

Chapter 3 TAIL UNIT
(Completely revised)

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DESCRIPTION AND OPERATION

General

1. The tail unit comprises two tail booms, twin fins and rudders, and a single tail plane and tab. The tail booms are cantilevered from the main plane stub booms; the rudders and interposed tail plane are attached to the fins, which are built integrally with the rear of the tail booms. A pivoting skid and shock-absorber unit is fitted

to the undersurface of each boom at the rear end to prevent damage should the tail touch the ground. The components of the tail unit are shown in fig.1.

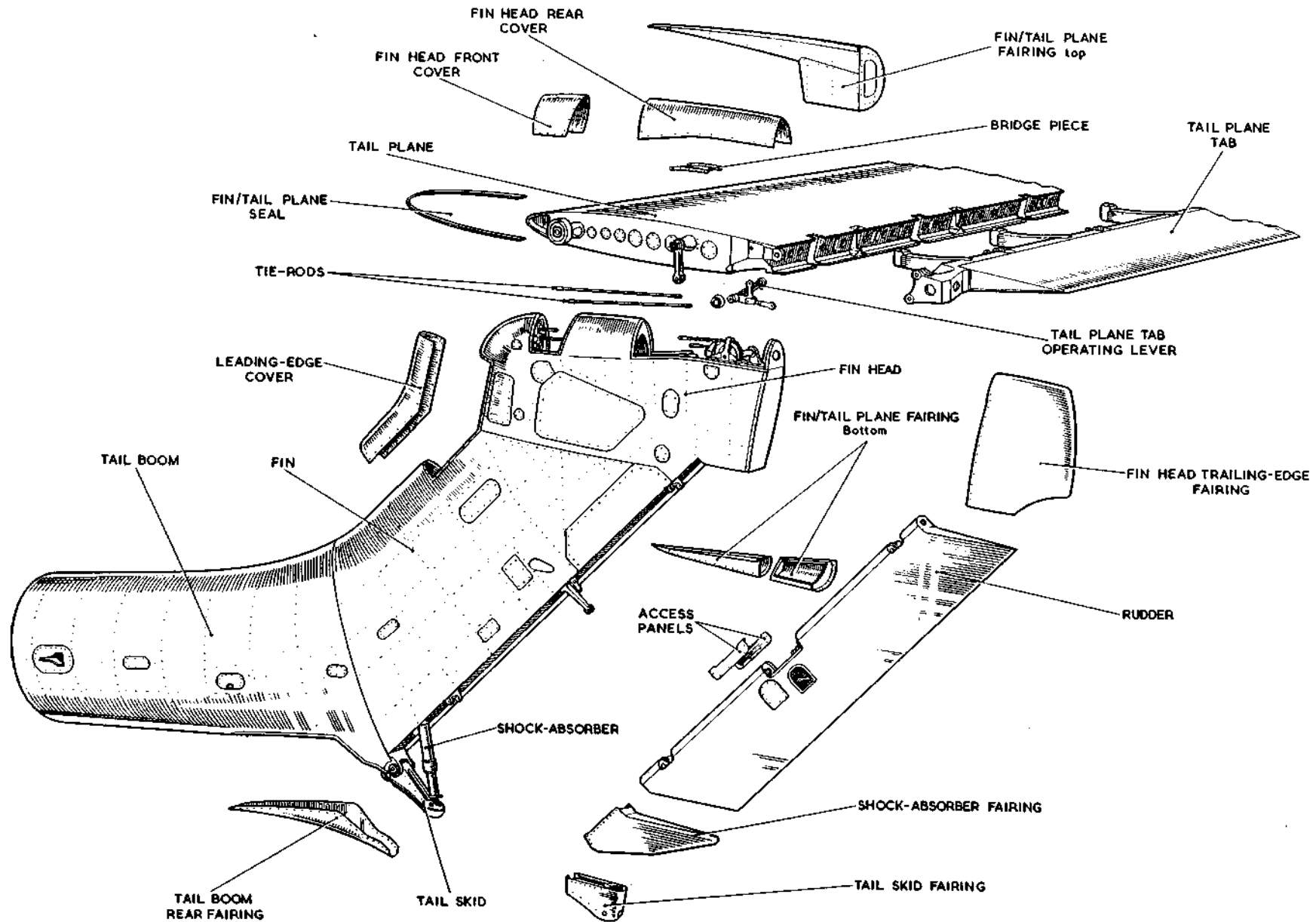
Tail boom and fin (fig.2)

2. Each tail boom is an oval section light alloy structure consisting of a series of frames to which the skin covering is riveted. The skin is reinforced by stringers and reinforcing plates. A T-section forging is riveted

to the forward face of the boom and forms a joint ring for attachment to the stub boom on the centre section.

