Section 1

PILOTS' CONTROLS AND EQUIPMENT

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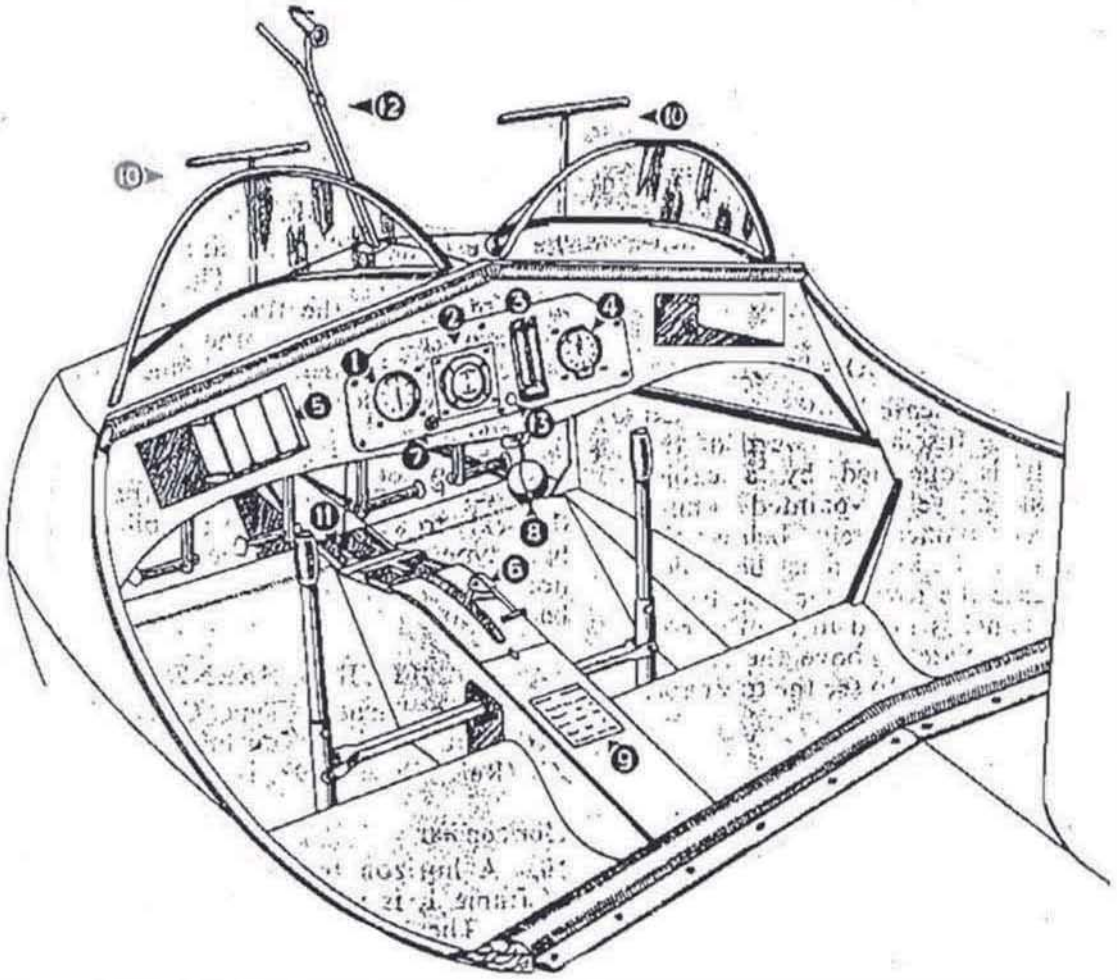
ILLUSTRATION



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13 WATER TRAP

Fig. 1. Flying controls and instruments

Introduction

1. This section is intended to serve as a general guide to the location of all cockpit controls and instruments, together with the method of operating the controls where this is not obvious. The layout of the cockpit is illustrated in fig. 1.

FLYING CONTROLS

2. The glider has side-by-side seating for instructor and pupil. The main flying controls, which are conventional in operation, are duplicated; subsidiary controls, for the lift spoiler and tow release, are centralised within easy reach of both the instructor and pupil.

LIFT SPOILER CONTROL

3. The lift spoiler control is centrally placed in the floor of the cockpit; it is moved aft to open the spoilers. The control is spring-loaded and must be held in the fired open position; it may be retained in the fully open position when the glider is parked by using the safety harness as retaining straps. The spoilers are automatically locked in the closed position to prevent them "floating" in flight.

TOW RELEASE CONTROL

4. The Ottfur tow release hook is mounted in the nose of the fuselage forward of the front skid. It is operated by a cable, terminating in a yellow-painted knob, centrally placed immediately below the instrument panel; the knob must be pulled sharply to release the tow cable. A transparent plastic panel is fitted in the floor of the cockpit, immediately above the release hook, enabling the pilots to see the tow cable attachment in flight.

WARNING

It is essential that the tow cable is fitted with a cable release ring (Ref. No. 26EY/41) both for winch launching and aero-tow. The use of any other type of ring may cause jamming and failure of the release.

INSTRUMENTS

5. The instrument panel carries the instruments shown in fig. 1. The turn-and-slip indicator is operated electrically, the power being supplied by dry batteries stowed in a pocket on the port side of the instrument panel; it is controlled by a switch, positioned alongside the instrument, which is moved down for OFF and up for ON. The instrument is intended for instruction and intermittent use in blind flying, and under these conditions the power supply is adequate for several months' use.

6. The turn-and-slip indicator is less sensitive and gives higher rates of turn than the normal instrument fitted to powered aircraft; the calibration is as follows:—

Rate 1 (pointer movement ⅛ in. from zero) = 450 deg. per minute.

Rate 2 (pointer movement ¼ in. from zero) = 1,170 deg. per minute.

Rate when the limit stop is reached = 2,250 deg. per minute.

SEATS

7. The removable seats are of spruce and plywood construction. The seat bearers are slotted into the fuselage frame behind the seats and rest on the fuselage frame immediately in front, to which they are secured by a leather strap; they are not adjustable.

8. Metal pans are fitted at the back of the seats to accommodate the pilots' Mk. 5 back-type parachutes; when parachutes are not worn the pans are closed by plywood back-rests.

FLYING HARNESS

9. Sutton harness, Type QL, is fitted at both seat positions; on later aircraft Type ZB (Ref. No. 6F/198) is fitted.

Horizon bar

10. A horizon bar, fitted on the aft face of frame 1, is provided for each seat position. The bars are manually adjusted for height while the aircraft is in rigging position and the pilot sitting in the attitude he normally adopts when flying. The pilot will indicate when the bar is set in the position he requires it to be locked.

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Section 4

LOADING AND C.G. DATA

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Introduction

1. The purpose of this chapter is to describe the method of calculating the position of the centre of gravity of the glider, when loaded for flight.

Definition of centre of gravity position

2. The position of the centre of gravity is defined by its distance, measured parallel to the fuselage datum line, from a reference point referred to as the C.G. datum point (*para.* 4), the position of which is arbitrarily selected by the manufacturers. The distance is referred to as the arm of the C.G.; it can be calculated from the following expression:

$$\text{Arm of C.G.} = \frac{\text{Total moment}}{\text{Total weight}}$$

$$= \frac{\text{Tare moment} + \text{Sum of load moments}}{\text{Tare weight} + \text{Sum of load weights}}$$

3. The moment of any item of load is the product of its weight in pounds, and its moment arm, which is the distance in inches from the C.G. datum point, measured parallel to the fuselage datum line. The moment arms and moments of all items placed forward of the C.G. datum point are negative, and of those placed aft of the C.G. datum point are positive.

C.G. datum point

4. The C.G. datum point is at the leading edge of the wing root with the fuselage datum line horizontal.

C.G. limits

5. The approved limits of travel of the centre of gravity are 23·5 in. to 30·5 in. aft of the C.G. datum point. These limits must never be exceeded.

Tare weight and C.G.

6. The tare weight of the glider is 598 lb., its C.G. is 40·90 in. aft of the C.G. datum and its moment is 24,458 lb. in. positive.

Weight limitations

7. The following weight limitations apply:—

Maximum permissible all-up weight	1,050 lb.
Without nose ballast weight:	
Maximum permissible load	450 lb.
Minimum permissible load	230 lb.
With nose ballast weight (Ref. No. 26EE/164)	
Maximum permissible load	340 lb.
Minimum permissible load	114 lb.

Calculations of C.G. position

8. The C.G. position of the glider and crew in take-off condition may be calculated from the expression given in para. 2 as follows:—

	Weight (lb.)	Arm (in.)	Moment (lb. in.)
Tare weight and moment	598	40.90	24,458
Pilot	180	1.25	225
Pupil	180	1.25	225
Parachutes (2)	40	12.00	480
All-up weight and moment	998		25,388

$$\text{C.G. position} = \frac{\text{Moment}}{\text{Weight}} = \frac{25,388}{998}$$

=25.44 in. aft of C.G. datum.

9. If the glider is flown solo, by a pilot whose weight, complete with parachute, is less than the minimum permissible load of 230 lb., the position of the C.G. will be beyond the aft limit of the C.G. travel (*para.* 5) as shown in the following example.

	Weight (lb.)	Arm (in.)	Moment (lb. in.)
Tare weight and moment	598	40.90	24,458
Pilot	180	1.25	225
Parachute	20	12.00	240
All-up weight and moment	798		24,923

$$\text{C.G. position} = \frac{\text{Moment}}{\text{Weight}} = \frac{24,923}{798}$$

= 31.23 in. aft of C.G. datum.

The provision of the C.G. is beyond the approved limit of 30.5 in. aft of datum. It can be corrected by fitting the 40 lb. ballast weight in the stowage on the nose of the aircraft; this moves the position of the C.G. forward to a position within the C.G. limits, as shown in the following calculations:—

	Weight (lb.)	Arm (in.)	Moment (lb. in.)
All-up weight and moment (without ballast)	798	31.23	24,923
Ballast in nose	40	47.00	1,880
All-up weight and moment (with ballast)	838		23,043

$$\text{C.G. position} = \frac{\text{Moment}}{\text{Weight}} = \frac{23,043}{838}$$

=27.497 in. aft of C.G. datum.

The position of the C.G. is now within the approved limits.

Modifications

10. The following modifications affect the tare weight and moment; they are allowed for in the tare weight and C.G. position given in para. 6. The embodiment of any modifications subsequently approved, may affect the tare weight and C.G. position, and their weight and moment must be taken into account when calculating the all-up weight and position of the centre of gravity of the glider so modified.

Modification No. 1, 6, 8, 10, 11, 12, 13, 14, 15, 16, 18, 36, 38, 39, 40, 41.

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Section 5

AIRFRAME STRUCTURE

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General *(fig.1)*

1. The fuselage is of wooden construction. Forward of frame 5, the wing rear attachment frame, the construction is of semi-stressed skin and consists of built-up frames interspaced with longerons and stringers. The whole of the forward structure is covered with a plywood skin and the side panels of the cockpit, between frames 2 and 3, are double skinned. Post Mod.38 all external plywood is fabric covered.

1A. A stowage fitted to the nose of the aircraft accommodates a 40 lb. *(cast iron)* ballast weight.

COCKPIT

2. The cockpit provides for side-by-side seating and is contained in the portion of the fuselage from the nose back to frame 3. A box structure runs down the centre of the cockpit and forms a division between the seats; this box contains the aileron, elevator, rudder and lift-spoiler control runs. The rudder pedals and towing release are mounted on frame 1, and the control columns are mounted on frame 2. The cockpit floor stretches between frames 1 and 2; this is recessed to provide wells for the pilots' feet. The pilots' seats are located between frames 2 and 3. Frame 3 forms the back rest for the pilots and accommodates the parachute boxes and detachable seat-backs.

