

## Chapter 3      TAIL UNIT

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#### Introduction

1. This chapter contains a general description of the tail unit, together with

the servicing information necessary to maintain the structure in an efficient condition. Illustrations showing the method

of slinging and dismantling the structure into its major components are also included.

### DESCRIPTION

#### General

2. The tail unit (*fig. 1*) consists of a conventional fin, rudder, tail plane and elevator assembly mounted on the lower fin structure, which is an integral part of the rear fuselage. An anti-buffet fairing, mounted to the rear

end of the fin structure, extends aft between each half of the elevator just below the rudder. The incidence of the tail plane may be varied in flight by an electric actuator. The elevators have a power assisted control, consisting of a hydraulic booster jack, to

facilitate control at high speed, and the rudder incorporates a small electrically-operated trimming tab. The lower part of the fin structure is described in Chapter 1 of this Section, and the tail plane, elevator and rudder controls in Chapter 4.

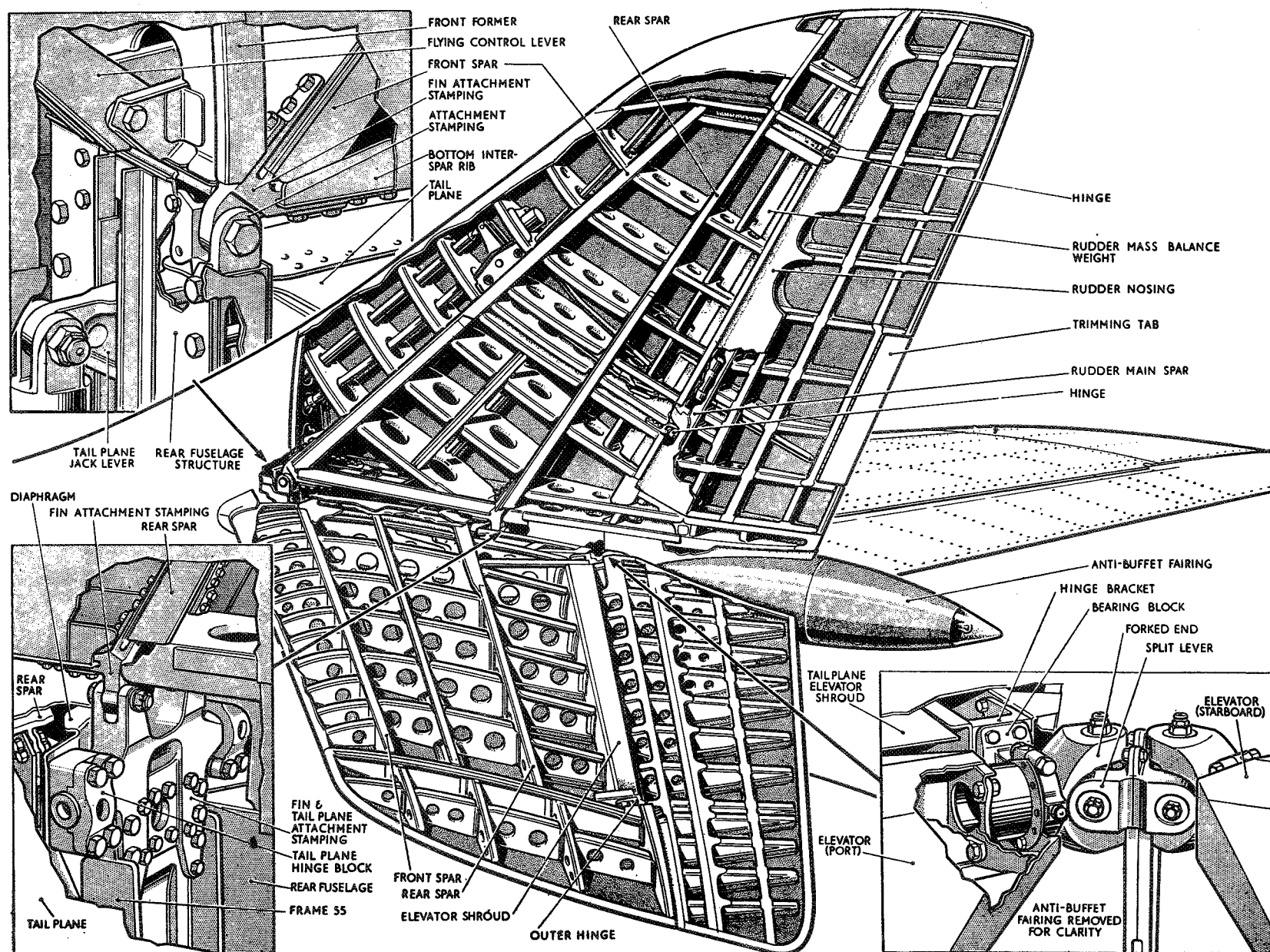


Fig. 1. Tail unit

**Fin**

3. The fin is constructed in two portions, the lower portion being an integral part of the rear fuselage structure. The upper fin consists of front and rear spars, nose ribs, inter-spar ribs and a rudder shroud, the complete structure being covered with a light-alloy skin. The rudder shroud structure, aft of the rear spar, carries the two rudder hinges and the top leading edge tip of the fin is detachable and contains the suppressed aerial for the I.F.F. installation.

