; the weight in flying order was 3,300 lbs.

of pressure moves backwards, thus bringing the machine back to its normal position. Similarly if the machine begins to dive the centre of pressure moves forward, and thereby tends to restore balance. Mr. Handley Page is of the opinion that the machine would fly without the tail planes, and only fits them as an extra precaution, and to gain greater controllability. Constructionally the wings differ considerably from what has now become more or

having spars tapering towards the tip the camber is gradually decreased. In the lower plane the angle of incidence diminishes from 4° at the root to no angle of incidence at the tips. The upper plane also has a maximum angle of incidence of 4° at the root, but has a negative angle of incidence at the tips.

Although the machine is claimed to be inherently stable, *ailerons* are fitted to the upper main plane, so that



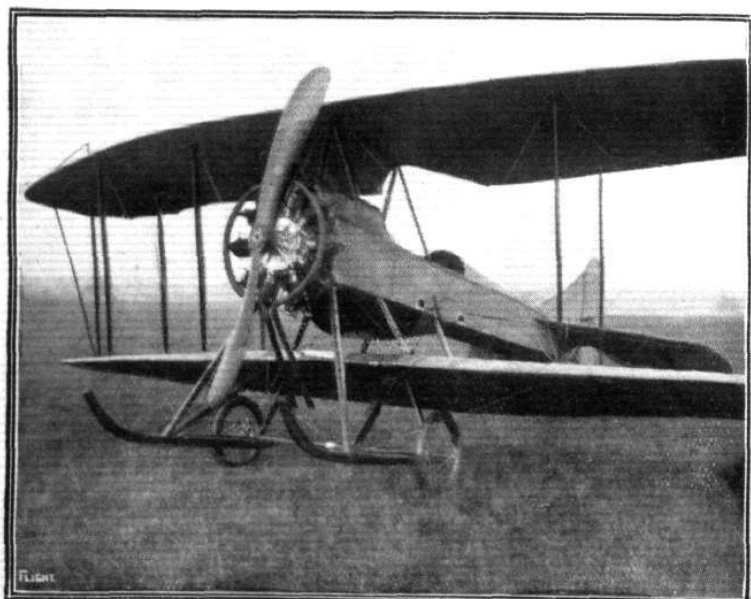
One of the strut sockets on the H.P. biplane showing pulley for aileron cable, and on the right a fuselage joint.

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less standard practice. There are two main spars, both of I section, the front one of which is made of spruce, whilst the material used in the rear spar is ash. In addition to these two main spars there are four subsidiary spars of the lattice-girder type, which serve to support the ribs. These latter consist of two thin strips of wood secured to the upper and lower edges of the spars respectively. These strips correspond with the flanges of the ribs in the majority of machines. No webs are employed, and the shape of each individual rib is determined by the depth of the various spars. Thus by

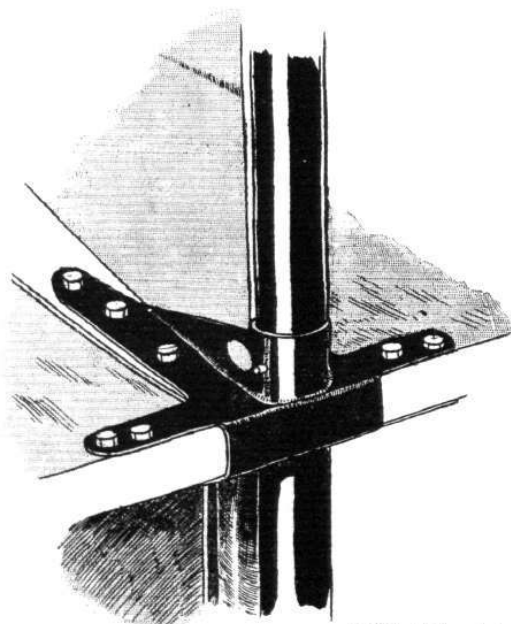
should the pilot desire to right the machine he is able to do so. This is, we think, a very good arrangement, and does not by any means indicate that the designer lacks faith in the stability of his machine, but most pilots, we feel sure, prefer a machine which it is possible to right, should need arise, by means of the usual controls, no matter how stable the machine may be.

From the accompanying illustrations, it will be seen that the planes are staggered forward. The reason for this is that by staggering the planes the gap can be considerably



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THE NEW HANDLEY PAGE BIPLANE.—View showing the chassis, engine mounting, &c.

