R. SAULNIER.

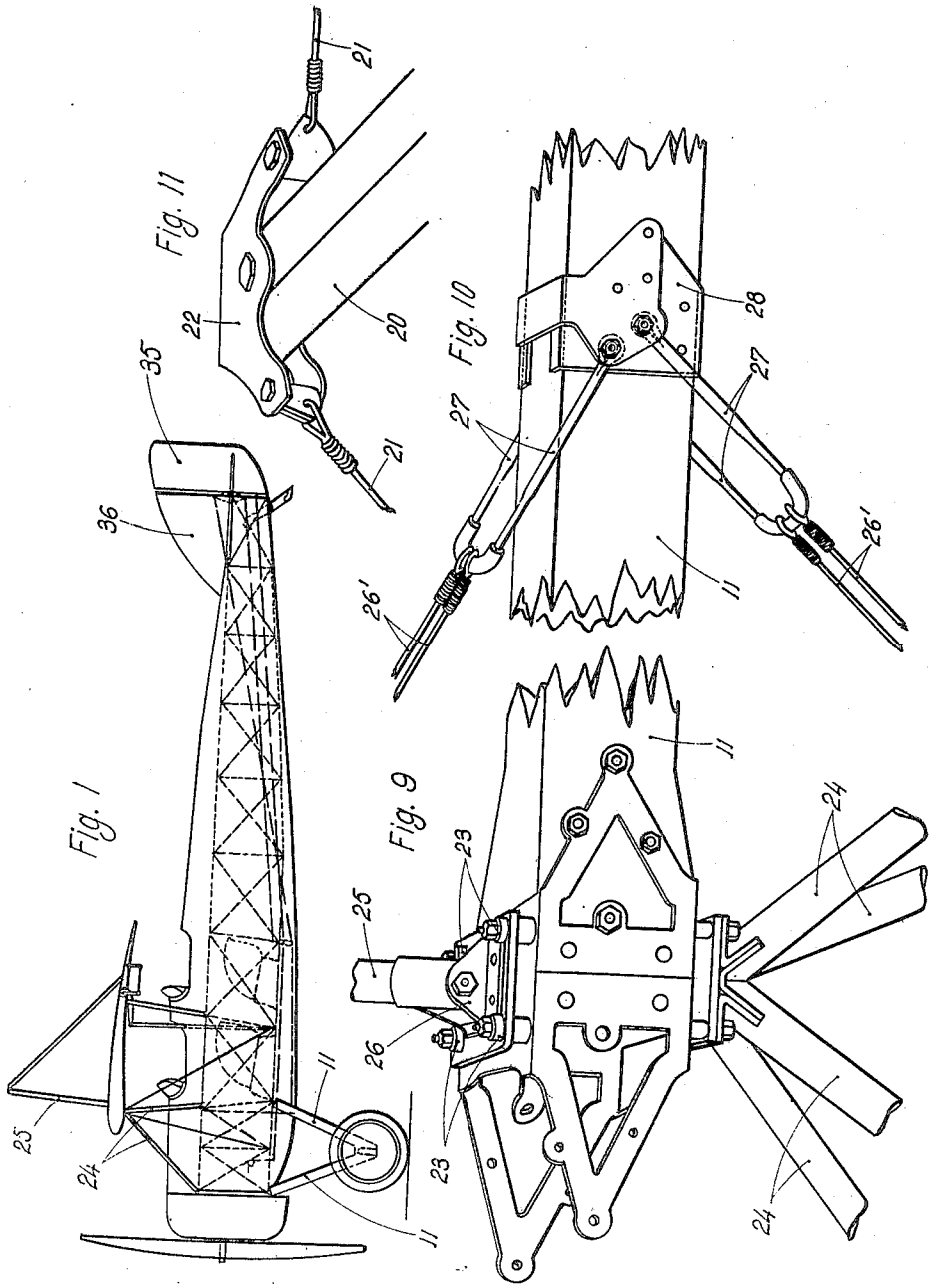
TWO-SEATER MONOPLANE AEROPLANE.

APPLICATION FILED MAR. 7, 1921.

1,433,657.

Patented Oct. 31, 1922.