**Fin attachments**

4. The upper fin is mounted to the lower fin and rear fuselage structure by fittings bolted to the front spar, inter-spar bottom rib and rear spar, which engage with further fittings carried at the top of frames 52 and 55. The front attachment fitting consists of two forked eye-ended stampings which are bolted to the front spar and bottom inter-spar rib of the fin structure. These fittings engage with fork-ended stampings which are bolted to the top of frame 52, and the assembly is secured by special bolts. The rear attachment fitting consists of two forked eye-ends which are bolted to the rear spar and bottom inter-spar rib, one on each side of the centre-line. These fittings engage with twin fork-ends at the top of a large attachment stamping bolted to frame 55 and the assemblies are secured by special bolts. The stamping, bolted to frame 55, incorporates a trunnion on each side of which the tail plane pivots.

**Rudder**

5. The rudder is hinged to the upper fin structure at two points and consists of a main

spar, sub-spars, nose ribs, main ribs and a trailing edge section. The structure, which is strengthened by stiffeners, is covered with a light-alloy skin and incorporates distributed mass-balance and a small trimming tab. The hinge blocks and operating lever are bolted to the main spar and the mass-balance weights project forward on brackets attached to the rudder nosing, which is formed by the main spar and the nose ribs. The trimming tab is located in the lower trailing edge on a piano type hinge and is operated by a small electric actuator bolted to the forward face of the main spar.

**Tail plane**

6. The tail plane is an all-metal cantilever structure of swept-back design, which is constructed in one piece and provided with variable incidence control. Basically it consists of front and rear spars with nose ribs, inter-spar ribs and tail ribs, together with an elevator shrouding; the complete assembly being covered with a light-alloy skin. The unit is anchored at the front spar to an electrically-operated actuator and hinged at the rear spar on trunnions at the top of frame 55. Operation of the actuator thus raises or lowers the leading edge to provide the variable incidence control. The elevator shroud structure carries the inner and outer hinges for each elevator.

**Tail plane attachments**

7. The tail plane is mounted to the lower fin and rear fuselage structure by fittings bolted to the front and rear spars. The forward fitting consists of a large lever which is bolted to the forward face of the front spar centre section member at the centre-line

rib and anchored at its forward extremity to the extensible shaft of the incidence controlling actuator situated in the lower fin structure between frames 51 and 52. The rear fittings consist of hinge blocks secured to mounting blocks which are bolted to the tail plane rear spar and hinge ribs on each side just outboard of the centre-line rib. These hinge blocks pivot on trunnions projecting from each side of the fin and tail plane attachment stamping bolted to the top of frame 55.

**Elevators**

8. Each elevator consists of a main and sub-spar, together with nose ribs, inter-spar ribs, tail ribs and a trailing edge member, the complete structure being covered with a light-alloy skin additionally strengthened by a top and bottom stiffener. The main spar carries the outer hinge, together with the inner hinge and interconnection assembly. The outer hinge (*fig. 8*) consists of an adjustable ball race mounted in a bearing block bolted to the tail plane structure. The inner hinge and interconnecting assembly (*fig. 1 detail and fig. 9*) consists of a fork-end bolted to the inner extremity of the spar, which pivots in a split bush type bearing carried in a block and cap assembly bolted to the tail plane structure. The elevators are interconnected by a split lever bolted to the fork-ends of the interconnecting assembly to form a universal joint and operating lever, which is in connection with the hydraulic booster jack unit via a control tube. The nosing, between the inner and outer hinges, is filled internally with lead to form a distributed mass-balance.

**SERVICING**

systems, which are described in other chapters of this volume. The structure, access panels and fasteners should, however, be examined

in a similar manner to that described in Chapter-2 of this section, and reference should be made to Chapter 4 for the recommended

**General**

9. In general little servicing is necessary to the tail unit apart from the servicing of the

procedure for rigging and setting the control surfaces.

#### Lubrication

10. It is necessary to lubricate the tail plane pivots when replacing or fitting a new tail plane, as indicated on fig. 10, otherwise the only lubrication necessary is that required for the control surface hinges and operating gear which is described in Chapter 4 of this section.

### REMOVAL AND ASSEMBLY

#### General

11. The removal of the fin, rudder, tail plane and elevators is illustrated in fig. 2 to 13 inclusive, the procedure being given in the keys to the illustrations. In general, the assembly of the components is a reversal of the removal procedure, but where there is any special assembly feature it is covered in the key to the illustration concerned.