FUSELAGE NECK

3. Projections from frames 4 and 5 form the principal structure in the fuselage neck and these are braced by diagonal members at the sides. The whole neck is plywood covered, the portions of the neck forward of frame 4 and aft of frame 5 serving only as fairings. The wing attachment fittings are located at the top of the fuselage neck.

REAR FUSELAGE

4. The rear fuselage is of braced girder construction and is fabric covered. The main structural components are the side panels, which consist of top and bottom longerons, interspaced by a diagonal bracing system. The two side panels are braced together by two further diagonal bracing systems that form the top and bottom of the rear fuselage. The underside is plywood covered to withstand damage from stones thrown up by the wheel on landing.

FIN

5. The fin is built integral with the fuselage. The stern-post of the fuselage acts as the fin rear spar, and a second fin spar, forward of the stern-post, also acts as a second rear-fuselage frame.

LANDING WHEEL AND SKIDS (*fig.* 2)

6. The alighting gear comprises a single landing wheel and nose and tail skids. The landing wheel is carried in a bearer box fitted centrally in the underside of the fuselage, between frames 4 and 5. The nose skid is anchored at the front to frame 1, and is flexibly attached to frames 2 and 3 by cylindrical rubber buffers, which absorb landing shocks. The underside of the skid is fitted with a metal skid plate to withstand wear. The metal tail skid is attached to the underside of the fuselage between the front and rear finposts.

MAIN PLANE

General (*fig.* 3)

7. The main plane is of wooden mono-spar construction and built in two sections which are joined together, and to the fuselage neck, at the centre line, with shackle pins. The structure is fabric covered.

MAIN SPAR

8. The main spars are straight and are positioned at one third of the chord aft of the leading edge, they are of box construction with spruce booms and plywood webs. The spar is blocked solid at the root and at the strut attachment and aileron control pulley positions. Diaphragm members are fixed inside the spars at approximately every second rib position.

RIBS

9. The twenty-seven main ribs in each wing are spaced one foot apart and are constructed with a centre web of plywood, the spruce members forming the structure of the rib being positioned on either side of this plywood web. Intermediate ribs are positioned between the main ribs in the nose box forward of the spar, these extend from the leading edge to the front face of the main spar.

WING ATTACHMENTS

10. The front attachment fittings are mounted on short, stub spars forward of the main spar. These fittings form a link between the port and starboard wings and do not connect to the fuselage.

11. The wing main attachment fittings are mounted on the main spars. They are made from heavy-gauge duralumin plates which are fitted with removable steel bushes in the attachment holes.

12. The wing rear attachment fittings are mounted on diagonal spars aft of the main spar. The fitting is a welded steel assembly, and is bolted to the spar and through an angle bracket to rib 1. The diagonal spar is curved at the root end, and passes through rib 1 to take the attachment fitting, the outboard end being attached to the main spar at rib 5.

FALSE SPAR

13. A false spar is positioned outboard of rib. 14 to carry the aileron. This spar is built up from spruce members and is plywood covered on its rear face. It carries five fork-ended eye-bolts which act as aileron hinges.

AILERONS

14. The aileron structure consists of a main spar, a torsion spar and straight and diagonal ribs. The main spar is straight and is constructed from spruce members, which are plywood covered, on their forward face. Five eye-bolts are fitted to the spruce members to act as hinges. The torsion spar only extends over the centre portion of the ailerons; it is positioned four inches aft of, and parallel to, the main spar. The gap between these two spars is plywood covered to form a torsion box. The aileron ribs are of similar construction to the wing ribs and line up for position with the main ribs in the wing. The end bays of the aileron, which are not covered by the torsion box, each have a diagonal rib; these ribs react torsion loads and also stiffen the structure against the pull of the fabric covering.

TAIL UNIT

General (Fig. 1)

15. The tail unit consists of a tail plane, elevator and a single fin and rudder.

TAIL PLANE

16. The tail plane is of two-spar construction. The rear spar is straight and at right angles to the fuselage. The front spar is parallel to the leading edge, which tapers from the centre line of the fuselage to the tips.

17. The area between the two spars is taken up with the rib structure, seven straight ribs being positioned on each side of the centre-line, spaced one foot apart, and three diagonal ribs which react the torque loads on the tail plane.

Attachments

18. The tail-plane attachment to the fuselage consists of four eye-bolts, fixed in blocks glued into the corners formed by the spars and the outboard faces of the centre ribs. The nuts for these attachment fittings are on the top surface of the tail plane.

19. The rear spar is braced to the fuselage by a strut on either side. The strut attachment fittings are positioned at approximately half the semi-span of the tail plane and consist of two flanged plates which are bolted together through the spar.

20. The rear spar of the tail plane carries the elevator hinge fittings, which consist of fork-ended eye-bolts through the centre line of the spar.

ELEVATORS

21. The elevator structure consists of a front spar and diagonal ribs which extend back to the trailing edge member.

22. The elevator spar is straight and extends to the full span of the tail plane. It is built up from spruce members and is covered with plywood on its forward face. A built-up torsion box is located at the centre of the spar and this reacts the torque loads in the portion of the elevator that crosses the fuselage.

23. The elevator-operating lever is a welded fitting made from steel plate; it is bolted to the torsion box on the centre line of the spar. Five hinges, in the form of eye-bolts, pick up the female hinges on the tail plane spa to mount the elevator.

FIN

24. The fin is built integral with the fuselage (*para.* 5).

RUDDER

25. The rudder is of single-spar construction and is fitted with an aerodynamic nose-balance in front of the upper portion of the spar. The nose balance is plywood covered and has four internal ribs to maintain its profile.

26. The rudder spar is built up from spruce members and is plywood covered on its forward face.

27. The structure, aft of the spar, consists of seven straight ribs, spaced nine inches apart, and three diagonal ribs, secured to the spars with plywood gussets. The diagonal ribs pass through the main ribs from the spar to the trailing edge, the joints being made with plywood gussets. The trailing edge is of spruce and is laminated at both ends to shape the member; plywood covering on both sides also act as gussets for the ribs. The whole structure is fabric covered.

28. The rudder is hinged to the fin by eye-bolts fixed through the spar, one being positioned just below the nose balance and the other near the bottom of the spar.

29. The rudder-operating lever is located near the bottom of the spar at the junction of the bottom rib and two of the diagonal ribs. The lever is made from birch pl wood and has brass bushes let into its ends to take the connection pins.

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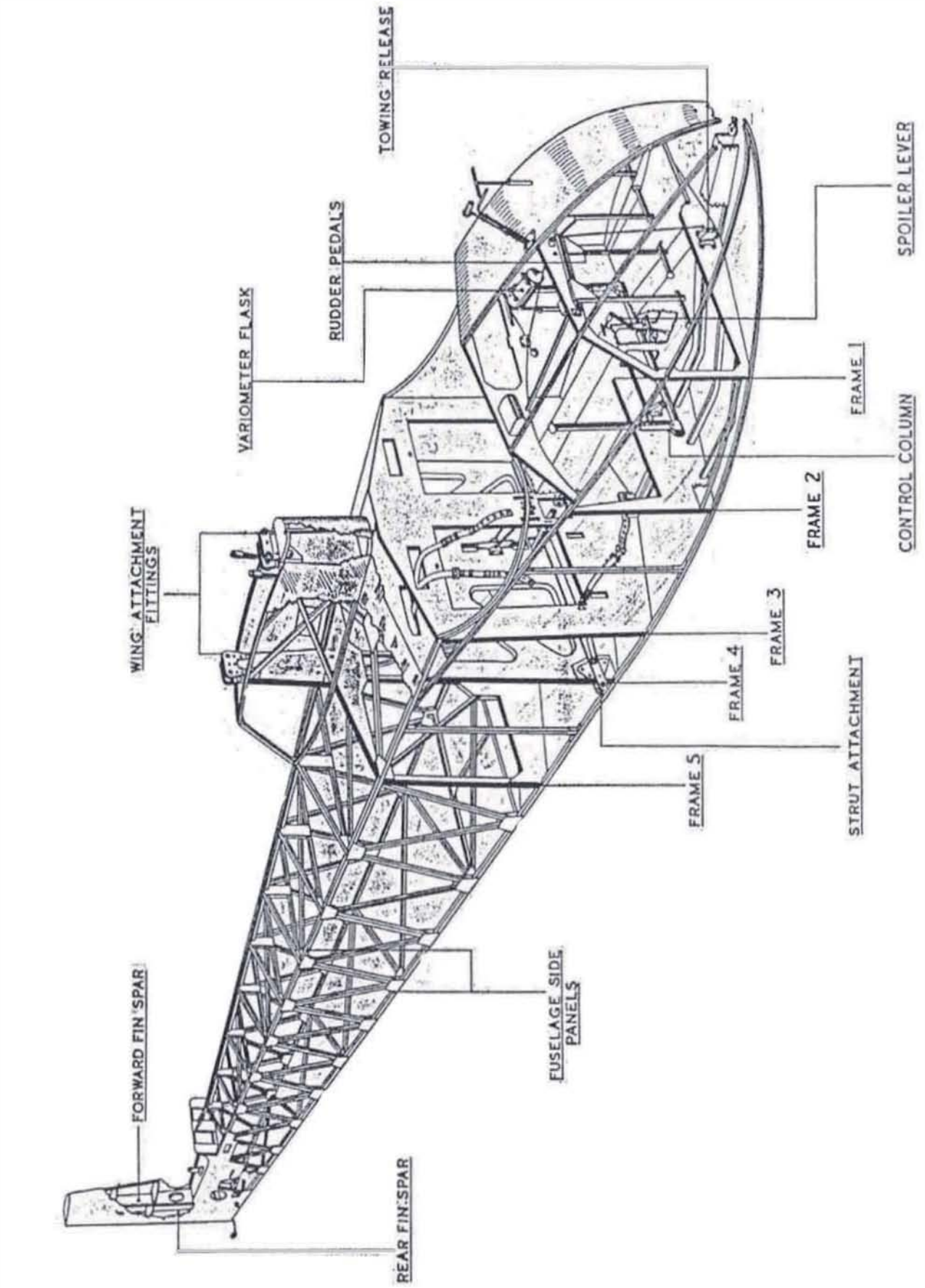

