

DESCRIPTION

General

1. The movement of the first and second pilots' control columns and rudder pedals is transmitted to the respective control surfaces in a conventional manner by cable, pulley and rod. The layouts of the rudder, elevator and aileron control circuits are shown in Fig. 10 and 11. Elliptical pulleys, to which the cables are positively secured, are used in each of the circuits. These pulleys progressively increase the gear ratio between the cabin control and the control surface as the former is moved from the neutral position. The gear ratio reaches its maximum when the control column or rudder pedals are at full travel.

2. Tabs are incorporated on all the control surfaces. The aileron tabs are adjustable for both servo action and for alterations to lateral trim. The rudders support small trim tabs only. The aileron and the rudder tabs are only adjustable when the aircraft is on the ground. The elevator trim tab is the only tab surface adjustable from the cabin, and is dual controlled by a hand wheel on each control box.

NOTE...

Servo action on the elevator tab is not normally required.

Cables and pulleys

3. The ailerons, elevator and rudder

are operated by 25 cwt. cables each of which is provided with turnbuckle adapters. Each length of cable has a part number and an individual mark number, whilst adjacent turnbuckles and adapters are made non-interchangeable to avoid incorrect assembly. The cables are directed through the airframe by a series of fibre fairleads and guarded pulleys (Fig. 1), which run on sealed ball races.

Flaps and dive brakes

4. The flaps and dive brakes, both of which are operated by hydraulic jacks, are hinged upon the main plane rear spar. The inner and outer flaps are interconnected by a torque tube and rods. An electrical position indicator, which is fitted on the starboard side, records the position of the flap on a cabin indicator. The dive brakes are hinged immediately outboard of the flaps and they can either be selected ON or OFF; there are no intermediate positions. Dual control is provided for the flaps and dive brakes.

SERVICING

Setting the aileron control

5. Proceed as follows:-

(1) Lock the elliptical sprockets at the base of the first and second pilots' control columns with the locking plates as shown in Fig. 12.

(2) Couple the upper and lower

sprocket chains; tension and adjust the tie-rods so that both control column grips are offset from the vertical 1.3 in. (pre Mod. 3167) or 0.35 in. (post Mod. 3167) to starboard at the extreme top. Check that, in this position, the chains are equally disposed about the drive sprockets.

(3) Lock the aileron differential pulley in the neutral position as shown in Fig. 12.

(4) Couple up and tension the cables. The positions of the various turnbuckles are shown in Fig. 10. Apply a Mk. 4 tensionmeter (Fig. 2) to the cables in the flap shroud on each side, and check that the tension on the 20 cwt. scale is 70 lb. \pm 10 lb. When fitting a new cable a tolerance of \pm 20 lb. is allowed up to the first inspection.

NOTE...

The ideal temperature for checking cable tensions is 60 deg. F. and the following corrections should be applied to compensate for other temperature conditions:-

Add 4 lb. to the required cable tension for each 10 deg. above 60 deg. F. Deduct 4 lb. from the required cable tension for each 10 deg. below 60 deg. F. Whenever practicable, the cable tensions should be checked under conditions of even temperature, i.e., in an enclosed space.