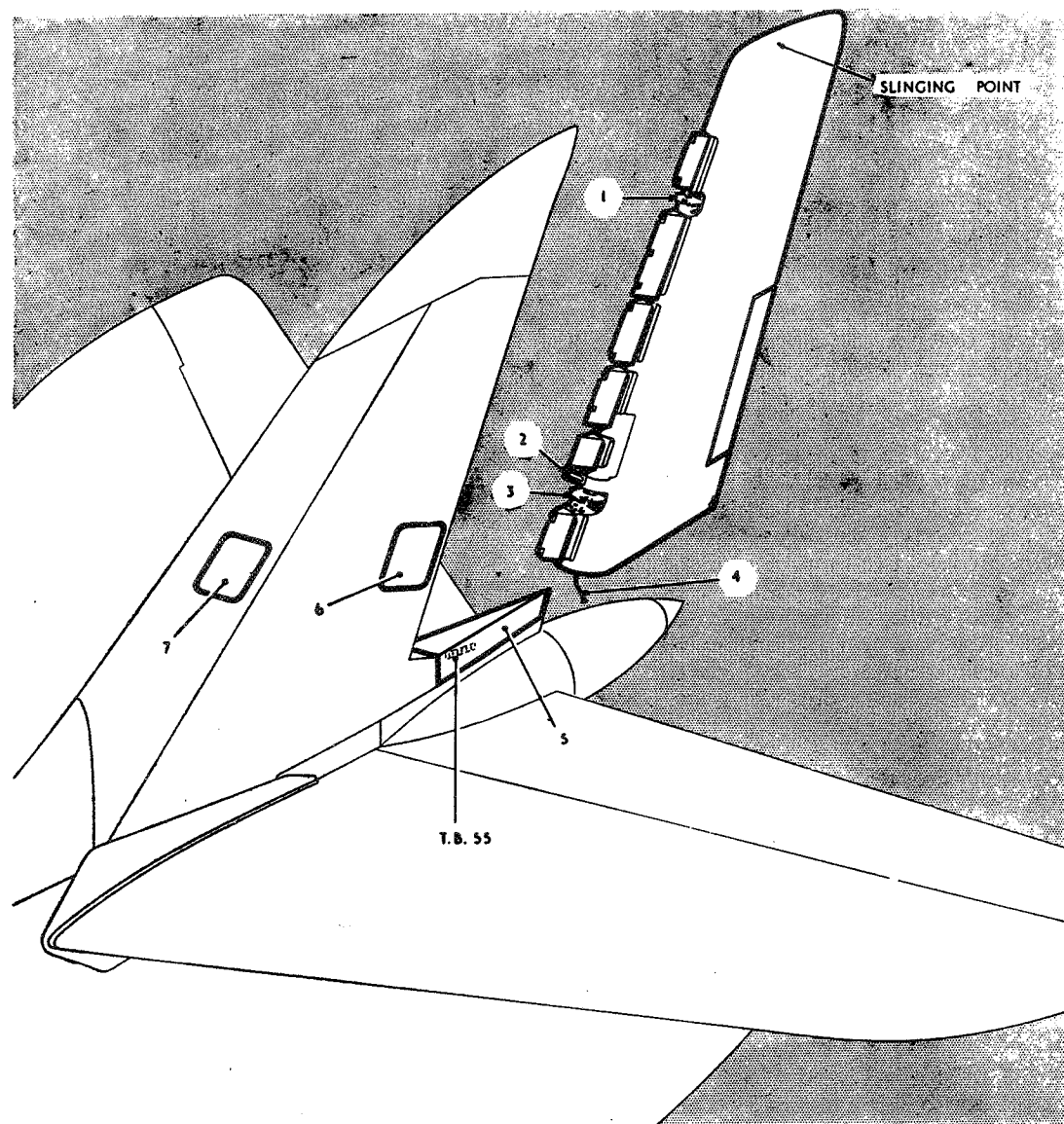


Fig. 2. Removal of rudder

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# **REMOVAL OF RUDDER (fig. 2)**

Remove the access panels (7) port and star-board in the fin and disconnect the Bowden cable from the trim tab at the transmitter.

Remove the port access panel (6) in the fin, pull the Bowden cable through the duct and unloop.

Remove the rear end detachable portion of the fin (5) and disconnect the cable (4) from the trim tab actuator at terminal block No. 55.

Remove the bolt from the rudder lever

connection (2) (*detail fig. 3*) on the star-board side of the rudder.

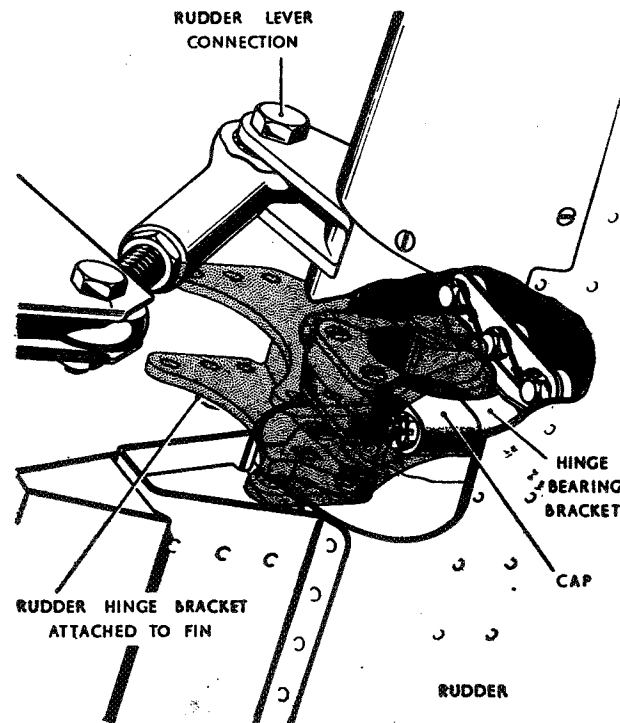
Attach the sling (*fig. 4*).