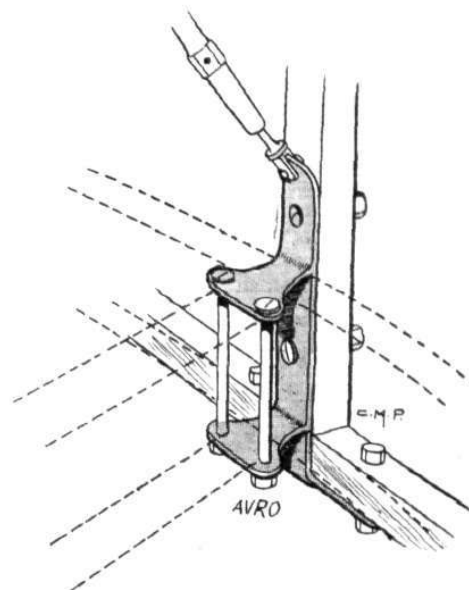
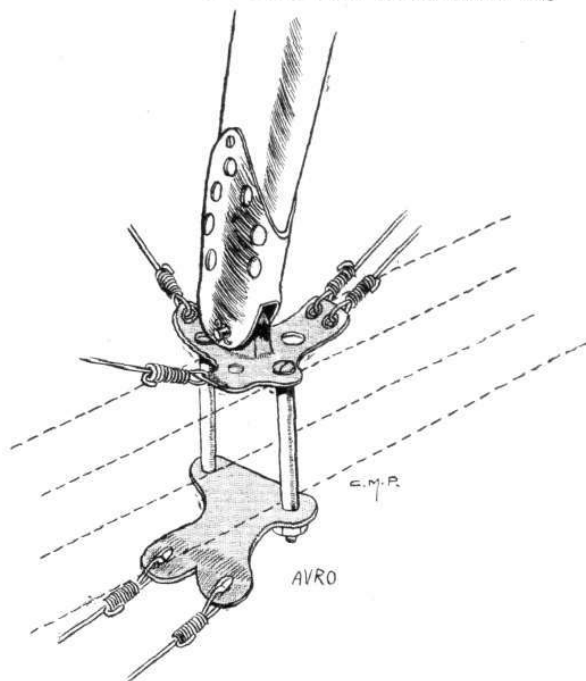


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Sketch showing the neat steel clip by means of which a joint is formed for the tail fin, rudder post, tail plane and fuselage on the H.P. biplane.

in comfort, protected as he is against the flow of air. The controls are of the usual Avro type and consist of a vertical lever pivoted on a longitudinal rocking shaft. A to-and-fro movement operates the elevator, whilst the ailerons are actuated by a side-to-side movement of the

bearings, the front one of which is formed by four tubular extensions of the *longerons* which converge until they meet on a channel steel ring which carries the front ball-bearing. A small inspection door on each side of the engine housing permits of a general examination of the



Attachment of inter-plane struts to spar on the Avro biplane, and on the right attachment of lower plane to fuselage.

hand lever. A foot-bar operates the rudder through double control wires. In this particular machine dual control is not fitted, but could easily be introduced by lengthening the longitudinal rocking shaft.

At the rear the *fuselage* terminates in a vertical knife's edge to which is hinged the rudder, which is of the usual Avro type; as are also the tail plane and elevators. A swivelling tail skid of the laminated steel spring type protects the tail planes against contact with the ground.

In the front portion of the *fuselage* and enclosed by one of the neatest aluminium shields we have seen is the engine—an 80 h.p. Gnome—which is carried in double

magneto, carburettor, oil pump, &c., whilst for close inspection the whole engine housing can be removed by undoing the butterfly fasteners by means of which the cowl is attached to the *fuselage*.

The planes as well as the *fuselage* are covered with a fabric, which has squares of stronger threads woven into it, so that should the fabric become pierced by a bullet or through any cause, these squares will prevent the fabric from tearing.

One of our sketches illustrates the very neat *aileron* hinge employed. In order to prevent the air from escaping through the opening between the rear spar and

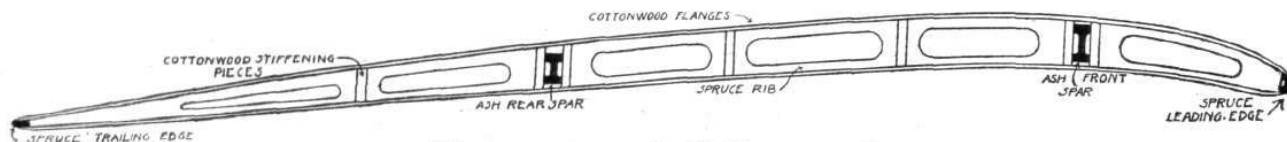


THE 80 H.P. AVRO BIPLANE.—Three-quarter view from behind.

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strengthened by cottonwood distance pieces where pierced for spars, and are equally spaced by means of leading and trailing edge laths. The whole of the woodwork is well varnished before being covered with fabric, and is strongly braced internally to take the backward thrust imposed on the planes in flight. The planes are covered

cables. Three upper tie wires are attached to the front spar from the pylon. The breaking load of the upper wires is not less than two-thirds that of the lift wires. The three warping wires are attached to one main wire passing over pulleys on the rear chassis. The rear spar is, therefore, not bent when the wing is warped, but has



Rib construction on the Blackburn monoplane.

with finest quality fabric, which is fitted down with split cane beading.

