Chapter 2 MAIN PLANE

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WARNING . . .

Explosive bolts are used in the undercarriage bay; refer to Lethal Warning Notice at the front of this book.

DESCRIPTION

1. The swept-back main planes are fully cantilever stressed skin structures comprising inner and outer planes joined at the spars by wedge joints secured by special tapered bolts. The inner plane-to-fuselage joint is of similar wedge construction, the spars of the two inner planes bolting together at the fuselage centre-line, thus forming integral construction. The inner and outer plane intersection is faired to

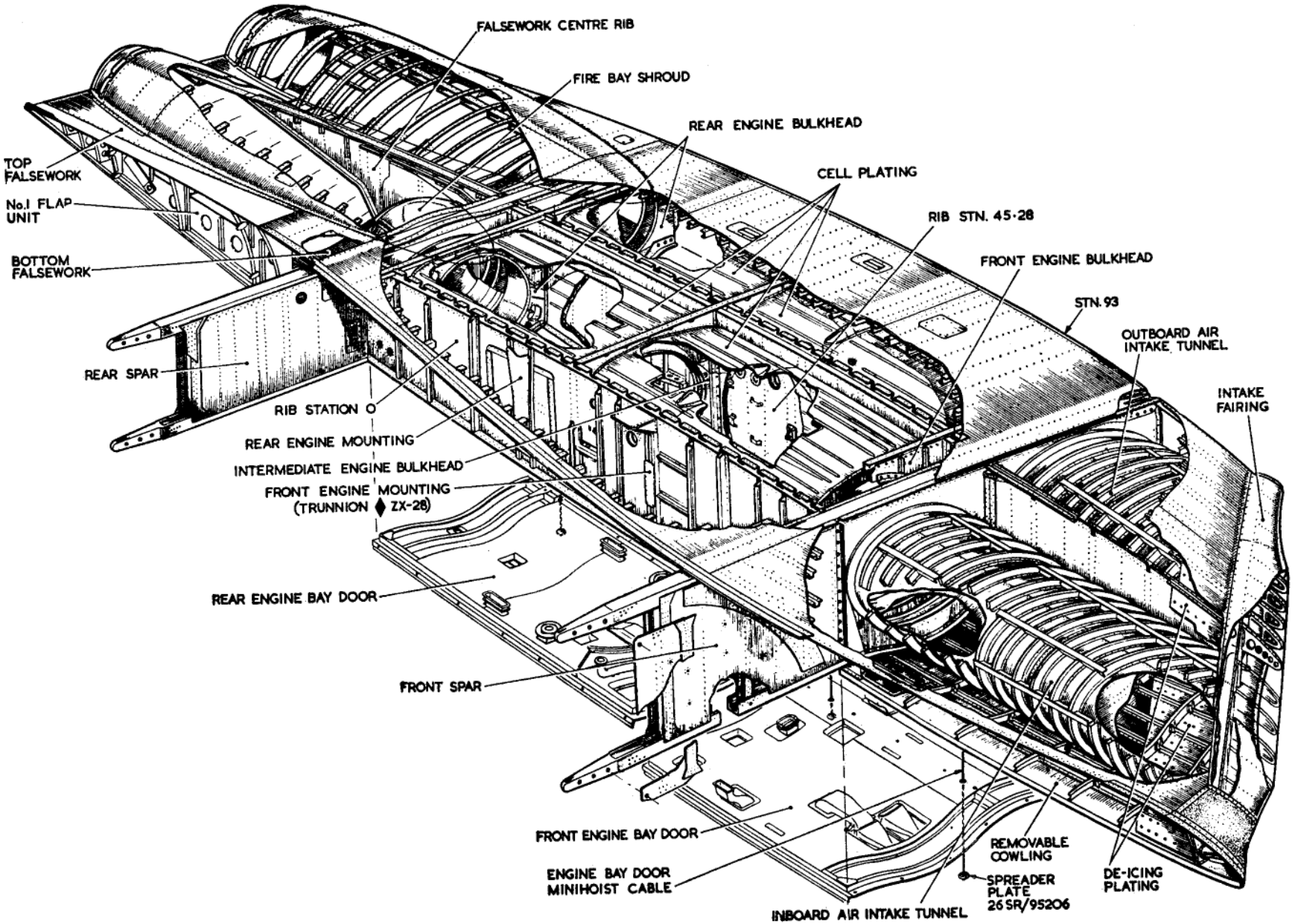

Fig. 1. Inner plane

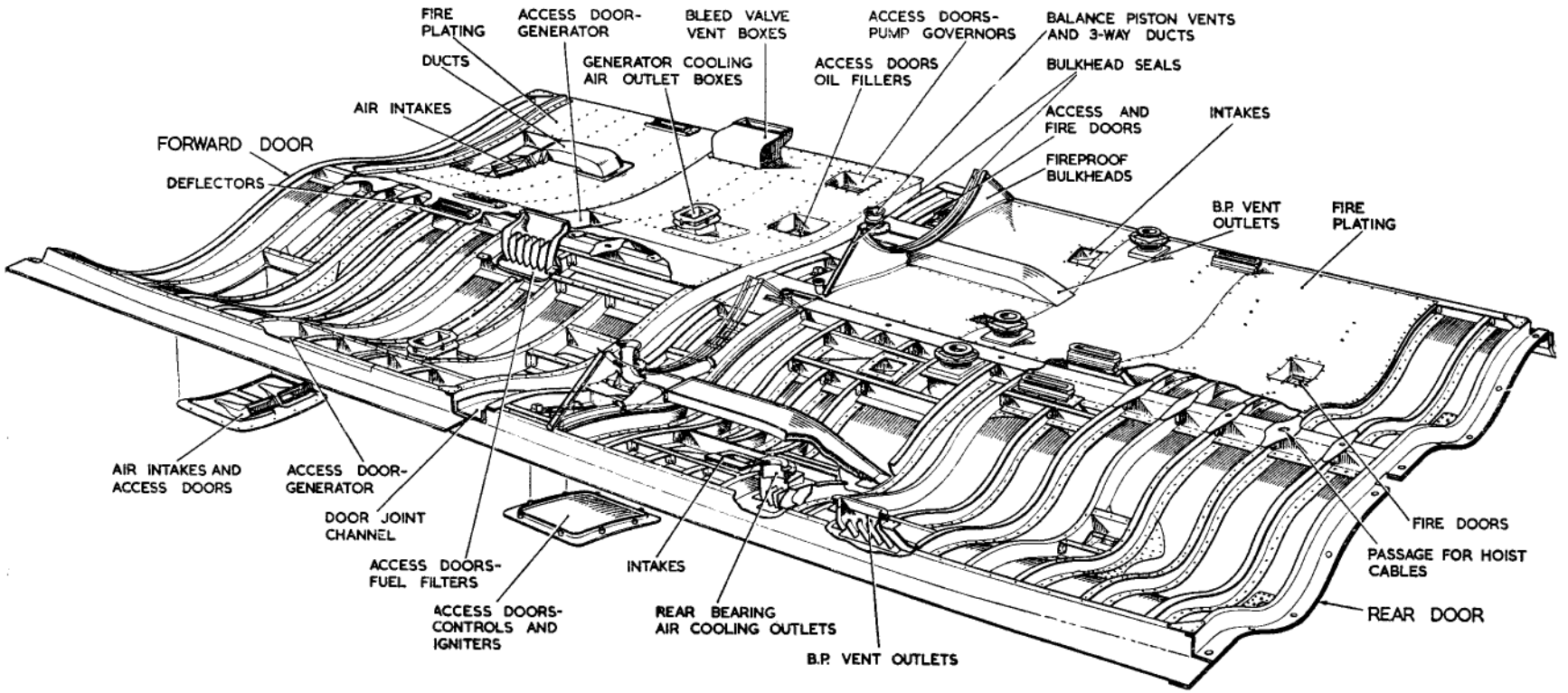

Fig. 2. Engine bay doors—port side

maintain smoothness of contour. The outer plane leading edges carry thermal de-icing ducts, the trailing edges being shrouded in those areas adjoining the flaps and ailerons. Boundary layer fences are fitted at Stn. 351, and vortex generators to the upper surfaces in the line of the airstream over each inboard aileron. Five of the outer bays in each outer plane serve as fuel cells, whilst the two inner bays provide housing for the sideways-retracting main undercarriage unit. Detachable stalks are used (*Sect.* 4, *Chap.* 2, *App.* 1) when underwing fuel tanks or heavy underwing stores are to be carried. Each inner plane houses two engine change units (E.C.U.s) in separate cells, these being numbered from 1 to 4 commencing with the port outer. The trailing edge is split, forming No. 1 flap, and enclosing the rear underside of the engine exhaust pipe outlets.

INNER PLANE (*fig.* 1)

2. The spars, wedge jointed and bolted to both the fuselage and outer plane, are virtually of continuous construction. Three main ribs at Stn. 0, 45·28 and 93, secured to the spars, form the engine cells. These are divided by intermediate bulkheads into two zones, viz., compressor and combustion zones. The three main ribs provide attachment for the engine mountings and engine controls, the latter passing along the left-hand side of each installation and connecting the throttle control on the pilots' control pedestal with the fuel control unit on the engine (*Sect.* 4, *Chap.* 1). Forward of the front spar, air intakes for the engine units are formed in the structure and faired into the aerofoil contour: aft of the rear spar the upper surface falsework takes the form of and encloses the outlet pipes.

◀**2A.** In the mouth of each outboard air intake at the inboard end is a vertical and horizontal guide vane assembly. The vertical vane upper and lower ends are attached by special bolts which screw into anchor nuts, the horizontal vane being attached to the air intake division by two Avdel rivets and screws which also screw into anchor nuts.▶

3. The upper surface stressed skin covering is reinforced with Z-section boom type

chordwise ribs and channel-section spanwise stringers. The lower surface, between the front and rear spars, is covered by the removable engine doors. Access doors are provided in both the upper and lower surfaces for general servicing purposes, cooling and venting.