Take off the two nuts and remove the bearing cap at the top hinge (1).

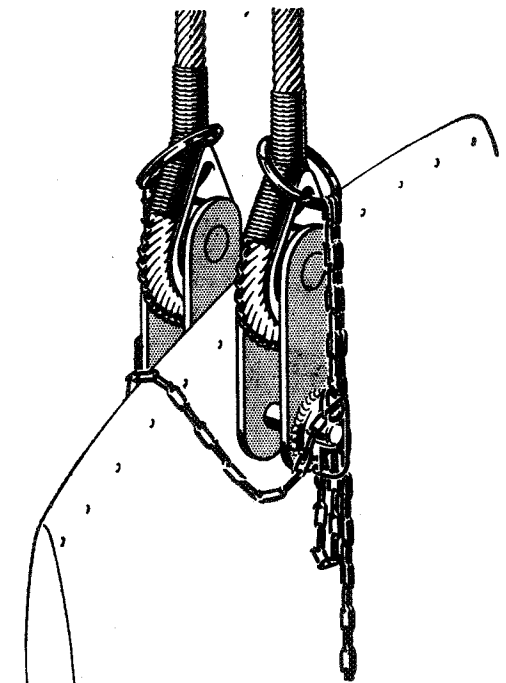
Take off the two nuts and remove the bearing cap at the bottom hinge (3) (*detail fig. 3*) and remove the rudder.

## **Note . . .**

*The tab is attached to the rudder by a piano hinge and riveted, therefore it is not easily removable.*