5 SHEETS—SHEET 1.



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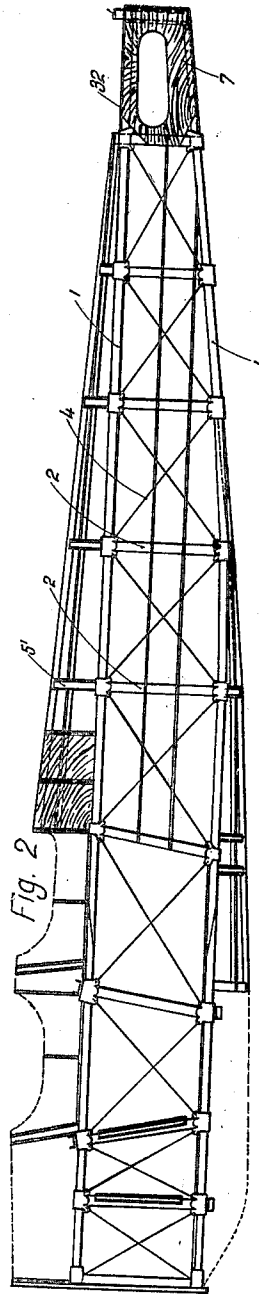

Fig. 2

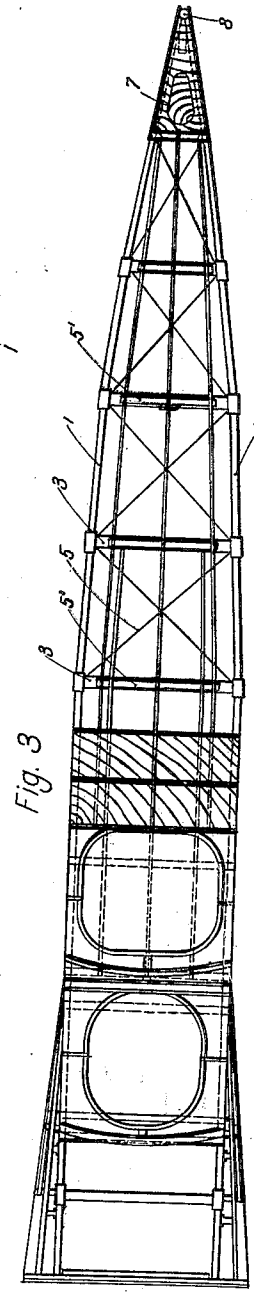

Fig. 3

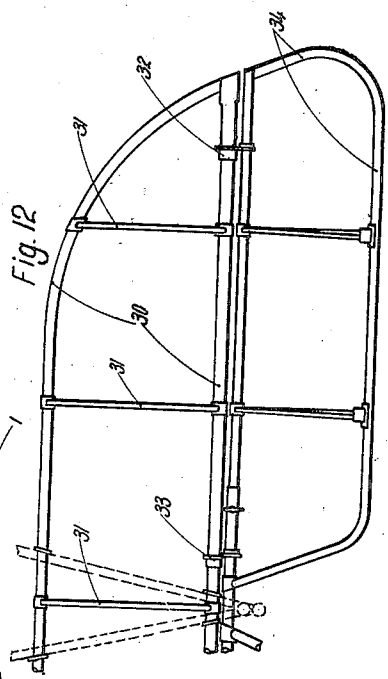

Fig. 12

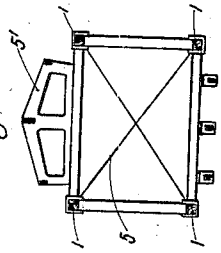

Fig. 5

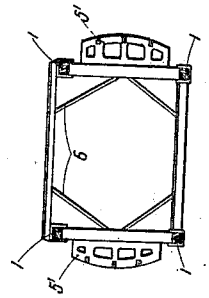

Fig. 4

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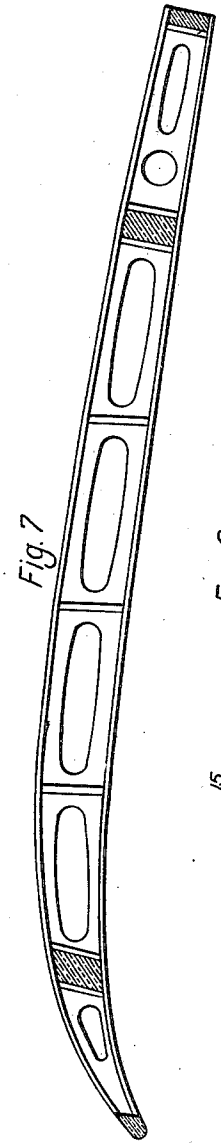