The machine is supported on a very strong chassis composed of two long skids connected up to the fuselage by heavy ash struts. The skids and struts are of specially selected straight long-grained English ash, thoroughly seasoned and designed to withstand alighting on rough uneven ground. To the skids are attached a pair of wheels whose axle is held down by strong elastic shock absorbers, thus preventing shocks due to landing being transmitted to the main frame. The wheels are built up with specially wide hubs to resist any side thrust, and are streamlined with fabric.

The fabric with which the fuselage and planes are covered is very strong compared to its weight. It is carefully stretched on the framework, and is rendered oil- and water-proof by the application of a non-inflammable solution, which impregnates and tightens the fabric and gives a smooth and highly-polished surface.

The standard type of control is fitted, i.e., foot bar for operating rudder, to-and-fro motion of vertical column for operating elevators, and rotating handwheel for lateral balance. All control wires are duplicated.

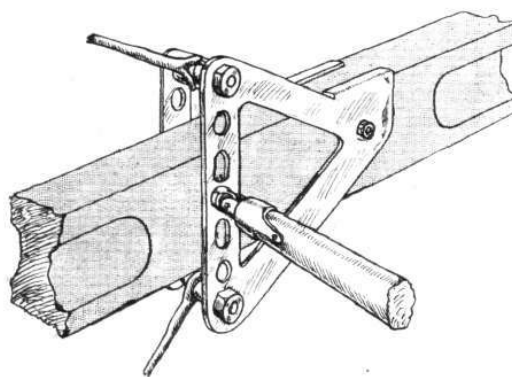
An 80 h.p. Gnome engine is mounted in front of the fuselage, the supporting plates being of pressed steel. Engine controls are fitted on the right hand of the pilot's seat, and in a convenient position for rapid operation.

The seats for pilot and passenger are arranged in tandem, the passenger in front being situated over the C.G., thus enabling the machine to be flown either with or without a passenger without altering the balance.

For taking the weight of the machine in flight, each front spar is stayed to the chassis by three stranded

an angular movement about the hinge on the fuselage; the corresponding top wires pass over a pulley on the pylon. All cables have a factor of safety of ten, and are spliced and bound with galvanised steel wire.

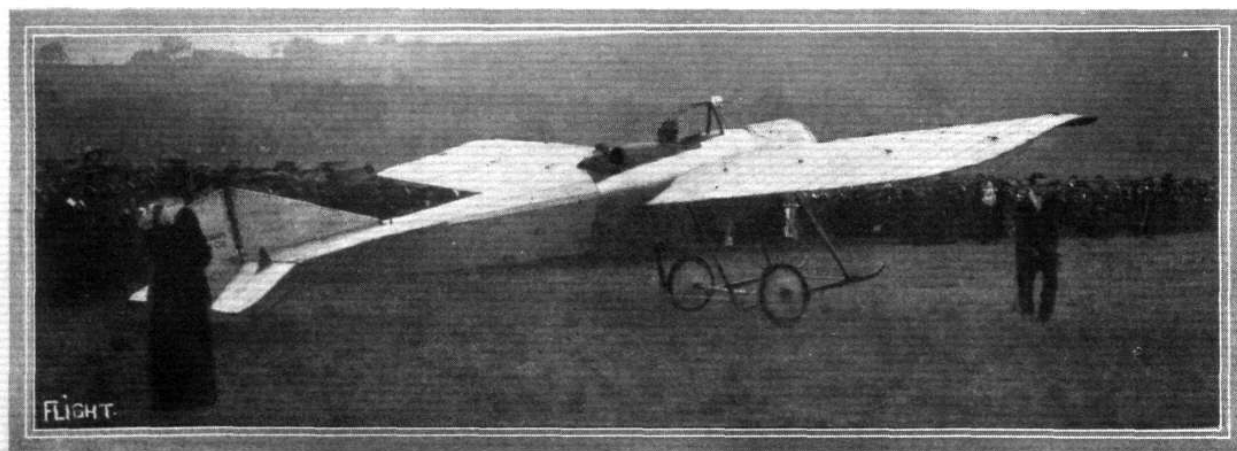
A Blackburn propeller of 9 feet diameter, built of specially selected laminated walnut, is coupled direct to the engine.



Attachment of bracing cables to main spar.

A lifting tail of 30 sq. feet area is fitted. Rudders and elevators are double surfaced.

The accommodation for both pilot and passenger is very comfortable, and a scuttle is fitted up to each seat which prevents the force of the wind from being uncomfortable on the pilot's and passenger's faces. The speed of the machine is 70 m.p.h., and the gross weight 1,500 lbs.



View from behind of the 80 h.p. Blackburn monoplane.