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AIR PUBLICATION 1273.
2nd Edition, March, 1928.

AVRO, TYPE 504N, AEROPLANE.

180 H.P. LYNX ENGINE.

This descriptive handbook is issued for the information and guidance of all concerned.

By Command of the Air Council.

W. Nicholson

AIR MINISTRY.
Issued June, 1928.

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PREFACE TO SECOND EDITION.

The Second Edition of A.P. 1273 describes the aeroplane modified up to January, 1928. The principal changes that have taken place in the design and construction since the date of the first edition are as follows :—

(i) Substitution of streamline wires for cables in the undercarriage bracing.

(ii) Provision of a new type of shock-absorber for the tail skid.

(iii) Substitution of wheel for handle in front cockpit petrol control.

(iv) Removal of priming pump from floor to starboard side of cockpit.

(v) Deletion of thermometer in oil system.

(vi) Provision of special tools for erecting purposes.

This edition also includes the subject matter of A.P. 1231, Avro 504 N. Rigging and Maintenance Notes.

LIST OF ILLUSTRATIONS.

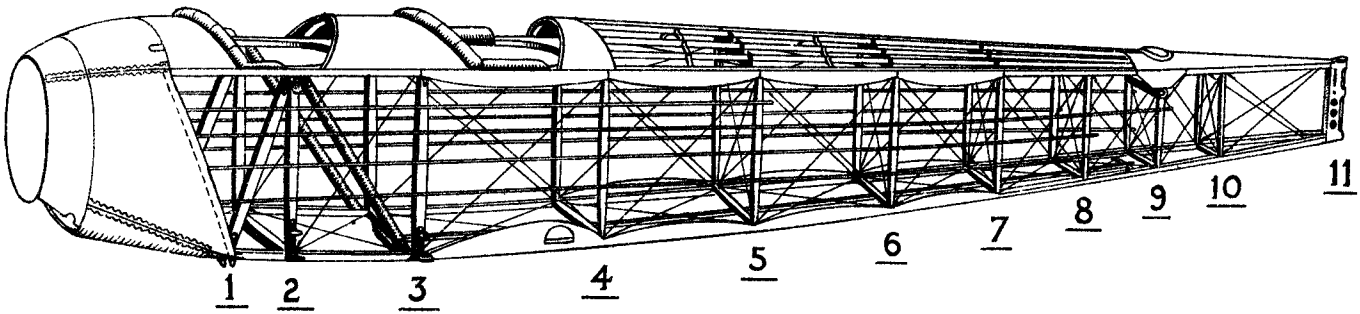

FIG. I. — FUSELAGE.

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Malby&Sons Photo Litho

CHAPTER I.

CONSTRUCTIONAL DETAILS.

General.

1. The Avro 504N is a training aeroplane fitted with a 180 h.p. Lynx engine.

2. Two cockpits are built into the fuselage, one beneath the centre section plane and the other immediately to the rear of this. Engine and aircraft controls are fitted in each cockpit and are permanently interconnected.

3. The principal differences between the previous type 504 aircraft (504K fitted with Mono. engine) are that the tail plane is now adjustable and the tail skid is steerable ; the top main planes are altered at the roots, and the centre section plane is cut away to allow a much greater range of upward and forward vision ; also the ailerons are tapered at the outer end. The undercarriage component comprises oleo legs, radius rods and rear compression struts. Each cockpit is equipped with an instrument board. Two petrol tanks are carried under the top main planes, the petrol from both tanks being gravity fed through a three-way cock. The oil tank is supported from the engine mounting struts and forms an undershield shaped to the engine cowling line.

Fuselage.

4. The fuselage (fig. 1) is constructed on the usual girder principle comprising four longerons interconnected by a number of struts and bracing wires. The longerons are butt-jointed in their length by fishplate fittings at the middle of the second cockpit and thus the fuselage is divided into two portions. The longerons forming the rear portion are each built in two lengths spliced and bound with tape. The longerons are normally of ash. When of spruce, the splice of the rear portion is fitted with a special bearing plate to provide a hard face under the strut attachment, the splice being located under a side strut position. A number of three-ply stiffeners are fitted to the longerons. The framework has a suitable rounded contour given to it by the addition of formers and stringers. The struts interconnecting the longerons are arranged to form a series of frames, ten in number, whilst the longerons at their rear ends are secured to a single upright member which provides the socket for the rudder post. For convenience, the frames may be numbered from 1 to 11 (including the sternpost), commencing from the

forward end of the aircraft, and the spaces between adjacent frames may be termed bays and be designated by the numbers of the particular frames bounding them. Thus No. 11 is the sternpost, and the cockpits may be said to be located in bays 1–2 and 3–4 respectively.

5. Frames 1 to 3 are of heavier section than the remainder and are secured to the longerons by means of jointing plates. These plates are bolted to both the longerons and the struts. Fitted beneath the plates, securing the lower joints of frames 1, 2 and 3 are the attachment fittings to which the various struts of the undercarriage are secured. The ends of the spars of the lower planes are received in sockets formed in the plates securing the lower joints of frames 2 and 3. The sockets for the lower ends of the centre section struts are fitted above frames 1 and 2. A diagonal spar is fitted in each side panel of bay 1–2 and a pair of diagonally placed tubular steel struts is fitted between frames 2 and 3, to stiffen the fuselage. A three-ply former is fitted to frame 1 to receive the engine cowling side panels ; this gives the fuselage an almost circular cross section.

6. The rear -portion of the front cockpit is located in bay 2–3. On account of this the upper cross strut of frame 2 has been omitted, and the two upper longerons are supported by a heavy spruce ring which has been fitted between them in order to frame the cockpit. A similar ring frames the top of the rear cockpit, and fitted between the two rings is an inter-longeron cross strut known as the front cockpit stiffener. Another stiffener is fitted behind the rear cockpit framing ring. The inter-longeron struts forming frames 4 to 10 are secured to the longerons by having their extremities inserted into sockets of the type shown in fig. 2. These

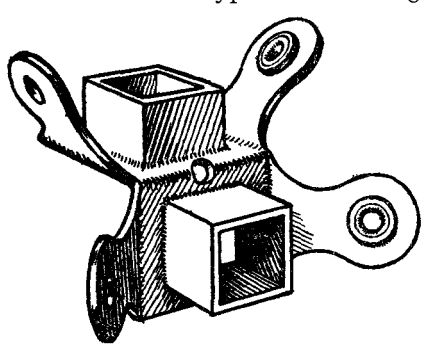

FIG. 2.—STRUT SOCKET, FUSELAGE REAR PORTION.

sockets are fitted to the longerons by small bolts taken diagonally through the longerons, which bolts also secure,

to the inner faces of the sockets, lugs to which internal bracing wires are attached. Other lugs are formed integrally with the socket plates. A socket to take the ends of the tail plane leading edges is built into frame 9. This socket is formed of a length of steel tube at the ends of which sockets are provided for the reception of the ends of the struts. The socket, known as the tail plane leading edge sleeve, is secured to the longerons by means of a plate or lug welded to its upper surface. Wood packing blocks are inserted between the under surface of the longerons and these bolt lugs. The tail plane leading edge sleeve is illustrated in fig. 3.

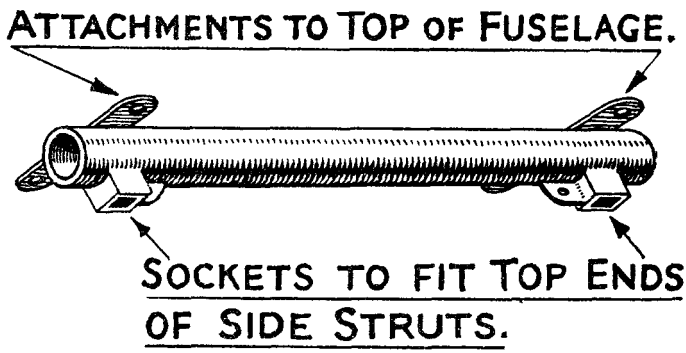

FIG. 3.—TAIL PLANE LEADING EDGE SLEEVE.

7. The sternpost consists of a tubular steel shank, fitted with a sheet steel bracket which provides a housing for the tail incidence gear, and to which the longerons are connected and secured by bolts. For details of the tail plane mounting *see* paras. 33 and 34.

8. The upper and lower panels of bays 9–10 and 10–11 are covered by three-ply decking. In the upper decking a hand hole is provided to give access to the tail plane leading edge socket. This hole is normally closed by an aluminium disc.

9. The stringers give a streamlined form to the fuselage; they are fitted to the sides and upper and lower faces of the fuselage as follows. Four stringers are fitted to each side of the fuselage and run parallel to its centre line. The topmost stringer terminates a few inches behind frame 5; the second and fourth stringers end a few inches to the rear of frame 9; the third stringer extending to the rear of frame 8. Two stringers are fitted along the bottom of the fuselage between frames 3 and 9, but terminating a few inches to the rear of the latter frame. These stringers which are of a spindled

section are supported, where they cross the various frames, by thin wooden brackets, known as " biscuits," which are pinned to the fuselage side struts. From behind frame 4, five upper stringers run rearwards at the top of the fuselage to a light former fitted a few inches in front of frame 9. They are supported on suitable formers fitted above the various frames over which they pass and two additional formers fitted between frames 4 and 5 and 5 and 6. To steady the upper and lower stringers between their points of attachment to the frames, lengths of tape are fitted. These tapes are secured at each end to the upper longerons and are taken around beneath the lower longerons. At the points at which they cross the various stringers they are given a complete turn round those components and glued.

Fuselage bracing.

10. With the exception of panel 1–2, all the side panels are cross braced by wires. Panel 2–3 is braced by one wire and the diagonal tubular steel strut (*see* para. 5). All the lower panels are cross braced with the exceptions of panels 9–10 and 10–11 (three-ply wood is fitted at these last two panels). Bracing of the upper panels is carried out in bays 4–5, 5–6, 6–7, 7–8 and 8–9. Internal bracing is carried out in frames 5 to 10.

11. Piano wire is used throughout in the bracing and the wires are attached at one end direct to lugs or eyebolts on the jointing plates of the panels and at the other to turnbuckles. These turnbuckles are in turn secured by pinning to lugs or eyebolts in the jointing plates of the panels. Where two bracing wires cross each other, one is bound with three turns of linen tape for a distance of about 2 in., to prevent rubbing. Since the bracing wires are of piano wire and of relatively heavy gauge, it is not convenient to secure them to their anchorages by bending and binding ; the method detailed below has therefore been evolved. On the centre portion of each wire two thimbles formed by a coil of piano wire are threaded and the ends of the wire bent to form hooks. The hook is engaged with the bracing plate or turnbuckle to which the wire is to be attached, and a thimble slipped up to pass over the free end of the hook. After this has been done the end of the hook is bent up over the thimble and then cut off.

12. Each turnbuckle adopted for the fuselage bracing comprises a yoke, the shanks of which are bent back to form a knuckle joint with the bracing plate, an eyebolt, and a special nut. The crutch of the yoke is shaped to provide a hemispherical socket for the reception of the corresponding portion of the nut. Each end of the hemispherical portion of the nut

has a cylindrical shank. Flats are provided on the forward portion of the shank, and the rear shank is counter-bored and drilled with four holes for a locking wire. To ensure that a sufficient number of threads are engaged, the screwed end of the eyebolt must always pass through the nut. The locking wire is passed through one of the holes in the rear shank and is bound to one of the shanks of the yoke after the turnbuckle has been adjusted. The bolt used is a plain eyebolt. Attachment of the eyebolt to its lug is effected by a pin passed through its forked end and the lug. A split pin renders the joint secure.

Seating unit.

13. The seats for the pilot and the observer are mounted on a framework (shown in fig. 4) which provides foot rests for both and the mountings for the dual control gear. This

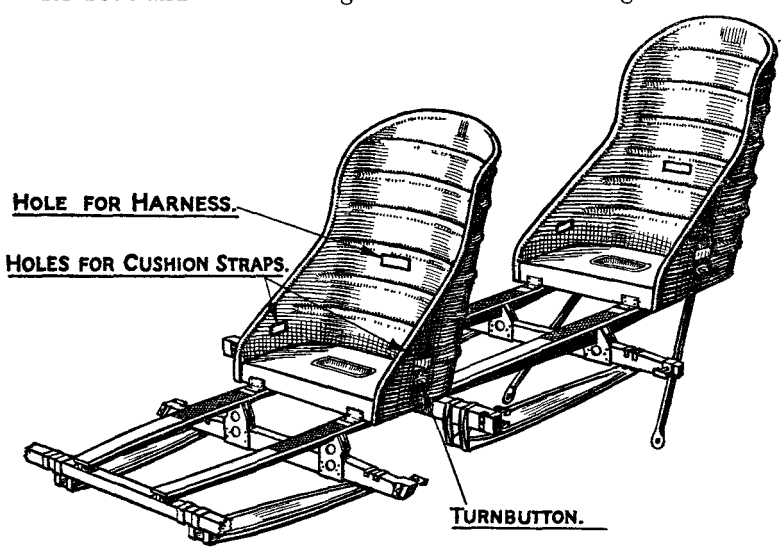

FIG. 4.—SEATING UNIT.

framework is built into the fuselage, from which it cannot be removed unless the forward end of the latter be dismantled. Both seats are mounted across the rear end of the frame and are of a type which provides for the reception of the Irving type parachute. The frame is composed of two **T** section beams interconnected by four cross bars and secured to the side members of the fuselage by means of special brackets. The rear end of the frame is further steadied by two tubular steel struts taken to the lower longerons and by cross bracing wires between the struts. A pair of aluminium

covered footboards are mounted between the two forward cross bars of the framework and are underslung from pairs of steel straps. A second pair are slung in a similar manner between the two rear crossbars. Foot grips are fitted to the upper surface of the **T** beams for use of the pilot and the observer when entering their respective cockpits. Padding at the cockpits is omitted near the seat position in order to avoid obstruction when the parachute is released.

14. Holes are made in the back and sides of the seat to pass the connections for the Sutton harness. There are also two short lengths of cable anchored to the rear ends of the seat bearers, and lugs are provided at the top ends of the seat struts. The ends of the cables are brought together behind the rear seat and hold the end of that part of the harness which passes through the back of the seat. The seat strut fittings form an anchorage for the portions of the harness that pass over the sides of the seat. The harness fittings for the front seats are similar, the back anchorage cables being brought through a centre star plate to the bottom corners of bulkhead No. 2 and the front cables anchored to the bottom longerons in line with the side of the seat. Cushions are made to fit each seat and are held by tabs that pass through the sides of the seat and are fastened to turnbuttons.

Undercarriage.

15. The undercarriage is of the oleo type, with radius rods and rear compression struts. The oleo leg (shown in fig 5) absorbs the shocks on landing and comprises a central oil chamber on either side of which are mounted a number of compression rubbers and separator plates with suitable guide rod, the rubbers being enclosed in a telescopic cylinder.

16. Fig. 6 shows the arrangement of the undercarriage. The front strut or oleo leg is joined to the fuselage immediately beneath fuselage side strut No. 1 by the attachment fitting as shown. The pin centres length from this attachment fitting to the wheel axle fitting is 3 ft. $3\frac{1}{2}$ in., in standing position. These centres move out to 3 ft. $10\frac{1}{4}$ in. when the aircraft is flying and move in to 3 ft. 0 in. when the leg is fully compressed on landing.