**Fig. 3. Rudder operating lever and bottom hinge**



**Fig. 4. Attachment of rudder sling**

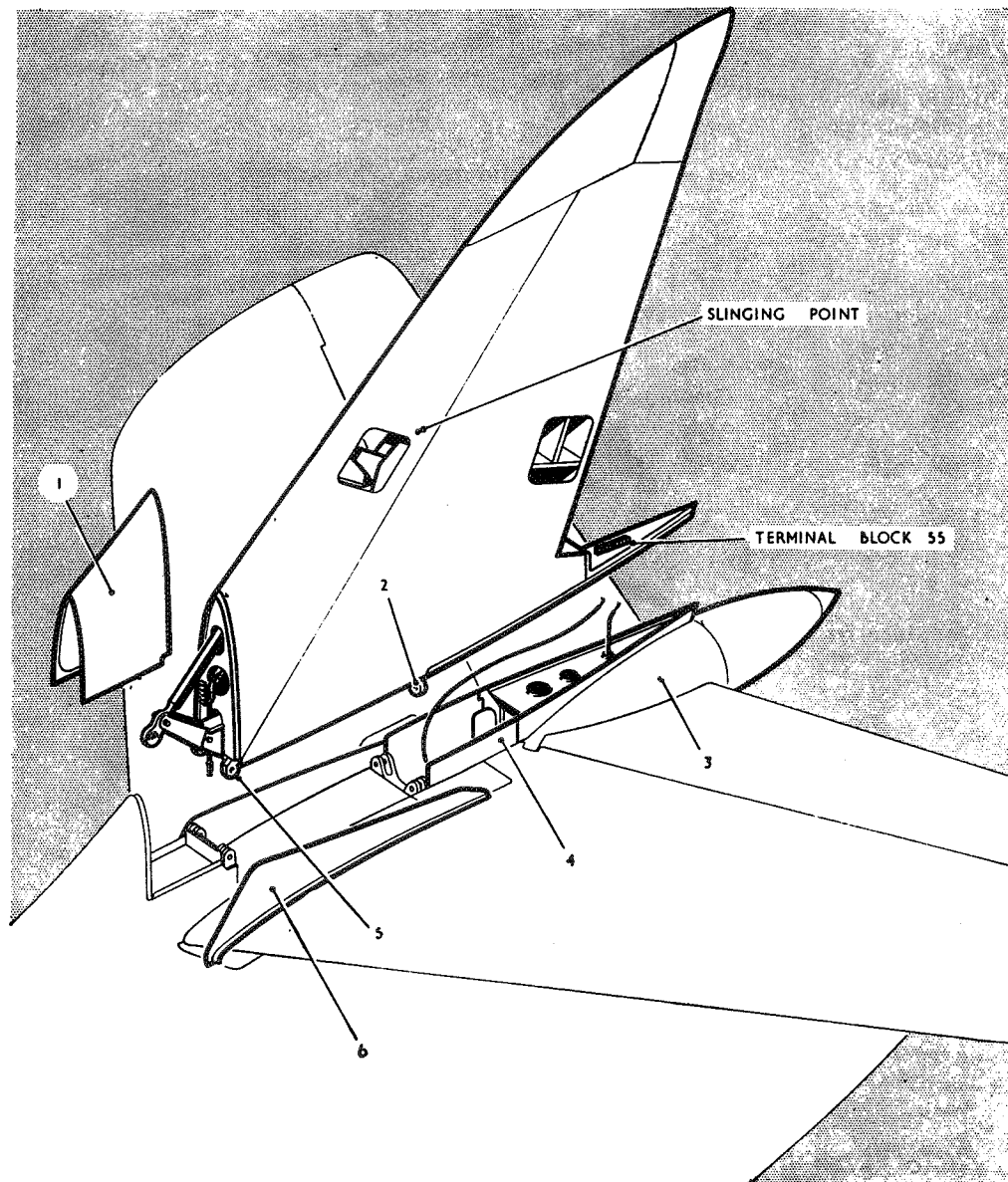


Fig. 5. Removal of fin

### KEY TO FIG.5 REMOVAL OF FIN

Remove the rudder (fig.2).

Remove the rear end detachable portion of the fin and disconnect cable assembly R.17 and cable to the tail navigation light at terminal block 55.

Remove the anti-buffet fairing (3)

Remove the top tail plane fairings (6) port and starboard.

Remove the access panel (4) port and starboard.

Remove the access panel (1) and disconnect the flying controls and the cable assembly R.5 at the terminal block 46 mounted on the front diaphragm of fin.

Attach the sling (similar to fig.4, but a different pin is used).

Lower the tail plane to the fully negative position, remove the fin rear attachment bolts (2) (detail fig.6) port and starboard, remove the front attachment bolts (5) (detail fig.7) port and starboard and lift off the fin.

#### Assembly

During assembly, ensure that there is a clearance of 0.040 in. between the top and bottom tail plane fairings and the fin structure. This is essential to eliminate the possibility of scoring of the fin on tail plane movement. ►