Spars

4. The spars are fabricated girders having channel-section booms, with web plates riveted to the faces. Vertical stiffeners in the form of gusset plates are riveted to the webs, with additional strengthening at Stn. 0 where the engine bay and inner webs are bolted together. In the region of the rear spar, protection from excessive heat is provided by a heat shield and a flow of cooling air between the shield and the spar lip. The port and starboard spars are jointed at the fuselage centre-line, the front spars at fuselage Stn. 462·68 and the rear at Stn. 634·2. Wedge ends on the port spars mate with V-shaped forks on the starboard, the joints being secured by tapered bolts. To facilitate inspection, access panels are fitted, post-Mod. 3074, near selected spar joints. Cracks may develop in the bottom flanges of the web plates at the rear of the front inner plane spars and at the front of the rear inner plane spars; Mod. 2849 provides for damaged flanges to be cut away and replaced by steel liners (*fig.* 10).

Engine cells (*fig.* 1)

5. Each cell houses an E.C.U. with its fire protection system of bulkheads, fire plating, detector switches and spray nozzles. There are three bulkheads, one just aft of the front spar, an intermediate bulkhead comprising four independent sections dividing each engine cell into two separate fire zones, and the third just forward of the rear spar. The third fire zone is aft of the rear bulkhead and covers that area occupied by the exhaust unit. Shrouds, in conjunction with the rear bulkhead, cover the joint between the E.C.U. and the exhaust unit. The forward zone fire plating, which extends from the forward to the intermediate bulkhead, is of light alloy sheet. In the rear zone, between the intermediate and rear bulkheads, heat-resisting steel is used. In each case the sheet is strengthened by longitudinal stiffeners. In emergency, access to the engine cells is obtained through fire doors (painted red and marked FIRE PANEL) in the undershield formed by the rear engine bay doors.

6. Servicing access panels, numbered on the inner surfaces for ease of assembly, are provided on the main plane upper surface and in the engine bay doors. In addition, openings in the doors and panels provide cooling air inlets and exhaust vents. The upper surface cooling panels carry spring and cable-operated louvres which provide convection cooling when the aircraft is on the ground. The louvres are opened by cable as the undercarriage is lowered, and closed by springs when the legs are retracted. Removal of four skin plugs, in the main plane upper surface immediately above Stn. 0 and 93, gives access to sockets used for positioning the engine hoist beam. Panels over Stn.45·28, the main longitudinal member dividing the inner plane into two engine cells, provide access to passages for cable slings used for raising or lowering the engine doors.

7. To counteract the transfer of heat from the engine and jet pipe to the surrounding structure, the ejector action of the main gas stream at the propelling nozzle is used to draw air into the engine cell through intakes in the front engine bay doors. Induced by fifteenth-stage vent exhaust, the cooling air is passed through the intermediate bulkhead and exhausted through the rear door. Air from the rear door intakes, after cooling the engine, passes along the surfaces of the jet pipe and shrouds, and is exhausted through ducts in the falsework surrounding the end of the jet pipe, into the main gas stream.

Engine doors (*fig.* 2)

8. A removable double-skinned door, in two sections, seals the engine cells and forms the undersurface of the inner plane. These front and rear sections are joined by a transverse channel member which forms part of the intermediate bulkhead; the channel member must be removed when installing or removing an engine (Sect. 4, Chap. 1). The door front section embodies the lower segment of the intermediate bulkhead. Each section is provided with access doors, each marked to indicate its purpose; a warning notice is included for the high energy ignition plug.

Engine mountings

9. Each engine is mounted in its cell at two points on each side. The front attachment brackets provide anchorage for the adjustable mounting struts, the upper ends of which are connected to a ball-jointed harness attached to the compressor casing. These front attachments do not carry forward thrust, movement of the harness being limited to that necessary to allow for engine expansion, torque reaction and airframe distortion. Each rear mounting bracket houses a trunnion bearing attached to the turbine nozzle box, the trunnion being secured to the bracket by a taper bolt assembly (Sect. 4, Chap. 1).

Intermediate bulkhead (*fig.* 1)

10. This bulkhead, at the forward end of the combustion chamber, is made in four independent sections and separates the compressor and combustion bays. The upper section is integral with the wing structure, the lower with the forward section of the engine doors, and the two side sections are secured to the main ribs. The four sections, panelled with heat-resisting steel, engage with each other and the engine, all mating faces being rubber sealed.

Trailing edge

11. The inner plane trailing edge is in two halves, the upper being a fixed structure embodying the jet pipes, the lower hinged and forming No. 1 landing flap. The fixed structure, with spanwise Z-section members and chordwise plate ribs, is covered externally with stressed skin panels; the rear edge in the area of the jet pipe outlets, is reinforced by stainless steel plates.

Flaps (*fig.* 5)

12. The inner plane flap construction is similar to the trailing edge fixed portion (para. 11) except that the framework is

covered internally and externally with stressed skin panels. The inner skin rear edge, in the area of the jet pipe outlets, is also reinforced with stainless steel plate. The flap actuating mechanism, mounted in units bolted to the rear spar rear face, is connected to and transmits movement through fittings on the flap end ribs.

Inner plane-to-fuselage fairing

13. The inner plane-to-fuselage joint is faired by drag angles bolted and riveted to the skin. The drag angle at the leading edge lower surface, and on the inner plane lower surface between the front and rear spars, is bolted to the fuselage; in all other areas rivets are used.

(*Continued on back of next leaf*)

OUTER PLANES (*fig.* 3)

General construction

14. The construction is conventional, with two built-up spars and a number of rigidly-constructed ribs dividing its length into bays. The two inner bays house the main wheel units and their retraction mechanism, the next five bays house fuel cells, the first

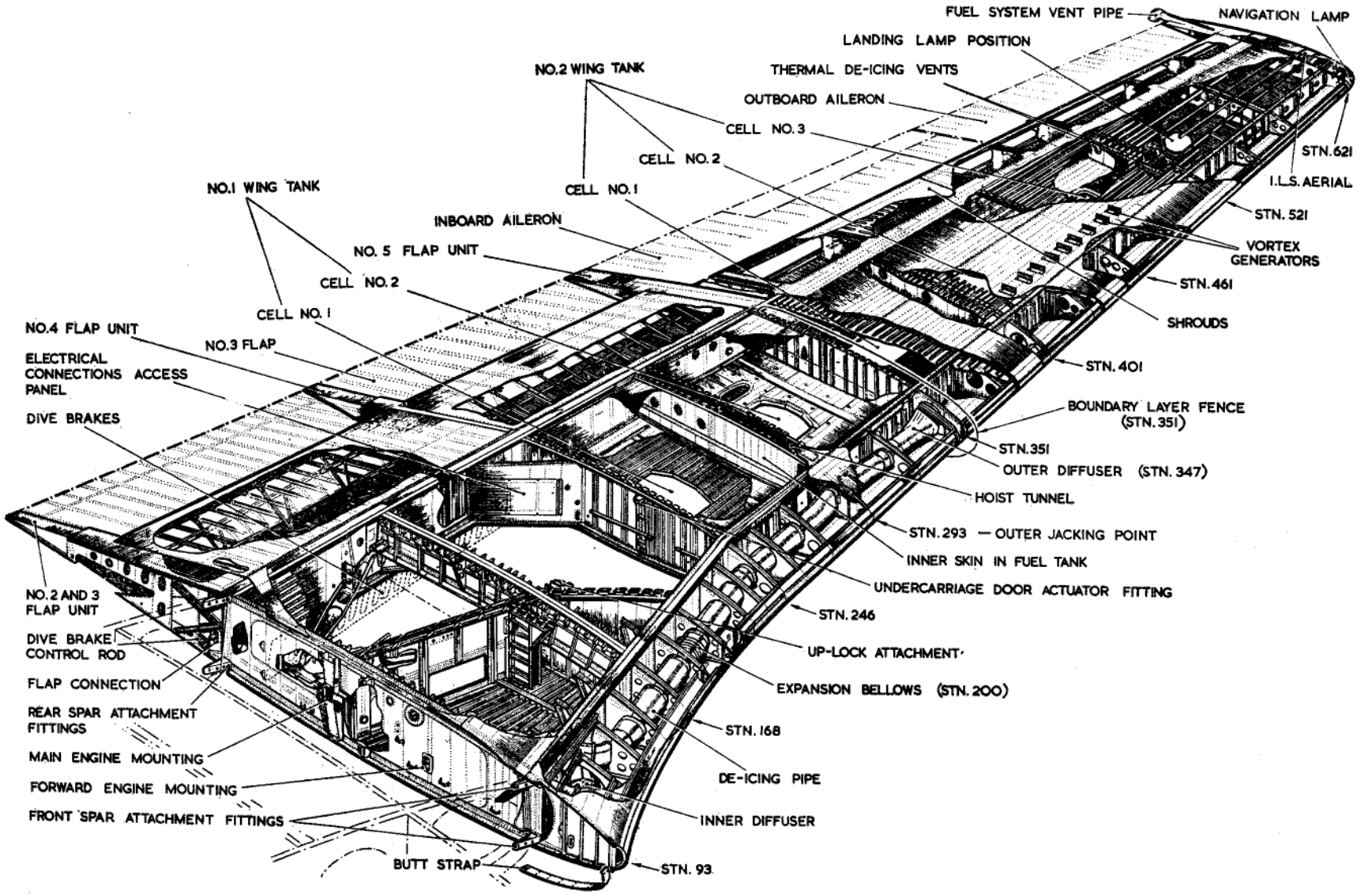

Fig. 3. Outer plane

two to form No. 1 wing tank and the other three No. 2 wing tank. A landing lamp and its retraction equipment is fitted outboard of the fuel tanks. The detachable wing tip is secured to the outer plane outer rib. Attached to the outer plane are two landing flaps (inboard) and a split aileron (outboard), their operating units being secured to the rear main spar rear web. Dive brakes are located immediately aft of the main wheel doors, the brackets for these and the various controls and pipelines being secured to the rear spar.