17. Radius rods of tubular steel connect the axle to the lower end of a pair of faired tubular steel V-struts, these V-struts being attached at their upper extremities to fittings beneath fuselage side struts Nos. 2 and 3 immediately under the front and rear spar joints on the fuselage. Bracing for the undercarriage struts is carried out by 2 B A streamline wires, while the radius rod members are braced by 35 cwt. cable with turnbuckles, the cables not crossing but looped

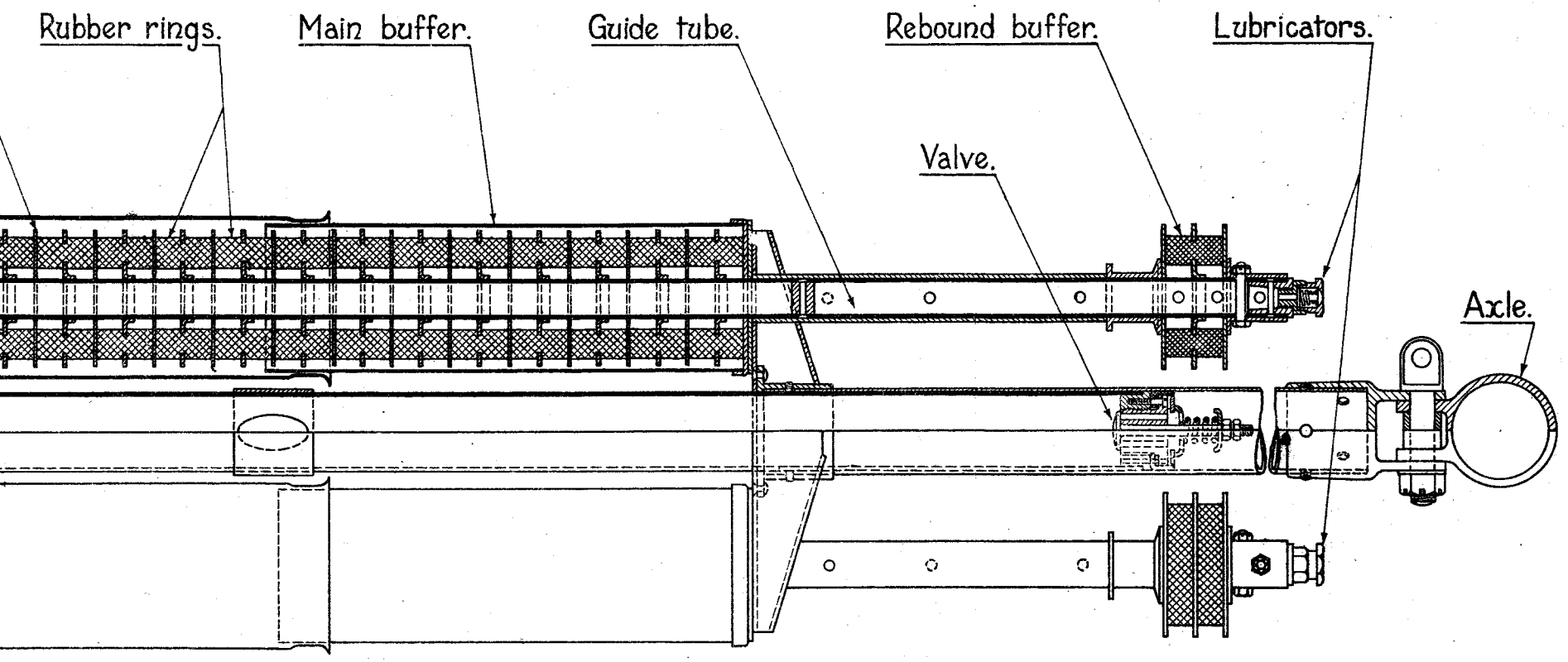

FIG. 5. OLEO LEG.

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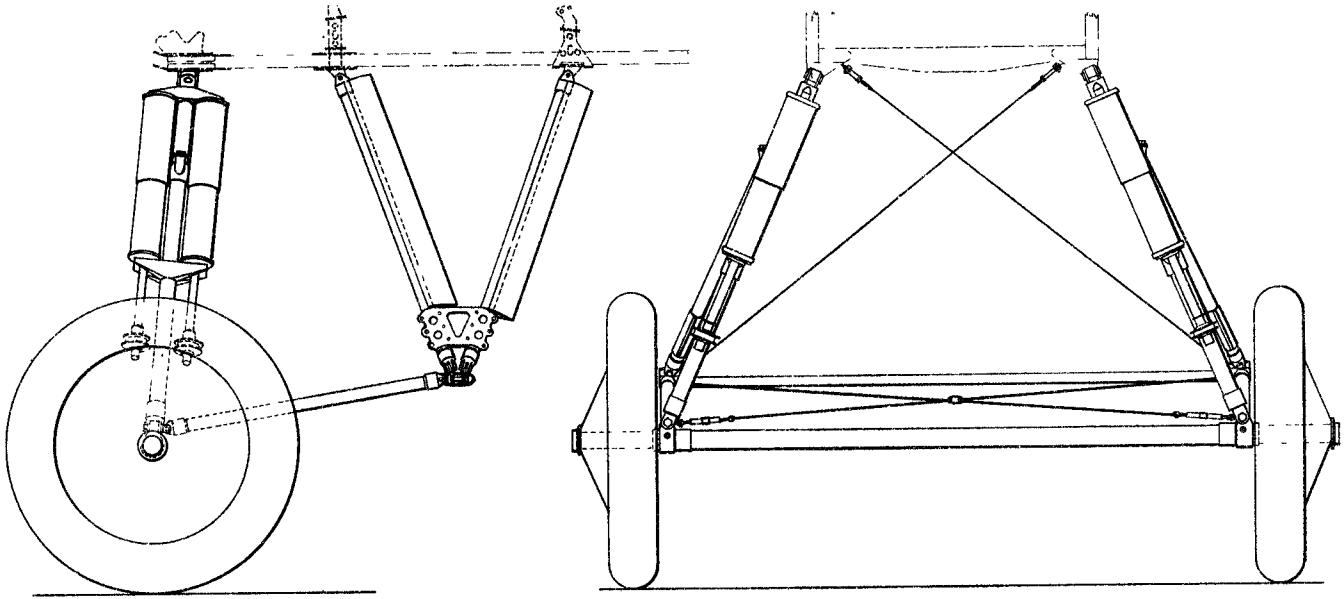

FIG. 6. UNDERCARRIAGE.

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N.P. To follow fig. 5 to face page 12

around a central ring. From the point of junction of the V-strut lower extremities and the transverse tubular member of the undercarriage, a pair of stay wires run up on each side to fittings mounted one beneath the front spar and one beneath the rear spar of the lower planes at the position of the inner interplane struts.

Tail skid.

18. The steerable tail skid is illustrated in fig. 7. The steering lever is formed of 10 S.W.G. mild steel plate with a

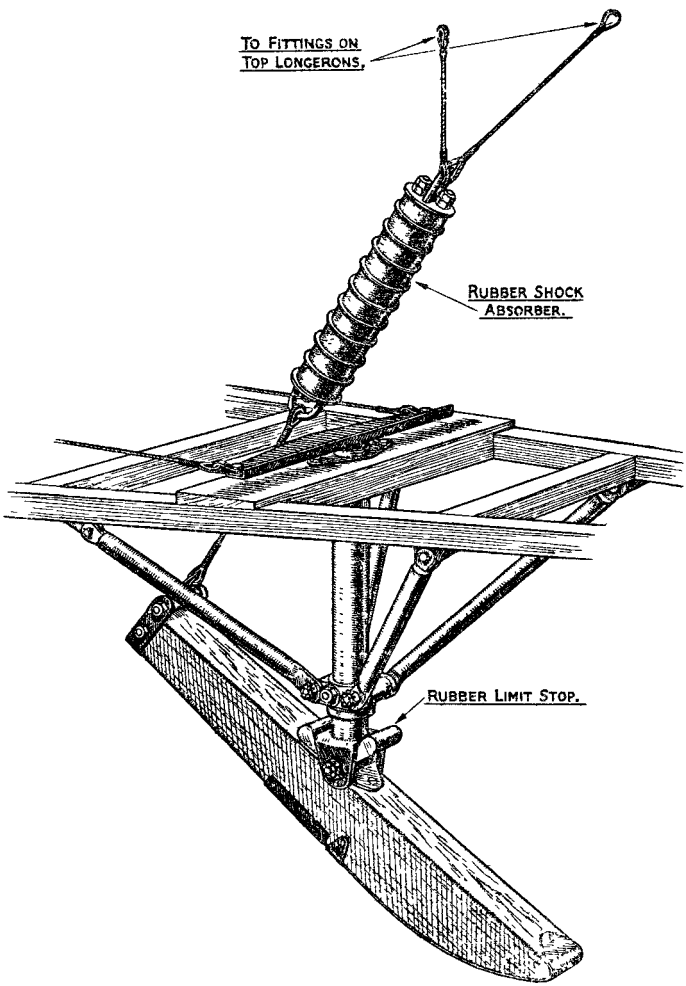


FIG. 7.—TAIL SKID.

short piece of steel tube welded on at its centre which is spigoted into the upper end of a tubular skid post and secured by two bolts. Cable connection to the steering lever is made by shackles and thimble with spliced eye. The skid is formed of wood mounted in the forked extremity of the skid post. A metal shoe is fitted to prevent rapid wear of the skid through contact with the ground.

19. The skid post turns in and is steadied at its lower end by a bush to which are fitted the lower ends of four tubular steel stays, the upper ends of the stays being fitted to the lower longerons of the fuselage beneath frames 9 and 10. The upper end of the skid post passes through a hole cut in a wood transverse member taken across the lower longerons in bay 9–10 and is axially located in its two guides by a split pin taken through its end to bear on an armouring plate fitted to the transverse member. A rubber buffer absorbs the shock of landing and is connected by cables between the forward end of the skid and the upper jointing plates of frame 10.

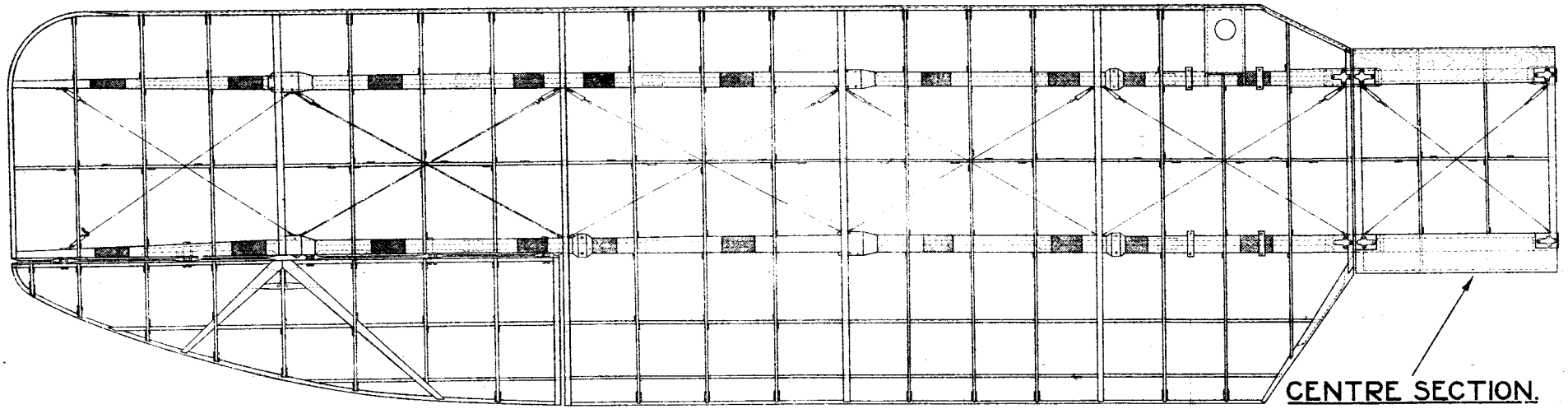
Main planes.

20. The upper and lower planes are not interchangeable, the top main plane being cut away at the root to allow a good range of vision. The planes are built as skeleton frames, as shown in fig 8. The bottom plane construction follows the same arrangement as the top plane, except that the leading and trailing edges at the root of the wing are cut away as shown, also three-ply wood is fitted in the bays formed by the first two ribs from the root, affording a footrest by the cockpit entrance. The following are the main plane components :—

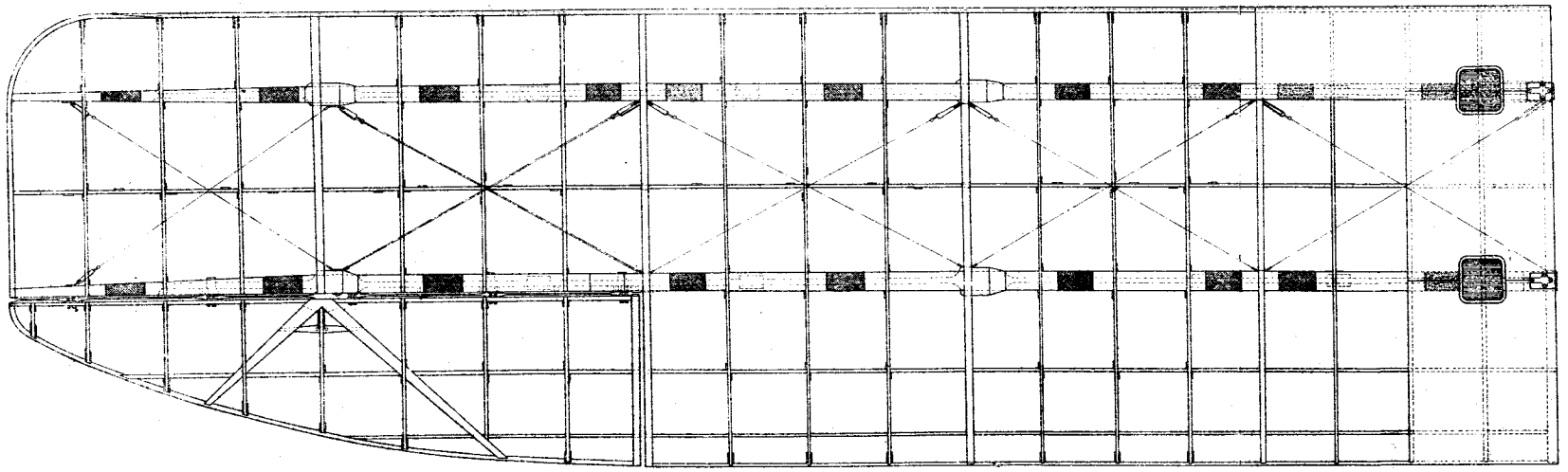
Front spar.	Front stringer.
Rear spar.	Centre stringer.
Main ribs.	Rear stringer.
Auxiliary ribs.	Trailing edge.
Leading edge.	Bracing.

21. The front and rear spars run the entire length of the plane, and through them the entire load is carried. Mounted equidistantly across the spars are the five main ribs. These serve to tie the main spars together and give stiffness to the plane. The auxiliary ribs are fitted between the main ribs, three being fitted in each bay. These ribs serve to maintain the correct section of the plane between the main ribs. Beyond the fourth main rib, the auxiliary ribs and remaining main rib are discontinued at the rear spar ; in the rectangular bay thus formed an aileron is fitted.

22. In the main the spars are of I section, but at the points at which the interplane strut sockets are fitted they are left with a full section ; both spars taper towards their outer ends.



TOP PLANE.



BOTTOM PLANE.

FIG. 8. MAIN PLANES & CENTRE SECTION PLANE.

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The compression ribs are built up and have their upper and lower faces formed by single strips of wood. The ribs are built up over the main spars to which they are permanently attached.