FIG. 1. FUSELAGE

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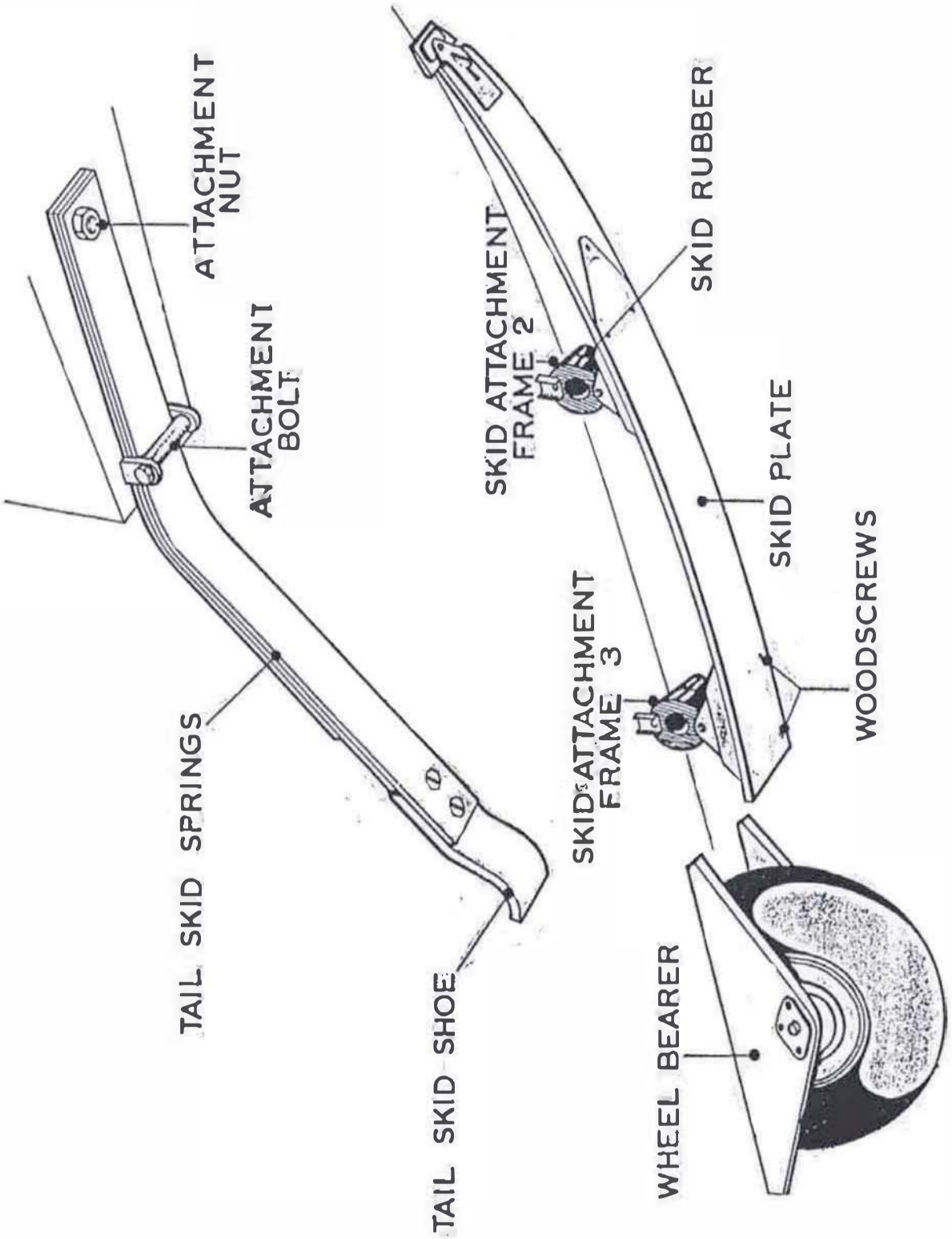

FIG.2. LANDING WHEEL & SKID.

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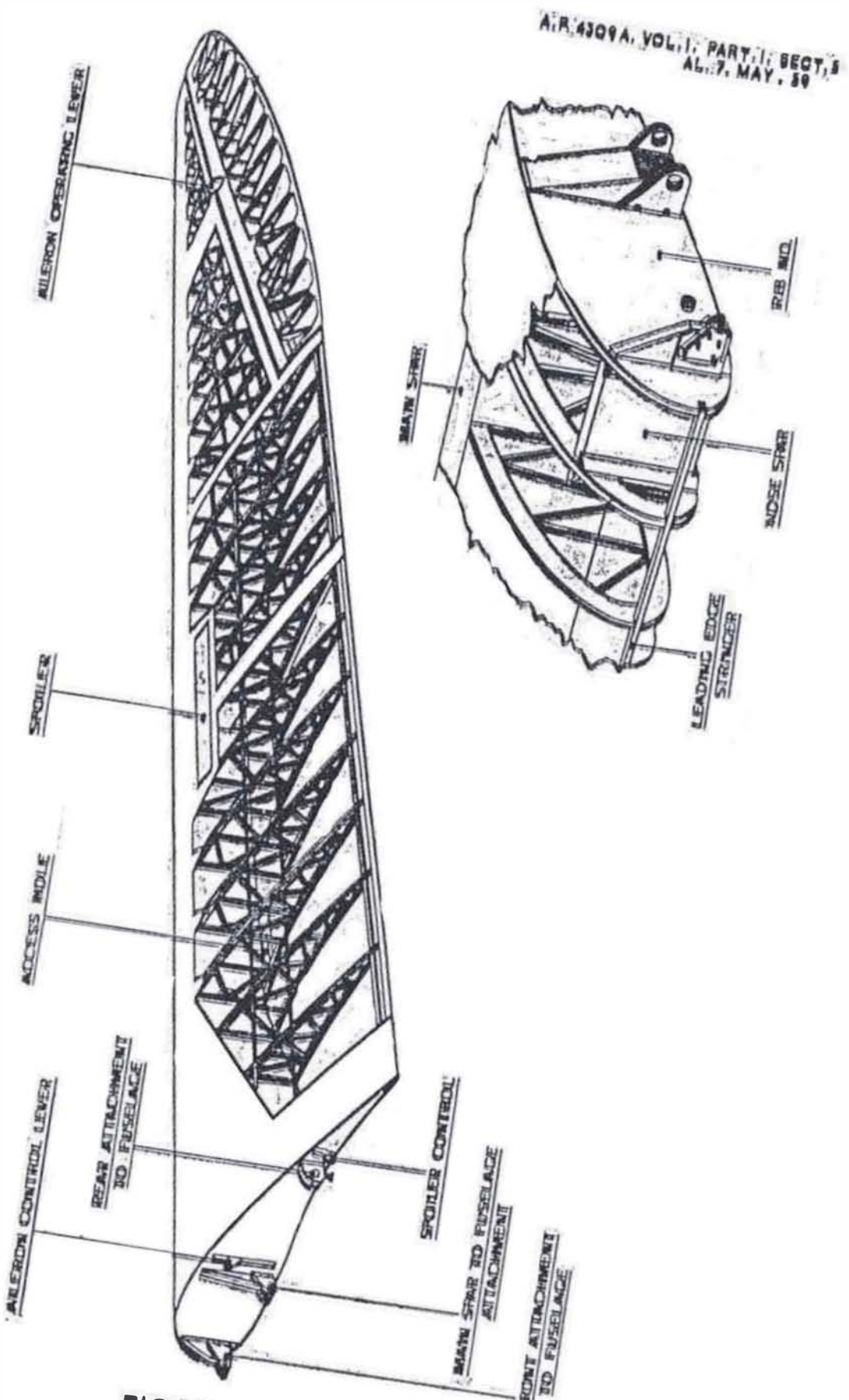

FIG.3. MAIN PLANE

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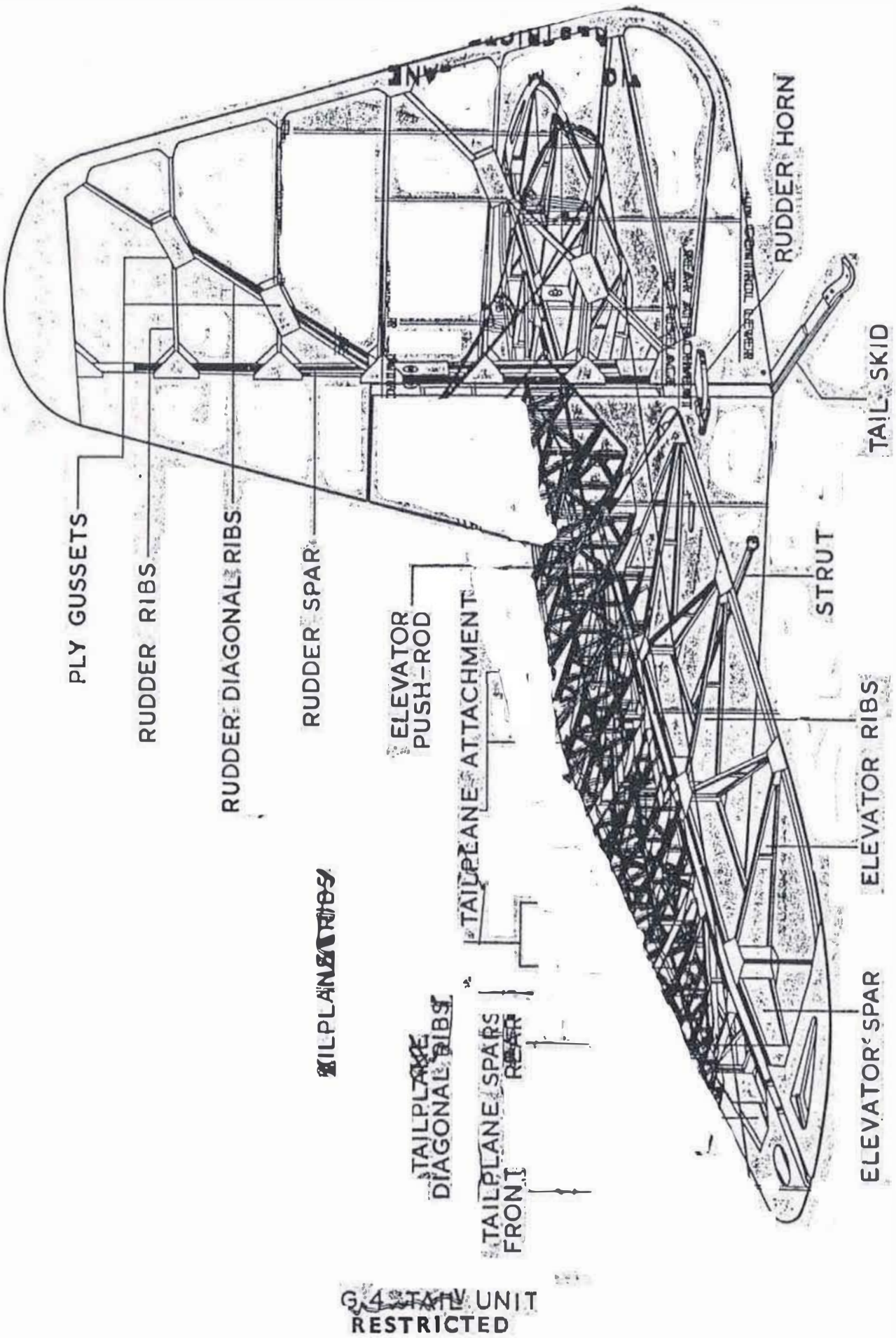

G.4 TAIL UNIT

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Section 6

FLYING CONTROLS

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General

1. The flying controls comprise lever, torque tube, push-pull tube and cable systems. The layout of the controls is very simple and each run forms a closed circuit within the component. Adjustment is effected by turnbuckles in the cables and adjustable ends on certain of the push-pull tubes. An illustration of the flying controls layout is given in Part 2, Sect. 3, Chap. 1.

AILERON CONTROL

2. The aileron control is operated by the control columns in the cockpit. The two control columns are pivoted to a transverse torque tube and are linked transversely by a push-pull tube. The movement is transferred from this tube to the aileron torque tube by a fully universal lever, attached to its centre. The aileron orque tube passes aft down the centre of the cockpit, being pivoted to the structure at frames 2 and 4. Push-pull tubes transmit the control from a double lever at the end of the torque tube, behind frame 4, to the aileron control levers in the wing roots; the levers at the end of the torque tube are set up to give a differential movement to the ailerons. From the levers in the wing roots the control is taken by cables to the operating levers on the ailerons. The cables pass through fairleads at ribs 9 and 9B and round pulleys between ribs 19 and 20. The torque tube in the cockpit is covered by a plywood control box.