Fig. 7

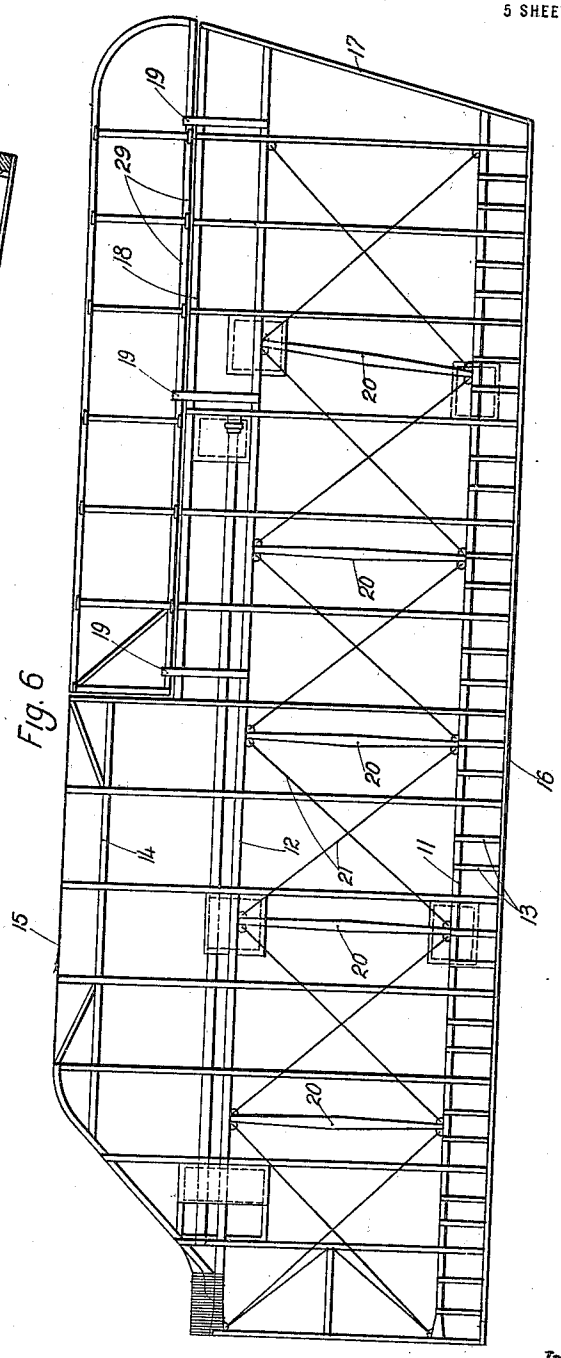

Fig. 6

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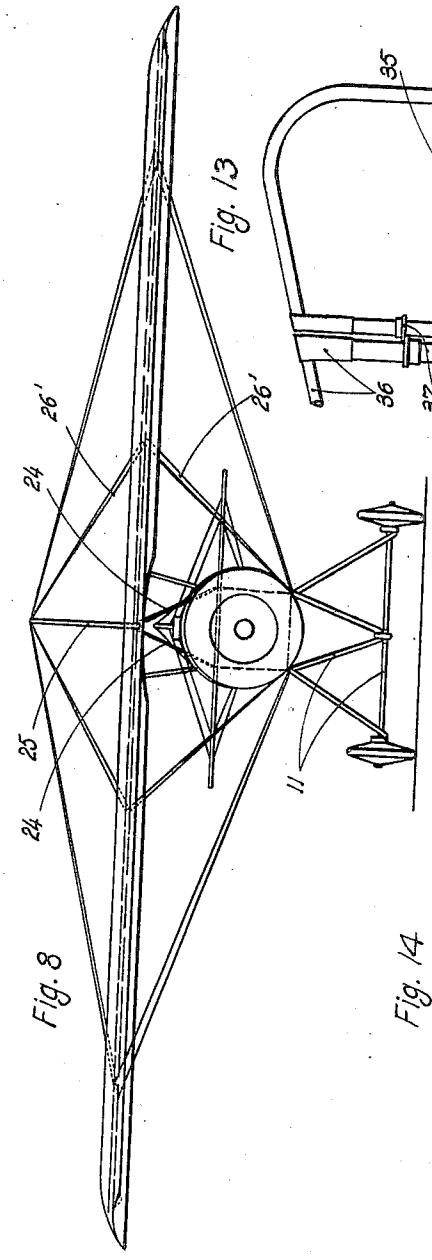