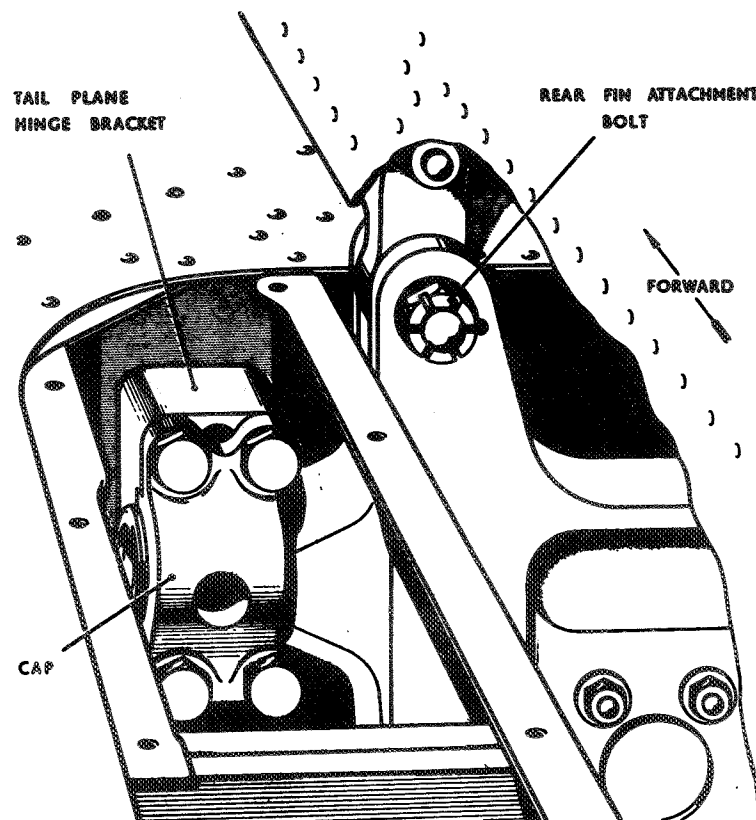


FIG.6. Rear fin attachment and tail plane hinge bracket and cap

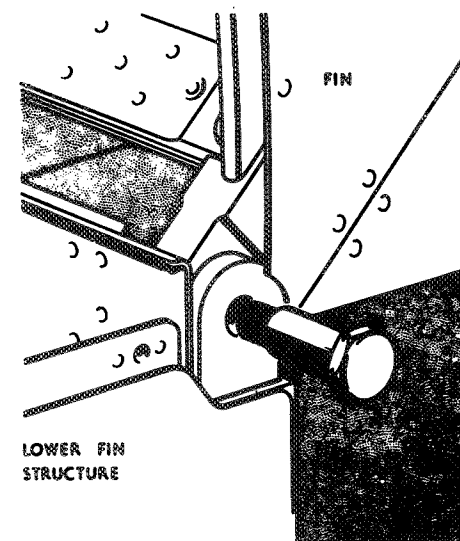


FIG.7. Fin attachment - front

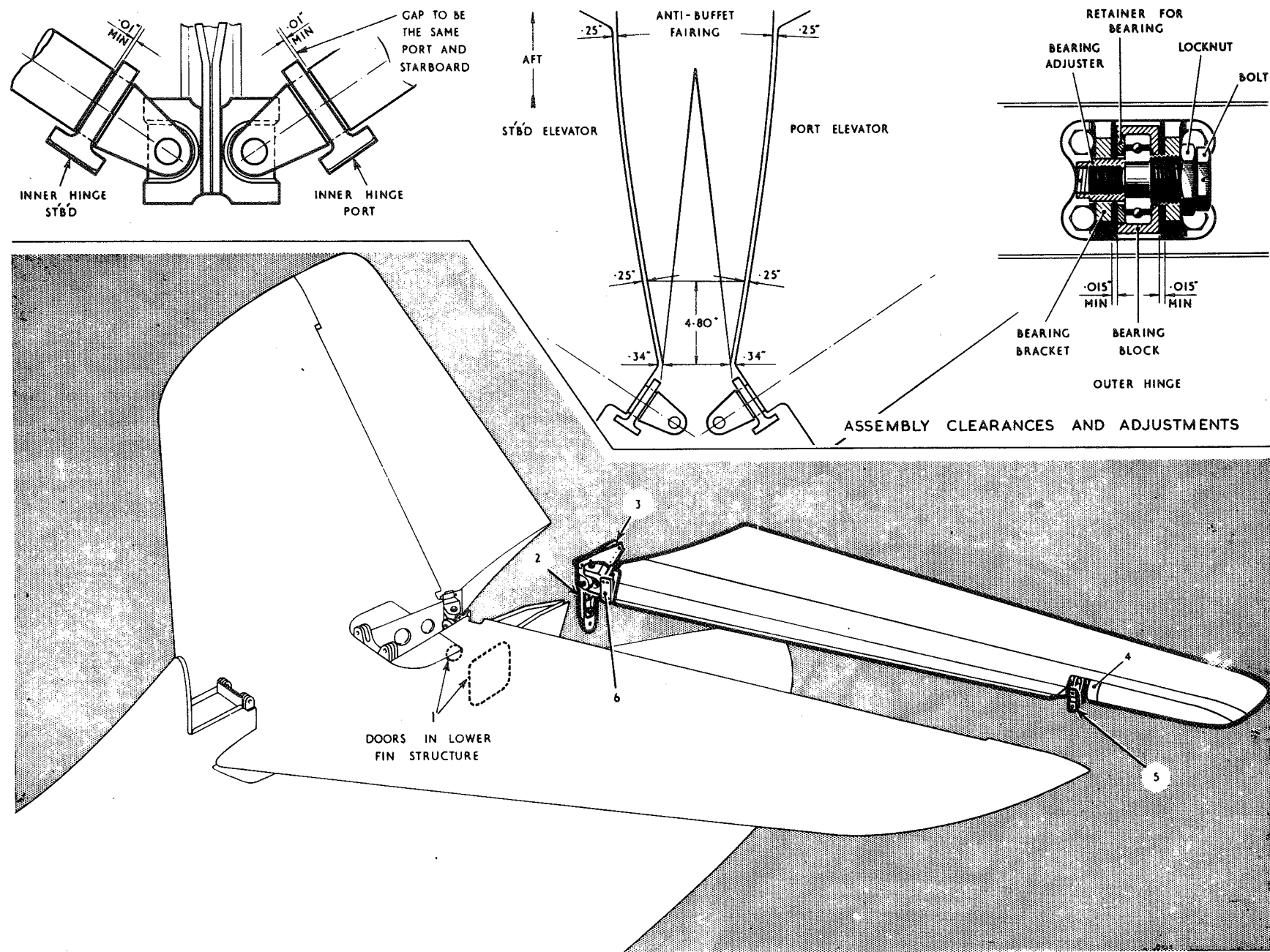


Fig. 8 Removal of elevator

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**Key to Fig. 8—REMOVAL OF ELEVATOR**

The removal of the port elevator is described below; the removal of the starboard elevator is similar. Either the port or the starboard elevator may be removed first, but it is not advisable to remove the port and starboard elevators while attached to each other. The elevators may be removed without first removing either the rudder (fig. 2) or the fin (fig. 5). If however they have been removed, the first operational sequence below will have been carried out, in which case proceed with the second operation.

Remove the anti-buffet fairing (3) and access panels (4) (fig. 5).

Remove the access doors (1), port and starboard, to the elevator control lever and disconnect the flying control (detail fig. 9).

Remove the four bolts from the elevator control split lever (2) (detail fig. 9) connecting the port and starboard elevators.

**Note . . .**

*The tail plane must be in the fully negative position to allow the removal of the bottom bolt on the split lever.*

Remove the four bolts attaching the inner hinge bearing block (3) (detail fig. 9) and the two bolts attaching the outer hinge bearing block (4) on the port elevator to the tail plane and remove the elevator with the inner and outer hinge bearing blocks attached. There is no provision for slinging the elevators.