ELEVATOR CONTROL

3. The transverse torque tube, to which the control columns are pivoted, is itself pivoted to the front of frame 2 in the cockpit and fore-and-aft movement of the control columns operates this torque tube. A lever in the centre of this tube is connected to a push-pull tube which, at its aft end, is connected to a lever on frame 4. The control is taken from this lever by cables to a further lever which is mounted on top of the decking under the tail plane. This lever is connected to the operating lever on the elevator by an adjustable tube.

RUDDER CONTROL

4. The rudder pedals in the cockpit are suspended from the upper portion of frame 1, they are of the pendulum type and the control is duplicated between the corresponding pedals by torque tubes. The control is taken from the inner pedals direct to the rudder operating levers by cables. These cables pass through fairleads at frames 3, 4 and 5; they pass through the fuselage skin to connect to the operating levers between the stern post and fin post. The control cable from the inner rudder pedal on the port side connects to the starboard operating lever, and that from the inner pedal on the starboard side to the port operating lever. The cables diverge, between the fairleads on frame 5 and those on the fuselage side, where they pass through to connect to the rudder operating arms. A rubber compensating cord is attached to the forward face of both inner rudder pedals, which passes forward round a pulley in the nose of the fuselage.

SPOILER CONTROL

5. The spoiler control lever is mounted in the control box on the floor of the cockpit. From this lever a cable passes aft round a pulley on frame 2, through fairleads on frames 3 and 4 and round a pulley on frame 5, which changes the direction of the cable to vertical. At a point about six inches above the pulley on frame 5 the cable is attached to link plates which allow two

separate cables to be taken off, one to each wing. The cables enter the wings through rib 1, where they pass round a pulley; from here they pass through the ribs to another pulley between ribs 9 and 9B. After passing round these pulleys they connect to the spoiler operating levers. These levers are in the form of triangular plates, mounted vertically, the bottom corners forming the pivots; the spoiler cables attach to the rearmost corners and from the forward corners push rods take the control to the spoiler operating horns. The system is so arranged that the three points formed by the joints between the spoiler horn and push rod, the operating lever and push rod and the pivot of the operating lever pass through dead centre when the spoiler is in the closed position, thus locking it into the wing.

6. A tension load on the spoiler cables opens the spoilers and the system is returned to the closed position by an elastic cord, attached to the wing structure and connected to a lever positioned alongside the triangular operating lever.

QUICK-RELEASE HOOK

7. The quick-release hook is operated by the yellow-painted knob underneath the centre of the dashboard. A cable from this knob is taken to the quick-release hook at the bottom of frame 1; this cable passes through a fairlead on the dashboard and round a pulley on frame 1.

This leaf issued with A.L. No 2, November, 1949

SECTION 1

HANDLING

LIST OF CHAPTERS

Note.—A list of contents appears at the beginning of each chapter

Chapter 1

GENERAL

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LIST OF ILLUSTRATIONS

GROUND EQUIPMENT

1. The following items of ground equipment are provided for servicing the glider. In addition, trestles will be needed to support the fuselage during rigging operations; these are simple in construction and should be constructed locally to the details given in fig. 2.

Ref. No.	Drg. No.	Description	Application
—	21B/4/1	Board incidence "A"	Main-plane ribs No. 1 and 14
—	21B/4/2	Board incidence "B"	Main-plane rib No. 25
—	21B/4/3	Board dihedral "C"	Main-plane
—	21B/4/4	Board incidence "D"	Tail-plane

Chapter 2

GROUND HANDLING

LIST OF CONTENTS

ILLUSTRATION

Introduction

1. This chapter contains information on handling the glider on the ground.

GROUND TOWING

By tractor

2. The glider may be moved in the forward direction only, by tractor, and for towing by this means, the only point of attachment for the tow rope is the quick-release hook in the nose of the fuselage. The tow rope must be fitted with attachment ring *(Ref.No. 26EY/41)* which must be inserted into the quick-release hook with the larger of the two rings vertical in the operating ring of the release hook *(fig.1)*. During the towing operation the glider should be held level by a man at the wing tip.

3. The speed of the towing vehicle should never exceed a fast walking pace and on no account should sharp turns be made. If a sharp turn is necessary, the tow rope must be disconnected and the glider should be man-handled into its new direction *(para.4)*.

By hand

4. The glider may be moved by hand in either direction, by three men, two of whom should push or pull at the strut connection fitting on the main plane, the third man should lift the tail skid clear of the ground, using the lifting point at the rear of the fuselage, forward of the tail plane. Care should be taken not to push or pull at the centre of the main-plane struts, and when moving backwards, ensure that the ground aft of the tail is clear of obstructions which might damage the elevators or skids.

PICKETING

5. Post Mod.40, provision is made for picketing the glider, it should normally be housed in a hangar either complete or with the wings removed *(Part 2, Sect.2, Chap.1)*. If, due to exceptional conditions, it is necessary to leave the glider in the open, it should be picketed by ropes attached to the rings on the main-plane struts upper attachment fittings to concrete blocks or ground pick-up rings, and the main wheel should be chocked fore and aft. Additionally, the tail skid should be roped down in a similar manner and, if necessary, a further picketing point is available at the release hook, providing the attachment is either by a looped cable on the hook or the correct attachment ring *(Ref.No.26EY/41)*. No other attachment may be used at this point as it may cause damage to the release-hook mechanism.

Ballast may also be placed in the cockpit if considered necessary.

PARKING

6. The glider may be parked with one wing tip resting on the ground. The fuselage should be across wind with the wing on the ground pointing into wind. A suitable weight should be placed on the wing tip; a heavy-duty motor tyre is the most suitable object to use as it can be straddled across the wing o without causing damage. If any other type . weight is used it is important that the load is evenly distributed, on suitable packing, over the plywood tip and that it does not rest on the fabric further inboard. The lift spoilers should be left in the open position when the glider is on the ground; they will be released by the pilot before take-off.

7. When parking the glider on tarmac, concrete, etc., in moderate winds, the main wheel should be chocked fore and aft and the tail skid should be chocked on the down-wind side, to prevent the glider moving and turning into wind.

◀ FITTING AND REMOVING BALLAST WEIGHT

8. When the aircraft is to be flown solo by a light weight pilot, the ballast weight is fitted by slotting it into the container in the nose of the aircraft. The weight is rotated until the hole in the weight coincides with the holes in the container. The pin attached to the container is pushed through the holes in the container and firmly secured in this position with a washer and safety pin.

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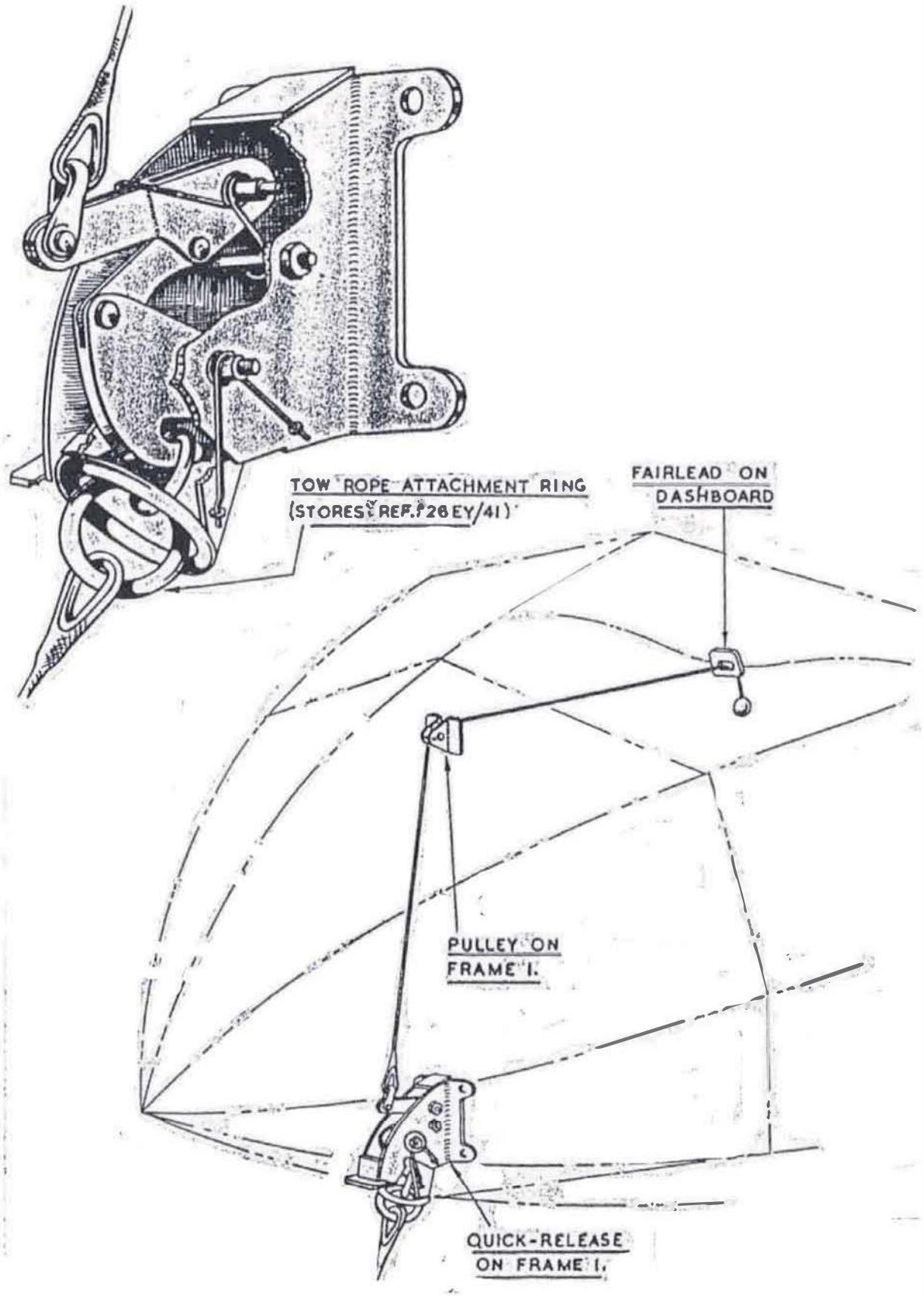