23. The auxiliary ribs are formed by lengths of shallow section spruce taken from leading to trailing edge on each side of the main spars. Their upper and lower edges are suitably spaced by three-ply distance pieces to give the plane its correct section. The leading edge is built of wood in two sections, joined end to end. The main length is of a hollow half-round section, whilst the shorter is of a solid half-round section. The hollow section is run from the inner main rib to between the two outer auxiliary ribs beyond the fifth main rib. The noses of the main and auxiliary ribs are fitted into its hollowed rear edge. The solid sectioned length is taken around the plane tip and secured to the ends of the spars. The trailing edge is formed by a length of oval sectioned steel tubing and is fitted between the first and fourth main ribs. It is secured rigidly to the ribs. To stiffen the auxiliary ribs, three stringers are fitted. The front stringer is located midway between the two spars and is run the entire length of the plane. The stringer is formed by two strips of spruce separated by a number of three-ply strips and is run through all the ribs concerned. The two rear stringers are formed by single lengths of spruce of suitable cross-section. These are fitted between the rear spar and trailing edge and are run between the first and fourth main ribs. Like the front stringer, they are run between the top and bottom plates of all the ribs concerned. The plane is cross-braced between each pair of main ribs, one of the outer bays having double bracing wires as shown in fig. 8.

Aileron.

24. The aileron has a large portion faired-off or clipped, and is built up from a spar, trailing edge, auxiliary ribs, box ribs and stringers in much the same way as the main plane. Attachment of the aileron to the rear spar of the plane is effected by hinge joints built up from eyebolts and hinge pins. Five pairs of eyebolts are mounted equidistantly along the front spar of the aileron to engage five eyebolts fitted to the rear spar of the main plane. The joint is made by pins inserted through the heads of the eyebolts.

Centre section.

25. The centre section shown in fig. 8 is built up in a manner similar to that employed for the main planes, and is in effect formed by a bay included between a pair of main ribs. The point of difference between the centre section and such a bay lies in the leading and trailing edges, which are of three-ply

wood, and the fact that only two auxiliary ribs are fitted. The leading and trailing edges are brought close to the main spars to reduce the chord of the centre section and so allow an increased field of view and easier access to the cockpit. The plywood forming the leading and trailing edges is covered with aluminium sheeting.

Main plane, centre section, and aileron fittings.

26. Except for the internal bracing plates, aileron hinges and other bolts in the aileron gap, all metal fittings are assembled after the ailerons, planes, &c., have been covered with fabric. The main plane fittings consist of strut socket plates, aileron control pulleys, bracing plates, control levers and skids. The interplane strut socket plates are fitted to the main spars of the upper and lower planes on the inside of the third and fourth compression ribs, at which points the spars are built up to receive them. Aileron pulleys of the type shown in fig. 9 are fitted to the upper and lower faces respectively of

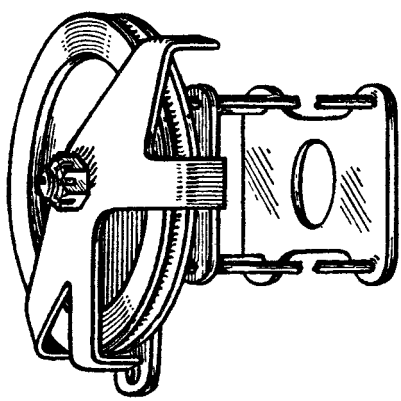

FIG. 9.—AILERON PULLEY.

the front spars of the upper and lower planes near the outer interplane struts.

27. Wing tip skids are fitted to the lower planes beneath [illegible] plates in conjunction with their cover plates serve to secure the ends of the spars of the upper planes and project beyond the sides of the centre section. Operating levers are fitted centrally to the upper and lower faces of the aileron spars.

1) Para. 27. *Add.* "The small bolt securing the skid in its front socket should be fitted so that it lies parallel to the wing chord. If fitted otherwise, it is liable to foul the aileron pulley when the skid is in contact with the ground. (See A.M.T.O. 169 of 1928.)"

29. Four different types of main plane interplane struts are provided : front outer, front inner, rear outer and rear inner struts between each pair of planes. Whilst the cross-section and overall length of each strut differ, the general appearance of each is much the same. The ends of the struts are given a coat of red lead and are push fits in the socket plates mounted on the planes. The centre section struts are similar to the interplane struts, but are much shorter.

Attachment of main plane and centre section to fuselage.

30. The centre section struts are first fitted to their sockets on the centre section and then the centre section is fitted to the fuselage. The struts are braced before the main planes are fitted. The upper sockets of the rear centre section struts are connected to bolts in the upper joints of frame 2 by means of steel tension straps. These straps are necessitated by the fact that no cross-bracing is fitted between these struts. Before fitting the main planes to the fuselage, the respective pairs are fitted with their interplane struts, the bracing wires attached and roughly adjusted. The actual attachment of the lower planes to the fuselage is effected through the lower jointing plates of frame 2 and 3. Jawed sockets project from the side plates of these joints to engage the ends of the spars. The joints are secured by bolts taken through the sockets and the ends of the spars. The socket plates and cover plates of the centre section project beyond the sides of the centre section. The jaws thus formed receive the ends of the spars of the upper plane, and the joints are secured by bolts taken through the spars and the plates. The main plane structure is completed by bracing wires.

Bracing.

31. The run of the bracing wires is as follows :—

(i) *Centre section bracing.*—The two front struts are cross-braced by double diagonal bracing. Of each diagonal, the upper ends of the two wires are shackled to lugs on the strut socket plates. Incidence bracing is effected between the front and rear struts by means of two wires fixed at their upper ends to lugs integral with the upper socket plates and at their lower ends to lugs on the lower socket plates.

(ii) *Main plane bracing.*—To a lug welded to each of the upper section centre socket plates a wire is fixed and run to a lug integral with the lower socket plate on the front and rear inner interplane struts respectively. Other wires are run from lugs on the upper jointing plates of these struts to lugs integral with the lower socket plates of the outer interplane struts.

Flying wires.

32. From a lug integral with the upper socket plate of the front inner interplane strut, a pair of wires are run. The forward wire is taken to a lug on the engine mounting ring. The rear wire is taken to a lug integral with the lower jointing plates of frame 2. From a two-holed lug on the upper socket plate of the rear inner interplane strut, two wires are run to lugs integral with one of the lower jointing plates of frame 3. From two holed lugs on the upper jointing plates of the front and rear outer interplane struts, pairs of wires are run to lugs integral with the lower socket plates of the front and rear inner interplane struts. The incidence wires are fitted as diagonal bracings between the front and rear interplane struts. The upper ends of the wires are fixed to eyebolts securing the upper strut socket plates and the lower ends to eyebolts securing the lower strut socket plates.

Tail plane.

33. This component consists of two parts, each part being built up and later covered with fabric. The leading and outer edges are formed of steel tube, and the inner edge of a length of channel sectioned spar. The auxiliary ribs, stringer, rear spar and cross bracing follow closely the design of similar components in the main planes. Four pairs of eyebolts are fitted to the rear spar to provide a hinged joint for the elevator. It will be seen that a portion of the leading edge projects beyond the side of the framework. This projection is housed in the sleeve fitted into frame 9 of the fuselage, where it is secured by a bolt taken through it and the sleeve. The complete tail plane is further supported by two pairs of tubular steel struts and a pair of auxiliary struts fitted to the rearmost pair, the latter connected at their lower extremities to the tail plane incidence gear (*see* fig 10).

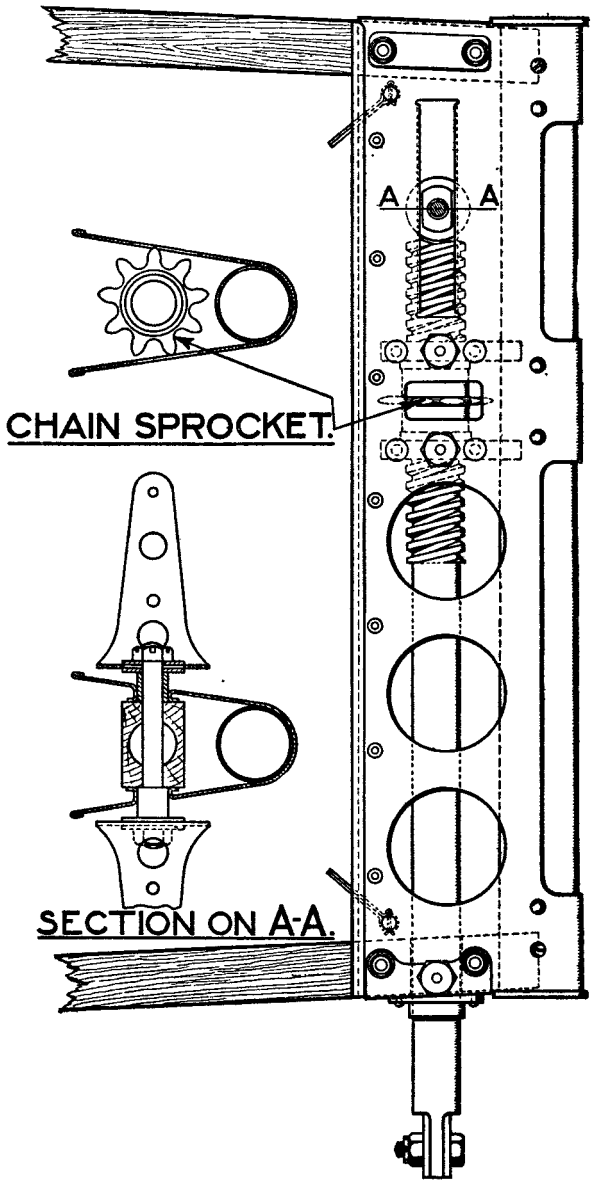

FIG. 10.—TAIL PLANE INCIDENCE GEAR.

Tail plane incidence gear.

34. The struts supporting the tail plane are of streamlined section. Their upper ends, which are solid with their shanks are secured to a pair of lugs bolted one to the leading edge of the plane and one to the rear spar. The lower ends of the forward pair of struts may be telescoped into the shanks of the stays and secured in any one of several positions. Five holes are drilled in the shanks of the end forgings and four in the shanks of the stays, the spacing being so arranged as to constitute a vernier adjustment. The holes are meshed by sliding the ends in or out to the desired adjustment. When adjusted, the ends are secured by bolts taken through them and the stays. The ends of these forward struts are secured in the forked ends of special plates mounted beneath additional cross struts fitted between the lower longerons midway in bay 8–9 of the fuselage. The lower ends of the rear pair of struts are connected to the lower end of an operating worm spindle of the tail incidence gear. All the struts are pin-jointed at their extremities to allow suitable movement for a variable incidence of the plane, which has a total range of 5°.

35. The spar at the rear of the tail plane is connected to a trunnion fitting attached to the top of the worm spindle. Fig. 10 shows the worm spindle, which is operated by a chain sprocket and housed in a steel sheet bracket having suitable lightening holes, the rear portion of the bracket enveloping the tubular steel sternpost.

Elevator.

36. The framework of the elevator is built up from a steel tubular outer edge fitted to a front spar and is stiffened by three auxiliary ribs and two box ribs. Four eyebolts are fitted to the front spar and, in conjunction with the four pairs fitted to the rear of the tail plane, form the hinged joint by means of which the two members are secured to each other. After the elevator has been covered with fabric, an actuating lever is mounted midway on the upper and lower faces of the front spar.

Rudder.

37. The framework of this component is formed by a steel tubular edge bent to shape and stiffened by one main rib, two auxiliary ribs, two spars, and a socket. At the lower end of the short front spar, a bush is fitted to receive the lower end of the rudder post. The framework is cross braced. After the rudder has been covered with fabric, an actuating lever is fitted to each side of the main rib close to where that component joins the socket tube. The rudder is placed in position over the sternpost, and the rudder post—a length of steel tube—

is inserted through the bush at the lower end of the front spar and is passed upwards and secured by bolts taken through the bush of the lower end of the socket tube.

CHAPTER II.

FLYING CONTROLS.

Aileron control.

38. The lower ailerons are directly operated through a system of cables from a control shaft mounted longitudinally beneath the seating unit. The control shaft is illustrated in fig. 11. It consists of a length of tube supported in two

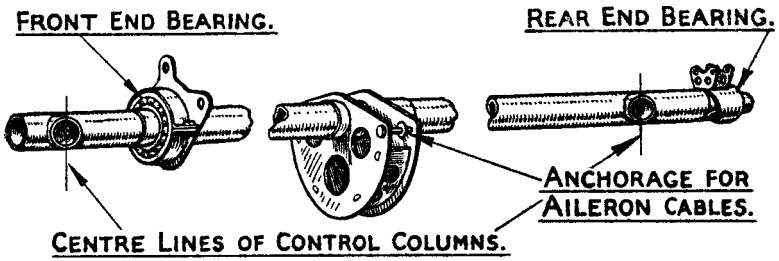

FIG. 11.—AILERON CONTROL SHAFT.

bearings fitted beneath the cross-bars of the seating unit. Stub axles are fitted at each end of the shaft to take the lower ends of the control columns which are pivoted about these axles. The ailerons are operated by rocking the shaft, and through the shaft a quadrant fitted towards the forward end of the shaft. A bolt is fitted between the cheeks of the quadrant at each end to form the anchorage of the control cables. The run of these cables for the port and starboard lower ailerons is similar but handed ; the run of the starboard control cables is described in the next two paragraphs.

39. Two cables are secured by means of their eyeletted ends to the bolt taken through the left-hand side of the quadrant. They are led beneath the quadrant and then around the right hand side of a four-grooved pulley mounted on the forward face of the bottom cross strut of frame No. 2. From there the cables are taken beneath the fuselage to a turnbuckle shackled to a bridge piece interposed in their run to a pulley fitted beneath the fifth compression rib. From there the leads are taken to shackles fitted to the head of the lower actuating lever of the bottom aileron. Between the two bridge pieces

of the port and starboard aileron control pulleys is a cable fitted with a turnbuckle. Roller guides for the cables are fitted beneath the lower longerons and eyeletted guides are fitted to the rear spar beneath the inner interplane struts. At the points at which the cables pass through their guides, they are protected by armouring sleeves wound from square sectioned wire. These guides are soldered in position.

40. Connection between the upper and lower ailerons on each side of the aircraft is effected by cables run from the heads of pairs of eyebolts fitted near the trailing edges. These eyebolts secure plates to which the upper ends of the actuating levers are braced. From the head of the actuating lever of the port upper aileron, a cable is run around the pulley above the fifth compression rib and thence above the front spar of the plane to a turnbuckle attached to a similar cable run from the starboard aileron. Above the interplane strut the cable is steadied in an eyeletted guide, and above the centre section strut in a roller guide. A guide of this type is necessary, as owing to the dihedral of the plane the cable would tend to rise clear of the spar at this point, and if a plain eyeletted guide were fitted, undesirable friction would result. Wire sleeves protect the cables where they pass through the eyeletted guides. When the control column is swung over to port, the starboard aileron control cables are tensioned and the starboard ailerons depressed. The port ailerons are raised through the cable taken above the upper planes.

Control columns.

41. These are of wood and shaped with a ball head. The lower end of each column is fitted with a plate to attach the column to the stub axle of the control shaft. The plates project below the shaft to take the elevator control cables. Fig. 12 shows the control columns and their fittings.

Elevator control.