Fig. 8

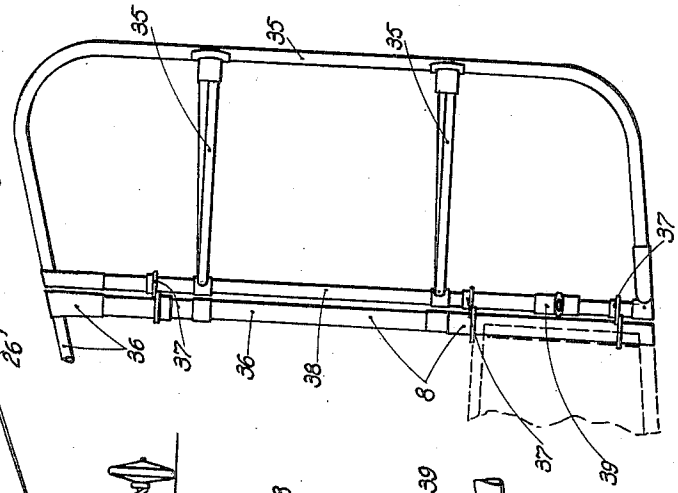

Fig. 13

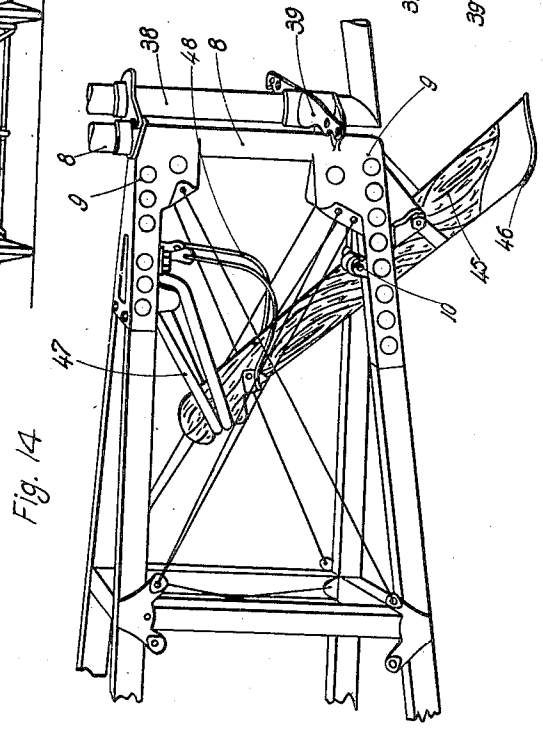

Fig. 14

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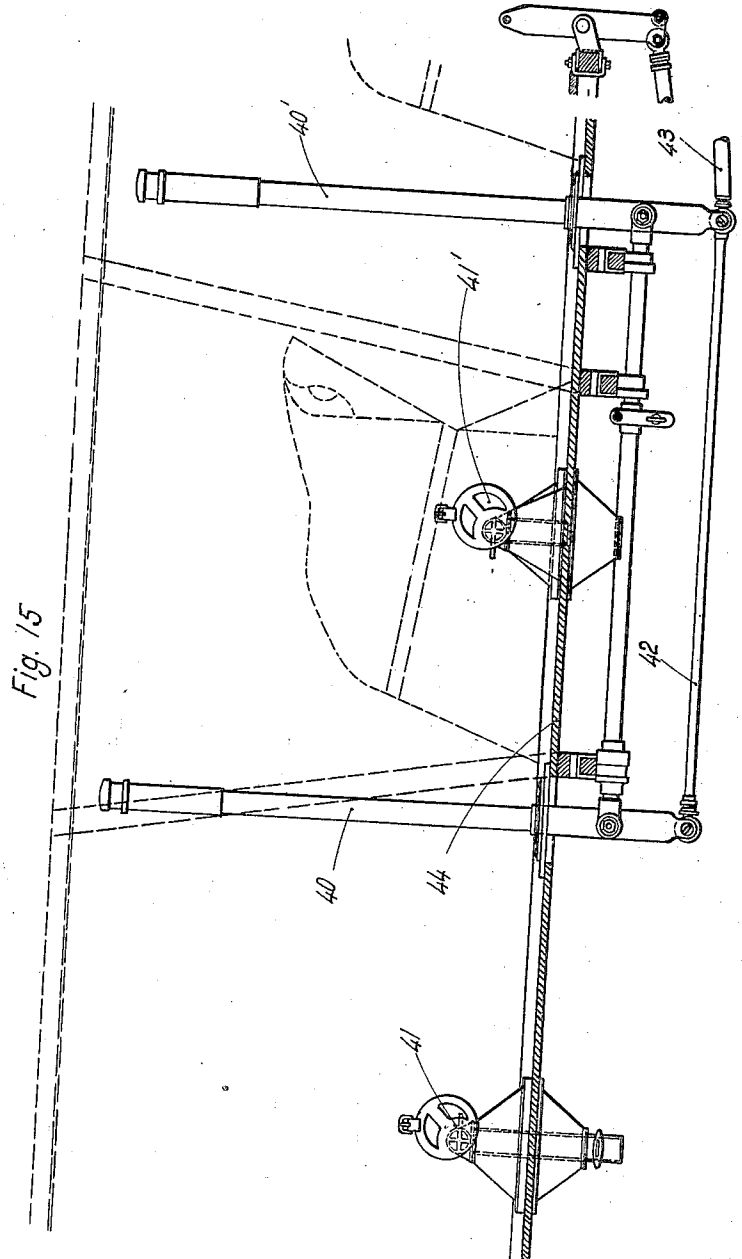
Fig. 15