(5) Remove the locking plates from the base of the control columns and

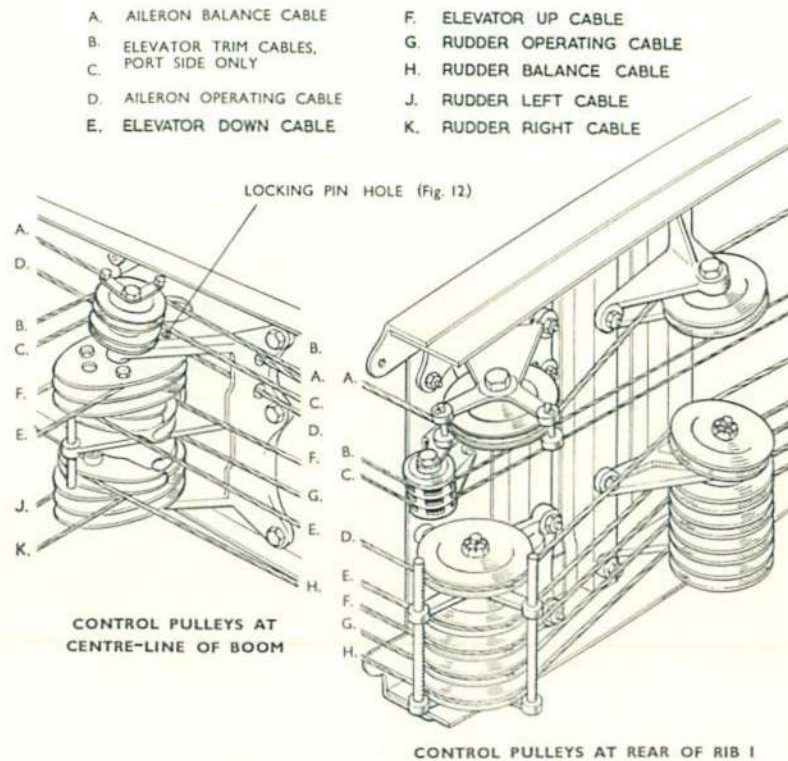


Fig. 1 Flying control pulleys

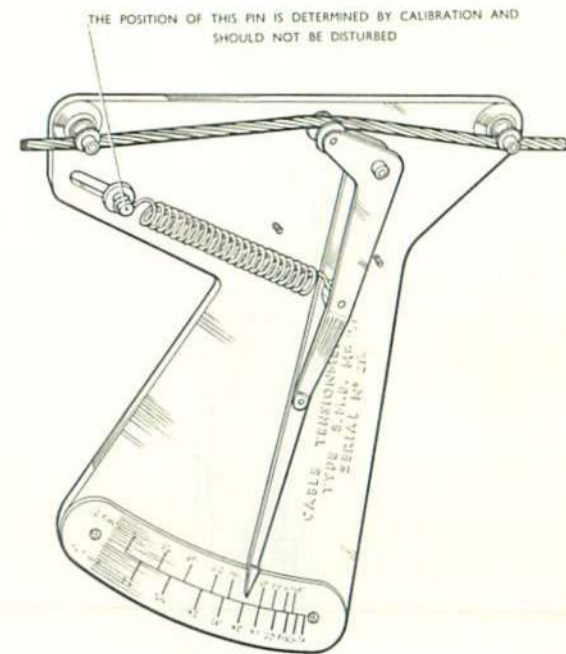


Fig. 2 Application of tensiometer

the bolts from the differential pulleys. Ensure that the latter withdraw freely.

(6) Check the functioning of the control surfaces by moving the control column handle and ensure that the maximum travel conforms with the dimension given in Fig. 13. The overall travel is governed by the non-adjustable stop plates at the base of the control columns (Fig. 3), but small adjustments to the connecting link (Fig. 4) may be made

to obtain the required travel in either direction.

Setting the aileron tab

6. The method of setting the quadrant to obtain the various degrees of servo movement on the tab is illustrated in Fig. 5. The correct range of movement is given in Fig. 13 which is obtained by lining up holes A and E (Fig. 5). This movement is subject to small alterations for correction of trim. Other settings give a lesser degree of overall movement. After

resetting the quadrant, the tab must be adjusted to the neutral position when the aileron is also neutral. This is accomplished by either lengthening or shortening the tab connecting rod. The subsequent adjustments which may be made to the tab connecting rods to correct lateral trim should be divided equally between the port and starboard tabs.

NOTE...