42. The elevators are operated by the fore and aft movement of the control columns through cables attached to their lower ends on each side of their pivotal points. The actual control cables are run from the rearmost column and the columns are interconnected by a curved tubular link, which passes freely through the web of the aileron control quadrant. The ends of the link are pinned between the ends of the plates fitted to the lower ends of the control columns. From each of a pair of two-holed bracing plates clipped beneath the head and nut of the bolt securing the link to the rearmost column, two cables are run through the interior of the fuselage to turnbuckles shackled to the lower actuating levers of the

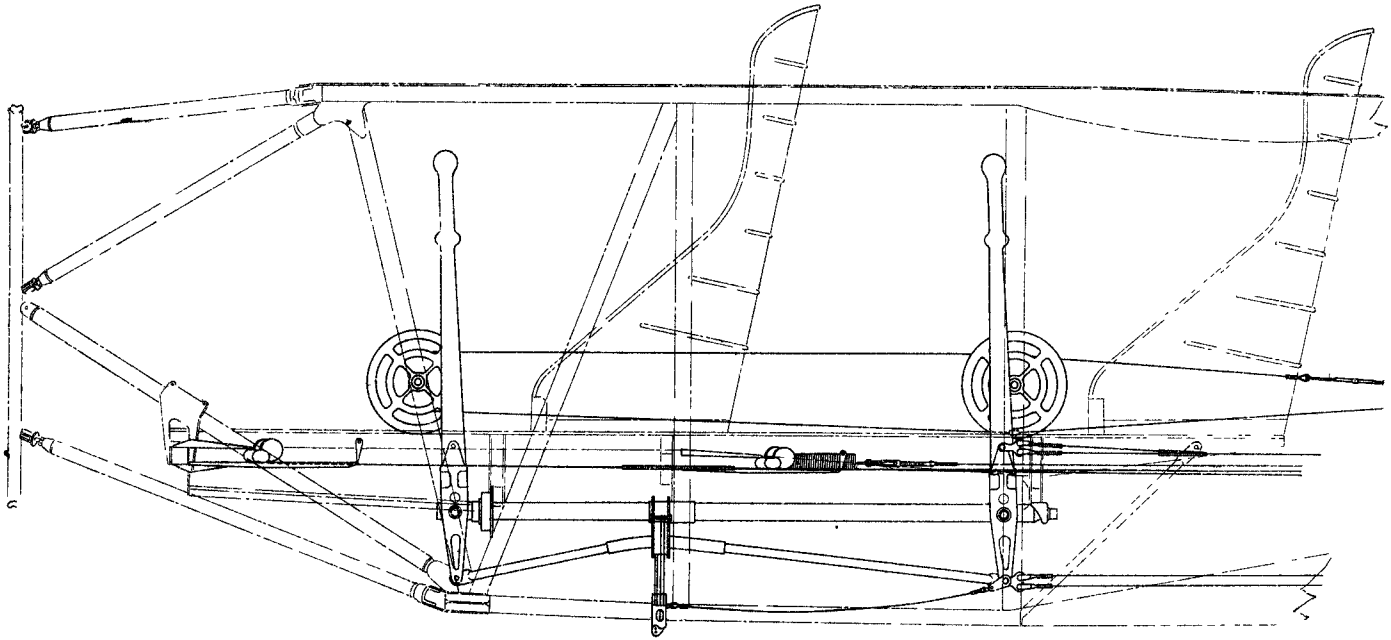

FIG. 12. ARRANGEMENT OF CONTROLS.

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Para. 43, line 7. After "seating unit" *insert* "Sheet aluminium guards fitted at either end of the front wooden cross member supporting the seat bearers fill the spaces between the foot-board and the diagonal tubular members forward of frame 1, and prevent the pilot's heels from becoming accidentally jammed in these spaces. (See A.M.T.O. 163 of 1928.)"

elevators on the same side of the fuselage as that on which they leave the control column. Cables are run in a similar manner from a pair of two-way bracing plates fitted beneath the head and bolt of one of the nuts securing the upper ends of the plates to the rear control column to the upper actuating levers of the elevators. At the points at which the cables leave the fuselage covering, they are armoured by sleeves of the type fitted to the aileron control cables. A bracing plate is mounted between the ends of the plates fitted to the rear control column. This plate is tethered by a 21-inch length of cable to a bolt fitted in bottom cross strut No. 2. This cable limits the movement of the elevators.

Rudder control.

43. The rudder is operated from two swivelling rudder bars fitted one in each cockpit. The bars are of ash armoured with brass plate, and they have aluminium foot grips fitted at each end. They are pivoted about fulcrum pins fitted in light brackets mounted on two cross-bars of the seating unit and work over light guides fitted between the cross-bars of the seating unit. To interconnect the front and rear rudder bars, two lengths of cable are run parallel to the centre line of the fuselage and are secured to bracing plates fitted beneath the foot grips on the ends of each rudder bar. From each of the bracing plates thus fitted to the rear rudder bar, two cables are run through the fuselage to turnbuckles shackled to the actuating levers on the same side of the rudder as that on which the cables leave the rudder bar. The cables leave the fuselage at frame 9 and pass through guides mounted on the packing blocks above the tail plane leading edge sleeve. At points where the cables pass through these guides, and level with the rear ends of the seating unit, armouring sleeves are fitted.

Tail incidence control.

44. The tail plane incidence gear is operated by wheel and cable, one wheel in each cockpit situated on the starboard side. To the control cables is attached a short length of chain which passes a chain sprocket-mounted on the vertical worm spindle of the incidence gear (*see* tail plane incidence gear, para. 34).

CHAPTER III.

ENGINE INSTALLATION.

Engine mounting.

45. The engine is the 180 h.p. Lynx (series IV) radial type, with seven cylinders. The crankcase at its rear end is provided with a cone-shaped engine bearer, which is mounted by sixteen

bolts to an engine mounting ring, the ring being supported from eight tubular steel struts carried by brackets on the top and bottom longerons of the fuselage. Two of the struts are of fixed length and the others are adjustable. In the bay immediately to the rear of the bearer ring are located the carburettor, oil breather pipe arrangement and the magneto. The oil tank is slung from the bottom engine mounting struts and suitably shaped to form an undershield, cowling being omitted at this position. The engine mounting is shown in fig. 13.

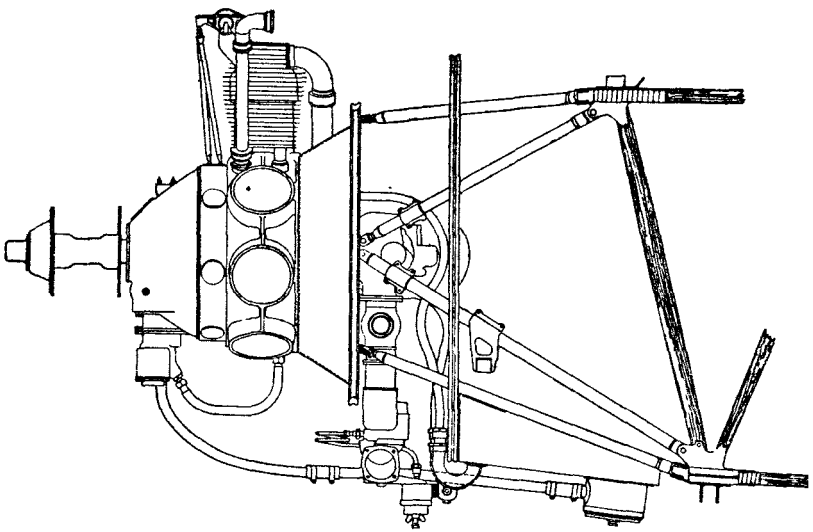

FIG. 13.—INSTALLATION OF LYNX ENGINE.

Petrol Tanks.

46. The two petrol tanks, each of 16 gallons capacity, are located one on either side of the top main planes, where they are slung from the underside near the plane root. They are shaped at the bottom with a curved nose and faired off rear portion. The length of the tank is the full chord of the plane.

47. The general construction is shown in fig. 14. The tank consists of tinned steel plates riveted with $\frac{3}{32}$ in. diameter copper rivets. The top and bottom plates are of 26 gauge plate, while the sides are of 24 gauge plate. Three baffle-plates of 26 gauge are fitted internally. Swaging in order to strengthen the plate is carried out on the top and bottom plates only. A sump is formed to one side of the tank at its lowest

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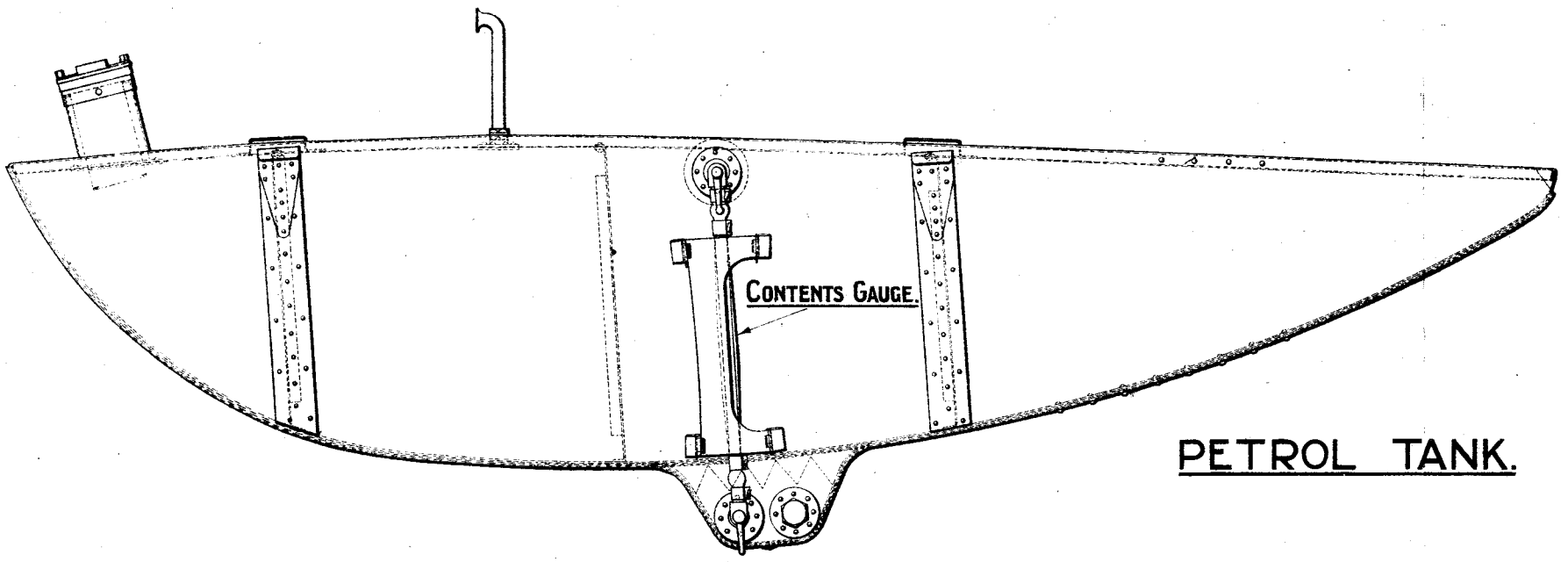
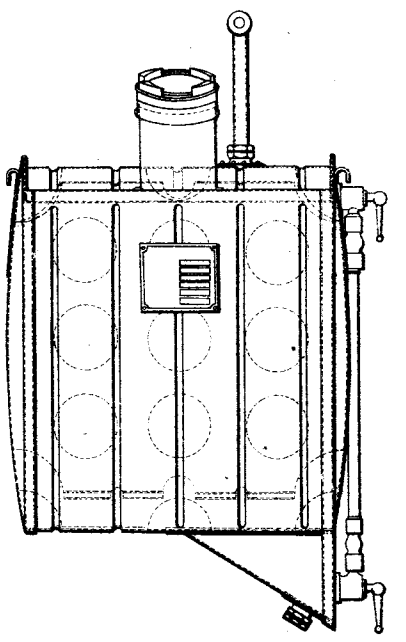
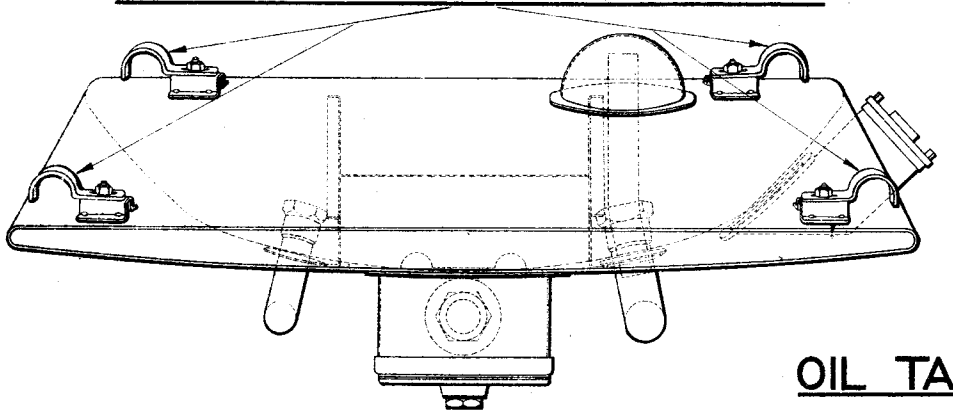


PETROL TANK.



ATTACHMENTS FOR ENGINE MOUNTING MEMBERS.



OIL TANK.

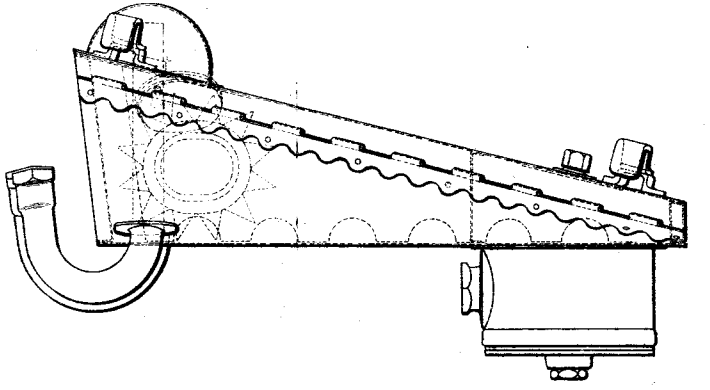


FIG. 14. PETROL AND OIL TANKS.

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point, the sump sloping to the position of the lower cock of the glass gauge, where also, to the side of the sump, the outlet connection is fitted.

48. The various fittings attached to the tank are a gauge glass with cocks and guard, filler neck and cap, drain plug to sump, vent pipe, suspending hooks and straps.

Petrol system.

49. A simple gravity feed system is employed. Petrol is led from both tanks to a three-way cock operated from both cockpits by handles fitted to a control shaft and flows direct to the filter and carburettor. Each main tank is fitted with a cock at its outlet, so that in the event of failure of the pipe line between the tank and the three-way cock the petrol supply is not lost. The cock is spring-loaded to remain in the open position and is operated by a bowden cable with a pull ring in the rear cockpit. The two rings are placed one on each side of the rear cockpit and may be hooked back when it is required to hold the cock in its closed position.

50. A priming pump is in communication with the three-way cock, the pump delivery pipe running to a priming manifold or distributor on the engine. Fig. 15 shows a general

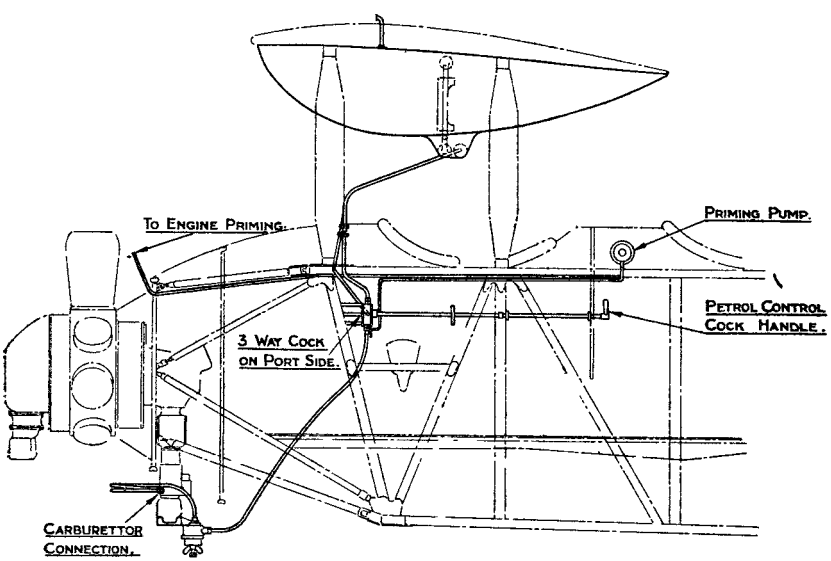

Fig. 15.—Petrol system 504N Lynx.

arrangement of the petrol system where the three-way cock is supported from a bracket on fuselage port side strut No. 1 and is in connection with the port and starboard gravity tanks

and with the filter open to the carburettor. The priming pump is mounted at the top of the fuselage with access from the starboard side between the two cockpits. The pump draws from a pipe with cock in connection with the three-way cock, forcing petrol through a delivery pipe led on the starboard side of the fuselage and up to the priming connection on the engine.