Spars

15. The spars are similar to those in the inner plane (*para.* 4), but the heavy channel-section booms taper to a lighter section at the wing tip. The inner-to-outer plane spar joint is similar to the inner plane-to-fuselage, the joint being reinforced by bolting together the web flanges of both spars, and by attachment of the outer plane skin to the inner plane channel section at Stn. 93 (*fig.* 10). The bolts adjacent to the front and rear spars, project from the outer plane rib at Stn. 93 and pass through the spar eye-bolts to give positive location.

Ribs and skin

16. The main structure at Stn. 93, 168, 240, 293, 401, 461, 521, 577 and 612, has built-up ribs with booms recessed for span-wise stringers to reinforce the skin. Rib 293 is a double rib, the space between the webs forming a hoist tunnel for use when assembling wing stalks and under-wing tanks. This station is also the outer jacking point when using the jacking beams, Ref. No. 26SR/95417 (port) and 26SR/95160 (starboard). The skin panels are mainly of 12 s.w.g. throughout, the main wheel bays being reinforced by a thinner gauge top inner skin. In each of the fuel cell bays, there is a thinner gauge inner skin to which small reinforcing plates are attached for the buttons retaining the flexible fuel cells (*Sect.* 4, *Chap.* 2, *App.* 2). The lower skin is fitted with fuel tank access panels, each having an inner skin to assist in supporting the fuel cells; the panel outer skins carry drain valves. At Stn. 551 a door surround in the lower skin carries the mounting for a retractable landing lamp, and at Stn. 535 two vents pass the leading edge thermal de-icing air to atmosphere. Nine vortex generators are fitted to each outer plane top surface to relieve aileron actuating rod load; they are positioned to the rear of the front spar, in line with the inboard aileron, and set at 20 deg. to the line of flight.

Leading edge

17. The leading edge skin is reinforced by plate nose ribs and Z-section stringers, the ribs between Stn. 93 and 345 supporting a thermal de-icing duct which terminates at each end in a diffuser. The duct has a bellows expansion joint at Stn. 200, and is supported by spring-loaded plungers to permit movement due to temperature changes. From Stn. 345, de-icing air flows freely along the leading edge until exhausted to atmosphere.

Trailing edge

18. The outer plane trailing edge is a shroud, covering part of the flaps and ailerons. It consists of a top and bottom skin with spanwise stiffeners and fluted reinforcing plates, attached to diaphragm-type and built-up ribs secured to the rear spar. Extensions of the ribs between Stn. 93 and 347 carry No. 2, 3, 4 and 5 flap units, support ribs at Stn. 365, 525 and 590 carrying the aileron hinges. A box structure built into the trailing edge between Stn. 455 and 467 carries the bearings of the aileron torque tube, which is connected to the control rods in the trailing edge. Two panels in the top skin give access to the aileron stops, and one in the bottom, access to the torque tube bearing and lever connections.

Wing tip

19. The wing tip comprises a flanged diaphragm end member, with metal skin supported by flanged diaphragm formers. Spigots in the end member engage sockets in the outer plane rib 612 to locate the tip which is secured by brass screws engaging anchor nuts on the inside of the rib. A pressure head is mounted at each wing tip forward end, the pressure and static lines being secured along the end member. Navigation lamps are fitted under detachable moulded covers outboard of the pressure head. The I.L.S. aerial is fitted centrally in the port tip, and the Glide Path aerial in the starboard, each under a detachable di-electric cover. At the rear of the wing tip, the fuel vent pipe protrudes clear of the main plane, terminating in a downward facing fibreglass tip. A lightning strike arrester is brazed continuously throughout its length to both the vent pipe and the skin panel.

Ailerons (*fig.* 4)

20. Each aileron is in two sections (to allow for wing flexing) joined by a bolt and a pin mounted in self-aligning bearings, the gap between the sections being sealed. Each section consists of a spar, ribs, nose diaphragms and a light channel-section trailing edge, the whole being covered by skin plating; the spar comprises a plate web and lipped angle-section booms, the web being reinforced by doubling plates at the hinge positions. The trailing edge of each aileron inboard portion is fitted with a balance tab, a trim tab (on the starboard aileron only) being carried inboard of the balance tab. For ground locking, the lock lever at Stn. 347 engages a fitting on each inboard section inner rib when the cockpit control is operated (*Sect.* 3, *Chap.* 4, *fig.* 31).

21. The aileron beaks project forward of the nose plating, and comprise skin-covered nose diaphragms, with gaps at the aileron hinge positions. The gap between the beak and the outer plane trailing edge member is closed by a fabric air seal, the attachment at the beak being by means of a frame held by quick-release pins.

22. Each aileron is mounted on four hinges. Three of these are pin joints running in ball bearings supported by formers of the outer plane trailing edge structure, the fourth combining the actuating skew-bar mechanism (*Sect.* 3, *Chap.* 4). Access panels are adjacent to all hinge positions, balance

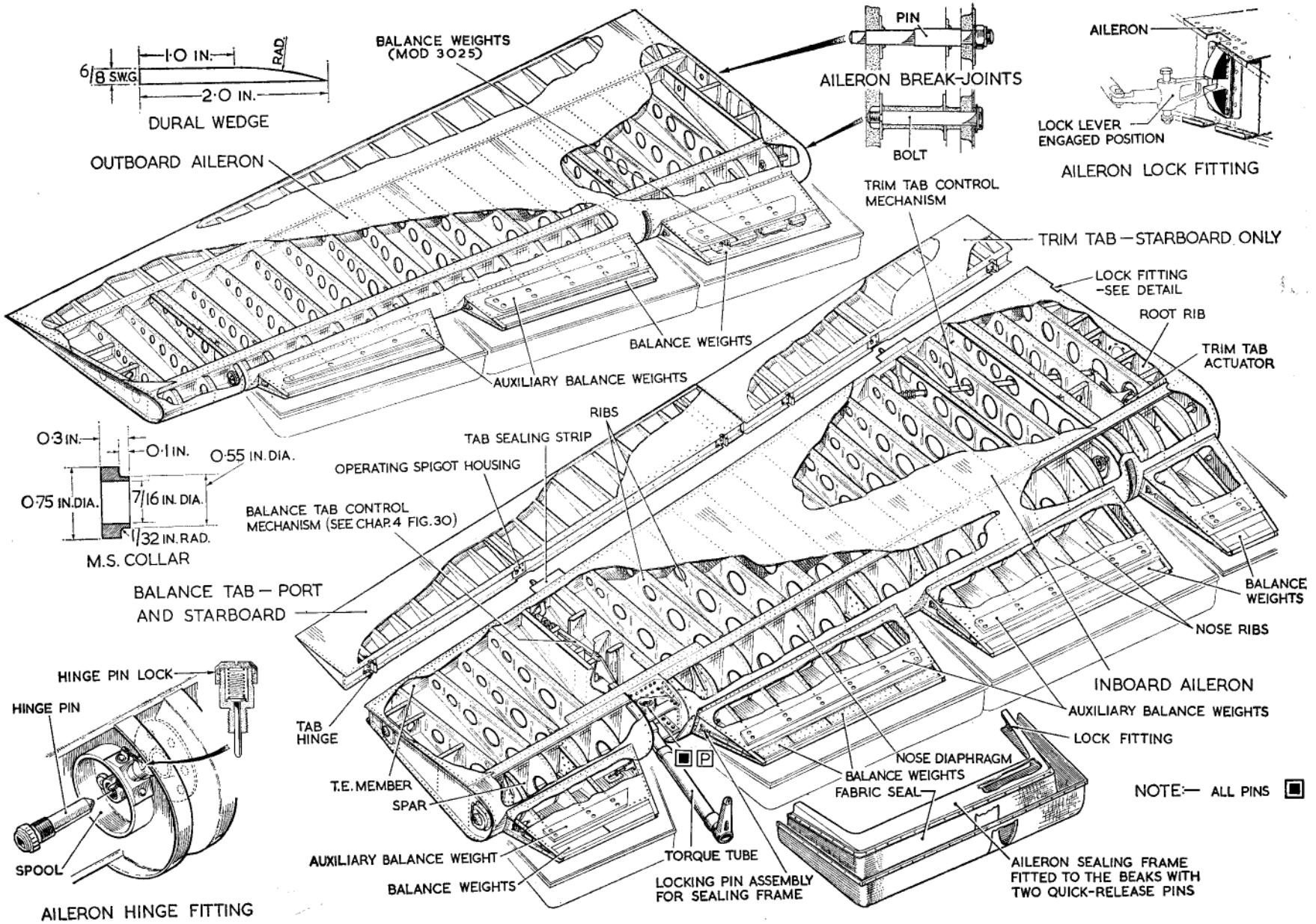

Fig. 4. Aileron

◀ *Further balance weights added, Mod.* 3025 ▶

and trim tab actuating mechanism and the aileron joint bolts.

Flaps (*fig.* 5)

23. Slotted flaps are fitted to the outer plane trailing edge, outboard of the jet pipes and inboard of the ailerons. The main flap spar is a channel-section plate with lightening holes, and vertical stiffeners to which are riveted built-up ribs of Z-section formers with cross channel bracing. The forward flap ribs are flanged plate diaphragms. The forward and main flaps are connected by their end ribs, and by two plate formers extending forward of the main flap nose plating. The actuating mechanism is located in fixed units attached to the outer plane trailing edge and connects with fittings on each flap end rib.