**Assembly of Elevator**

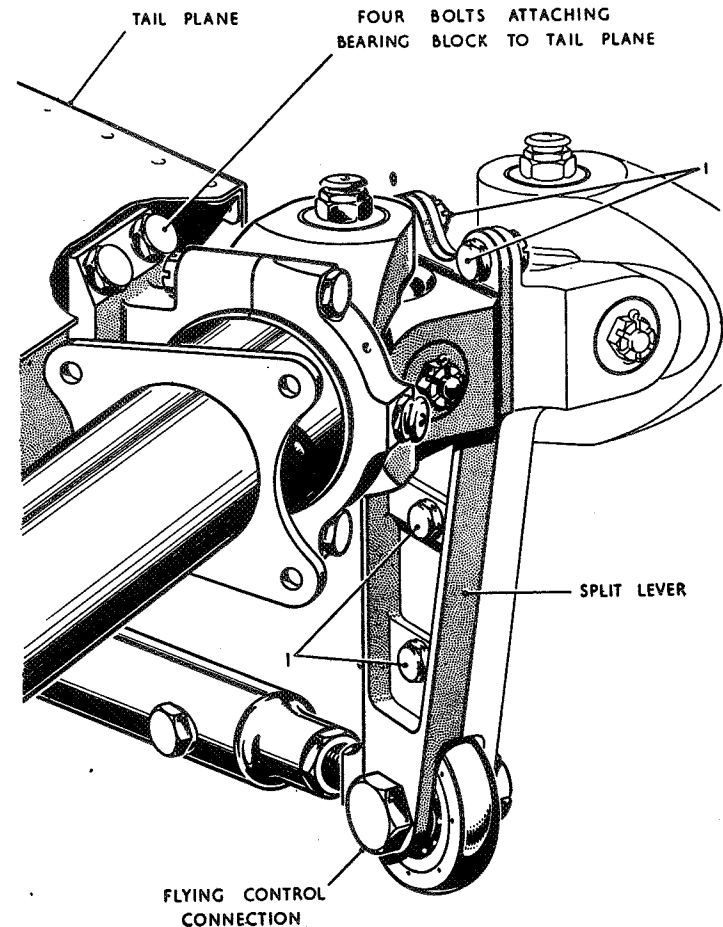
The assembly of an existing elevator is a reversal of the removal procedure, but when fitting a replacement elevator the following points must be noted:—

When offering up the elevator the bolts attaching the bearing blocks of the inner and outer hinges should be fitted but not fully tightened until the split lever has been assembled and bolted up tight.

It will be necessary to adjust the outer locating hinge of the replacement elevator to comply with the requirement given in fig. 8. This adjustment is accomplished by screwing the hinge bolt of the outer hinge assembly in or out of the bearing bracket as required. After adjustment the adjuster and hinge bolt must be locked to the bearing bracket with 18 s.w.g. nickel-alloy wire to Spec. D.T.D.268.

On early aircraft the adjustment will require the removal of the small access door (5, fig. 8) before fitting the elevator. After the correct fitting has been obtained the elevator must be removed to enable the hinge bolt and the bearing adjuster to be wire-locked. Finally, the access door must be replaced.

On later aircraft it is possible to adjust the outer hinge without removing the access door if the special spanner Pt. No. F.199406 and Pt. No. 199407 are used through the gap between the hinge and access door.



**Fig. 9. Split lever connecting port and starboard elevators and inner hinge bearing**

After fitment of the elevator, check, with the tail plane at zero incidence, that the minimum gaps as quoted on fig. 8 are obtained.