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UNITED STATES PATENT OFFICE.

RAYMOND SAULNIER, OF PUTEAUX, FRANCE, ASSIGNOR TO SOCIÉTÉ ANONYME DES AEROPLANES MORANE-SAULNIER, OF PUTEAUX, FRANCE, A CORPORATION OF FRANCE.

TWO-SEATER MONOPLANE AEROPLANE.

Application filed March 7, 1921. Serial No. 450,369.

To all whom it may concern:

Be it known that I, RAYMOND SAULNIER, citizen of the French Republic, residing at Puteaux, Department of the Seine, in France, and having P. O. address 3 Rue Volta, in the said city, have invented certain new and useful Improvements in Two-Seater Monoplane Aeroplanes; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The present invention relates to a two-seater monoplane aeroplane of the so-called "parasol" type, and especially designed for touring with a passenger behind the pilot, it may also be used as an instruction biplane, in which case it is provided with a double control. The wing is hollow, and the engine driving the tractor propeller is of the rotary type.

A large number of the constructional characteristics of Morane-Saulnier aeroplanes are incorporated in this type of two-seater which characteristics are described in the patent application Serial No. 442,425 filed Feb. 4th, 1921.

The accompanying Figures 1 to 16 will render it easy to understand the description of the several parts in which the present aeroplane differs from that described in the abovementioned patent application.

The parts of the aeroplane to be described comprise:—the body, the wings, the rigging, the manœuvring surfaces, the features of the double controls, and the skid.

Figures 1 and 8 show diagrammatically, the former a longitudinal view of the aeroplane in elevation, and the latter a front view.

Figures 2, 3, 4, and 5 relates to the body, Figure 2 is a longitudinal view in elevation, Figure 3 a plan view, and Figures 4 and 5 examples of cross-sections.

Figure 6 is an enlarged plan view of one of the wings.

Figure 7 is a view of one of the ribs of the wings on an enlarged scale.

Figures 9 and 10 show the brackets for staying the wings and connecting them together.

Figure 11 illustrates the brace fitting secured to the ends of the distance pieces including the interior bracing of the wings.

Figure 12 is a partial view of one of the fixed and movable tail planes for regulating the longitudinal stability of the machine.

Figure 13 is an enlarged view of the rudder for controlling the stabilizing of direction.

Figure 14 illustrates the means of mounting the rudder and tail skid at the rear of the body of the plane, and

Figure 15 illustrates the hand controls for the tail plane and wings flaps, and the foot control for the rudder.

The body is wholly of wood, and has a rectangular cross-section Figures 4 and 5, the sides are flat and the upper and lower surfaces are stream-lined and on them cloth is held by cross frames carrying longitudinal laths. These frames are shown at 5′, the body ends in front in the substantially hemispherical engine bonnet and at the back in a vertical nose carrying the rudder pin.

The girder which forms the body comprises four longitudinal spars 1 braced by uprights 2 and cross members 3 made of ash in front of the passenger, and of spruce behind. Two parts of ash and spruce are fitted together by bevelled joints glued, nailed and taped.