FIG. 1. KOTTFUR QUICK-RELEASE HOOK

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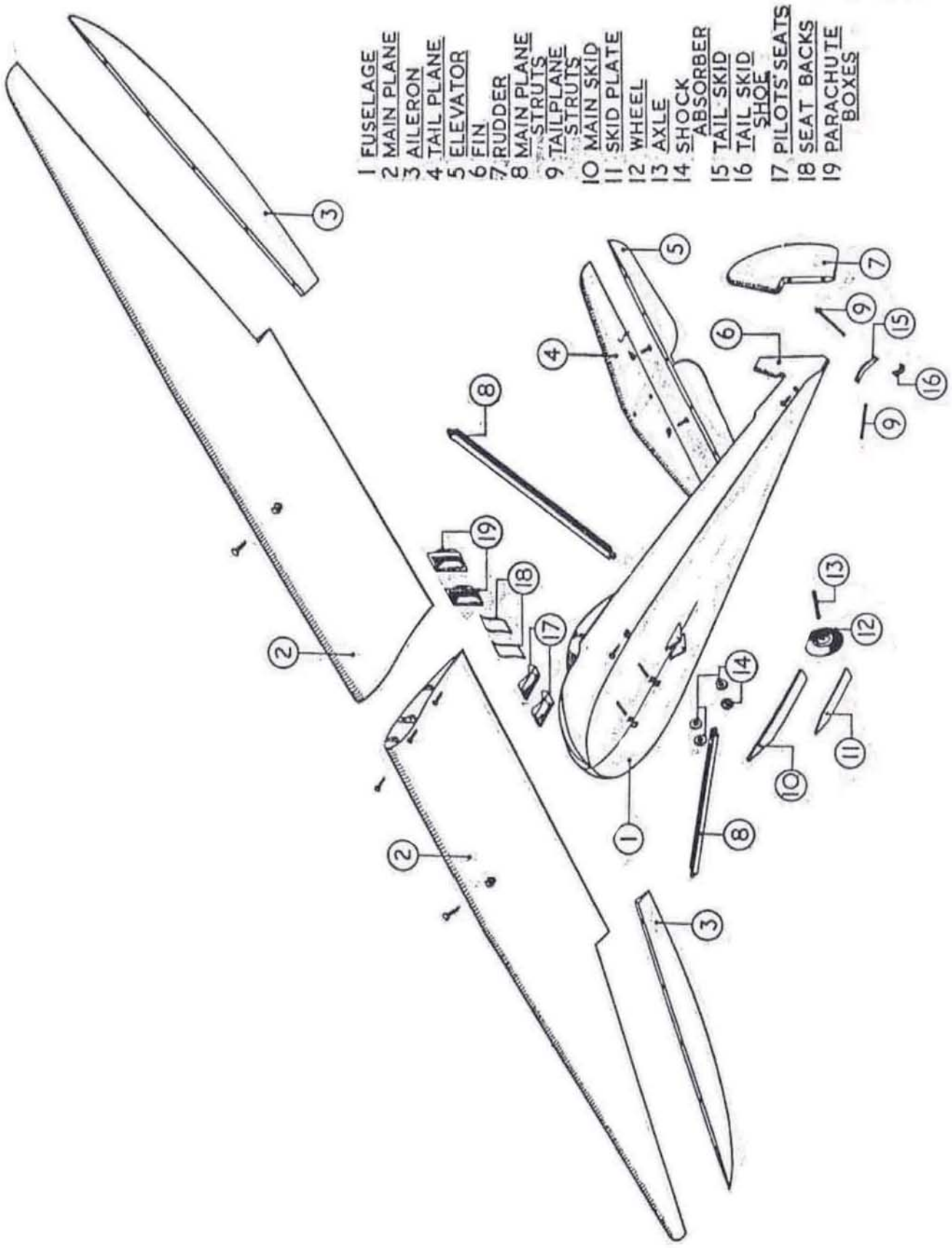

FIG. 1. MAIN COMPONENTS

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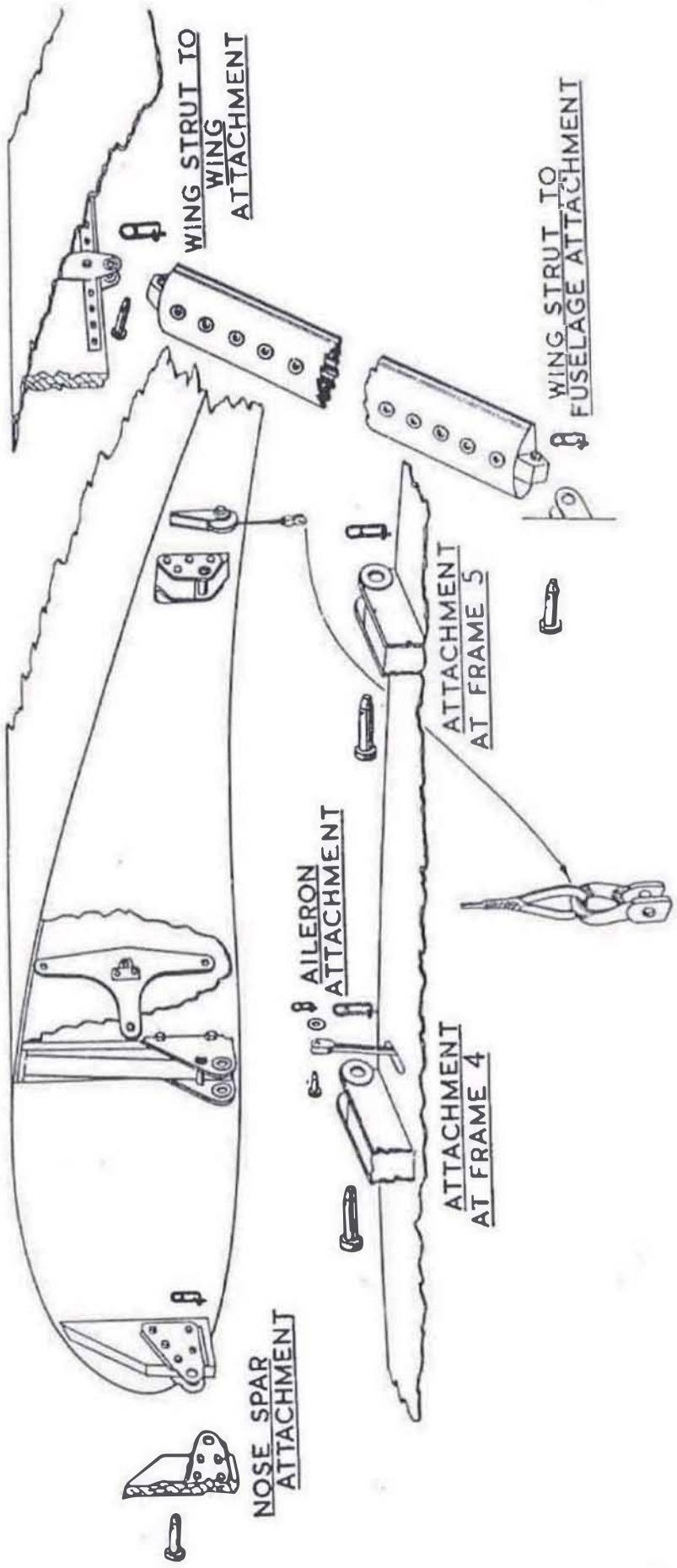

FIG. 2. MAIN-PLANE ATTACHMENTS

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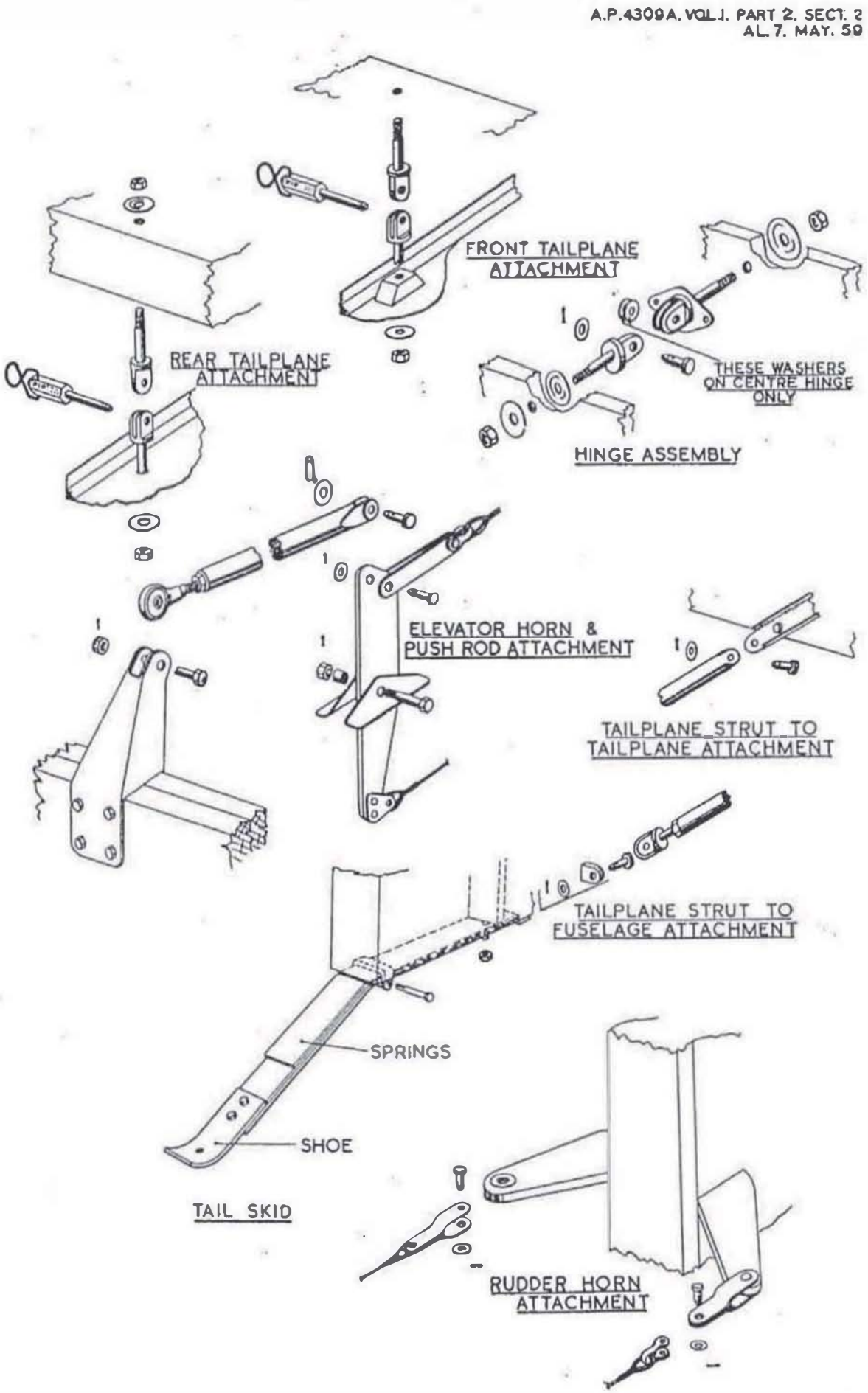
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FRONT TAILPLANE ATTACHMENT
REAR TAILPLANE ATTACHMENT
THESE WASHERS ON CENTRE HINGE ONLY
HINGE ASSEMBLY
ELEVATOR HORN & PUSH ROD ATTACHMENT
TAILPLANE STRUT TO TAILPLANE ATTACHMENT
TAILPLANE STRUT TO FUSELAGE ATTACHMENT
SPRINGS
SHOE
TAIL SKID
RUDDER HORN ATTACHMENT