3. The fin structure is an integral part of the tail boom, and consists of rear spar on which are mounted ribs covered by a skin reinforced by stringers. The upper part of the fin structure houses the tail plane mountings and operating mechanism which are supported on the fin main rib and

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Fig. 1 Tail unit components

◀ Access panels added ▶

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reinforced with further diaphragms and ribs. Mod.1055 introduces reinforcing patch plates on the inboard side of the fins at the intersection points of ribs and stringers.

4. The tail boom and tail skid fairings are made from 12 S.W.G. steel sheet to withstand the effects of touching the arrester wires when deck landing.

Rudder (Fig.2)

5. Each rudder consists of a spar to which are attached ribs and the rudder hinges. The skin is machined to a varying thickness; in general the thickness at attachment points is 0.060 in., and in the areas in between it is reduced to 0.025 in.

6. A trim tab, which is set on the ground at a pre-set angle (Sect. 3, Chap. 4) is attached to the trailing edge of the rudder.

7. The rudder has no built in mass-balance; the balance is achieved by a mass-balance on the end of the actuating arm as described in Sect.3, Chap.4.

8. Mod.700 introduces stops which are bolted to the fin skin just aft of the aperture in the skin which accommodates the balance weight. These stops prevent skin damage when the rudder is moved to full travel with full trim during ground checks.

Tail plane

9. The tail plane consists of two channel-section spars to which the

main, nose and trailing edge ribs are riveted. The ribs are cut away to permit the stringers which are Redux bonded to the skin to run unbroken across the tail plane. The machined skin is riveted to the ribs between the stringers. When mod.1112 is embodied, reinforcing angle plates are fitted to the rib flanges where they are riveted to the skin.

10. The tail plane pivot bearing casting and rear attachment casting are fitted to the main outer rib of the tail-plane. A bearing is fitted to the bearing casting and is housed in the fin head structure forming the tail plane pivot point. The rear attachment casting transfers the movement of the tail plane control unit to the tail plane.

11. The attachment brackets for the tail plane tab hinges are attached to the tail plane rear spar.

12. The operating mechanism, adjustment and setting, are described in Sect. 3, Chap. 4.

Tail plane tab (Fig.3)

13. The tail plane tab structure consists of a single channel-section spar to which light-alloy ribs are attached. The whole is covered by a machined skin of varying thickness; in general the attachment points are 0.06 in. thick and the areas between are reduced to 0.025 in.

14. Mass balance weights are attached to arms which project forward from the tab spar, and fit into apertures in the tail plane.

15. The operating mechanism and setting are described in Sect.3, Chap.4.

SERVICING

General

16. The servicing of the tail unit is confined to the rigging and lubrication of the flying controls given in Sect.3, Chap.4, and checking the tail unit rigging and drain holes given in Sect. 2, Chap.4.

17. All bearings of the control surfaces are lubricated on assembly with grease, XG-295.

18. Slings are provided to lift the tail plane, and the tail boom and fin (Item E 5 and E 6, Sect.2, Chap.4). Fig. 4 shows the method of attaching the slings.

REMOVAL AND INSTALLATION

General

19. In the following paragraphs the item numbers of access panels refer to the key numbers of Fig.6 and 7, Sect.2, Chap.4.