The uprights and cross members form, in the length of the body, ten bays braced vertically by double piano wires 4 and horizontally and transversely by single piano wires 5.

The first three bays are braced transversely by tubular trusses 6, as shown in Figure 4 .

The last bay 7 of the tail Figures 2 and 3, is strengthened by four panels of ply-wood glued and nailed on its faces. The nose in which the body or the back frame ends is formed by a tube 8 to which are soldered two gusset plates 9 connecting the longitudinal spars of the body, constituting an attachment for the bracings and the skid extensor (Fig. 15). The lower gusset carries the fork joint 10 for the skid. The ball bearing brackets for the rudder, to be described later, are soldered to the tube.

The fixing plates for assembling the aeroplane are of the kind described in the abovementioned patent application. The front

end terminates in a so-called "spider" which carries the rotary engine as in said application.

The under carriage 11 (Fig. 8) is of the same construction as that described in the abovementioned application.

The aeroplane is provided with two wings without dihedral angle or camber jointed directly together in the central axis of the machine; one wing is shown in plan Figure 6, and one of the ribs on a larger scale Figure 7. These trapezoidal wings have a gap above the body to improve the pilot's outlook. The outline of the wings is the same throughout. They comprise two spars 11 and 12 of spruce moulded in I shape with ties at the ends, fixing plates and ribs.

The I shaped ribs Figure 7, have a web of plywood with openings, threaded on the spars. They abut in front on the leading edge of moulded spruce with a tie at each rib and stretches 13. At the rear the ribs are connected together by a distance piece 14 and by the trailing edge 15 of piano wire, fixed on aluminum staples attached to the ends of the ribs. Two ties 13 for each rib between the longitudinal spars and the leading edge 16 keep the outline of the cloth in shape. The first rib towards the centre of the wings is of box pattern with wide sole plates of ash, strengthened between the spars by a distance piece of spruce. On the outside the last rib which is not so high and made of moulded spruce constitutes the side beading 17.

The last six ribs and the wing tip 17 are foreshortened in rear of the longitudinal spar 12 and fitted to a dummy rear spar 18; the gap thus formed accommodates the wing flap. The dummy spar of spruce carries three members 19 of wood serving for fixing the ball bearings of the wing flap.

All the ribs and ties are fixed to the longitudinal spars, edges and dummy spars by screws and cloth tapings, the double strips of cloth braid hold them in place.

The inside ends of the longitudinal spars are strengthened by conical chocks of ash on the flanges, glued and taped, and carry the fixing plates of the spars for joining the two wings. These fixing plates of sheet steel in one piece stamped out and bent are fixed by horizontal bolts and carry above and below, two soldered bosses through which pass vertical bolts which go through the ash chocks and secure the erection of the joint plates of the two wings. Each longitudinal spar which carries two guy fixing plates is strengthened at these places and on the flanges by two duralumin cheeks. Two sheet iron clips are fixed by bolts to the rear spar and are intended to carry the ball bearings of the driving shaft of the wing flaps.

The interior bracing of the wing consists of tubular distance pieces 20 of spruce square in section with filled up ends held by and bolted to sheet iron V-shaped forks and fixed by two bolts to the inside flanges of the two longitudinal spars. The turned up edges of the forks form on one side and the other, brace fixings for the lugs of the single bracings 21 of piano wire. This construction is shewn in Fig. 11, the V-shaped fork being shewn at 22.

The stresses of the bracings are thus directed to the middle, and between the two fixing bolts of the forks, to the axis of the tubular distance pieces, thus producing no secondary strain on the spars and distance pieces. The wing is covered with linen cloth fixed by bracelet lashings of string on the ribs and by sewing towards the rear and lateral beadings. Strips of linen cover the lashings and sewings. Inspection doors of aluminium are provided in the cloth to give access to the guy fixing plates and to the bearings of the driving shaft of the wing flaps.

The wings are joined together Figures 9 and 10, by the covering plates of the centre section which are fitted on the front and rear longitudinal spars by the four vertical bolts 23 passing through the end ferrules of the spars. The lower front plate is bolted by its bent edges to four tubes 24 in front of the centre section the lower ends of these tubes having fixing plates with bushings threaded and knurled on the tube stretching rod with two reverse threads and threaded tip with eye which are fastened by bolts in the upper sheet iron forks of the spider and to the ends of the first metal cross member in front of the pilot. In this way a quadrangular pyramid is formed which cannot be put out of shape, Figure 1.