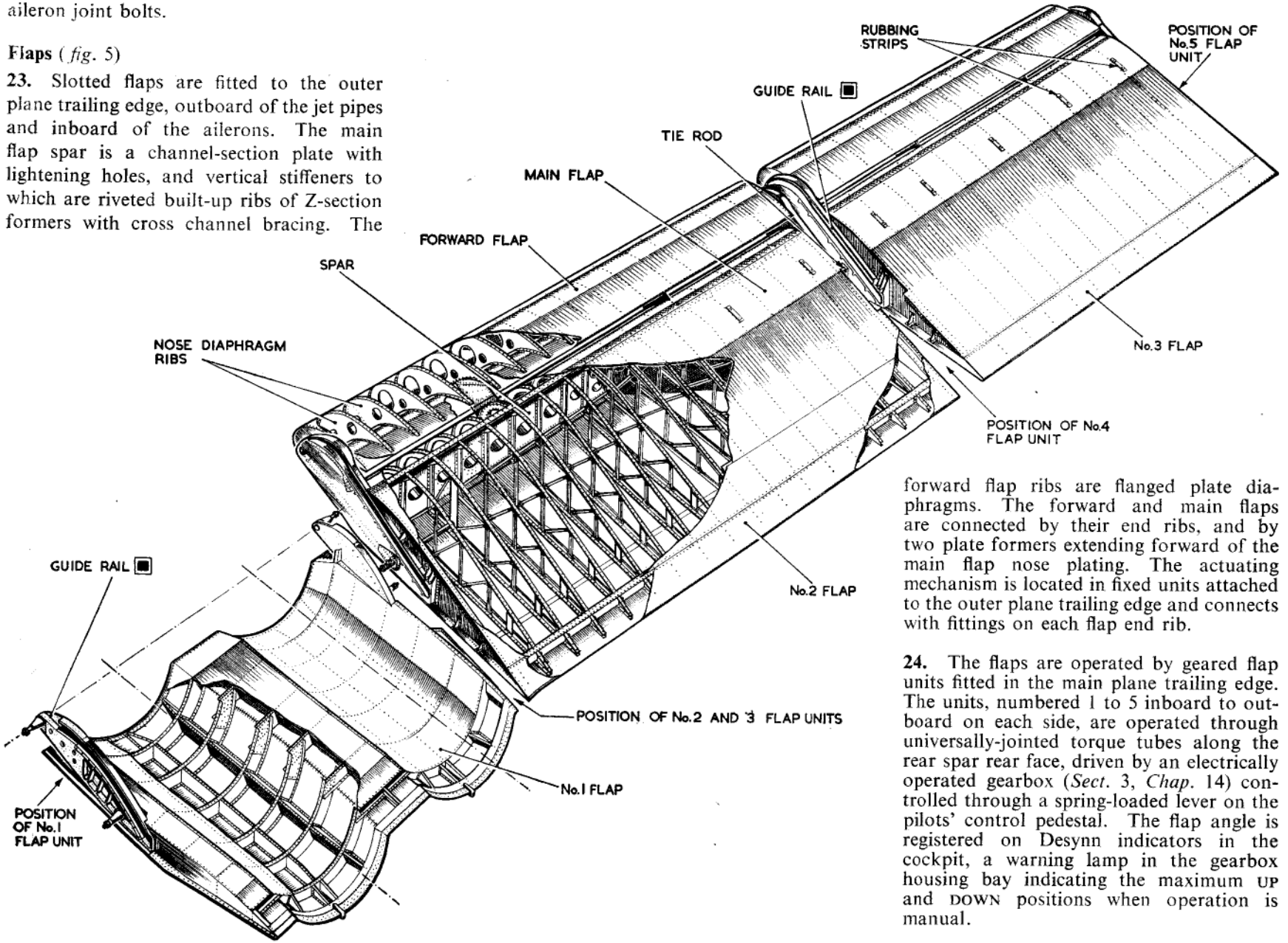

Fig. 5. Flaps structure

24. The flaps are operated by geared flap units fitted in the main plane trailing edge. The units, numbered 1 to 5 inboard to outboard on each side, are operated through universally-jointed torque tubes along the rear spar rear face, driven by an electrically operated gearbox (*Sect.* 3, *Chap.* 14) controlled through a spring-loaded lever on the pilots' control pedestal. The flap angle is registered on Desynn indicators in the cockpit, a warning lamp in the gearbox housing bay indicating the maximum UP and DOWN positions when operation is manual.

25. The flaps are supported by yoke nuts (*Sect.* 3, *Chap.* 4, *fig.* 33) and by rollers, mounted in the main plane trailing edge, running in guide rails at the ends of the

flaps during the first 30 deg. of downward travel. At 30 deg., the rollers leave the guide rail, and the telescopic tie rods reach and lock at their maximum length to act as radius rods, thus giving accelerated downward movement from 30 deg. to the fully-down position. On the main flaps there are access panels at the tie-rod attachment bolt positions, and on the forward flaps at the trailing edge adjacent to the end ribs.

Dive brakes (*fig.* 6)

26. On each outer plane, forward of No. 2 flap, there are four electrically-operated dive brakes, hinged at their leading edges to brackets on the rear spar lower boom. Each dive brake comprises a framework of lipped channel section reinforced with gusset plates, covered externally by and spot-welded to a metal skin which is slotted at each framework bay. The brake operating rods are connected to a screwjack rotated by a motor-driven gearbox, the connection between gearbox and jack being through universally-jointed torque tubes carried in brackets at the rear of the rear spar. Brake operation is controlled through a three-position lever on the pilots' control pedestal. When retracted, the brake is located in an aperture in the outer plane undersurface, plug plates (mounted on brackets and secured to support channels bolted to the aperture boundary members) mating with and sealing the slots in the brake skin. For setting the dive brakes see Chap. 4, para. 92.

Main wheel doors

27. When retracted into the main plane,

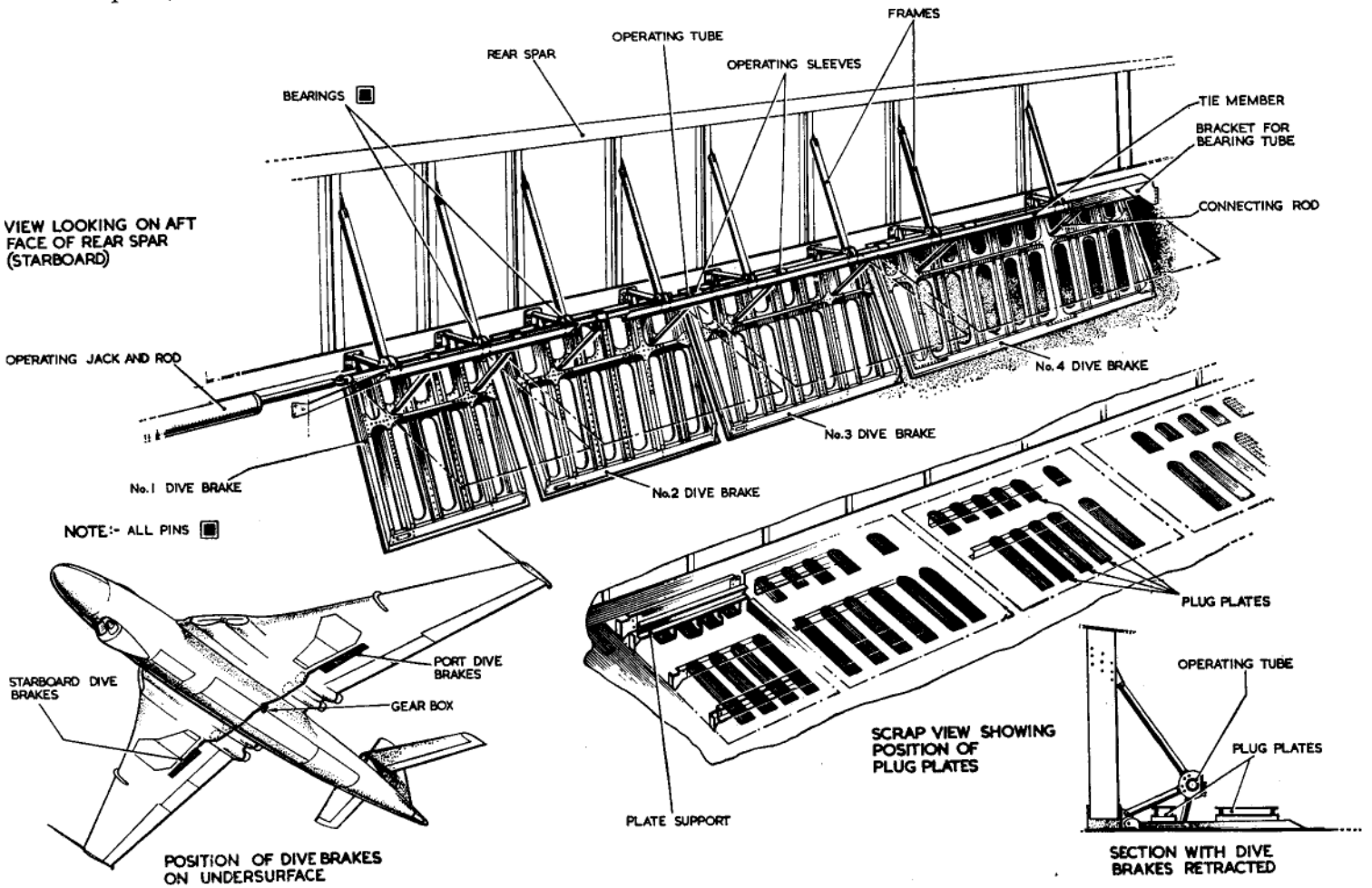

Fig. 6. Dive brakes

each main wheel unit is enclosed by two doors. The outer door, hinged to rib 240, is automatically controlled by an electrically-operated actuator which ensures that the door and wheel unit do not obstruct each other when the alighting gear is operated. When the latter is selected DOWN, movement of the door serves also to release the up-locks (*Chap.* 5, *fig.* 14). The door comprises a framework of Z-section boundary members with channel-section formers, strengthened with angle plates and covered inside and out with a metal skin; on later aircraft the inner skin is of fabricated glass-cloth. The outer skin is reinforced by fluted plating, the inner being dished to give clearance to the main wheels when retracted.