Oil piping.

51. The engine is lubricated on the dry sump principle, oil circulating to the main working parts and through other parts under pressure from the pump. The oil is finally dropped or splashed to the crankcase sump, the latter being drained by a scavenge pump which returns the oil to the tank.

52. Fig. 17 shows the arrangement of the oil pipes which comprise a feed pipe from tank to engine and a return pipe from engine to tank. A breather pipe is also incorporated in the system. This pipe is connected to the air intake and open to the oil tank. The capacity of the tank is 3½ gallons. A suitable pipe lead for a pressure gauge is taken to the cockpit.

Magneto control wiring and switches.

53. A diagram and general arrangement of the magneto wiring are shown respectively in figs. 16 and 18. Two tumbler switches are mounted in the front cockpit ; one of these, a double pole switch, is utilised for operating the magneto cut-out ; whilst the second, a single pole double throw switch, is

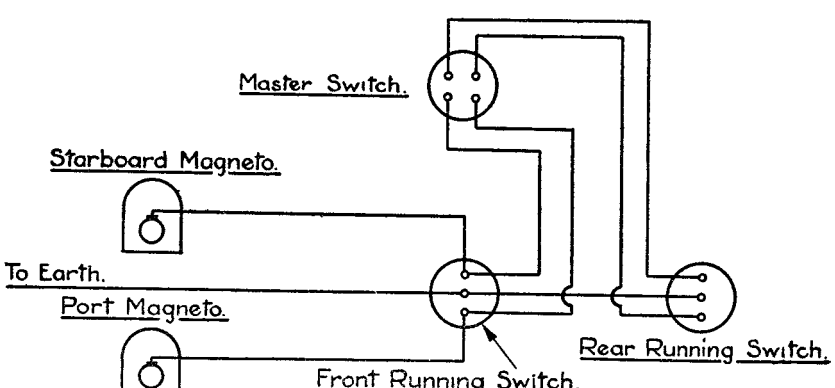

FIG. 16.—DIAGRAM OF MAGNETO WIRING.

the master switch for rendering inoperative the switch fitted in the rear cockpit. Switches are mounted on a special flame resisting celluloid plate attached to a three-ply wood baseboard.

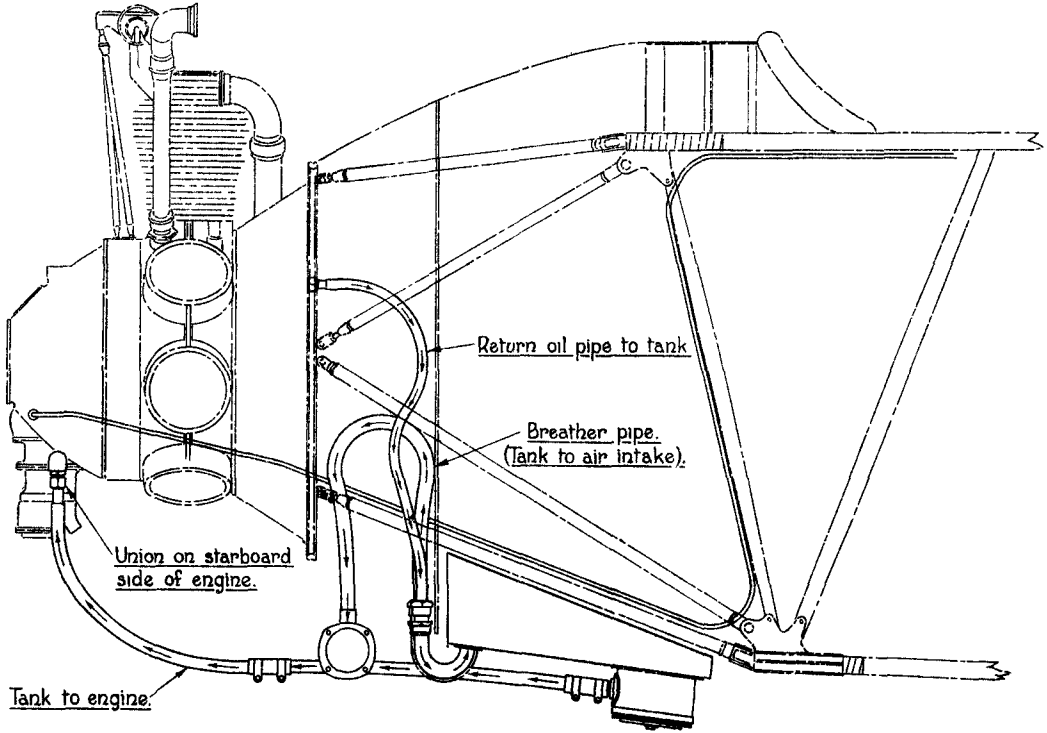

FIG. 17. OIL SYSTEM.

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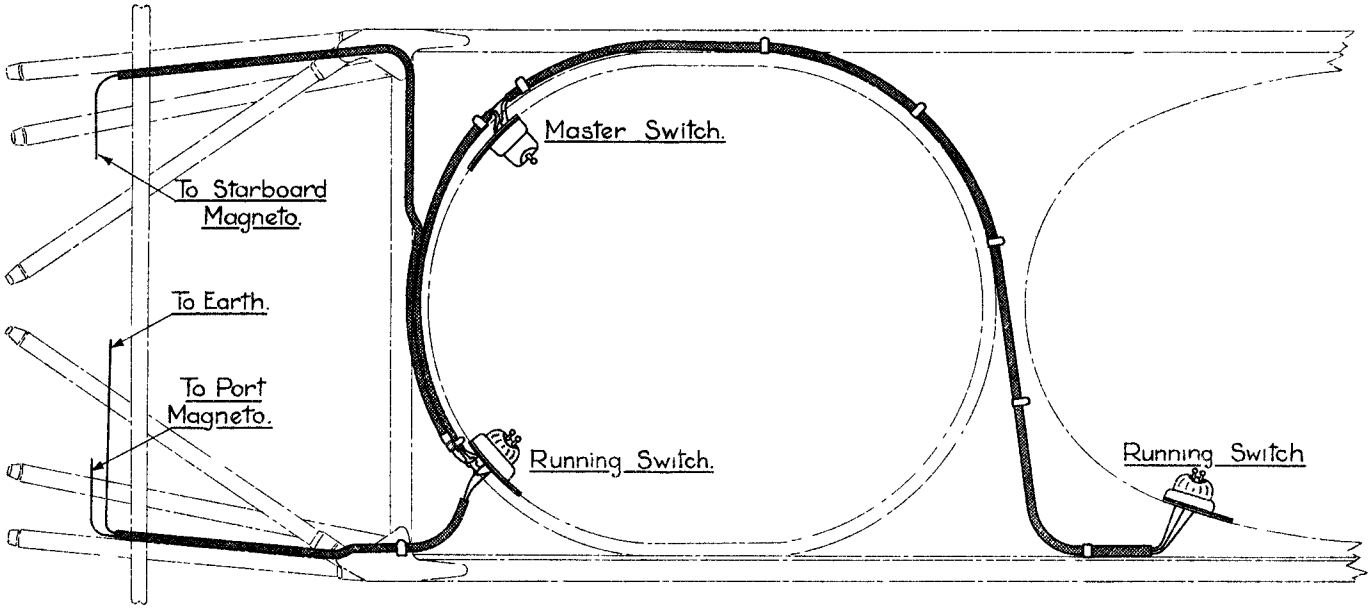

FIG.18. MAGNETO WIRING AND SWITCHES.

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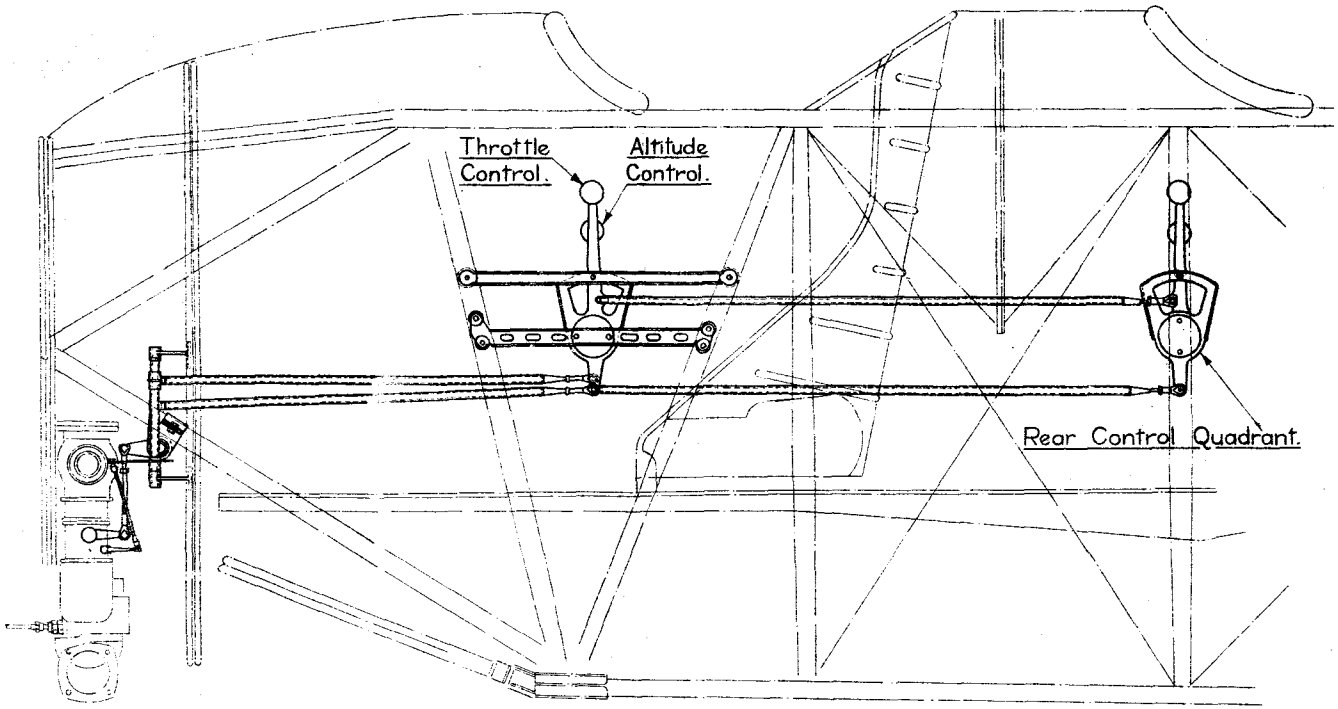
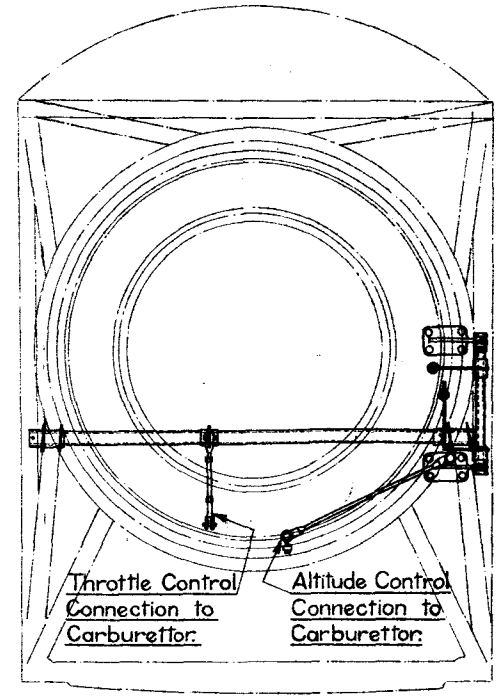
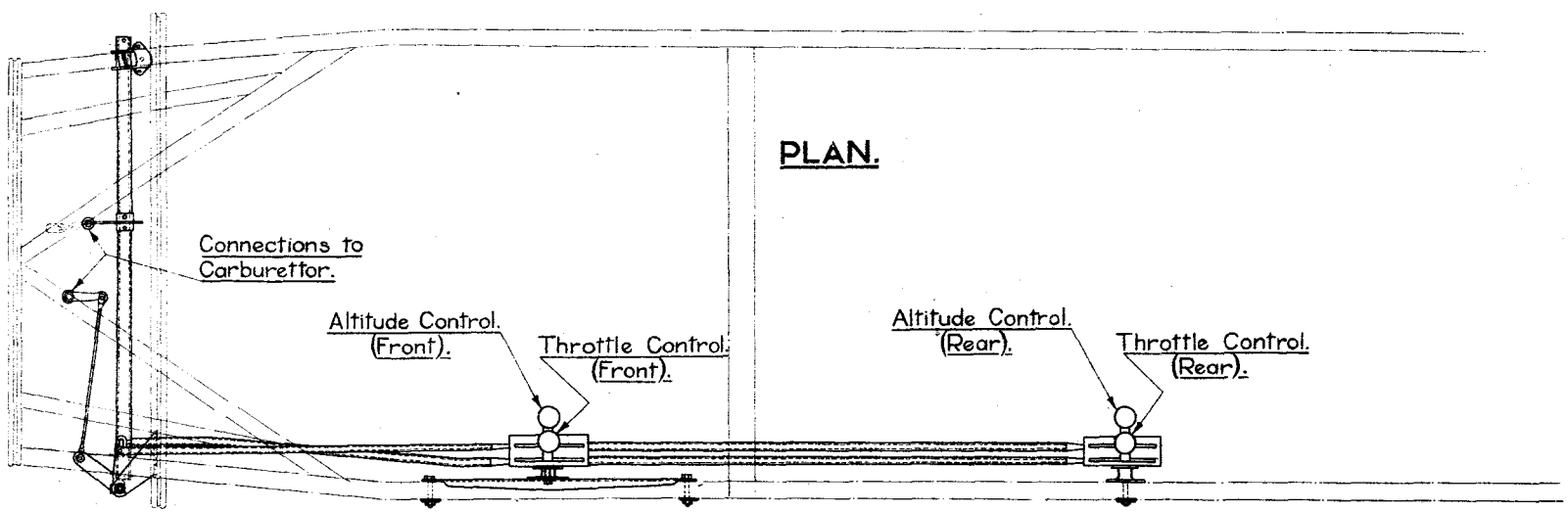
N.P. To follow fig 18 to face page 26



SIDE ELEVATION.



FRONT ELEVATION.



PLAN.

FIG. 19. ENGINE CONTROLS.

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Instructions are engraved on the plate. The connections between the various switches operating the circuit may be followed from the diagram, fig 16. Earth wires are coloured blue, magneto (port) red and magneto (starboard) green.

Hand starter.

54. A hand starter magneto is mounted on a platform between the seat bearers in bay 2–3. A tumbler switch, with suitable "run" and "stop" labels for operating, is mounted on the platform.

Engine controls.

55. The throttle and altitude controls are operated from two quadrants mounted one in the front and one in the rear cockpit. Both quadrants are fitted on the port side as shown in fig. 19. The two quadrants are of the same type and interconnected. In the front cockpit the quadrant is mounted on an aluminium supporting bracket and a steady channel fitted on the port side of the fuselage between the two diagonal struts in bay 1–2. The altitude control is locked in the closed position when the aeroplane is delivered from the manufacturers (*see* also para. 122, A.P. 1287 Lynx IV. aero engine).