20. It is essential that the correct bolts are fitted when the access panels are refitted. The plain lengths of the bolts are marked on the panels or on the adjacent structure, and when mod.1135 is embodied, the part num-

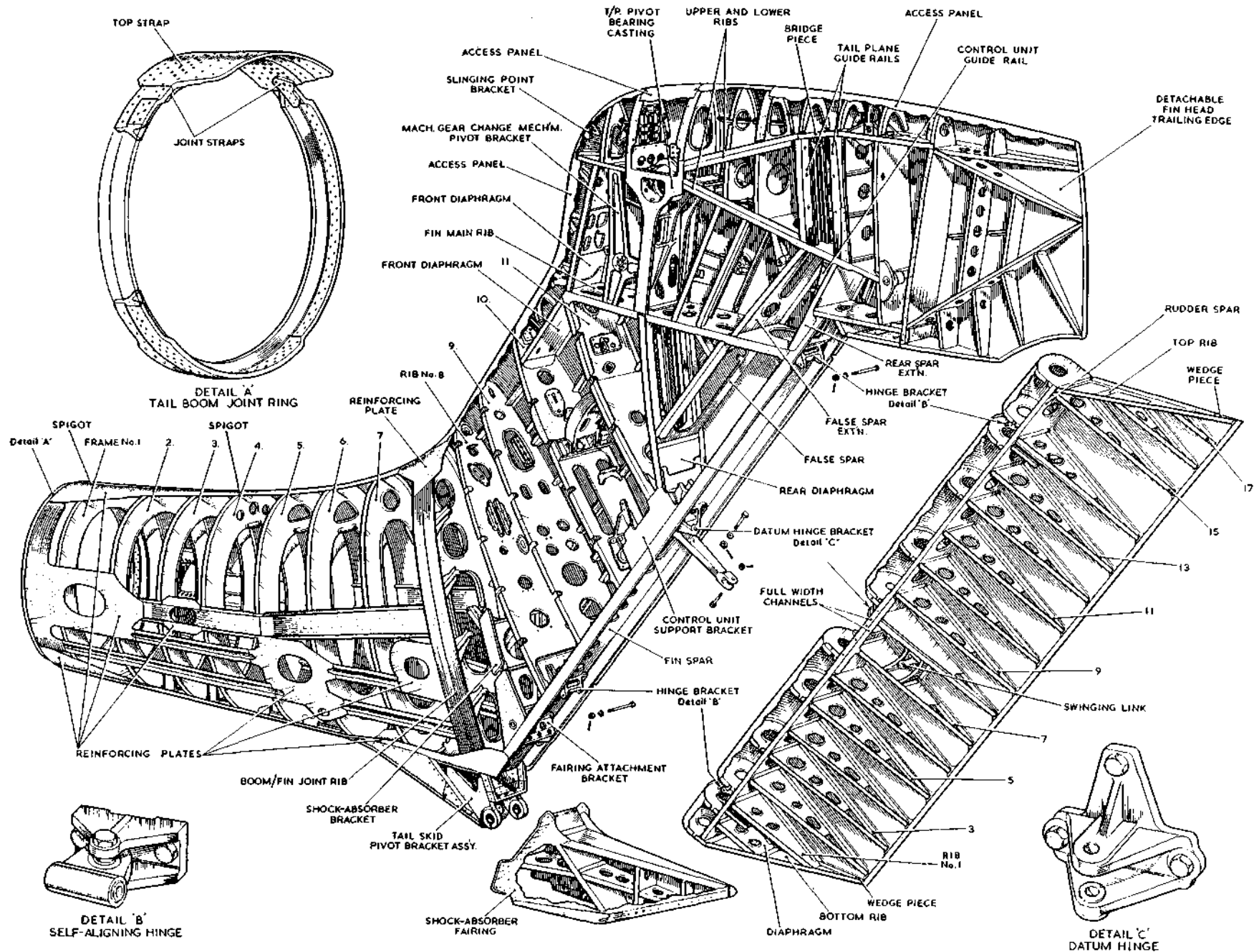


Fig. 2 Tail boom, fin and rudder structure

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ber of the bolt is marked on the tail trim unit panel (No.40) to show where special bolts are fitted.

21. During removal of components carefully note the position of bolts, shims, etc., and methods of locking to ensure that they are refitted in a similar manner.

TAIL PLANE TAB (Fig. 3)

Removal

22. Remove the tail plane tab as follows :-

- (1) Remove the access panels from the port and starboard bottom tail plane fairings (Item No. 129), and then remove the bottom and top tail plane fairings from the tail plane on both sides.
- ◀ (2) Release the hydraulic pressure as detailed in Sect.3, Chap.6. Connect a hand pump rig to the ground test points. Raise the tail plane to the fully up position by moving the control column aft whilst slowly applying hand pump pressure; cease pumping immediately the control column reaches its aft limit.
- (3) Disconnect the tail plane track member connecting-rods from the tab operating levers by removing a bolt from each lever.
- (4) Disconnect the bonding cable between the tab and the tail plane.
- (5) Disconnect the four self-aligning hinge brackets by removing the bolts from the hinge brackets of the tail plane.