28. The inner door, attached to the undercarriage main struts, is similar to the outer but has no inner skin. A gauze-covered triangular frame built into the outboard forward corner forms the pressure equalizing vent, and at the inboard edge two panels give access to the door flap hinges. The flap movement is controlled by the movement of the undercarriage through levers and control rods.

Explosive bolts

Warning

See the lethal warning notice at the front of this book.

29. Explosive bolts being used in two positions in the main wheel bay, caution is essential when servicing in this area. The bolts, for use only in extreme emergency, are located at the point of attachment of the actuator bracket to the outer door, and at the up-lock attachment structure of the outer plane. In each case warning notices are displayed, firing of the bolts being by selection of a switch, for the appropriate side, marked EXTREME EMERGENCY DOWN.

◀**29A.** Before fitting the electrical detonators No. 108 to the explosive bolts, the lead ends should be twisted together as a safety precaution and the label around each detonator must be removed. After a detonator has been fitted to an explosive bolt it should be checked for freedom of movement by gently pulling the leads and allowing the detonator to return gently to its fully-home position under the influence of the retaining spring. DO NOT allow the detonator to move under spring pressure alone.▶

Fuel tanks (*fig.* 3)

30. Five flexible fuel-cells are fitted in the outer plane bays (*para.* 14), the cells being secured by conical moulded buttons on the cells engaging holes in the plating lining the bays. The plating provides a smooth supporting surface to prevent damage by abrasion.

Landing lamp (*fig.* 3)

31. A retractable landing lamp is fitted to a hinged panel in the bay outboard of the fuel cells, the supporting frame being built into the wing structure and underside panel.

REMOVAL AND ASSEMBLY

Removal of outer plane flaps (*fig.* 8)

32. Slings are provided for removing No. 2 and 3 flaps, the procedure being as follows:—

(1) Lower the flap to the fully-down position.

(2) Remove the skin plugs from the sling attachment sockets which are clearly marked on the top surface.

(3) Attach the spreader bar of the appropriate flap sling (*Table* 1) to the flap by screwing the securing bolts firmly into the sockets. Attach the sling to the spreader bar and tension the sling to take the weight of the flap.

(4) Disconnect the link from the telescopic tie rod.

(5) Unbolt the tie rod from the flap and allow the rod to hang free.

(6) Undo the yoke nut and remove the ball ends (acorns) from No. 4 flap unit.

(7) Lower the flap until the rollers align with the guide rail slots, the rollers then being passed through the slots and the flap removed.

Assembly of outer plane flaps

33. The assembly sequence is the reverse of that given in para. 32, but reference should also be made to Sect. 3, Chap. 4, para. 157, in which the setting-up and adjustment procedure is described in detail.

Removal of inner plane flap

34. For No. 1 flap, the removal procedure is generally similar to that given in para. 32, except that a sling is not used. It is possible to manually support this flap when disconnecting and removing it; alternatively, an adjustable platform can be used to take the weight during removal operations.

Assembly of inner plane flap

35. The assembly sequence is the reverse of that referred to in para. 34, but reference should also be made to Sect. 3, Chap. 4, para. 156, in which the setting-up and adjustment procedure is described in detail.

Removal of ailerons

36. Referring to fig. 7 and 8 respectively for locations of access panels used in aileron removal and details of the aileron sling, proceed as follows:

(1) Remove the panel on the starboard aileron for access to the trim tab actuator, and disconnect the electrical cables to the actuator.

(2) Remove the aileron torque tube lever access panel 15 on the underside of the outer plane.

(3) Disconnect the connecting rod at the rear spar from the lever on the torque tube (*Sect.* 3, *Chap.* 4, *fig.* 30).

(4) Remove the nuts from the four taper bolts securing the lever to the torque tube, withdraw the bolts and remove the lever.

Note . . .

A mild steel collar, made locally to the dimensions given in fig. 4, *will assist in removing the taper bolts.*

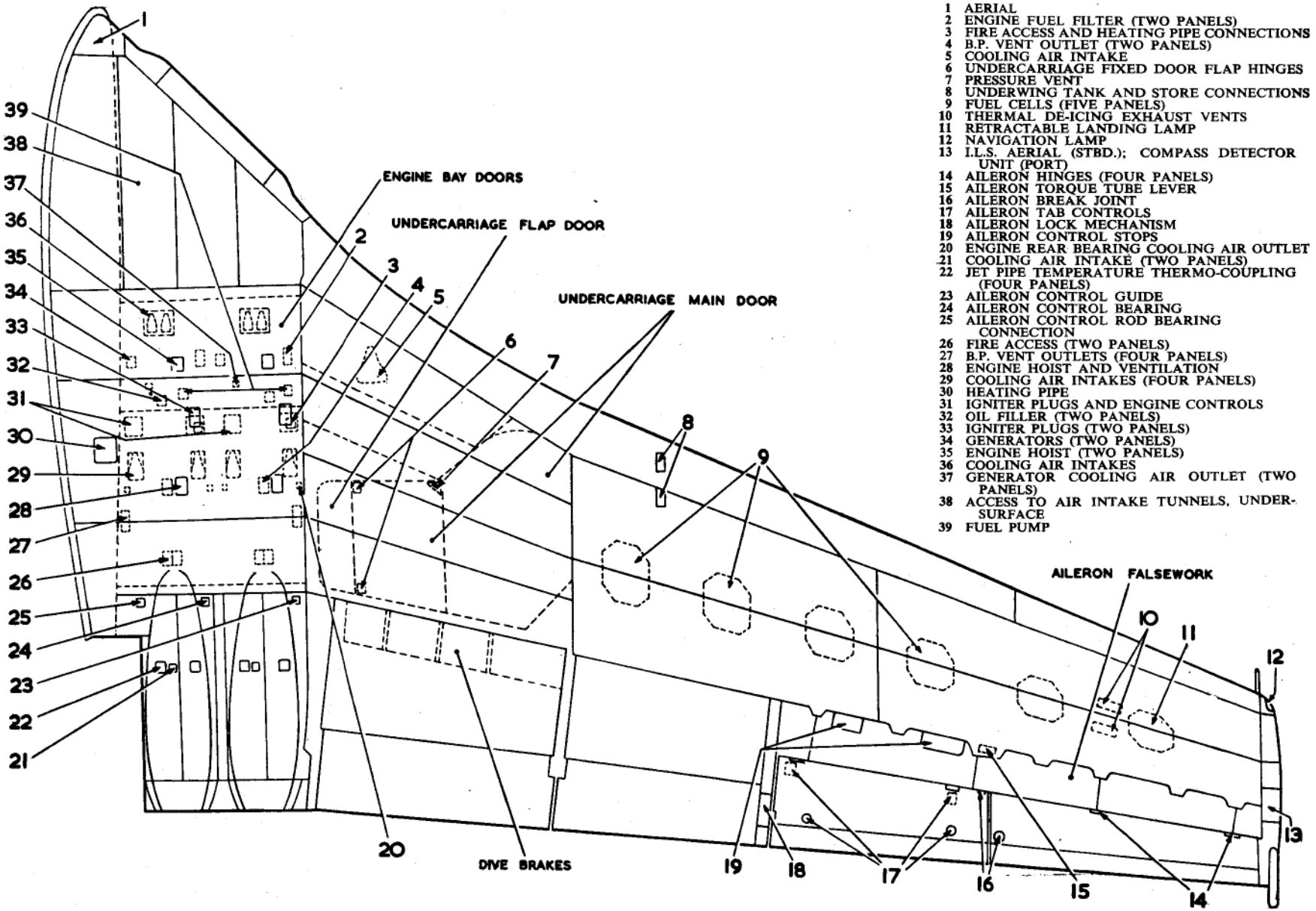

Fig. 7. Access panels

(5) Disconnect the oil pipe from the front bearing. Remove the bolts securing the bearing to the trailing edge diaphragm and withdraw the bearing from the torque tube.

Note . . .

This operation may be assisted by drifting the bearing off the tube by means of two locally-manufactured wedges (fig. 4).

(6) Attach the sling, Ref. No. 26ST/95017, to the aileron slinging points by means of the three eyebolts, and tension the sling to take the weight of the aileron.

(7) Remove the four aileron hinge access panels 14. Remove the locking pins and unscrew the hinge pins.

(8) Partially withdraw the aileron. Through the slots adjacent to the beak end ribs, withdraw the pins securing the beaks to the sealing frames.

(9) Disconnect the oil pipe from the rear bearing. Remove the bolts securing the bearing to the trailing edge member, and withdraw the torque tube together with the rear bearing which must not be disturbed.

(10) Withdraw the aileron from the outer plane.

Assembly of ailerons

37. The assembly sequence is the reverse of that given in para. 36, instructions on setting-up and adjustment being given in Sect. 3, Chap. 4.

Removal of trim and balance tabs

38. Remove the two vertical bolts securing the tab hinge brackets to the aileron trailing edge member, and slide the tab off the actuator spigot.

Removal of dive brakes (*fig.* 6)

39. (1) Select OUT on the cockpit control lever at the left of the control pedestal, and lower the brakes.

(2) At each dive brake, disconnect the two connecting rods by removing the split pins and withdrawing the pins.

(3) Remove the split pins, nuts and washers from the bolts at each hinge attachment to the rear spar, withdraw the bolts and remove the brakes.

Assembly of dive brakes

40. Ensure that OUT is selected on the cockpit control lever before commencing assembly which is a reversal of the procedure given in para. 39. After assembly, operate the brakes several times to ensure that, when fully IN, they fit snugly into the wing profile. Adjustment may be made at each connecting rod by slackening the lock nut and adjusting the rod length as required.

Removal of wing tip

41. (1) Remove the brass screws securing the detachable panel in the top skin, and remove the panel.

(2) Remove the adjustable clip securing the vent pipe joint between wing tip and outer plane.

(3) Remove the aerial cover and disconnect the plug from the aerial unit.