A clearance of 0.05 in. to 0.08 in. must be maintained between the

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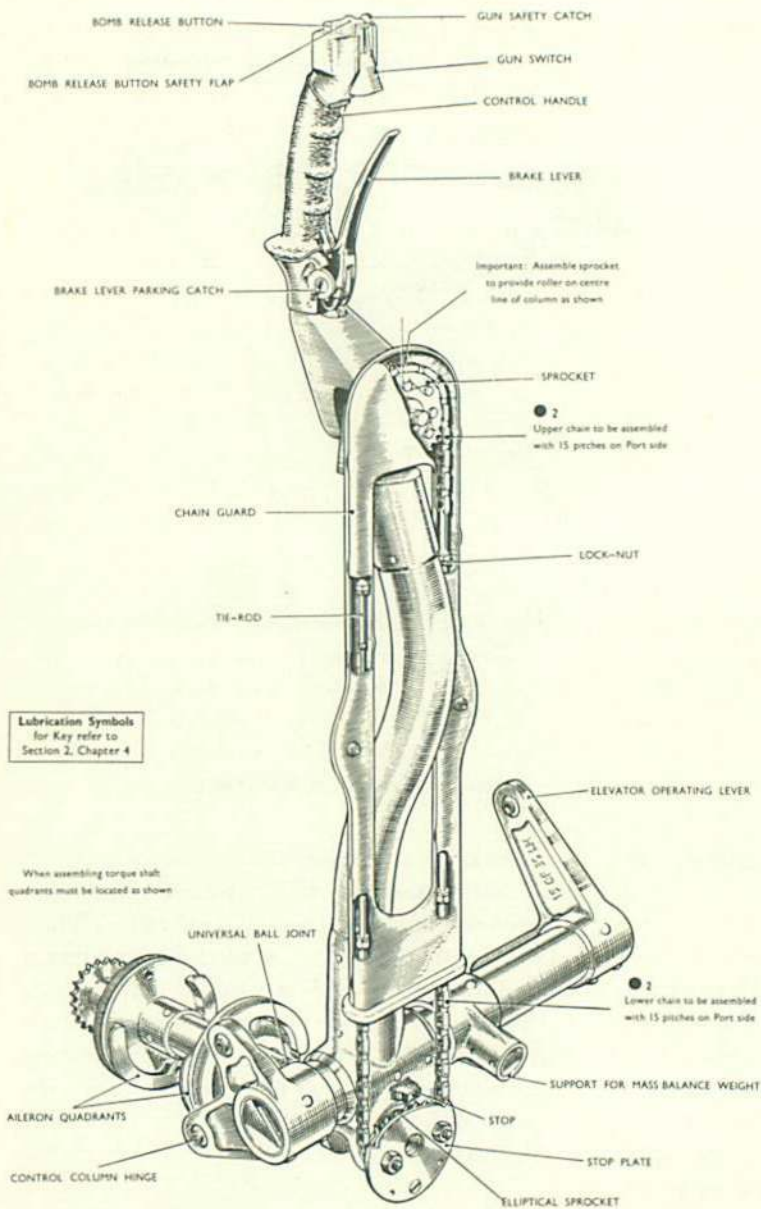
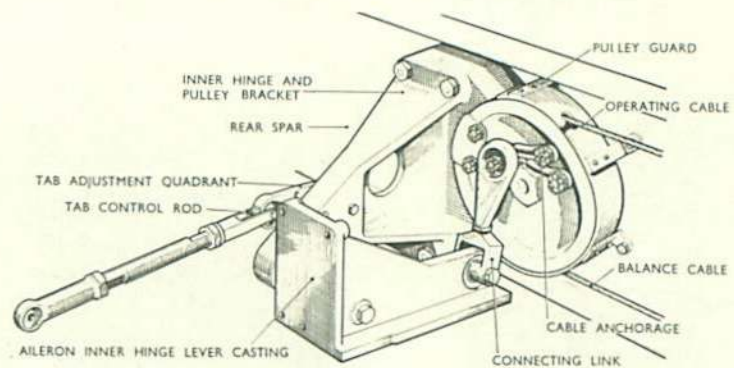


Fig. 3 First pilot's control column



Laminum shims may be placed behind hinge brackets to maintain gap between aileron and shroud.

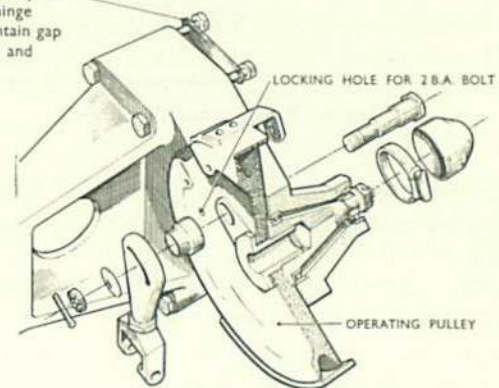


Fig. 4 Aileron operating unit

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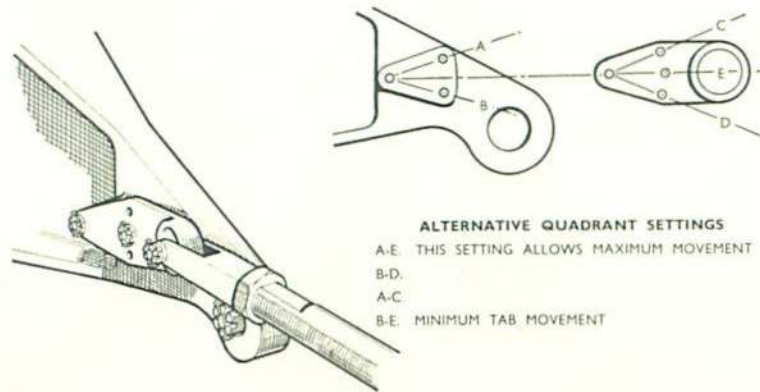