56. The quadrants are built up of the following components:—

Quadrants.
Throttle lever.
Altitude lever.
Bearing bracket.
Adjusting cap.
Bushes.
Feathered washers and friction washers.
Stop plate.

57. The quadrant is mounted on the bearing bracket to which it is riveted. The levers are mounted on the bracket and retained in position by the feathered washers, friction washers, and adjusting cap. The levers travel through slots in the quadrant, the respective slots being suitably marked for open and close positions.

58. Interconnection of the two levers is effected by rods taken between the levers. Similar rods from the front lever are taken to a lever system and layshaft for operating the throttle and altitude levers on the engine.

Cowling.

59. The sheet metal covering plates fitted to the forward end of the fuselage are of 20 gauge aluminium. This cowling comprises the following panels :—

1. Top panel, front.
2. Side panel, front.
3. Top panel, rear.
4. Side panel, rear.
5. Undershield, rear.

60. The oil tank forms a front undershield. The various panels have aluminium hinge strips riveted to their edges and are fitted with locking skewers. The arrangement of the cowling and lacing strips for securing the panels to the fuselage is shown in fig. 20.

CHAPTER IV.

AUXILIARY FITTINGS.

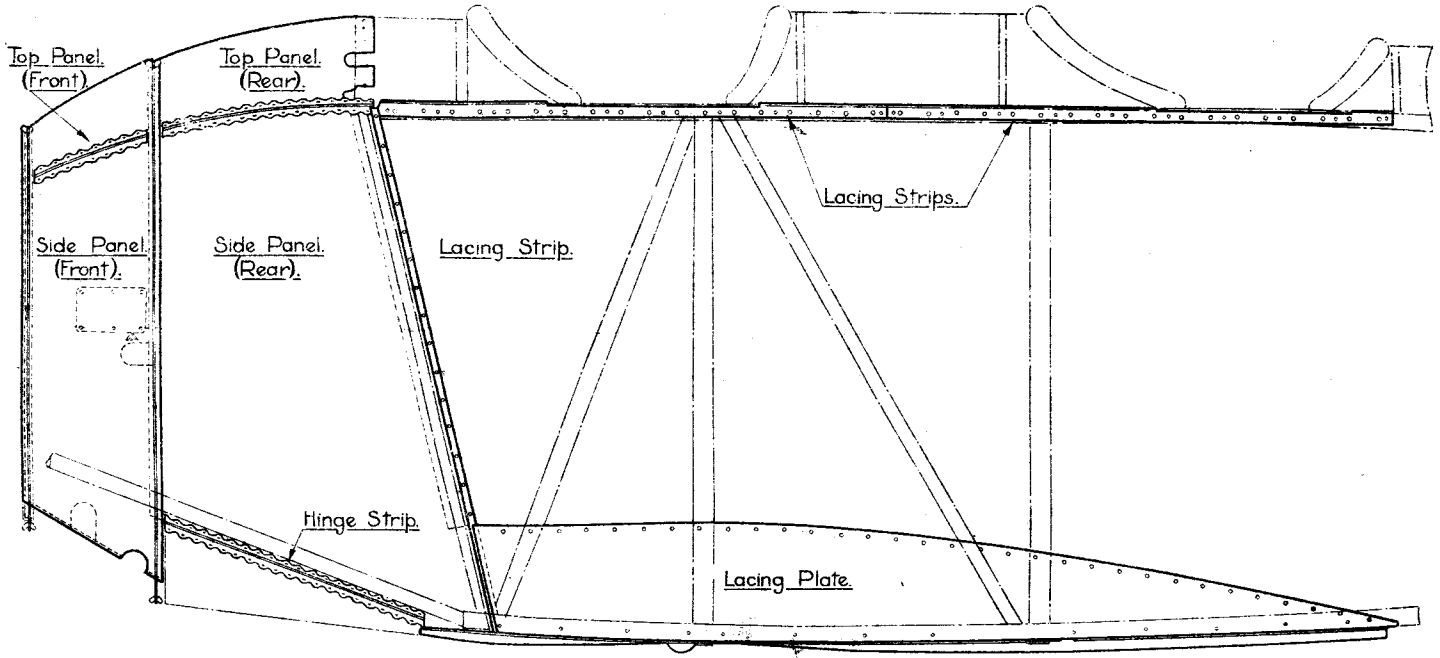
Instrument boards.

61.—(i) An instrument board is fitted in each cockpit. The board in the front cockpit is supported by brackets from fuselage side struts No. 1 and is shown in fig. 21. Above the instrument board a compass board is arranged for type 5/17 compass. This board is shaped and fitted immediately under the ply-wood decking of the cockpit and carries, besides the compass, a cross level Mark VA compass card holder, writing pad and engine revolution plate.

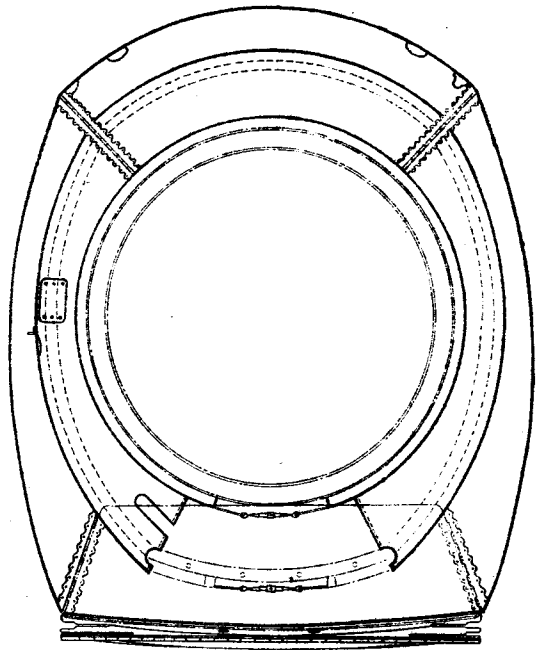
(ii) Mounted on the front instrument board are the following :—

Airspeed indicator	Mark IVA.
Watch	Mark V.
Altimeter	Mark V (0–16000).
Revolution indicator ..	Mark V.
Oil pressure gauge	Mark VIIB (0–60 lb.).
Map case.	

62.—(i) The instrument board in the rear cockpit shown in fig. 22 is mounted in bay 2–3 of the fuselage. A portion at the top of the board carries the compass and is attached to the upper decking of the fuselage. The lower edge of the board is supported by wires from lugs on the fuselage top longerons.



SIDE ELEVATION.



FRONT ELEVATION.

PLAN.

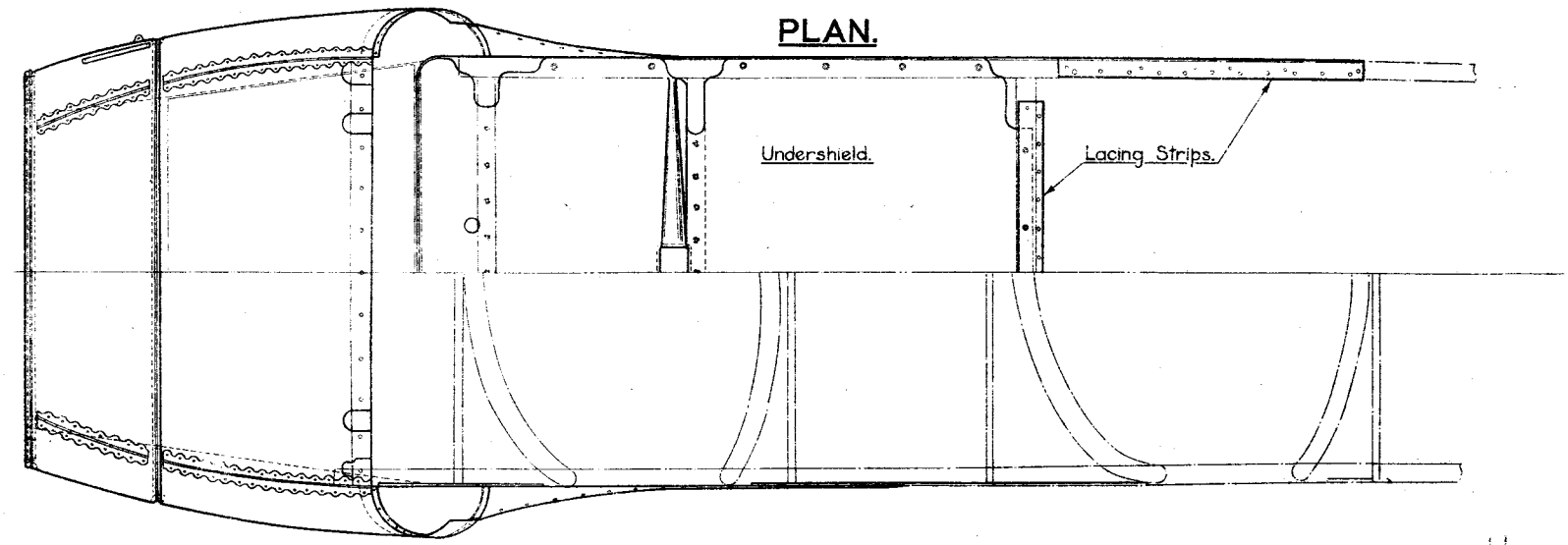


FIG. 20. ARRANGEMENT OF COWLING.

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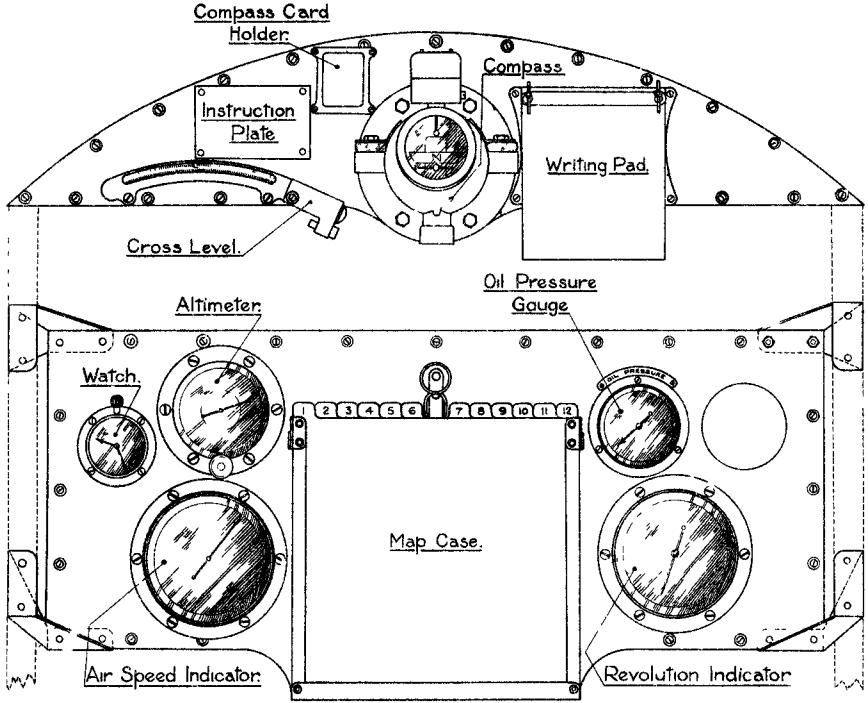

FIG. 21. FRONT INSTRUMENT BOARD.

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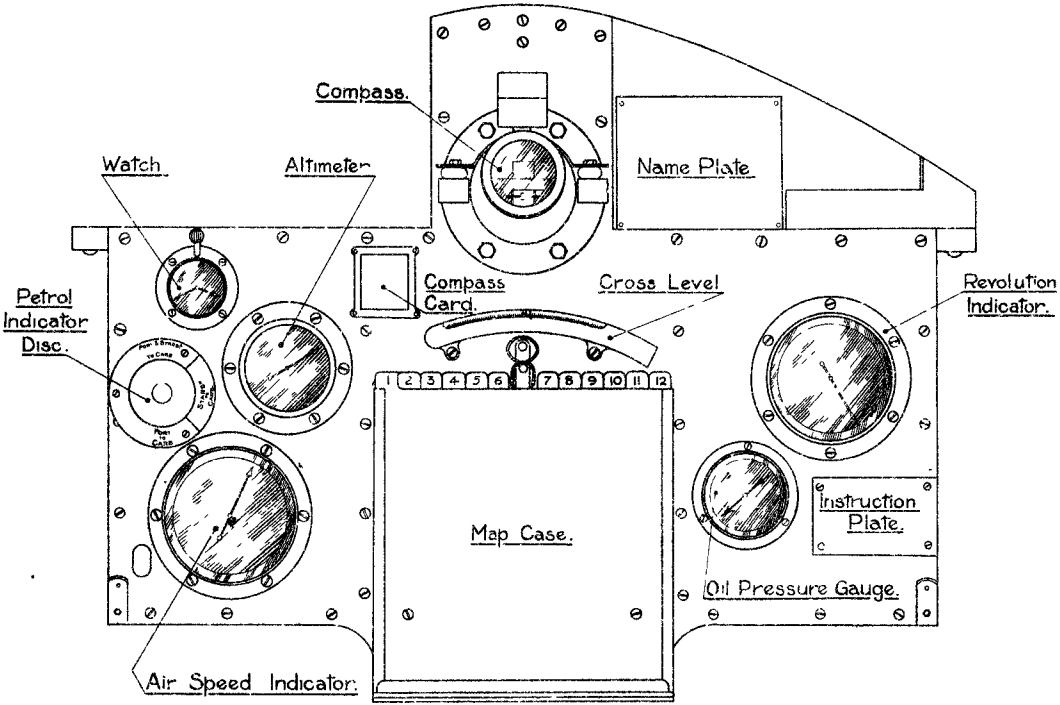

FIG. 22. REAR INSTRUMENT BOARD.

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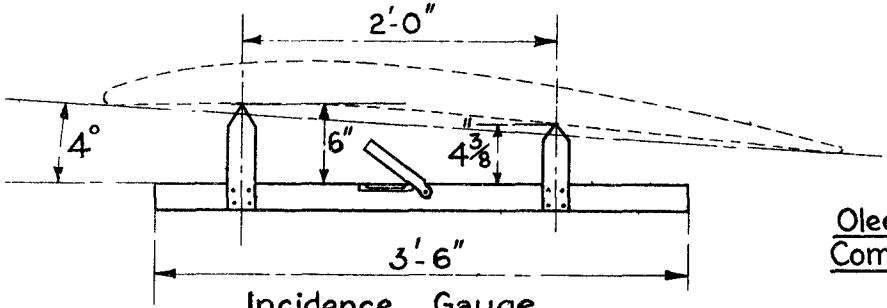
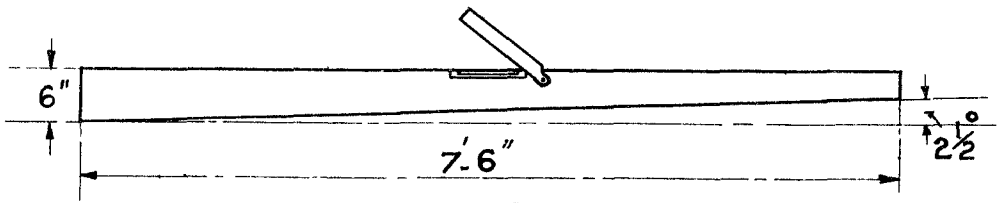
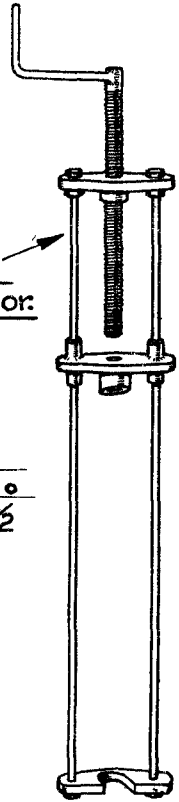


Incidence Gauge.