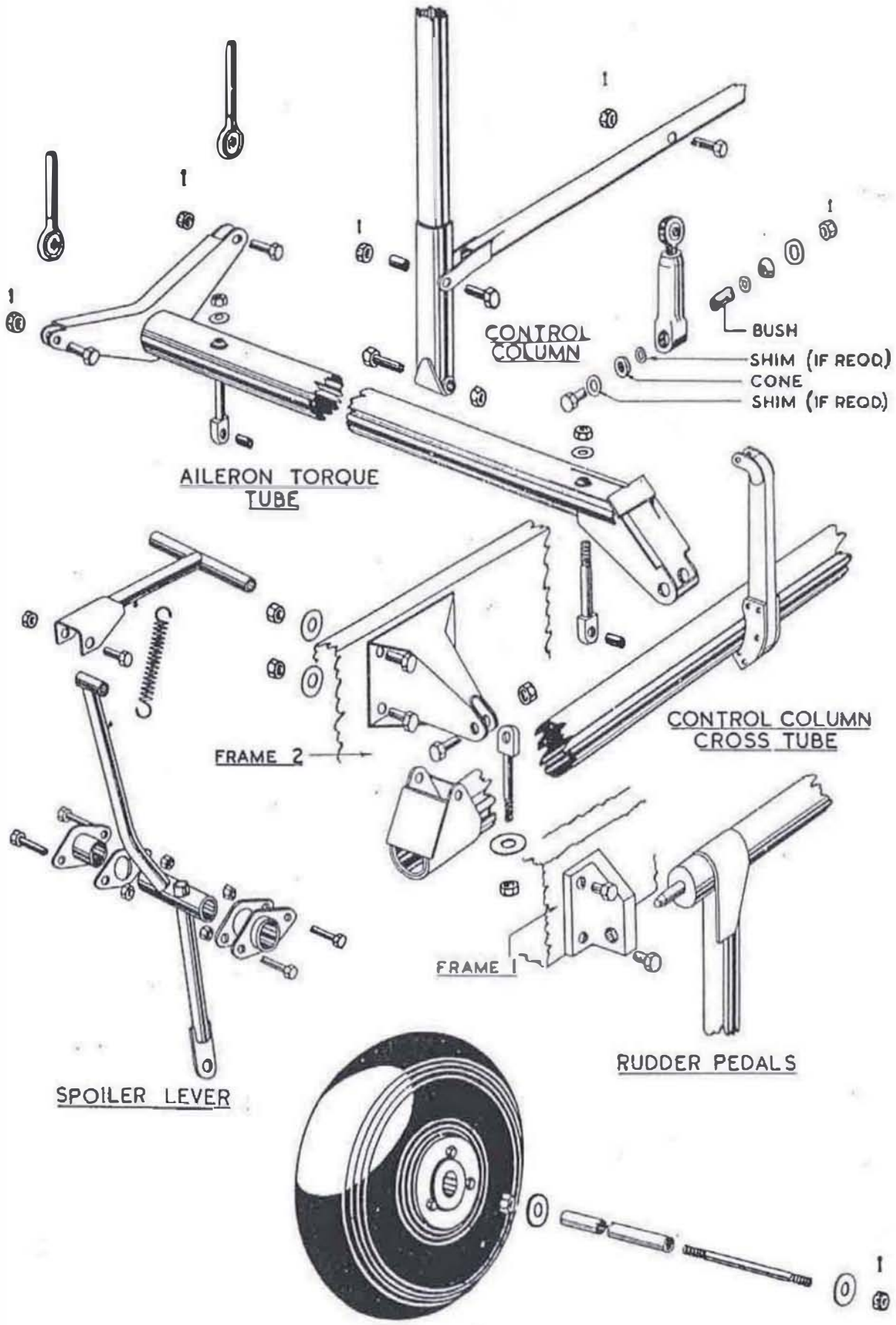

FIG. 4 COCKPIT CONTROLS AND LANDING WHEEL DETAILS

RESTRICTED

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A.P.4309A, Vol. 1, Part 2, Sect. 3

Chapter 1

RIGGING AND FLYING CONTROLS

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

General

1. This chapter describes the method of rigging the glider, using a spirit level and a parallel straightedge, at least 6 ft. 3 in. long, in conjunction with incidence boards, Part No. 21B/4/1, 21B/4/2 and 21B/4/4, and dihedral board, Part No. 21B/4/3.

2. The packing referred to in the rigging operations (*para. 8 to 11*) can, for convenient adjustment, take the form of a long wedge of approximately 2 deg. included angle and ⅛ in. wide. Alternatively, an adjustable level can be used and direct angular readings taken on the top edge of the incidence board, dihedral board or straightedge, as appropriate.

TRESTLING

3. For all rigging checks the glider must be rigidly supported so that the rigging datum lines are horizontal; trestles should be placed under the fuselage at frame 2 and forward of the tail skid, and under the main spar of each main plane, adjacent to the main strut attachment fittings. Suitable fuselage trestles, which can be manufactured locally, are illustrated in Part 2, Sect. 1, Chap. 1.

LEVELLING

4. To check the lateral level, lay a straightedge on the levelling blocks fixed to the front face of frame 3 (the rear bulkhead in the cockpit) and, using a spirit level, adjust the trestles under the wings until the straightedge is horizontal.

5. To check the fore-and-aft level, hold a straightedge so that its top edge lines up with the straight portion of the top longeron of the fuselage aft of the cockpit. Apply a spirit level and adjust the trestle forward of the tail skid either with packing or by moving it, until the straightedge is level.

6. An alternative method of checking the fore-and-aft level is to set up a straightedge, on any convenient support, at a distance of approximately 15 ft. from the side of the fuselage, approximately parallel to the longitudinal centre line of the glider, and at the same height as the top longeron. Level the straightedge and sight across the top edge to the top longeron.

RIGGING

DIAGONALS

7. Check the diagonal measurements with a tape measure, observing the following points :—

(1) Always select exactly opposite points when taking port and starboard measurements.

(2) Pull the tape to the same degree of tautness for opposite measurements.

(3) Note that the limits given on fig. 1 are not exceeded.

MAIN-PLANE INCIDENCE

8. To check the incidence of the main plane, proceed as follows :—

(1) Hold the incidence board, Part No. 21B/4/1, so that it rests on its two pointed legs on the top surface of one of the main planes, at rib No. 1 (the root rib), with the long rectangular leg in contact with the leading edge. Place a straightedge on top of the incidence board and a spirit level on top of the straightedge. The incidence is correct if the straightedge is level. If it is not level, raise the lower end of the straightedge by inserting packing between its bottom edge and the extreme end of the incidence board, until the straightedge is level.

(2) Measure the amount of packing inserted ; the incidence is within permissible limits if it does not exceed $\frac{5}{32}$ in. A corresponding adjustable-level reading, taken direct from the top edge of the incidence board, is 0 deg. $\pm$ $\frac{1}{2}$ deg.

(3) Using incidence board, Part No. 21B/4/1, on the same main plane at rib No. 14, repeat the procedure given at sub-para. (1) and (2).

(4) Using incidence board, Part No. 21B/4/2, on the same main plane at rib No. 25, repeat the procedure given at sub-para. (1) and (2). At this position the thickness of the packing must not exceed $\frac{1}{4}$ in. (adjustable-level reading 0 deg. $\pm$ $\frac{1}{2}$ deg.).

(5) Check the other main plane at similar positions.

Note . . .

The angle of incidence of the port main plane must not differ from that of the starboard main plane by more than $\frac{1}{2}$ deg.; therefore, if the packing used under the straightedges on the port and starboard sides (at similar positions along the main plane) are both at the same end of the incidence board the difference *between the two must not exceed :—*

Inboard position Rib No. 1—$\frac{1}{4}$ in.

Mid-wing position Rib No. 14—$\frac{1}{4}$ in.

Outboard position Rib No. 25—$\frac{5}{32}$ in.

If the packings are at opposite ends the sum *of the two must not exceed :—*

Inboard position—$\frac{1}{2}$ in.

Mid wing position—$\frac{1}{2}$ in.

Outboard position—$\frac{5}{32}$ in.

MAIN-PLANE DIHEDRAL

9. To check the dihedral of the main plane, proceed as follows :—

(1) Place a dihedral board, Part No. 21B/4/3, on one of the main planes so that the longer leg rests on the nose ply at rib No. 2 and the shorter leg at rib No. 8 (the inboard end of the spoiler) ; it must be parallel to, and approximately 16 in. aft of, the leading edge. Place a straightedge on top of the dihedral board and check with a spirit level. The dihedral is correct if the straightedge is level. If it is not level, raise the lower end of the straightedge by inserting packing at the extreme end of the dihedral board until the straightedge is level.

(2) Measure the amount of packing inserted, the dihedral is within permissible limits if it does not exceed $\frac{5}{32}$ in. A corresponding adjustable-level reading taken direct from the top edge of the dihedral board, is 0 deg. $\pm$ $\frac{1}{2}$ deg.

(3) Check the dihedral of the other main plane in a similar manner.

Note . . .

The dihedral angle of the port main plane must not differ from the starboard main plane by more than $\frac{1}{2}$ deg.; therefore, if the packing used under the straightedges on the port and starboard sides are both at the same end of the dihedral board (both outboard or both inboard) the difference *between the two must not exceed $\frac{1}{4}$ in. If the packings are at opposite ends the* sum *of the two must not exceed $\frac{1}{4}$ in.*

TAIL-PLANE INCIDENCE

10. Place the tail-plane incidence board, Part No. 21B/4/4, on the top surface of the tail plane, on either side of the fin, parallel to the longitudinal centre line of the fuselage. The top edge of the board will be level if the incidence is correct, if otherwise, place a straightedge on top of the incidence board and level it with packing inserted at the extreme end of the incidence board; the packing must not exceed $\frac{7}{64}$ in. in thickness. A corresponding adjustable-level reading, taken direct from the top edge of the incidence board, is 0 deg. $\pm \frac{1}{4}$ deg.

TAIL-PLANE LEVEL

11. Remove the fin fairing and place a straightedge on the top surface of the tail plane, parallel to the spar and just clear of the elevator operating rod, so that the ends rest on the gussets on the fourth rib from the centre. Check with a spirit level and, *if* required, raise the lower end of the straightedge by inserting packing on the gusset until it is level; the thickness of the packing must not exceed $\frac{6}{16}$ in. A corresponding adjustable-level reading, taken direct from the top edge of the straightedge, must not exceed 0 deg. $\pm \frac{1}{4}$ deg.

CONTROL SURFACE MOVEMENTS

General

12. The range of movement of each control surface is expressed as a direct measurement from the neutral position of the trailing edge to its position when moved to the stops in both directions.

13. The neutral position of the ailerons is represented by the adjacent trailing edge of the main plane. The neutral positions of the rudder and elevators must be temporarily located on a trestle which will remain in place during the checking operations.

Ailerons

14. With the control columns vertical, laterally, there should be no droop (the trailing edges of the ailerons should be in line with the trailing edge of the main plane). Move the control through its full travel and check the movement of the ailerons; the correct movement is 5·4 in. $\pm \frac{1}{4}$ in. upwards, and 3·6 in. $\pm \frac{1}{4}$ in. downward. Adjustment is effected at the fibre stock blocks on frame 4, either by filing or renewal.

Rudder

15. The neutral position of the rudder can be established by sighting from aft down the centre line of the fuselage; the balance portion of the rudder should also be in line with the top of the fin. The foot bars of the rudder pedals should now be all in line with the frame to which the rudder pedals are attached. Move the rudder through its full travel and check that the movement to each side of the neutral point is 14 in. $^{+2}_{-0}$ in. Adjust at the stops clamped to the cables aft of frame 4.

Elevator

16. To establish the neutral position of the elevators, place a straightedge obliquely on top of the tail plane so that it passes over the centre line of the fuselage at the leading edge, in front of the fin and over the inboard trailing edge of the elevator. The neutral position is $1\frac{7}{32}$ in. below the bottom edge of the straightedge. The control column should now be vertical fore-and-aft. Move the control column through its full travel and check the movement of the elevators; the correct movement is 7·6 in. $\pm \frac{1}{4}$ in. in both directions. Adjustment is effected at the stops on the front face of frame 4.

Spoilers

17. The movement of the spoilers is measured from the rear edge of the spoiler recess, at the surface of the main plane, to the top, rear, edge of the spoiler. The correct movement is $7\frac{1}{2}$ in. $\pm$ 1 in. and variation in movement between port and starboard spoilers must not exceed $\frac{1}{2}$ in. Adjustment of both spoilers is effected at the turnbuckle in the control cable in the cockpit, and of each spoiler individually at the turnbuckles in the main plane, aft of the spoilers.