Fig. 5 Aileron balance tab adjustment

aileron tab leading edge and both the upper and lower shrouds.

Aileron shroud

7. A clearance of 0.05 ± 0.02 in. at the outboard hinge to 0.10 ± 0.02 in. at the inboard hinge must be maintained between the aileron leading edge and both the upper and lower shrouds with the ailerons neutral. With the ailerons at full deflection, up or down, the minimum clearance is 0.002 in. Adjustment may be effected by the addition of laminum shims on the bracket attachment bolts up to a maximum thickness of $\frac{1}{8}$ in. The position of the shims for the inboard hinge bracket is shown in Fig. 4.

Setting the elevator control

8. Proceed as follows :-

- (1) Set the quadrant pulleys in the neutral position with the locking plate as shown in Fig. 12 and adjust

the connecting rod 'A' (Fig. 14) so that the control columns are also in the neutral position (i. e. , 1 deg. aft of the vertical).

- (2) Lock the elliptical pulleys at the forward end of each tail boom in the neutral position as shown in Fig. 12 and tension the cables between these pulleys and the quadrant pulleys.

- (3) Lock the control levers at the rear end of each boom as shown in Fig. 12 and tension the cables between the intermediate control levers and the elliptical pulleys.

NOTE...

It is important that both sets of cables should be tensioned at the same rate and that the tension, using a Mk. 5 tensionmeter, should be $80 \text{ lb.} \pm 10 \text{ lb.}$ on the 25 cwt.

scale. The tensionmeter is applied to the cables in the flap shroud. When fitting a new cable, a tolerance of $\pm 20 \text{ lb.}$ is allowed up to the first minor inspection. The ideal temperature for checking cable tensions is 60 deg. F. and the following corrections should be applied to compensate for other temperature conditions :-

Add 4 lb. to the required cable tension for each 10 deg. above 60 deg. F. Deduct 4 lb. from the required cable tension for each 10 deg. below 60 deg. F. Whenever practicable, the cable tensions should be checked under conditions of even temperature, i. e. , in an enclosed space.

- (4) Adjust the length of the operating rods at the rear end of each tail boom, so that the elevator trailing edge is in line with the tail plane. It is necessary to remove the tail plane extensions for this operation (Sect. 3, Chap. 3).

- (5) Remove the locking pins and the locking plate from the quadrant pulley. The pins should come away freely. Check the elevator for free and full movement, as indicated in Fig. 13, by operating the control column.

- (6) If the travel in either direction is not correct, it may be increased or decreased by adjusting the appropriate lever stop on the rear diaphragm of each tail boom (Fig. 15),