(4) On the port wing tip only, disconnect the cable from the terminal block adjacent to the compass detector unit.

(5) Remove the brass screws securing the wing tip to the outer plane rib at Stn. 612, and withdraw the tip until its boundary member spigots are clear of the outer rib sockets.

Assembly of wing tip

42. The assembly sequence is the reverse of that given in para. 41. Where a new tip is to be fitted refer to Vol. 6, Part 1, Chap. 3, fig. 47.

Removal of engine forward and rear doors

43. When only the forward door is to be removed, it will be unnecessary to remove the undercarriage fixed door. When removing the rear door, the flap of the fixed door will foul the engine door if not first removed. To remove the doors proceed as follows:—

(1) Remove the undercarriage fixed door and flap by disconnecting the linkwork at the flap, and removing the four bolts securing the fixed door to the undercarriage unit. Carefully note the positions of any shims, in order that unaltered settings are assured on reassembly

(2) From the inner plane upper surface over rib 45·28, remove the panels giving access to the hoist channels.

(3) Unreel sufficient cable from the hoist, Ref. No. 26SR/95134, to pass through rib 45·28 and the engine door. Press upwards the spring-loaded doors, situated centrally in the undersides of the engine doors, until they engage the spring-loaded catches. Thread the hoist cable ball ends through the passages at rib 45·28 and the engine door, until the balls hang clear of the door outer surface. Fit the hoists to the sockets exposed by removal of the access panels.

(4) Fit the spreader plates, Ref. No. 26SR/95206, to the hoist cables, and tension the cables. Remove the hoist operating handles.

(5) Remove the door securing bolts, and lower the door by operating the hoist brake levers, carefully squeezing the levers to obtain smooth controlled movement. To avoid damage and preserve surface finish, place the door in a component stowage rack, Ref. No. 4G/5634, until required for re-assembly.

(6) Remove the spreader plates, fit the hoist crank handles and wind in the cables. Remove the hoists from the sockets.

Removal of undercarriage outer door

44. With the undercarriage lowered, proceed as follows:—

(1) Ensure that the electrical supply from both batteries is switched off at the port console in the cockpit.

(2) Ensure that external electrical supplies are disconnected at the external ground supply point.

(3) Disconnect the electrical wires to the explosive bolts at the junction box adjacent to the actuator upper bracket in the wheel well.

Note . . .

When disconnected, the two leads from each bolt should be shorted together as a safety precaution before removing a bolt, if this is necessary. Access to the bolts, which secure the actuator fitting to the door, is through two panels in the door inner skin adjacent to the fitting.

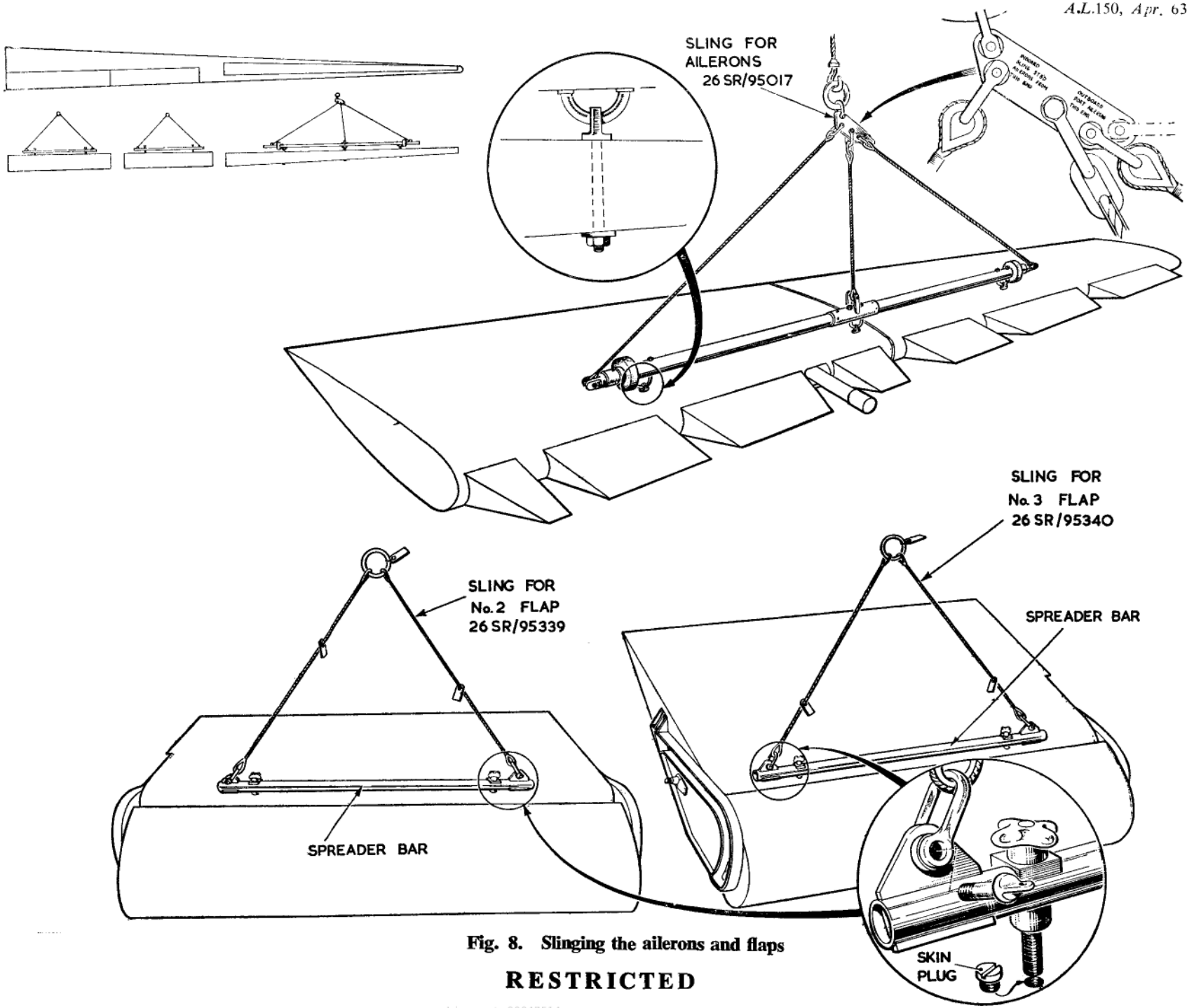

Fig. 8. Slinging the ailerons and flaps

(4) With the door supported at its free edge, remove the nuts, washer and bolt securing the actuator to the door.

(5) Remove the nut and bolt, and disconnect the up-lock spring box attachment at the door.

(6) Remove the nuts and bolts securing the two outer hinges of the door.

(7) With the weight of the door supported by suitable equipment, or manually (two men), disconnect the centre hinge and lower the door.

Assembly of undercarriage outer door

45. The assembly sequence is the reverse of that given in para. 44, followed by a check to ensure that the doors close correctly, and any necessary adjustment of the actuator limit switches. These are housed in the ram casing, the IN limit switch at the fixed end and the OUT limit switch at the other end of the casing, each being enclosed by a cover plate. The IN switches are set to cause the door to be strained ◀upwards against the stops after the latter have been adjusted to inset the door to the wing profile 0·05 in. for pre-Mod. 2202 aircraft or 0·25 in. for post-Mod. 2202 aircraft, measured between the door surface and the wing outer skin at the door forward edge. The main and emergency OUT limit switches are adjusted to give 75 deg. minimum door opening, i.e., a clearance of 0·75 in. between the down-coming wheel and the door (see also Sect. 3, Chap. 5, para. 49 and fig. 15).▶

46. Actuators are supplied with ram length adjusted and limit switches set. Where adjustment is necessary, the contact block may be moved in the direction required after releasing the retaining screw; after adjustment the screw must be tightened and wire-locked. When fitting a new door, the limit switch should be set out initially and progressively adjusted to give the desired setting. The shaped rubber pad at the door centre hinge position should be secured to the tray with a suitable Bostik adhesive. It must be a snug fit and clear the heads of the tray attachment bolts and rivets. With the door fully open the actuator must only lightly touch the pad. If necessary the pad must be shaped locally to clear protrusions on the actuator so that there is no undue pressure. Movement of the door controls the release of the undercarriage up-lock.

◀Undercarriage outer door adjustment

46A. To adjust the undercarriage outer door proceed as follows :—

(1) With the door disconnected from the actuator, set the adjustable door stops to inset the door to the wing profile, 0·05 in. pre-Mod.2202 or 0·25 in. post-Mod.2202.

(2) Adjust the door warning light microswitch so that the warning light comes on when the door forward edge is 0·06 in. below the outer plane skin line.

(3) Connect the actuator to the door and, with the door closed, stretch a line between the stop pads on the door and measure the distance between the line and the door skin inboard edge at the actuator centre line.

(4) Adjust the actuator IN limit switch progressively until a prestrain of 0·65± 0·05 in. is obtained, i.e., until the original measurement has been reduced by this amount.▶

Removal of outer plane (fig. 9 and 10)

47. In preparation for removal, remove the screwed plugs from the upper surface slinging positions at Stn. 168 and 293, lower the spreader bars into position and screw in the attachment bolts. The main planes must be trestled on each side after jacking; refer to Sect. 2, Chap. 4 for details of equipment and methods of use. Proceed as follows :—

(1) Remove the air-intake bottom fairing panel.

(2) Remove the engine doors (para. 43).

(3) Drain all fuel from the side to be removed.

(4) Jack at the main jacking points until the wheels are clear of the ground. Position steady beams and jacks (Sect. 2, Chap. 4).

(5) Disconnect the engine bay cooling louvre operating cable at rib 93.

(6) Remove the outboard engine (Sect. 4, Chap. 1).

(7) Remove the outboard and top sections of the engine cell plating, and the cell front and rear bulkheads.

(8) Remove the outboard air-intake tunnel.