FLYING CONTROLS

AILERON CONTROL

18. The aileron control is rigged and adjusted in the following manner:—

(1) Set the control column vertical and temporarily secure it in that position.

(2) Check that a line drawn through the push-rod attachment bolt holes in the double lever at the aft end of the aileron torque tube (aft of frame 4) is horizontal.

(3) Connect the lower ends of the push-rods to the aileron torque tube lever and the upper ends to the levers on the main plane root ribs, and adjust the length of the push-rods until the levers on the main plane root ribs are parallel to the root ribs.

(4) Connect the inboard ends of the aileron control cables to the control levers on the root ribs (the longer link-plate is attached to the lower arm of the lever) and their outboard ends to the aileron levers (the cable with the shackled end is attached to the lower lever).

(5) Adjust the cables at the turnbuckles, accessible through the panel on the underside of the main planes between ribs 5 and 6, until the trailing edge of the aileron is in line with the adjacent main plane trailing edge.

(6) Check and adjust the aileron movements as instructed in para. 14.

(7) Tension the cables to the limits given in para. 23 and lock all adjustments and connections.

(8) Check the static friction load (*para.* 27).

RUDDER CONTROL

19. The rudder control is rigged and adjusted in the following manner :—

(1) Set the rudder pedals so that the footbars are in line with the frame to which the pedals are attached.

(2) Connect the cables at the turnbuckles on the inboard rudder pedals and at the control levers on the rudder (the cable with the shackled end is attached to the port lever on the rudder and the starboard inboard rudder pedal.)

(3) Adjust the cables at the turnbuckles until the rudder is in line with the centre line of the fuselage.

(4) Check and adjust the rudder movements as instructed in para. 15 and lock the turnbuckles and connections.

(5) Check the static friction load (*para.* 29).

ELEVATOR CONTROL

20. The elevator control is rigged and adjusted in the following manner:—

(1) Set the control column vertical fore-and-aft, and temporarily secure it in that position.

(2) Adjust the connecting tube between the control column cross-shaft and the control lever on the front face of frame 4 until the centre of the top hole of the control lever is $1\frac{1}{8}$ in. from the front face of the frame.

(3) Connect the control cables at the turnbuckles on the control lever and at the lever in the rear fuselage (the cable with the shackled end is attached at the upper position on both levers) and adjust them until a line drawn from the pivot point of the lever in the rear fuselage to the top cable-attachment hole is inclined forward at an angle of 71 deg. to the fuselage datum (the top surface of the deck under the tail plane). The tail plane must be removed for the purpose of this adjustment.

(4) Connect the elevator push-pull rod from the lever in the rear fuselage to the control lever on the elevator, and adjust it until the elevator is in its neutral position.

(5) Check and adjust the elevator movement as instructed in para. 16.

(6) Check the tension of the cables and adjust to the limits given in para. 24; lock all adjustments and connections.

(7) Check the static friction load (*para.* 28).

SPOILER CONTROL

21. The spoiler control is rigged and adjusted in the following manner:—

(1) Connect the cable at the turnbuckle in the cockpit, at the shackles at the port and starboard wing roots and aft of the operating levers in the main planes, and adjust the tension of the cables until they are reasonably tight when the control lever is fully forward against its stop.

(2) Move the control lever in the cockpit to its full extent aft and check and adjust the spoiler movement as instructed in para. 17.

(3) Release the control lever and check that the spoilers are flush with the upper surface of the main plane and that the operating levers in the main planes are in contact with their stops.

CONTROL CABLE TENSIONS

22. The tension of the control cables should be checked with a S.M.E. Mk. 3 tensiometer (Ref. No. 1C/6134) at the positions given in the following paragraphs. They should be adjusted to the tensions stated.

Aileron control

23. Apply the tensiometer to the cables, accessible through the access holes in the underside of the main planes, between ribs 5 and 6. The tension should be between 40 and 50 lb.

Elevator control

24. Apply the tensiometer to the cables, accessible through the triangular door on the port side of the fuselage, aft of the cockpit. The tension should be between 35 and 40 lb.

Rudder control

25. The rudder control is automatically loaded by the rubber compensator cord in the nose of the fuselage. Its tension need not be checked.

STATIC FRICTION LOADS

26. The static friction loads of the controls should be checked with a spring balance applied at the positions given in the following paragraphs. When checking the load, move the controls through their full travel in both directions and take the average reading.

Aileron control

27. Apply the spring balance at the top of the control column; the average load must not exceed 4 lb.

Elevator control

28. Apply the spring balance at the top of the control column. Since the weight of the elevators affects the spring balance reading in both directions, the average load will be half the difference between the readings obtained during forward and aft movement of the control column; this must not exceed 2½ lb.

Rudder control

29. Apply the spring balance at the foot-bar of the rudder pedals; the average load must not exceed 7½ lb.

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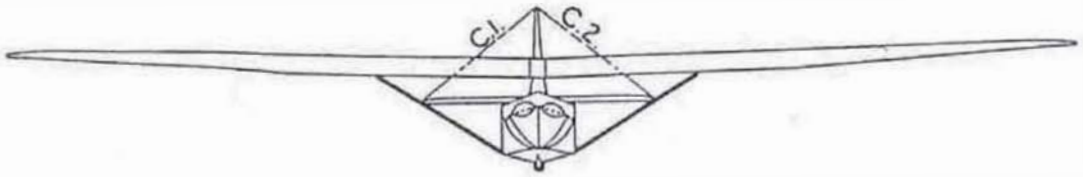
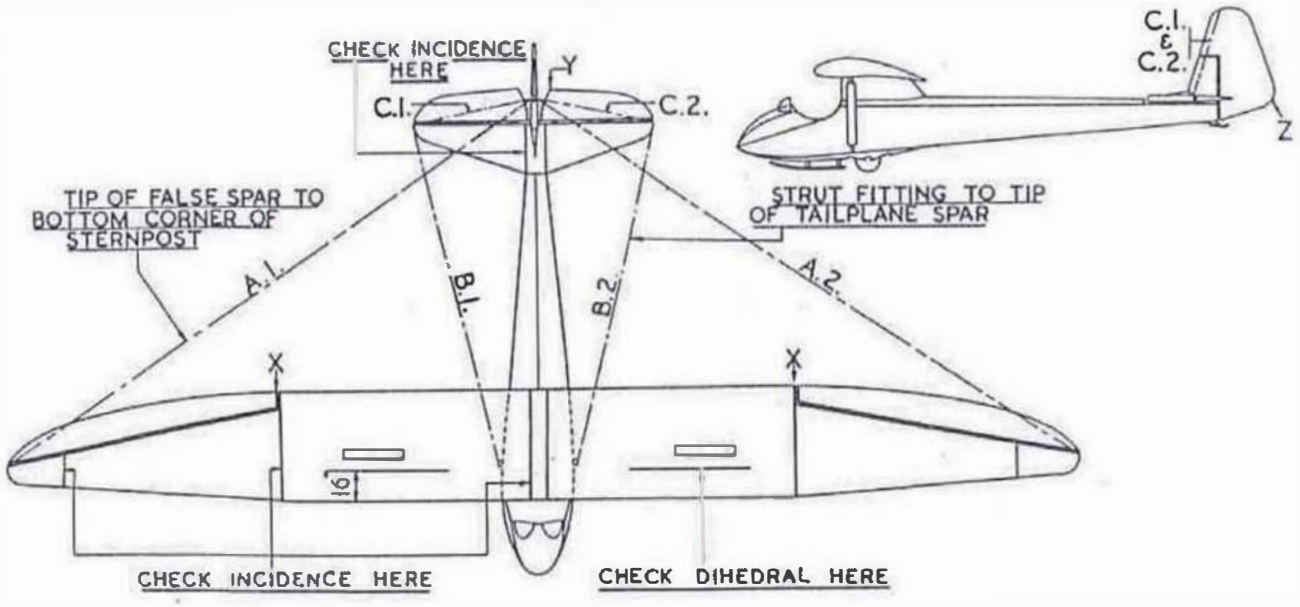




RIGGING DATA

HORIZONTAL DATUM LINE IS THE TOP LONGERON AFT OF FRAME 4

MAIN PLANE

DIHEDRAL $1\frac{1}{2}° \pm \frac{1}{2}°$

INCIDENCE $2° \pm \frac{1}{2}$ AT THE ROOT MAINTAINED TO RIB 14

BOTH WINGS TO BE WITHIN $\pm \frac{1}{4}°$ TO EACH OTHER

TAILPLANE

INCIDENCE $2° \pm \frac{1}{4}°$ WITH DATUM LEVEL

DIAGONALS

A.1. = A.2. $\pm 2"$

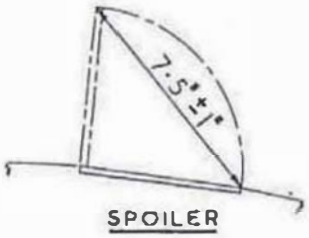
B.1. = B.2. $\pm 1"$

C.1. = C.2. $\pm \frac{1}{2}"$

WITH WINGS LEVEL WITHIN TOLERANCES TAILPLANE LEVEL MEASURED ON TAILPLANE SPAR TO BE WITHIN $\pm \frac{1}{4}°$

SPOILERS

TO BE WITHIN $\frac{1}{2}"$ OF EACH OTHER WHEN FULLY OPEN



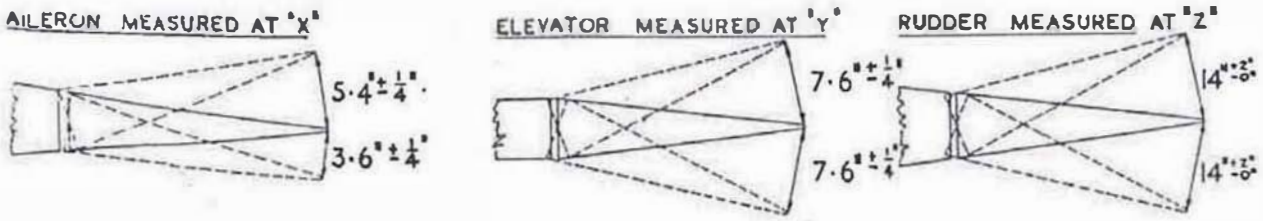


Fig.1 Rigging diagram

(A.L.6, Oct.58)