The lower plate for connecting up the rear longitudinal spar is soldered to the end of two tubes making triangles, the lower ends have adjustable fixing plates fixed to the ends of the upper cross member between the pilot and the passenger.

The upper union plates in front and rear carry two riveted and soldered forks with longitudinal axis for erecting the upper pylon for the bracing, consisting of two tubes jointed at the top, which thus are able to oscillate to right and left so long as the upper guys are not stretched. This front erection is shown Figure 9, the tube at 25 and the fork joint at 26.

The apex of the triangle carries a soldered plate the side edges of which constitute points of attachment for the piano wires of the upper guys of each wing; the tubes 24 of the centre section and the pylon are clinker built of wood.

The bracing, Figure 8, both lower and upper is of double piano wire. The wiring plates consist for each wing of two fixing plates on the body, two fixing plates for

each longitudinal spar, and the plate at the top of the upper pylon; a spar fixing plate is shown in Figure 10.

The metal fixings of the body consist of the ends of the two V-shaped lower cross members of duralumin, strengthened by U-shaped pieces of sheet steel, bent and riveted to the outside of each end of the cross members, and attaching these latter by bolts to the body fixing plates. The piano wire guys are erected in half on two small plates of rolled sheet iron which catch with each other by gaps, astride of the U-shaped ends of the fixing plates where they are held by two bolts passing through the arms of the U and the eyes of the small plates.

The guys are erected on these small plates by their turn-buckles with yoke.

The metal fixings of the longitudinal spar consist of staples of bent sheet steel and with tipped edges the sole of which rests on the spar, strengthened moreover by duralumin flanges. The fastening of the staples is secured by three bolts, two of which serve to fasten the corresponding inside fixing plates of the bracing, two big bolts for attaching the guy are arranged across the tipped parts.

The guys are curled on a sort of thimble provided with a small plate soldered and fitted before splicing on a cable end 27 with spliced buckles at both ends, these buckles inserted between the tips of the staples and the duralumin flanges 28 and traversed by the shanks of the big bolts, constitute a very secure means of attachment, Figure 10.

In case of sudden strain, or of shock, the half ring of cables stretches preventing the breaking of the piano wire.

In this way the advantages of the piano wire and of the cable are united, and fixing plates astride on the longitudinal spar allows the proper work of the bolts to be reduced. The upper guys are fixed on the other hand to the horizontal plate at the top of the pylon by their turn buckles with yoke.

The lower guys are double with two parallel wires and in addition a single bracing for the drag stresses. The upper guys have only one wire, except the end front guys which are double.

To prevent vibration when in flight, the lower guys with their bracings are, for each line, connected together by a spindle shaped wood lath in two pieces put together with screws and arranged horizontally towards the middle of the length of the guys, these laths are not shewn in Figures 1 to 8. The vibrations of the wires which have different size, length and slope, not being synchronous neutralize each other.

The surfaces of the control, of the wing flaps, of the tail plane and of the rudder have metallic ribs of duralumin, put together with steel sleeves, and split pins, the shafts of movable parts have ball bearings; the linen cloth with which they are covered is fastened by lashings on the ribs and by sewing near the edges, Figs. 1, 6 12 and 14. The small movable parts are not compensated.

The wing flaps Figure 6, for securing side stability are situated towards the rear edge of the wings, the contour of which they complete in the gap left by the shortened ribs, the front beading 29 of which forms the shaft and carries three ball bearings at 19.

These ball bearings are fixed on the brackets of the dummy spar 18 by two half-bearings of wood 19 clamped by two bolts between two steel plates. The control of the wing flaps is the same as that described in the beforementioned patent.

For longitudinal stability the tail plane consists of two horizontal and symmetrical parts one fixed or "Fixed plane" and one movable or "depth flap" (Fig. 12). The fixed trapezoidal part 30 in one single piece is made of two duralumin tubes, leading and side edges and rear spar connected by ribs 31. It is placed at the rear end of the body at 32, Figure 2, and fixed by four lugs, by two to the upper fixing plates of the last uprights and by two to the rear frame. The rear spar is provided on each side with lugs for bolting the brackets of the two ball bearings 33 of the shaft of the movable part.