(9) Remove the access panels under the front and rear spar joints.

(10) Attach the slinging beam and tension the sling.

Note . . .

If it is necessary to adjust the balance during removal, sandbags should be used.

(11) Remove the undercarriage outer door (para. 44).

(12) Disconnect the flap and remove the undercarriage fixed door (para. 43 (1)).

(13) Remove the undercarriage (Sect. 3, Chap. 5).

(14) Remove the outer engine air-intake fairing, aft of the front spar.

(15) Disconnect the leading edge anti-icing duct at the break joint.

(16) Remove the butt strap around the leading edge, and the top surface butt strap extending back to the front spar.

(17) Remove the flaps (para. 32 and 34).

(18) Remove the screws in the top surface plating between and over the spars.

(19) After ensuring that all electrical supplies are disconnected, disconnect the electrical wiring at the wing break panel in aircraft to Mod. 1785 standard where it is in the outer plane adjacent to rib 93. (In aircraft to Mod. 1835 standard, in-line crimp connections replace the wing break panel and will be found in the outboard intake bay, accessible with the fairing removed). To disconnect, the cable should be severed outboard of the crimp to ensure that the cable runs retain identification. When remaking the joint, the crimp can be removed. At the original wing break panel in the intake bay, there are also several plugs for miscellaneous services which must be disconnected.

(20) Remove the top surface stringer cleat bolts. On the two front and rear bolts it is only necessary to remove the nuts and cap washers from the outboard side.

(21) Disconnect the dive brake control rod.

(22) Disconnect the aileron control rod.

(23) Disconnect the flap control rod.

(24) Disconnect the aileron lock rod.

(25) Disconnect and blank off the fuel pipes.

(26) Disconnect and blank off the nitrogen pipe.

(27) Disconnect and blank off the hydraulic pipes.

(28) Disconnect and blank off the pressure head lines at the rear spar.

(29) Remove the bolts (18 front, 16 rear) securing the inner plane spar webs to rib 93.

(30) Remove the top and bottom false-work over the outboard jet pipe.

(31) Unlock the tab washers and remove the nuts and cup washers from the $\frac{7}{16}$ in. bolts (2 front, 2 rear) projecting from the outer plane rib.

(32) Remove the joint pins from the top and bottom spar joints at both spars.

Note . . .

*Mod. G.E.*2809 *introduces extractors Pt. No.* 70679 *Sht.* 997 *and* 1005 *for the removal of the spar joint pins* (*para.* 48).

(33) Withdraw the outer plane and lower on to suitable trestles.

(34) Remove the slinging equipment.

Note . . .

Where the outer plane is to be transported after removal, the wing tip, aileron and flap units must also be removed (*Vol.* 6, *Part* 2, *Leaflet C.*7).

Removal of outer to inner plane spar joint taper bolts

48. Special extractor equipment Pt. No. 70679, Sht. 997 and 1005, together with spanners as listed in Table 1, are provided for the withdrawal of the spar joint taper bolts; for details of the equipment refer to fig. 8A. When removal of the upper front spar central bolt necessitates the use of the extractor, clearance for the extractor block must be made by removing part of the top-hat section Pt. No. 66703-753N.D., on the intake fairing structure. (Vol. 6, Part 1, Chap. 3, fig. 55 refers). The removal procedure is as follows:—

(1) Before using the extractor, treat as follows:—

(a) Degrease all threads and bearing surfaces with Trichlorethylene.

(b) Rub molybdenum disulphide into these surfaces with a clean felt pad.

(c) Smear on anti-scuffining paste (D.T.D.900/4248) and assemble the extractor for use.

Note . . .

Keep treated surfaces clean and, to avoid contamination when not in use, store parts in a clean linen bag.

(2) Assemble the extractor 70679 Sht. 1003 so that the faces of Pt. No. 5787 and 5791 are flush when Pt. No. 5789 is screwed to within 0·10 in. of Pt. No. 5787 (*fig.* 8A); the assembly is then ready for use. If the surrounding structure prevents this assembly being used on its own, the extension outer sleeve 5803 and bolt extension 5805, which together convert the assembly 70679/1003 into assembly 70679/1005, must also be used.

(3) The method of bolt extraction is similar whichever extractor is used, the only difference being in the fitting of the assembly. The assembly 70679/1003 is screwed directly on to the taper bolt until the flush faces of Pt. No. 5797 and 5791 are in contact with the face of the spar; when using assembly 70679/1005, the bolt extension 5805 is first screwed on to the taper bolt, the extension outer sleeve is placed over it so that its inner face is in contact with the spar face, and assembly 70679/1003 is then screwed on to the bolt extension until the flush faces of Pt. No. 5787 and 5791 are in contact with the outer face of the extension outer sleeve.

(4) To extract the centre taper bolt, hold the large nut 5787 stationary with spanner HRW426 or OSW226 and turn the extracting bolt 5789 in a counter-clockwise direction, using spanner HRW422 or OSW222; apply shock load to the small end of the taper bolt if necessary.

Note . . .

These extractor assemblies are also to be used in conjunction with assembly 70679/997 *should this be necessary.*

(5) Having extracted the centre taper bolt, insert in its place a bolt A25-56U whilst extracting the inner and outer bolts. After loosening either one of these bolts, leave the loosened bolt in position to take the torque whilst extracting the other.

TABLE 1

List of extractor components (*fig.* 8A)

Ref. No.	Part No.	Description	Remarks
	70679-5735	Block	
	70679-5739	Bolt	
	70679-5741	Sleeve nut	
	70679-5763	Washer	
	70679-5803	Extension outer sleeve	
	70679-5805	Bolt extension	
	70679-5811	Flanged nut	
	70679-5813	Packing washer	
	70679-5865	Washer	
	70679 Sht. 1003	Bolt extractor	(Comprising Pt. No. 5787, 5789, 5791)
	A25-56U	Bolt, $\frac{7}{8}$ in. dia.	
1L/206	HRW422	$1\frac{1}{2}$ in. B.S. ring spanner	
1L/374	HRW426	$1\frac{3}{4}$ in. B.S. ring spanner	
1L/-	HRT538	Tube handles	
1C/207	OSW222	$1\frac{1}{2}$ in. B.S. spanner	Alternative to HRW422
1C/7040	OSW226	$1\frac{3}{4}$ in. B.S. spanner	Alternative to HRW426

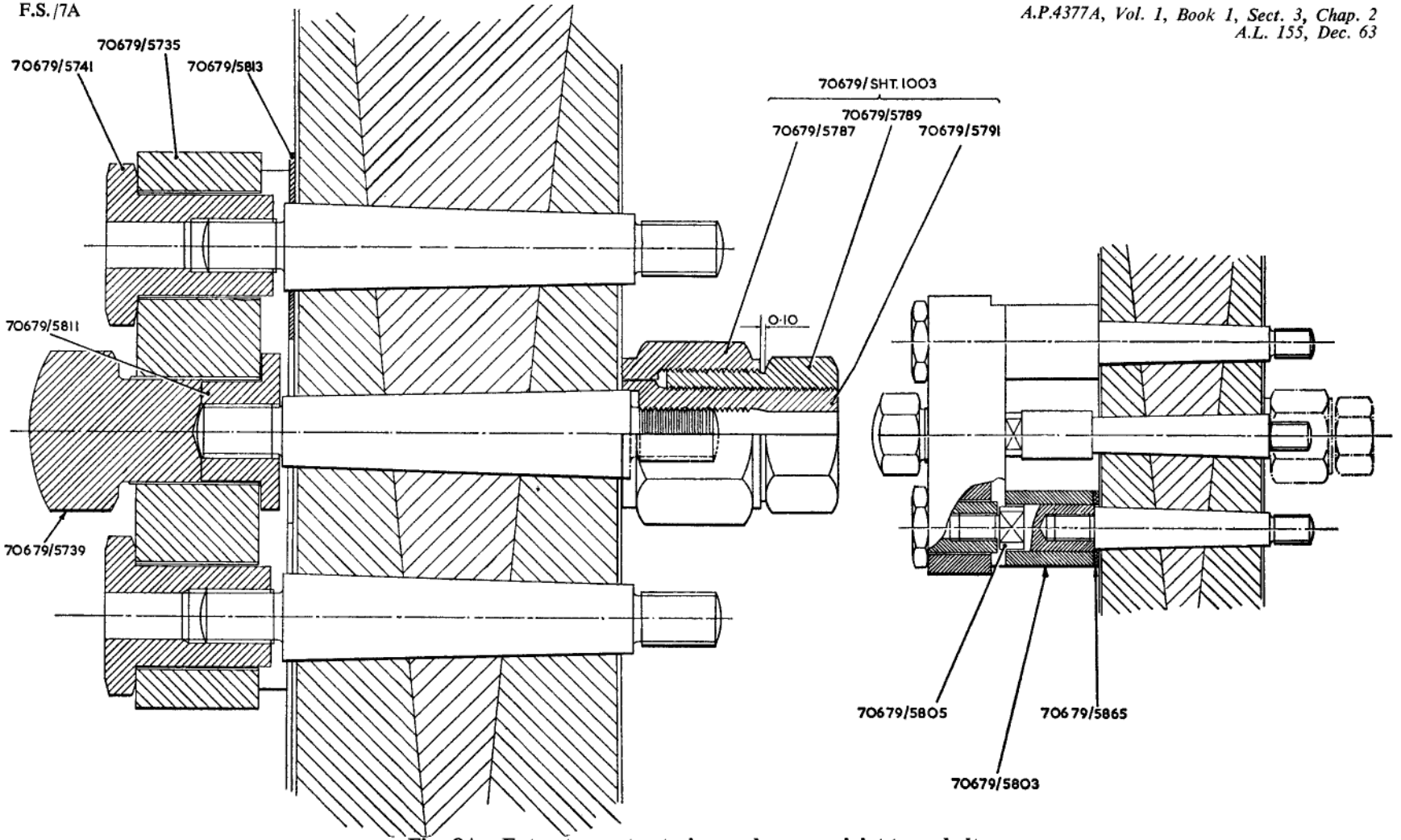

Fig. 8A. Extractor, outer to inner plane spar joint taper bolts

TABLE 2
Servicing and general equipment

Ref. No.	Part No.	Description	Remarks
26SR/95206	67479-2097	Plate, hoisting	For engine doors
26SR/95135	67479 Sht. 93	Tripod, hoist mounting	For installing engine doors and actuators
26SR/95134	A/21/61/2	Hoist, Minilift, 450 lb.	
26SR/95339	67479 Sht. 747	Sling, No. 2 flap	
26SR/95340	67479 Sht. 749	Sling, No. 3 flap	
26SR/95017	67479 Sht. 9	Sling, aileron	
26SR/95133	67479 Sht. 225	Sling, outer plane	
26SR/95276	67479 Sht. 491	Sling, inner plane	
4G/5634	—	Trolley, stowage, aircraft components	

Assembly of outer to inner plane

49. The assembly sequence is the reverse of that given in para. 46, with the addition of a blueing check on the joint pins to ensure a 90 per cent bearing area. For details of the check and of fitting a new outer plane refer to Vol. 6, Part 2, Leaflets C.7 and C.8.