(6) Support the tab in a suitable manner and withdraw the special bolts from the datum hinge castings on both sides; care must be taken to retain the shims fitted to the starboard hinge.

(7) Lower the tab clear of the tail plane.

- ◀ (8) Lower the tail plane by the hand pump to the neutral position, and disconnect the hand pump rig. ▶

Installation

23. The installation of the tail plane tab is the reverse of the removal; note the following details: -

- (1) The tab is located transversely by the port datum hinge. With this hinge bolted up, check that the mass balance arms are symmetrically disposed in their cut-aways in the undersurface of the tail plane. The clearance on the sides should be 0.080 in. to 0.20 in.
- (2) Check the gap at the starboard datum hinge and fit shims to a maximum of 0.1 in.
- (3) Check the shroud clearances; with the tab in the neutral position, the clearances should be 0.035 in. top and bottom. With the tab 30 deg. up this may increase to 0.140 in. at the top and 0.125 in. at the bottom.
- (4) Check the tab profile alignment; the maximum into or out of wind measurement is 0.040 in. on the top

surface and 0.035 in. on the bottom surface.

(5) Check the tab for smooth operation, and rig the tab in accordance with instructions given in Sect.3, Chap.4.

(6) Ensure that the metal at the bonding point is clean, assemble the joint with anti-oxidant paste, D.T.D. 5503 (Ref.No.33C/1402), clean off the excess paste with trichlorethylene (Ref.No.33C/547), and finally paint the connection with blue paint, D.T.D.827 (Ref. No. 33B/1076).

TAIL PLANE (Fig.1, 2 and 3)

Removal

24. To simplify the removal of the tail plane, remove the tab, as described in para.22; all the following components are to be disconnected or removed from the port and starboard finheads, unless otherwise stated, to allow removal of the tail plane: -

- (1) Remove the seals from over the outer ribs of the tail plane, the front and rear fin head covers and the access panels from both sides of each fin head; also remove the detachable sections at each end of the tail plane shroud.
- (2) Slacken and disconnect the tab operating tie-rods.
- (3) Remove the bridge pieces from over the cross-head tracks which are secured by nineteen $\frac{1}{4}$ in. B.S.F.

bolts; the method of wire-locking the heads of these bolts should be noted.

(4) Attach the tail plane sling (Item E6, Sect. 2, Chap. 4) to the rear slinging points only, in this instance, the two centre hinge brackets, as shown in Fig. 4, detail 'C' and support the tail plane by overhead tackle.

(5) Remove the control unit head greaser bolt and inner race from the tail plane operating link and radius rod assemblies, accessible through the panels, (Item No. 16 and 44). Hoist the tail plane to the fully UP position. Temporarily reconnect the radius rod to the actuator eye-end.

(6) Disconnect and remove the tab operating lever (Sect. 3, Chap. 4, Fig. 22). The long arm of the lever is secured by a bolt to its bearing housing, accessible through the detachable section of the shroud, and the bearing of the shorter arm is housed within a bridge fitting attached to the outer rib of the tail plane and secured by a bolt; withdraw the lever from the roller in the track member, and rotate the roller to remove it from the track member.

(7) Slacken and release the rudder balance cable from the operating levers in the fins, accessible through the panels, Item No. 21 and 123.

(8) Remove the rudder balance

cable pulley mountings, accessible through the panels (Item No. 20 and 124), by unscrewing $\frac{1}{4}$ in. B.S.F. and 2 B.A. skin bolts from the outboard fin skins. Dismantle the pulley assemblies and remove the cable; attach strings to the ends of the cable and pull them into the tail plane through the access panels in the underside of the tail plane.

(9) Disconnect the bonding cables between the tail plane and the fins, and the electrical cables to the navigation lights in the port fin head (Sect. 5, Chap. 1).

(10) Remove the cable guards from the pulley assemblies on the tail plane pivot bearing casting; slacken off the tail plane operating cables at the compensator unit, accessible through the panel (Item No. 17) in the starboard fin, and disconnect these cables between the pulley assemblies and the compensator unit and the gear change mechanism in the port fin, accessible through the panel, Item No. 124a. Attach strings to the cable ends and pull the cables into the tail plane through access holes underneath it.