Dihedral Board.



Oleo Leg Compressor.

FIG. 23. TOOLS USED FOR RIGGING.

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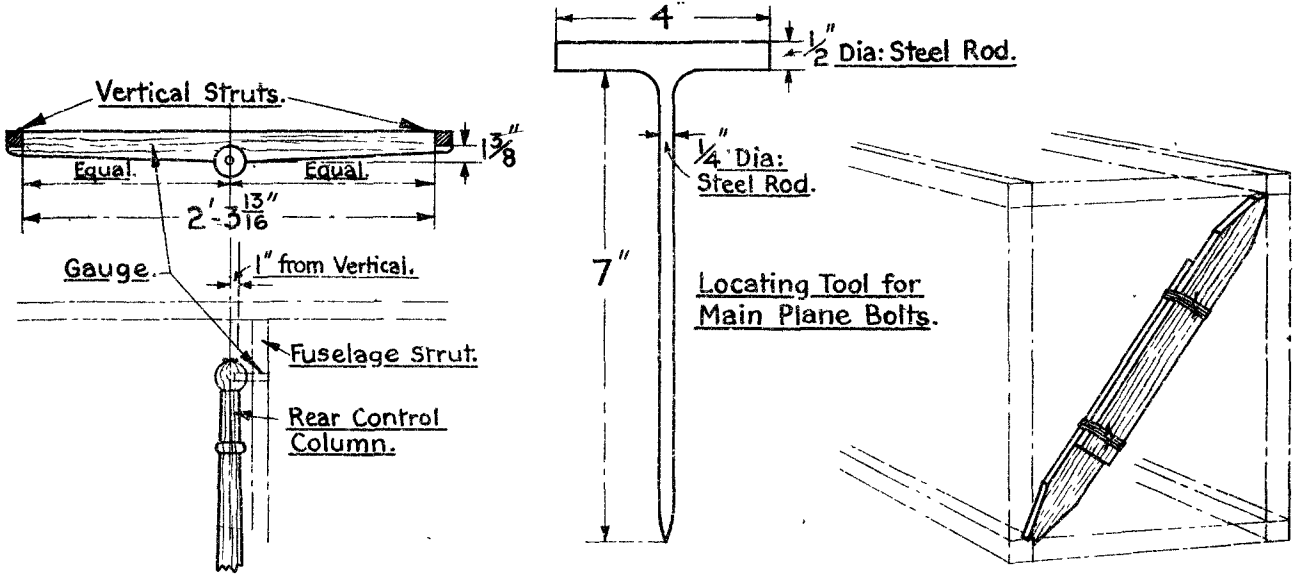

Gauge for Control Column.

Fuselage Internal Trammel.

FIG. 24. TOOLS USED FOR ERECTION.

N P To follow next fig 23 to face page 28

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(ii) Mounted on the rear instrument board are the following :—

Compass	Type 5/17.
Airspeed indicator	Mark IVA.
Watch	Mark V.
Altimeter	Mark V (0–16000).
Revolution indicator ..	Mark V.
Cross level	Mark VA.
Oil pressure gauge	Mark VIIB (0–60 lb.).
Map case.	
Compass card holder.	

Safety belt.

63. A pilot's safety belt is fitted in each cockpit. The cotton rope ends of the belts are each eye-spliced with thimble to a ring and fitting secured to the cockpit stiffeners. The bolt attaching the fitting is placed with its head on the underside of the stiffener, in order to present the full bolt diameter to the direction of shear.

Fire extinguishers.

64. Two chemical fire extinguishers are mounted in the aircraft, one in the rear cockpit on fuselage port side strut No. 3, and one along the T beams of the seating unit in front cockpit bay 1–2.

Covers.

65. Covers of Willesden green canvas are provided for the engine, airscrew, and cockpits.

CHAPTER V.

RIGGING AND MAINTENANCE.

Tools.

66. An incidence board, a dihedral board and an oleo leg compressor, as illustrated in fig. 23, are supplied by the manufacturer. Other special tools that are useful for rigging purposes and can readily be made up by units from local resources are mentioned below :—

(i) Gauge for setting control column.
(ii) Aligning tool for main plane bolt holes.
(iii) Fixed trammel for main planes.
(iv) Adjustable gauge for fuselage internal cross bracing wires.

The dimensions and shapes of these special tools are shown in fig. 24.

RIGGING.

Truing up the fuselage.

67. Before commencing to true up the fuselage, the fabric side covering should be removed, and if the tail skid, tail plane and rudder are already mounted these should be dismantled. Slacken all centre section and undercarriage bracing wires should these components be in position.

68. The fuselage will be placed across two trestles and so adjusted that it is longitudinally and transversely level. For convenience in levelling and truing up, the fuselage side struts from front to rear, including the sternpost, are numbered 1 to 11. (*See* Fig. 25.)

69. One trestle will be located beneath side strut No. 1, but slightly to the rear in order to clear the undercarriage front strut attachment when this member is assembled, and one trestle will be placed beneath the bay formed between side strut No. 10 and the sternpost, No. 11. That portion of the top longerons of the fuselage between side struts No. 1 and No. 3 is horizontal and parallel to the thrust line. From No. 3 strut the longerons converge in side elevation towards the vertical sternpost, and are symmetrically spaced about the axis of the fuselage, this axis or centre line of the fuselage being 3 in. lower than the thrust line of the engine. The tail of the fuselage should be packed up by means of the rear trestle until the upper longerons forward of strut No. 3 both lie in the same horizontal plane, the fuselage being then ready for the rigging position check. (*See* para. 74.)

70. To check that the fuselage is horizontally symmetrical when the rigging position has been verified, first mark the mid-points of all the side struts from No. 3 to No. 11 (sternpost). To obtain these points, measurements are made between the inner faces of the longerons ; marking should be done in indelible pencil and on the outer face of the struts. Stretch a thin cord between the outer faces of the side struts of frame No. 3 and the sternpost, so as to pass across the mid-points previously marked on these struts. When stretched tightly the cord should cross each of the intermediate side struts at its mid-point and the side bracing wires at their point of intersection. The side bracing wires should be adjusted until the marked points on the side struts and the stretched lines are in the same horizontal plane. The sternpost may be checked vertically by a plumbline dropped through the bore of the tube and tested around its periphery. Adjustment is effected by tightening or slackening the side bracing wires of the adjacent bay.

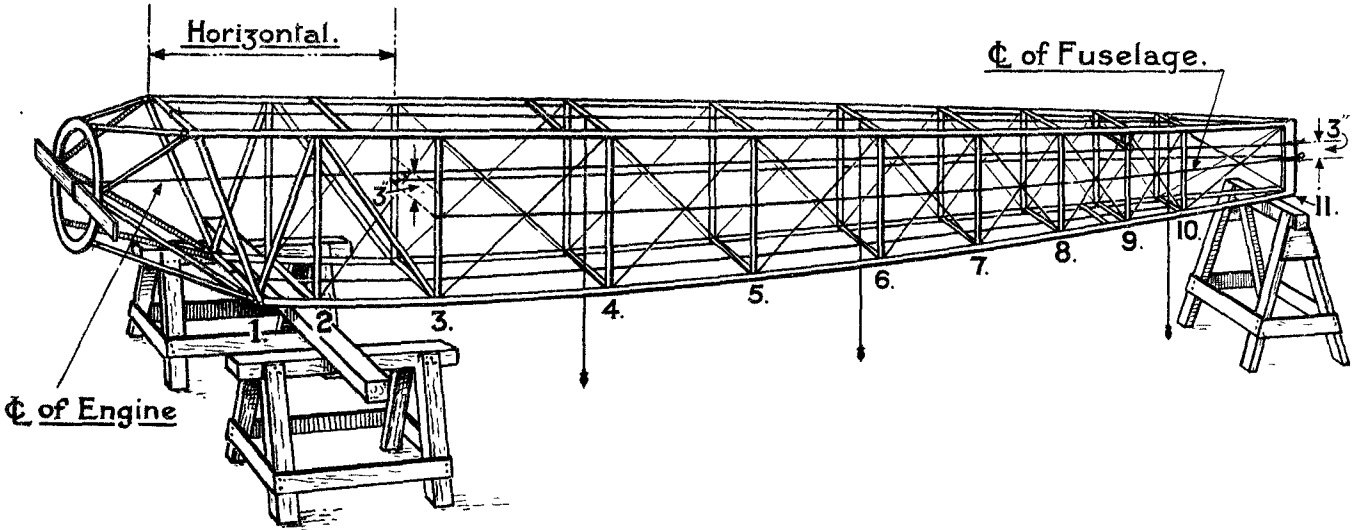

FIG. 25. TRUING UP THE FUSELAGE.

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71. To check that the fuselage is symmetrical in plan view, mark the centre points of all upper and lower cross struts as previously shown for the side struts, but the markings in this instance should be made on the lower faces of the upper and lower cross struts. Stretch a thin cord between the lower cross struts of frames 1 to 10, so that the ends of the cord lie across the centre marks on those struts. The cord should then pass beneath the centre points of all intermediate cross struts. To bring all struts into line, adjust the cross bracing wires of the lower panels. Stretch another thin cord between frames 1 and 10 so that it passes beneath the mid-points of the upper cross struts of these frames. The cord should then pass beneath the mid-points of all intermediate struts and the points of intersection of the upper cross bracing wires. These latter must be adjusted accordingly.

72. To ensure that at any point the cross section of the fuselage is rectangular, a plumbline is dropped from the mid-point of each upper cross strut. The plumbline should touch the mid-point of the corresponding lower cross strut and also the point of intersection of the cross bracing wires of the frame concerned. An alternative check may be applied by using the adjustable fuselage gauge shown in fig 24. Adjustment may be made by tightening or slackening the cross bracing wires of the frames.

73. A further stretched line, tied at its front end to a straightedge clamped across the engine plate so that the line lies centrally with the centre line of the engine, is passed horizontally through the fuselage, and must terminate 3 in. above the middle point of the sternpost when the engine centre line and fuselage centre line are parallel and in the correct relation. The plumblines previously dropped from the mid-point of each cross strut will just touch the central stretched line. The use of the central line in the fuselage will necessitate the removal of the seats in each cockpit, a hole, however, is provided in each of the instrument boards to allow the line to pass through.

Rigging position.

74. The aircraft is in rigging position when the top longerons of the fuselage between side struts No. 1 and No. 3 are longitudinally and transversely horizontal, and this is checked by placing spirit levels on the upper cross struts for the transverse level and on the upper longerons for the longitudinal level. Additional checking can be obtained by a straightedge, cut from a three-foot length of 9 × $\frac{3}{4}$ in. ash, having its longer edges parallel and a recess cut from the

lower edge of sufficient depth to clear the padding around the cockpits. This straightedge may be straddled over the decking and cockpits so that it rests on the longerons; a spirit level placed on its upper edge will thus give the transverse check for level. An additional check for the longitudinal level may be taken by the use of the incidence board shown in fig. 23 as used for checking the centre section and main plane incidence described in para. 88. The vertical registering members of the board which have a difference in height corresponding to 4° angle of incidence, are held under and against the front and rear bottom spar fittings on the fuselage, and a spirit level placed on the straightedge member of the gauge board will determine the correct level longitudinally.

Truing up the undercarriage.

75. The undercarriage is assembled on the fuselage when the latter is in rigging position and supported on trestles, the front trestle being sufficiently high to permit the undercarriage to be mounted in position without its wheels coming in contact with the ground. The centre of the axle must be under the centre of the fuselage. The fore-and-aft position is fixed by the struts. Transverse adjustment is given by cross bracing wires which should be of equal length and may be checked by trammelling. A further check may be obtained when the main planes are erected by taking measurements from the axle extremity to a point on the leading edge of the lower plane, preferably to the special gauge plate fitting with marked point provided for the manufacturer's trammel check for the dihedral of the main planes. The measurements thus taken should be equal on either side, when the undercarriage will be in its correct position. Figs. 6 and 5 show the undercarriage and oleo leg.

Tail Unit.

76. The tail plane is in two parts, *i.e.*, divided to admit the fuselage. The leading edge of the plane (there is no front spar) is of tubular steel. The inner end of each part projects beyond the side of the framework and is inserted in a sleeve fitted into frame No. 9 of the fuselage, where it is secured by a bolt taken through the projection and the housing sleeve. The spar at the rear of the tail plane is connected to a trunnion fitting attached to the top of the worm spindle of the tail incidence gear. It should be noted that the adjustment provided on the tail plane struts is for other types of aeroplanes and the setting of these struts should not be disturbed. If the setting be accidentally altered the

struts must be reset to pin centre lengths of 3 ft. $1\frac{5}{16}$ in. for the front and 3 ft. $9\frac{3}{4}$ in. for the rear struts. The range of incidence of the tail plane is shown in fig. 26.

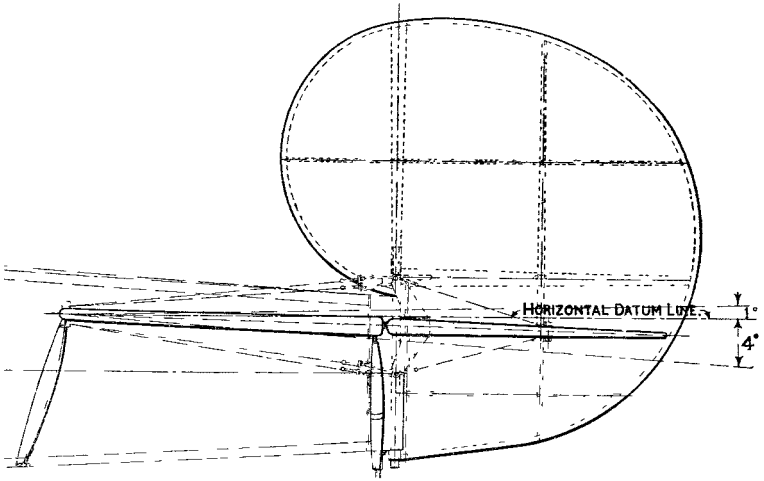


FIG. 26.—TAIL PLANE RANGE OF INCIDENCE.

77. The tail plane leading edge and rear spar must be horizontal and square with the fuselage. Check for the horizontal by placing a level across the rear spar of each plane. With the pin centre lengths given above the tail plane setting should fall correct. In plan view the tail plane should be square with the centre line of the fuselage. A convenient check on this is to measure the distance from the centre of the eyebolt in the leading edge of the plane to the centre of a bolt hole in the root fitting for the rear spar of the bottom main plane ; this measurement should be equal on both sides of the fuselage.

78. The incidence of the tail plane can be varied during flight by means of hand wheels in the cockpits. Dismantling of the tail plane does not disturb this control, which may be operated after the tail plane has been removed without affecting the subsequent assembly of the plane.

79. The rudder is of the balanced type (there is no fin) and should be parallel to the line of flight when the rudder bars are square with the axis of the fuselage. To ensure this, clamp the rear rudder bar in the desired position whilst the rudder control cables are being connected up. The turnbuckles are then manipulated so that the rudder is parallel to the line of flight when sighted from the rear cockpit. The tail skid control cables are then coupled up to the springs on the rear rudder bar.

80. With the rear control column set 1 in. forward of the vertical position measured at the centre of the top ball grip, the elevators should be in line with the tail plane. This adjustment is made with the tail plane in neutral position, and is facilitated by the use of a wooden gauge cut 4 in. wide and 2 ft. 6 in. long and bored with a hole to retain the upper end of the column in the desired position when one edge of the wood is suitably shaped to fit against the side struts adjacent to the control column position. The elevator control cables may then be connected up to bring the elevators into the desired position. The gauge is shown in fig. 24.

Erecting and truing up the centre section.