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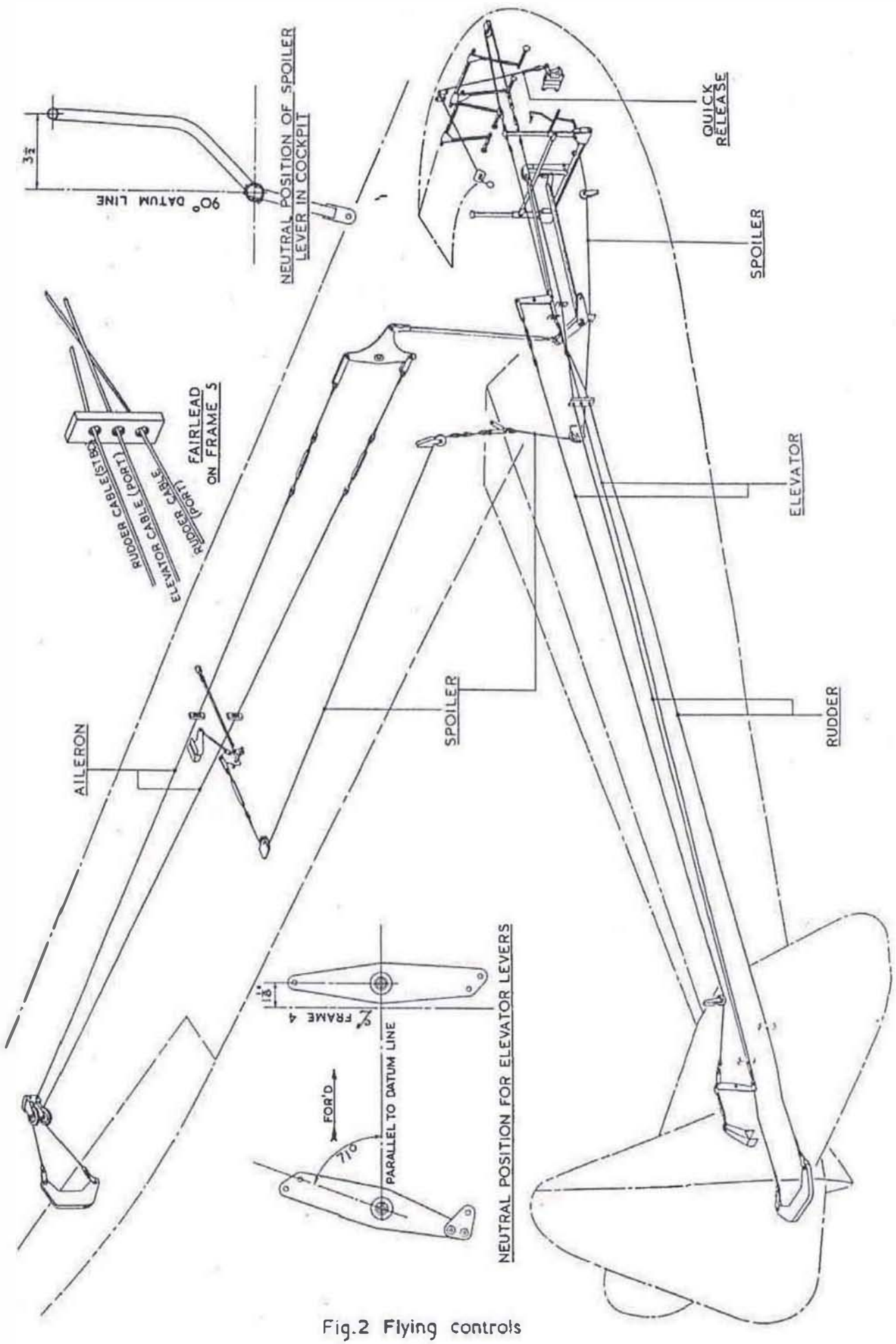

Fig.2 Flying controls

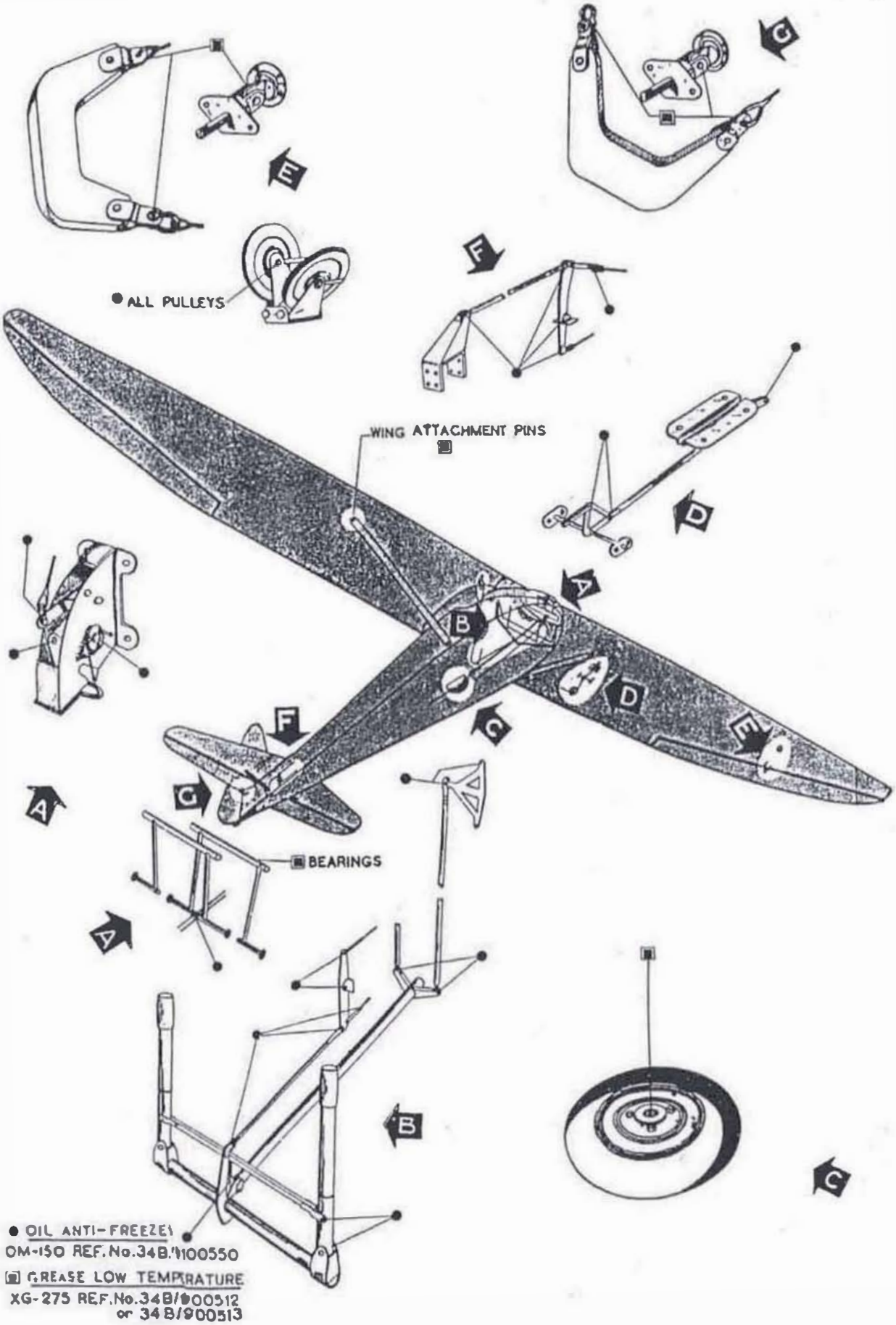

FIG.3. LUBRICATION DIAGRAM
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Section 2

ASSEMBLY, DISMANTLING AND REMOVAL

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

General

1. The purpose of this chapter is to describe the method of assembling the glider from its main components and the removal of individual items of the main components. Neither the dismantling of the complete glider nor the assembly of individual items is described, since these are mainly reversals of the particular assembly or removal operations, but where this is not the case it is described in the relevant paragraph.

2. The glider is so designed that it can easily be assembled and dismantled without the use of special tools and equipment other than fuselage trestles. It normally will be received broken down into the following components :—

Fuselage, complete with fin and rudder and tail-plane struts.

Port and starboard wings, complete with ailerons.

Tail plane and elevator, assembled together as one unit.

Main-plane struts.

Wing root fairing.

Tail plane-to-fin fairings.

Attachment and locking pins (these are normally packed in a canvas bag stowed in the cockpit).

ASSEMBLY

MAIN PLANES

3. The method of assembling the main planes to the fuselage is as follows :—

(1) Support the fuselage in the rigging position (*Part* 2, *Sect.* 3, *Chap.* 1), either by one man holding it at the side of the cockpit or in fuselage trestles (*Part* 2, *Sect.* 1, *Chap.* 1).

(2) Attach the two main-plane struts to the fuselage with half-inch diameter shackle pins, inserting them from the front. Lock the attachment pins with safety pins and rest the outboard ends of the struts on the ground.

(3) With one man at the wing tip, one under the main spar at the wing root and one man steadying the wing at the root trailing edge, lift the starboard wing and align the wing root attachment fittings with the attachments on the fuselage neck.

(4) Insert the main spar attachment pin; this should be done from the port side of the fuselage by the man who was steadying the trailing edge. Lock the attachment pin with a safety pin.

(5) Attach the wing strut to the main plane with a half-inch diameter shackle

pin, inserting it from the front, and lock the pin with a safety pin. The man supporting the wing tip should remain in position, but if a man was supporting the fuselage he is now free to assist in the assembly of the port wing.

(6) Insert the wing rear attachment pin and lock it with a safety pin.

(7) Assemble the port wing and strut in a similar manner.

(8) Insert the wing leading edge connection pin and lock it with a safety pin.

TAIL PLANE

4. The tail-plane struts are normally attached to the fuselage and tied across the top with a length of cord. The struts should be untied and their outboard ends rested on the ground. The method of assembling the tail plane to the fuselage is as follows :—

(1) Raise the tail plane with one man at each tip and pass one tip across the fuselage to another man on the opposite side. Set the elevator fully up so that its control lever can be admitted under the plywood nose of the fin, and lower the tail plane into place on its attachment fittings. One man should be positioned at the side of the fuselage under the tail plane to guide it into place.

(2) Insert the tail-plane attachment pins. Four separate pins are used ; they should be inserted from the outside and when pushed fully home they lock themselves in place. The pins can only be removed by pulling on the rings in the heads.

Note .....

The pins must be inserted by hand pressure only. They must not be driven in with a hammer.

(3) Attach the tail-plane struts. On early gliders this attachment is made with self-locking pins in a similar manner to the tail plane attachment. On later gliders the struts are attached with shackle pins which shou d be pushed home and locked with a safety pin.

AILERON CONTROL

5. Connect the aileron control by lining up the end of the push-rod in the fuselage neck with the lever at the wing root and inserting a shackle pin ; lock the shackle pin with a safety pin.

SPOILER CONTROL

6. Connect the shackles at the ends of the cables which protrude from the fuselage neck aft of frame 5, to the control cables protruding from the main-plane root ribs aft of the diagonal spar.

ELEVATOR CONTROL

7. Connect the elevator control by joining the push-rod from the elevator lever to the control lever in the rear fuselage with a shackle pin. Lock the shackle pin with a safety pin. The elevator control push-rod normally remains attached to the elevator control lever when the glider is dismantled.

FAIRINGS

8. Attach the wing root fairing by hooking the key-hole slots at the front of the fairing on to the studs at the front of the fuselage neck. Lay the fairing over the top of the wing and hook the rear channel of the fairing on to the trailing edge of the wing. Tighten it in position with the two wing nuts on the bolts which pass through the rear channel.

9. Attach the fin fairing by sliding its rear end under the special washers on the tail-plane rear attachment fittings and engaging the front fastener. The fastener is locked when the slot in its head coincides with the lines marked on the fairing.

REMOVAL

AILERONS

10. To remove an aileron proceed as follows :—

(1) Remove the split pins and the shackle pins connecting the controls to the operating levers on the aileron. The operation is facilitated by holding the trailing edge of the aileron and pulling on the upper control cable ; this relieves the pressure on the pin, which can then be withdrawn.

(2) Remove the split pins and washers from the shackle pins at the aileron hinges.

(3). Support the aileron and withdraw the hinge pins. One of the hinges is washered to take up end play, the number and position of these washers should be noted.

RUDDER

11. The rudder is removed in a similar manner to the ailerons (*para.* 10).

ELEVATOR

12. The tail plane must be removed from the fuselage in a reverse manner to that given for its assembly in para 4, before the elevator can be removed. The elevator is then removed in a simular manner to the ailerons (*para.* 10)

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