(11) Remove the cross-head bolts, accessible through the panels (Item No. 15 and 43), raise the tail plane and disengage the cross-head block complete with spherical bush and sliding blocks, (Sect. 3, Chap. 4, Fig. 13) from the rear attachment casting.

(12) Unbolt and remove the tail plane pivot bearing caps secured by eighteen $\frac{1}{4}$ in. B.S.F. and two $\frac{1}{2}$ in. B.S.F. bolts. The tail plane must be raised to an approximately vertical position to permit the removal of eight skin bolts, which secure each bearing cap to the inboard skin; three of the interior bolts are fitted head uppermost.

Note...

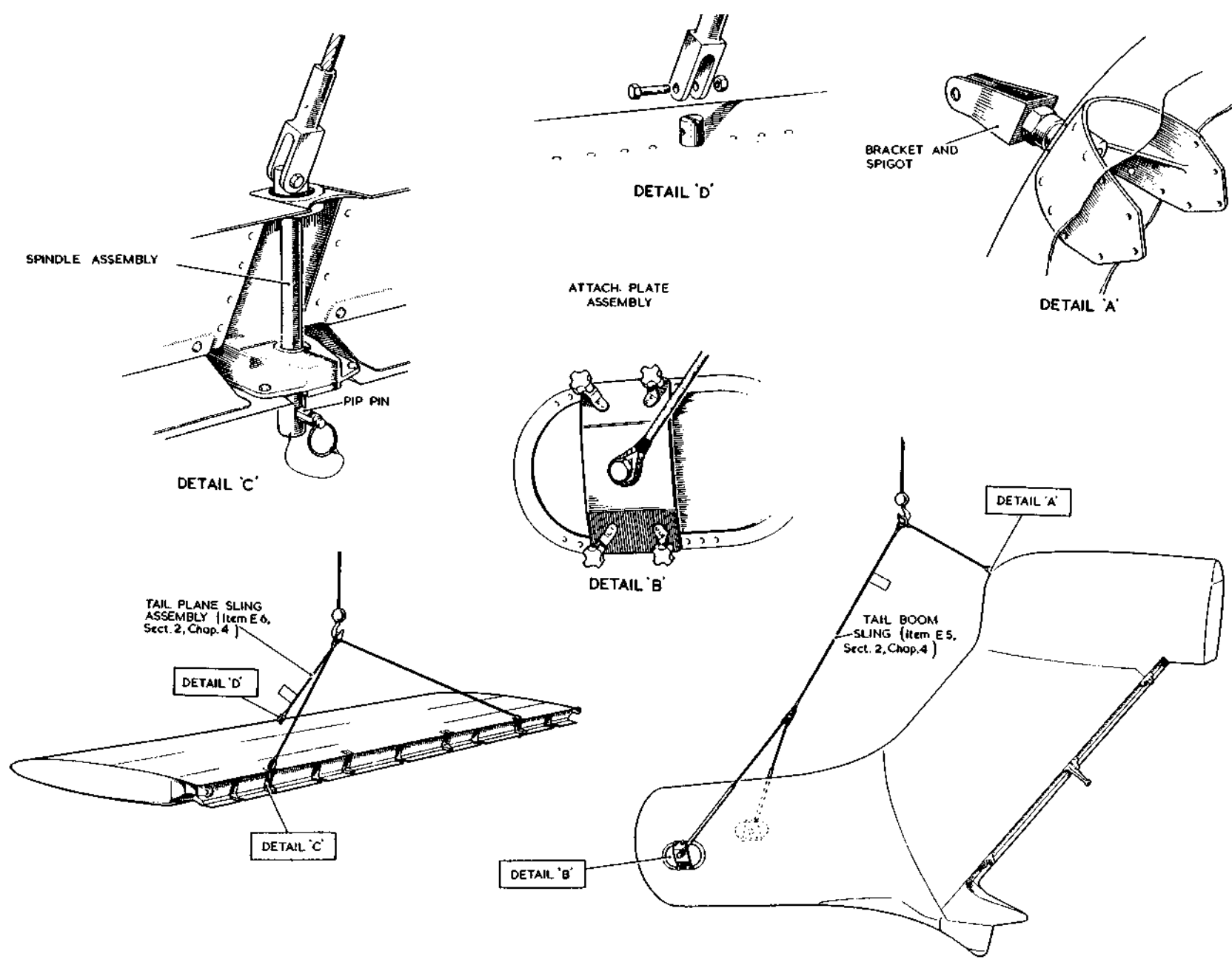
The pivot bearing caps and housings are matched components and it is most important that the caps are not lost or damaged, since to replace a complete bearing assembly entails the complete dismantling of the fin head.