81. The centre section struts are first fitted to their sockets on the centre section plane (which has a large portion cut away to allow upward and forward vision) and the centre section then mounted with the fuselage in correct rigging position and supported on the trestles so that the under-carriage wheels are clear of the ground.

82. Place the centre section struts into their sockets in the centre section and ensure that they fit accurately. The struts should be lightly tapped home, and if too large should be carefully reduced with glass paper or a fine file. Having fitted the struts to the centre section, the assembly thus formed is mounted in place on the fuselage, the lower ends of the struts being inserted into their sockets and forced home by hand pressure alone; if the struts refuse to bed down correctly they must be reduced with glass paper, but all ends so treated with glass paper or filed must be given a coat of red lead. The ends of spare interplane struts have a surplus length partially sawn through for the purpose of protecting the end of the strut when stored or in transit. This protecting end must therefore be removed.

83. When correctly adjusted, both main spars should be horizontal; this may be checked by spirit level or by measurements taken between the underside of the spars and the longerons immediately in front of each strut. The measurements taken forward of the pair of front struts should be equal; this also applies to those taken forward of the rear struts.

84. Any difference that may occur between these measurements will be caused either by the struts not bedding home into their sockets or by their being incorrect in length; these defects must be remedied.

85. A fine adjustment may be made to ensure that the front spar is horizontal by manipulating the cross bracing wires between the two front struts until diagonal measurements made by trammel between the gauge marks on the upper and lower socket base plates are equal. Similar measurements may be made between the rear spars after the main planes have been fitted, when they may be adjusted horizontally by the landing wires of the inner bays.

86. The front struts should be vertical both in front and side views. The angle of incidence is 4° ; the stagger 2 ft.

87. The stagger should first be adjusted. Drop plumblines from the gauge points on the base plates of the front strut upper sockets and then adjust the incidence wires until these gauge points are shown to be vertically above the gauge points on the base plates of the lower front strut sockets. With these points in line the distance between the plumblines and the centres of the lower plane front sockets should be 2 ft. If necessary, the correct stagger must be obtained by slightly inclining the centre section struts by further adjustment of the incidence wires.

88. The angle of incidence should be checked and adjusted by the incidence board which is shown in fig 23.

89. The shorter member of the instrument is placed beneath the mid-point of the rear spar, and the tip of the other member brought under the mid-point of the front spar ; the level on the straightedge should then indicate that the latter is horizontal. Should this not be indicated, adjustment will have to be made either by shortening the centre section struts or by placing thin pieces of packing in their sockets. Before adopting these measures, however, it should be ascertained that all the struts are bedded home correctly in their sockets.

90. Attach the tension straps fitted from the upper sockets of the rear centre section struts and connected to the upper joints of frame 2 using, as required, the two plain and one tapered washers at the top ends of the straps.

Assembling and truing up the main planes.

91. The planes are first assembled with their leading edges resting on felt on a level floor, and the struts worked home into their sockets by hand pressure alone. The landing and flying wires are connected up and are tightened sufficiently to hold the planes together. The gap should be measured, both between the centres of the leading edges and trailing edges, and should be 5 ft. 6 in. in each instance.

92. The planes are then lifted bodily and attached to the fuselage. In fitting the planes in place the spars are engaged in their sockets, no attempt at this stage being made to register the bolt holes. The end of the lower plane is then supported on a trestle and suitably packed up to avoid disturbing the fuselage. Next, the bolt holes through the sockets are made to register. A T-headed spike shown in fig. 24 is utilised to effect this, and obviates the necessity of making the final registration with the securing bolts. The upper planes are first attached and the forward joint secured previously to making the rear joint. On no account may the split pins securing the bolts through the main plane joints be omitted; these pins must be opened carefully to prevent shanks breaking off short or in any other way jeopardizing their efficiency.

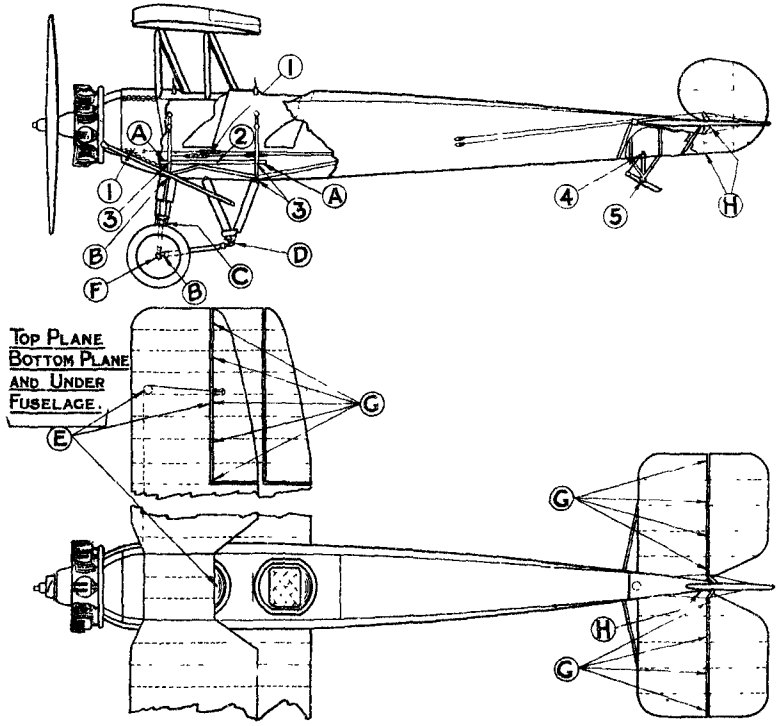
93. Having fitted the planes to one side of the fuselage, the remaining pair are fitted to the other side in a similar manner. All bracing wires are connected up and both sets of planes brought approximately to the correct dihedral and incidence, after which the trestles supporting the lower planes are removed.

94. The angle of incidence is adjusted to that of the centre section by means of the incidence wires. Checking is carried out with the incidence board as for the centre section. *see* paras. 88 and 89.

95. The stagger is then checked. The leading edge of the upper planes should project 2 ft. beyond the leading edge of the lower planes. This measurement may be checked at various intervals by a plumbline dropped from the upper planes. The stagger must be made correct, even though the incidence is thereby slightly altered.

96. To check that the leading edges of the planes are at right angles to the centre line of the fuselage, measurements are taken on both upper and lower planes from the centre of the front bolt of the outer interplane strut socket plate to the centre of the sternpost, and from the front bolt of the interplane strut socket to the centre of the airscrew boss. Corresponding measurements on each side of the fuselage should be equal. A further measurement may be taken on each side from the interplane strut socket to a point on the extremity of the tail plane leading edge, this check ensuring that the tail plane and main planes are square with each other and with the fuselage when measurements on each side are equal.

97. Adjust the dihedral of both upper and lower planes to $2\frac{1}{2}°$. This may be checked by using the dihedral board



Numbered Parts
Should Be Oiled After
Every 2 to 3 Flying Hours.

(1) Front and Rear Rudder Bar.
(2) Control Shaft Steady Bearing.
(3) Control Column Pins.
(4) Tail Skid Lever Pins.
(5) Tail Skid Bearing.

Lettered Parts
Should Be Greased
After Every 10 Flying Hours.

(A) Control Shaft Bearings.
(B) Chassis Leg Joints.
(C) Oleo Leg Guide Tubes.
(D) Radius Rod Eyebolts.
(E) Aileron Control Pulleys.
(F) Wheel Bearings.
(G) Aileron and Elevator Hinges.
(H) Rudder and Adjustable Sternpost Bearings.

FIG. 27 LUBRICATION POINTS.

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along the front spars, and adjustments made by means of the landing wires, the inner landing wires being adjusted first. An alternative check may be applied by using the trammel shown in fig. 24, between the marked points on the leading edges which are affixed when the aeroplane is built.

98. After the main planes have been trued up, the aileron controls are connected and adjusted so that, when the control columns are central, the trailing edges of the ailerons droop $\frac{1}{4}$ in. below those of the main planes. The control columns may be held in position for this purpose by using the gauge illustrated in fig. 24.

MAINTENANCE.

Lubrication.

99. The moving parts of the aileron controls and other fittings should be lubricated to ensure smooth working. The points at which the lubricant should be applied are shown in fig. 27, and the type of lubricant used is distinguished by using a figure series for the oiling points and a letter series for the greasing points. The majority of the lubrication points are parts of the flying controls, and it is especially necessary that these should receive proper attention. The control cables should be frequently inspected for signs of fraying, which may occur near pulleys and fairleads.

Oleo legs.

100. The oleo legs may be filled either when the undercarriage is hanging from the fuselage or before the legs are assembled as part of the undercarriage, the latter method being preferable. The oleo legs are filled, when fully extended, by pouring oil through the filling aperture until the oil overflows. The oil used should be a mixture of oil, castor, pure, 70 per cent. and oil, paraffin, 30 per cent., as laid down in Air Ministry Technical Order 111/1927.

101. The oleo leg requires periodical attention with regard to the oil level, which should never be allowed to fall below the valve in the piston ; the compression rubbers should also be inspected. When the leg is properly adjusted, and is taking the weight of the aeroplane, there should be no gap at the points A shown in the illustration of the bottom end of the guide tubes, fig. 28. After continuous use, gaps will appear

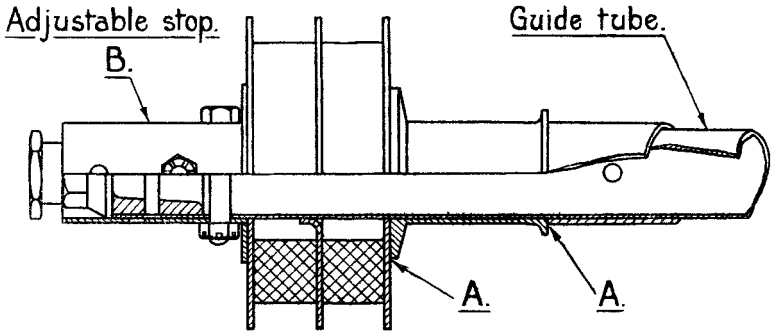

FIG. 28.—OLEO LEG CLEARANCES.

at these points as the compression rubbers take a permanent set, and when this gap on each guide tube is $\frac{3}{8}$ in., it should be closed by moving the adjustable stop B along the guide tube and fitting the two bolts through the extra holes provided in the stop. When this adjustment has been taken up and the gap again reaches $\frac{3}{8}$ in., one separator plate and one compression rubber must be added to each part of the buffer, and the adjustable stop B is then moved back to its original position. The bolts that hold the stop must always be carefully fitted, as they carry practically the whole weight of the axle and wheels while the aeroplane is flying.

102. When it is required to dismantle the oleo leg the following sequence of operations should be followed :—

(i) Jack up fuselage until the oleo leg is hanging freely.

(ii) Disconnect the leg from the fuselage and swing it clear to give access to the top end.

(iii) Extend the leg sufficiently to allow the compressor to be fitted with the middle crosshead of the compressor over the top end of the guide tube of one rubber buffer.

(iv) Screw up the compressor until the load has been removed from the rebound buffer at the bottom end of the guide.

(v) Remove the two bolts under the rebound buffer and drop the buffer off the guide tube.

(vi) Unwind the compressor to allow full extension of the main buffer ; with a few more turns the compressor may be removed.

(vii) Remove the bolt at the top end of the guide tube ; this allows the guide tube and rubber buffer to be withdrawn from the top and bottom brackets on the main tubes.

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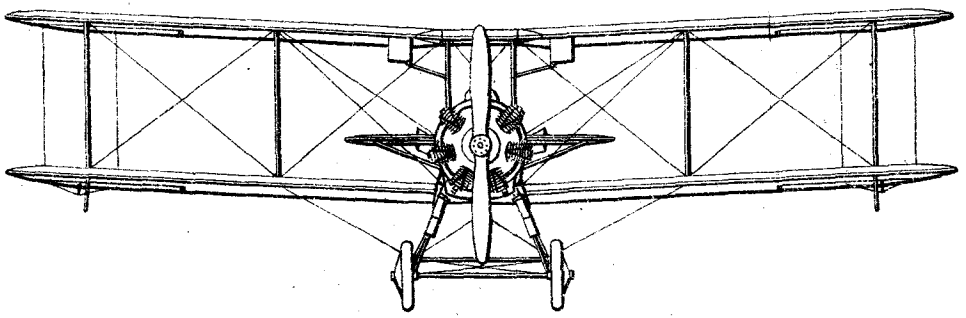

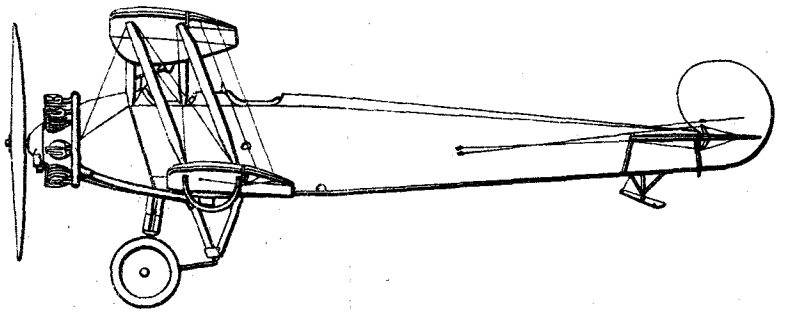

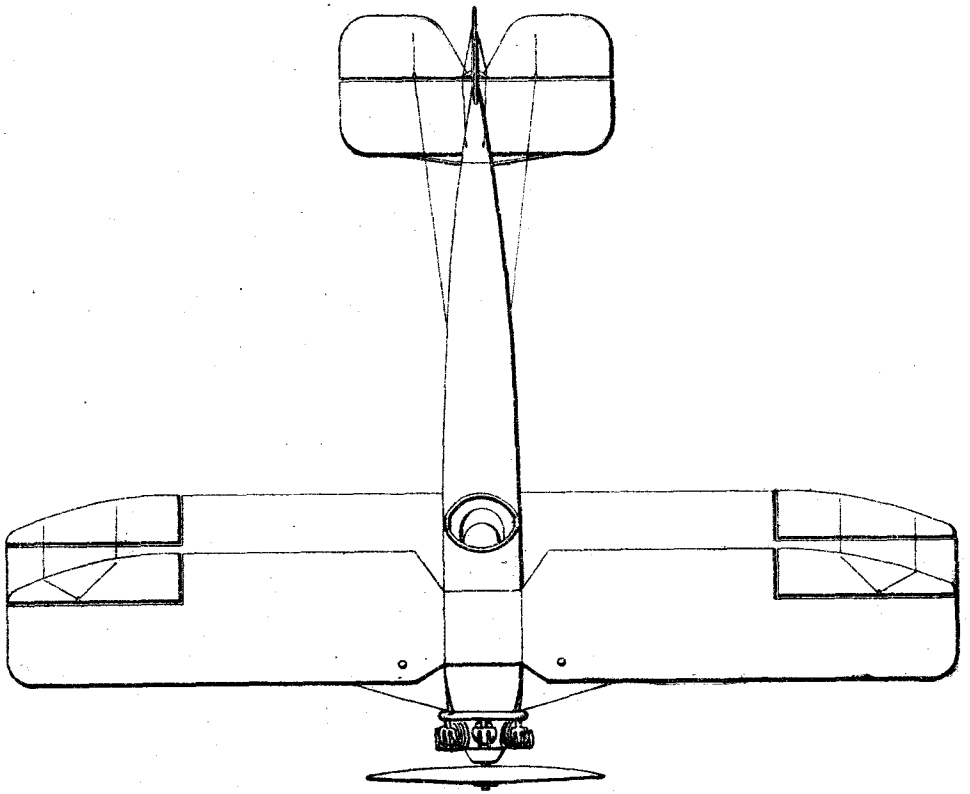

AVRO 504 N.
180 H.P. LYNX.

FIG 29.

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