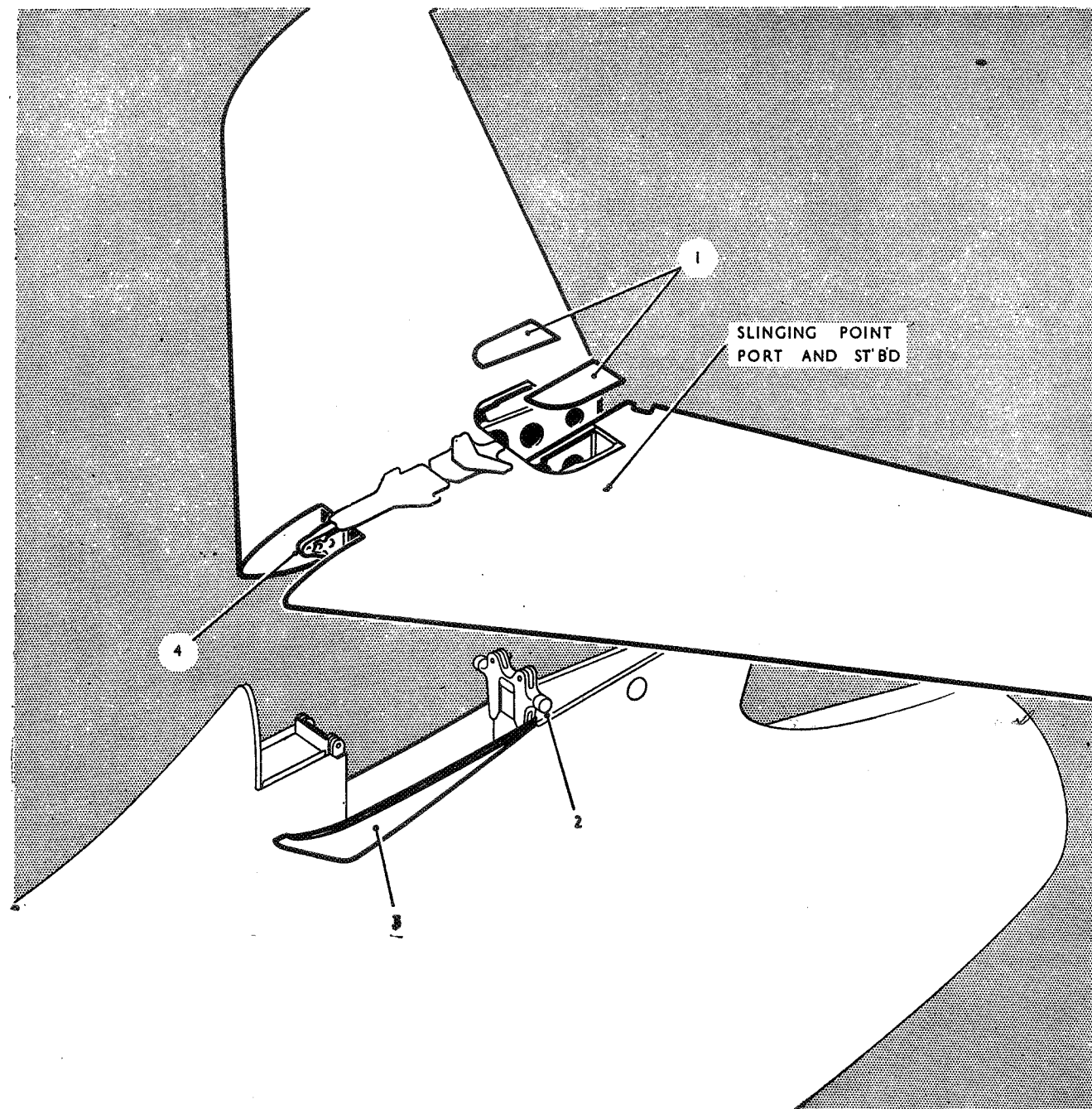


Fig. 10. Removal of tail plane

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### KEY TO FIG.10 REMOVAL OF TAIL PLANE

Remove the rudder (fig.2).

Remove the fin (fig.5).

Remove the elevator (fig.8).

Remove the bottom tail plane fairing (3), port and starboard.

Remove the plug (fig.11) and attach the tail plane sling (fig.12).

Remove the pin from the Desynn transmitter connecting rod (shown in detail, fig.13).

Remove the bolt attaching elevator feel unit lever and the jack lever (4) (shown in detail, fig.13) on the tail plane to the actuator in the lower fin structure.

Remove the access panels (1) port and starboard on the top surface and the access panels port and starboard on the under surface of the tail plane.

Take-off the four bolts at the hinge bracket and cap (fig.6), port, and remove the cap, push the tail plane forward as far as possible, turn the hinge bracket in an anti-clockwise direction looking forward and remove. Repeat for the starboard bracket—except that the bracket is turned in a clockwise direction—and lift off the tail plane.

The brackets and caps are carefully matched and must be kept paired port and starboard.

### Assembly

During assembly, ensure that there is a clearance of 0.020 in. between the top and bottom tail plane fairings and the fin structure. This is essential to eliminate the possibility of scoring of the fin on tail plane movement. The tail plane pivots (2) must be smeared with grease XG-275. ►



Fig.11 Plug for tail plane slinging hole

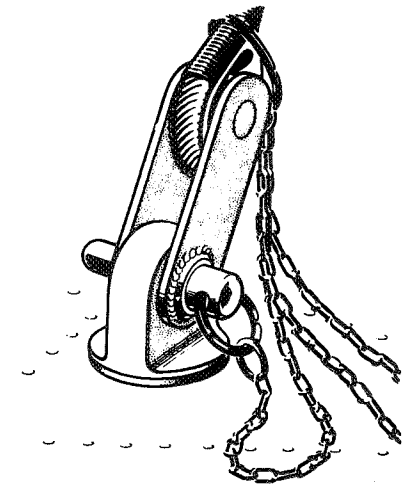


Fig.12 Attachment of tail plane sling

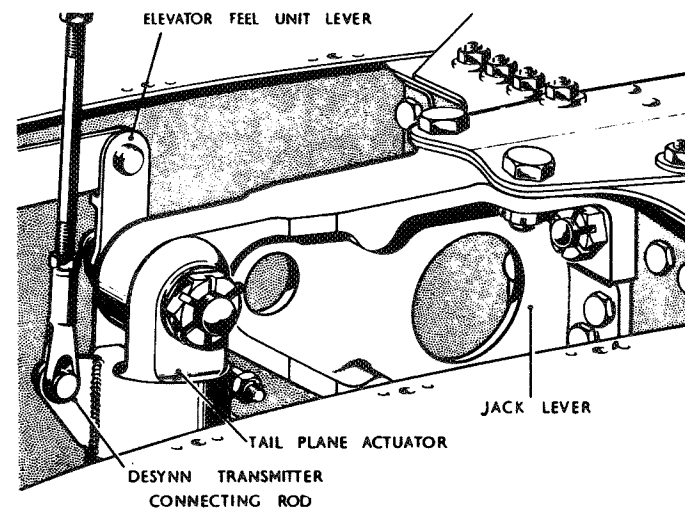


Fig.13 Attachment of jack lever to tail plane actuator

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