(13) Check that all disconnections have been made and that the controls are clear of the fins; lift the tail plane clear of the fins and lower carefully.

Installation

25. The installation of the tail plane is the reverse of that given in para. 24 for the removal of this component. It is important that the following details receive attention before and during installation :-

(1) Before offering up the tail plane, lubricate all bearing surfaces with grease, XG-295; these bearings are the main pivots, the control unit head inner races, the cross-head blocks and their spherical bearings and slides, and the tab operating lever rollers. The tracks for the cross-head assembly and the tab lever rollers also must be lubri-



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Fig. 4 Tail plane, tail boom and fin slinging

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cated and the components must be free to rotate and/or slide.

(2) Remove all loose objects, such as nuts and pieces of locking wire, from the fin heads. If possible, X-ray the tail plane to be assembled for the presence of similar objects.

(3) Check that the control cables, the bonding cables and electrical cables are undamaged, and that guide strings are attached to their ends. Care must be taken not to kink the cables when they are drawn through into the fin heads.

Note...

The tail plane operating cables cross over within the tail plane between the pulleys on the port ribs No.4 and the pivot pulleys on the port side. When mod. 983 is embodied, ensure that the cables run correctly over the slotted fairlead bolted to the port rib No.3. To ensure that the cables are run correctly, check that an eye end comes off the rear pulley on the starboard side, and a fork end of the rear pulley on the port side.

(4) Bolt down the pivot bearing caps using the $\frac{1}{2}$ in. bolts only. Then check the tail plane for free movement and a clearance of 0.3 in. \pm 0.015 in. between the tail plane skin and the fin heads throughout the normal range of movement, before fitting seals and fairings. Finally, finish bolting down the bearing caps.

(5) Note that the cross-head block journals are off-set when inserting

the assembly in the rear attachment castings; (the centre line of the rear journal is inboard of the front journal centre line); manipulate the sliders into their tracks and bolt up when the tail plane is in the fully down position.

(6) Use bullets, diameters 1.021 in. and 0.749 in., to assist the entry of the inner races and greaser bolts respectively, when connecting the control unit head to the radius rods and operating links.

(7) When the tail plane has been installed, tension and rig the rudder balance, tail plane and tab control systems in accordance with instructions given in Sect.3, Chap.4.

(8) When the access panels are re-fitted, ensure that the bolts are of the correct length, to avoid fouling the various control mechanisms. The plain lengths of the bolts and Part No. of special bolts will be stencilled on the appropriate panel of all post Mod.532 and 1135 aircraft.

(9) Ensure that the metal at the bonding point is clean, assemble the joint with anti-oxidant paste, D.T.D.5503 (Ref. No. 33C/1402), clean off the excess paste with trichlorethylene (Ref. No. 33C/547), and finally paint the connection with blue paint, D.T.D.827 (Ref.No.33B/1076).

RUDDER

Removal

26. Remove a rudder as follows:-

(1) Remove the rudder centre hinge and actuating arm access panels (Item Nos.126A and 127 port rudder, or 131 and 132 starboard rudder).

(2) Remove the actuating arm attachment bolt.

(3) Disconnect the bonding flex at the centre hinge.

(4) Remove the nuts from the horizontal hinge bolts at the top and bottom hinges, and the vertical bolt at the centre hinge.

(5) Support the rudder, remove the hinge bolts and lift the rudder clear of the fin.

Installation

27. Installation is the reverse of removal, but the following points must be noted :-

(1) Ensure that the self-aligning ball races, hinge and control mechanism are adequately lubricated during assembly using grease, XG-295.

(2) The shroud clearance must be between 0.10 in. and 0.20 in. up to 20 deg. rudder movement; from 20 deg. to full travel the clearance can decrease to 0.07 in.

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