The movable part 34 is formed of two symmetrical trapezoidal surfaces connected in front by the hinge rod into a single piece; the rudder works between the two surfaces. The shaft is provided with four ball bearings two on each side, the cages of which are bolted to the corresponding lugs of the rear spar of the fixed plane.

For stability of direction the rudder Figures 1, 14 and 15 consist also of two parts placed vertically above and at the end of the body in the central plane of the machine; a fixed part or "vertical drift" 36 and a movable part 35 or "real rudder." The triangular fixed part consists of three tubes and distance pieces. It is fixed to the body by the free lower end of the front vertical distance piece which engages with a socket fixed on the upper cross member of the ninth bay, and by the free lower end of the rear tubular spar which engages with the virtical tube of the rear frame 8. These fittings are held together by bolts fastened by split rings.

The tubular spar 8 towards its upper part is provided with lugs for bolting the upper ball bearing race 37 of the rudder. The trapezoidal moveable part consists in front of a vertical shaft 38 of duralumin of a length equal to that of the rear frame and to the drift spar; a flattened tube constitutes the wing tip and trailing edge; they are con-

nected by ribs. Three ball bearings 37 are placed on the vertical shaft, and their races have lugs for bolting to the corresponding lugs of the rear frame and of the drift spar. A beam with two driving points of attachment 39 of chilled steel with soldered sleeve is fastened by split rings on the shaft and provides for controlling the rudder. The rear surfaces are connected to each other and to the lower spars of the body by eight wire guys with turnbuckles.

The controls of the manœuvring members are the same as those described in the beforementioned application, and it is therefore only necessary to describe the case where the aeroplane is arranged for purposes of instruction, that is to say, when it is provided with double control.

The arrangement is shown in Figure 16. The tail plane and the wing flaps are operated by hand through control levers 40 and 40′ with double motion, whilst the rudder is operated by foot by the bars 41 and 41′.

Levers and rudder bars are connected and made to operate jointly by suitable transmission rods or wires such as 42 and 43.

In this case the rear position is provided with a seat without elbows and the warping shaft is provided in the rear with a second fork which receives the second vertical control lever; the connection rod is interrupted for the joint at the lower end of the second lever. All these joints are provided with ball bearings.

The duralumin tube of this second lever with a stop-pawl is fitted into the lower stiffening of steel and therefore can be taken to pieces. The second rudder bar 41′ is fixed to the floor, below the pilot's seat, and connected with that in front by four wires (not shown), two on either side of the shaft carried in forks of sheet iron soldered to the horizontal tube; these wires are thus above the floor 44.

The skid Figure 15 consists of a skid 45 of hickory faced with a friction shoe 46 of sheet steel, hinged to the shaft of the lower fork 10 of the rear frame. At the upper end a shock absorber 47 fixed at the other part to the frame secures elasticity. A safety wire 48 fixed also to the rear frame limits the movement of the skid and prevents the shock absorber from being broken.

Claims:

1. In a two-seater monoplane, the combination with elevated wings and a rotary engine, of a body consisting of a main rectangular fabricated girder, said girder being made up of a series of transverse square frame sections and connecting longitudinal battens, the side faces being flat, the upper and lower faces rounded or stream-lined and the forward end of said girder circular in cross section, said rounded or curved formation of the top and bottom being produced by mounting on certain frame sections supplemental frame sections of the shape desired.

2. In a two-seater monoplane, the combination with a body and a rotary engine, of adjoining elevated wings comprising a single span, said wings consisting in part, of front and rear longitudinal spars, metallic plates or brackets for securing the inner ends of said adjacent spars together to form a continuous wing, means carried by said brackets for connecting thereto exterior bracing struts for said wings and means carried by the front longitudinal spars of each wing section for securing thereto diagonal bracing wires extending to the upper strut and downwardly to the body.

3. In a two-seater monoplane, the combination with a body and a rotary engine, of adjoining elevated wings comprising a single span, said wings consisting in part of front and rear longitudinal spars, metallic plates or brackets for securing the inner ends of said adjacent spars together to form a continuous wing, a vertical strut mounted in the upper portion of said bracket, downwardly extending diagonal struts having their upper ends mounted in the lower portion of said bracket, wire securing brackets carried by the front longitudinal spar of each section, diagonal bracing wires extending from said brackets to the top of the upper strut and downwardly to the body, forming a quadrangular pyramid not subject to deformation.

In testimony whereof I affix my signature.

RAYMOND SAULNIER.