Removal of inner plane

50. For information on removal and replacement, refer to Vol. 6, Part 2, Leaflet C.9.

◀ **Removal of guide vanes and spraymat heaters**

51. Disconnect the spraymat heater electrical cable at the junction box and attach a pilot line to the cable end to assist in feeding back the cable during reassembly. Remove the special bolts securing the vertical guide vane feet to the air intake skin, and the screws and Avdel rivets securing the horizontal vane to the air intake division. Extract the guide vanes from the intake in a forward direction, at the same time easing the spraymat electrical cable through the slot in the intake skin and anti-icing plating.

Assembly of guide vanes and spraymat heaters

52. The assembly sequence is the reverse of that given in para. 51. The screws securing the guide vanes at the air intake leading edge are to be locked with varnish (Ref. No. 33H/179 or 175). Whenever the screws are removed or are found loose during servicing they are to be coated with similar varnish before being replaced. ▶

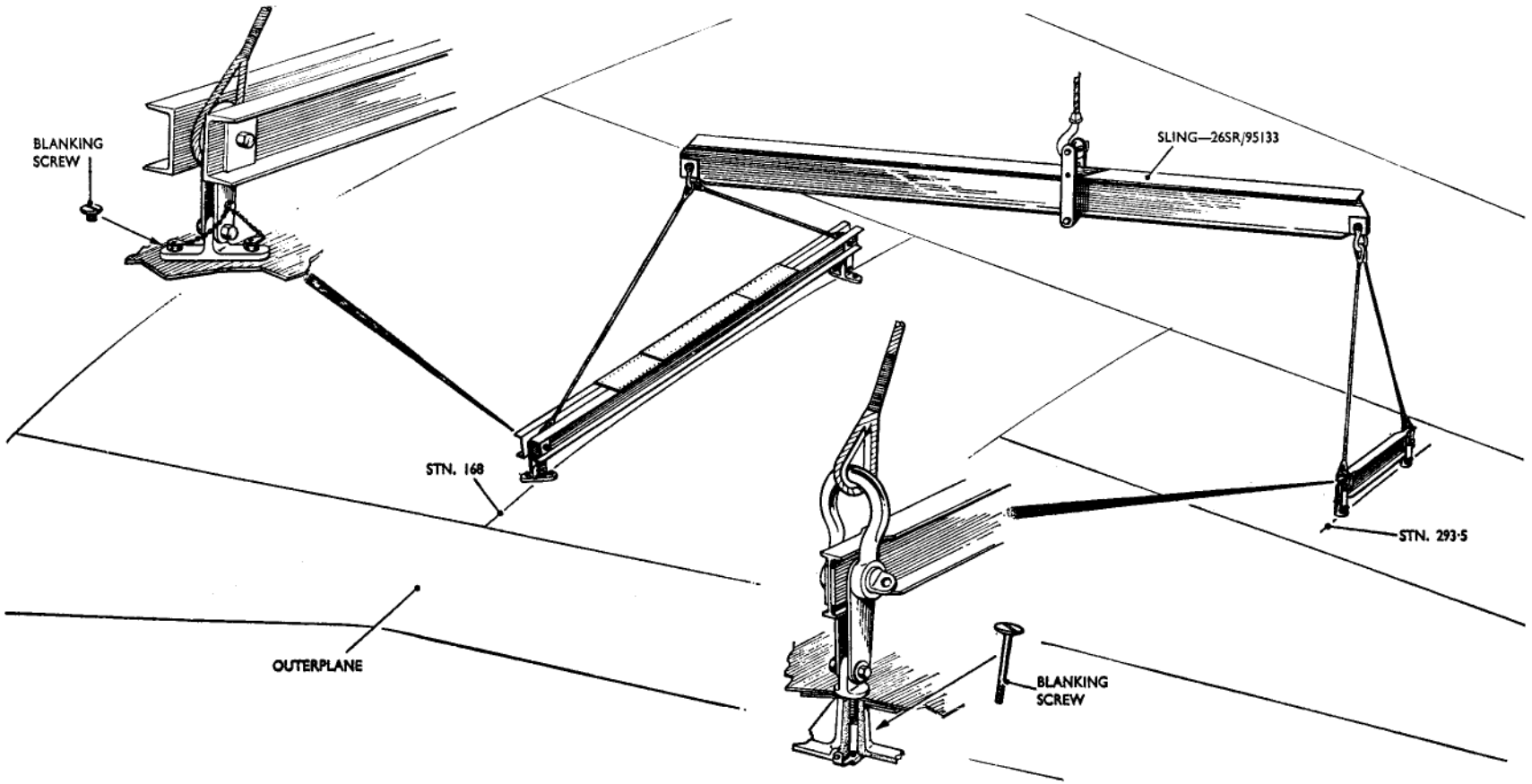

Fig. 9. Outer plane sling

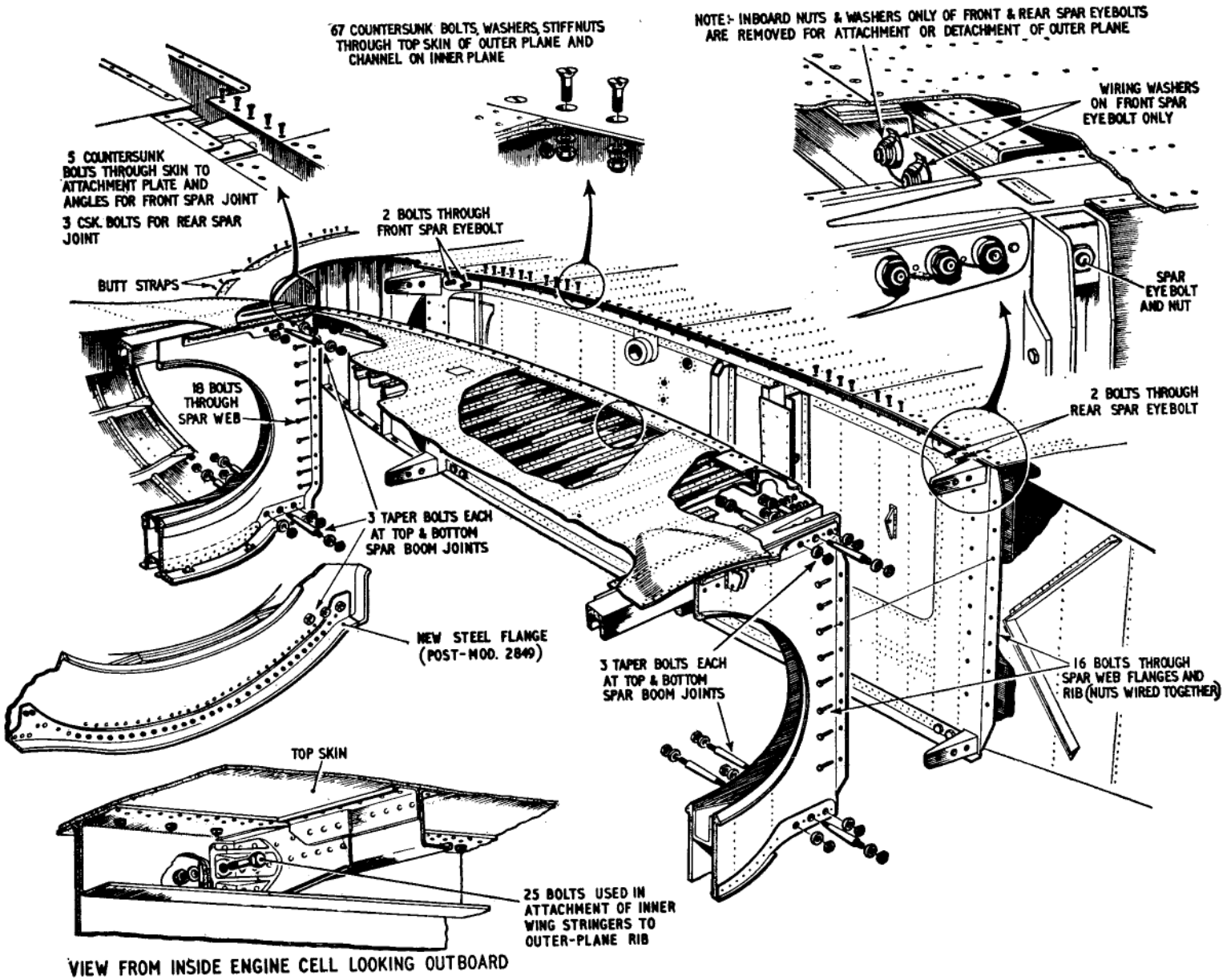

Fig. 10. Outer-to-inner plane joint

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