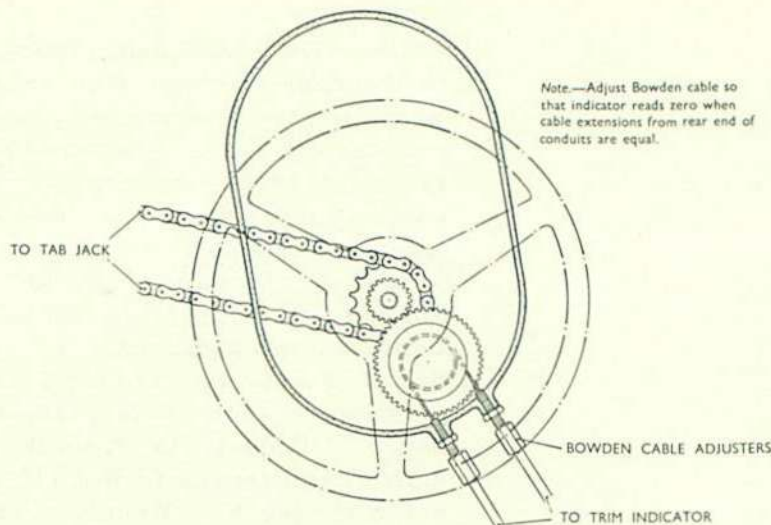


Fig. 6 First pilot's elevator trim control and indicator

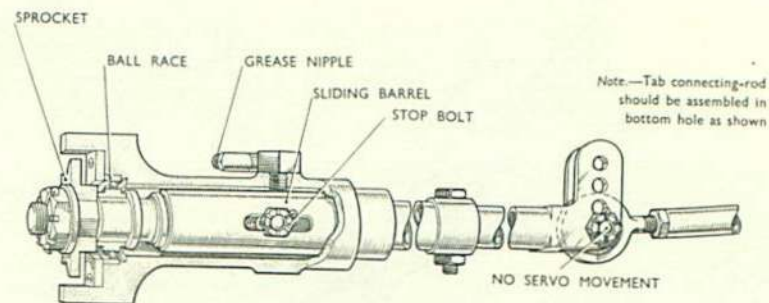


Fig. 7 Elevator tab jack

and then tightening and wire-locking the stop bolt locknuts.

(7) With the tail boom stops engaged by movement of the control column, adjust the appropriate stop bolt on the quadrant pulleys in the cabin, so that there is 0.03 in. clearance. Make these adjustments with the control column fully forward and fully back. Check that the control column has a free and unobstructed travel over its full range ($8\frac{1}{2}$ deg. \pm 1 deg. forward of neutral and 17 deg. \pm 1 deg. aft of neutral). There must be a clearance between the control column and the instrument panel (control column forward) of 0.10 in. minimum.

Elevator shroud

9. The gap between the elevator leading edge and both the top and bottom shrouds must be 0.08 in. $+0.05$ in. -0.02 in. with the elevator neutral and 0.002 in. with the elevator in any other position. The shroud rivets may be filed as necessary to ensure these clearances.

Setting the elevator trim control

10. Proceed as follows:-

(1) Set the 1st pilot's elevator tab control wheel in the cabin so that, with the position indicator reading zero, an equal length of cable is extending from the rear end of each Teleflex tube. At the ends of the trim cables, 5.8 in. of Teleflex cable must be exposed in the mean

position. The Bowden cable adjusters (Fig. 6) provide a means for obtaining small corrections to the position of the indicator.

(2) Set the tab jack (Fig. 7) on the rear spar of the tail plane in the neutral position (i. e., by taking the mean extension of the ram).

(3) Place the chain on the sprocket with an equal number of pitches on each side. Connect and tension the cables between the chain and the Teleflex controls.

(4) Set the elevator neutral, and initially adjust the tab connecting rod to set the tab at neutral with the tab position indicator at zero.

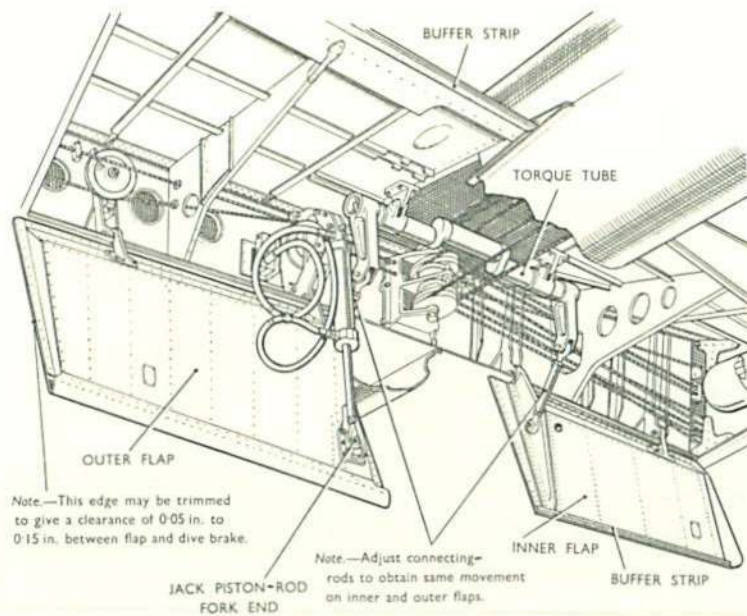


Fig. 8 Flap

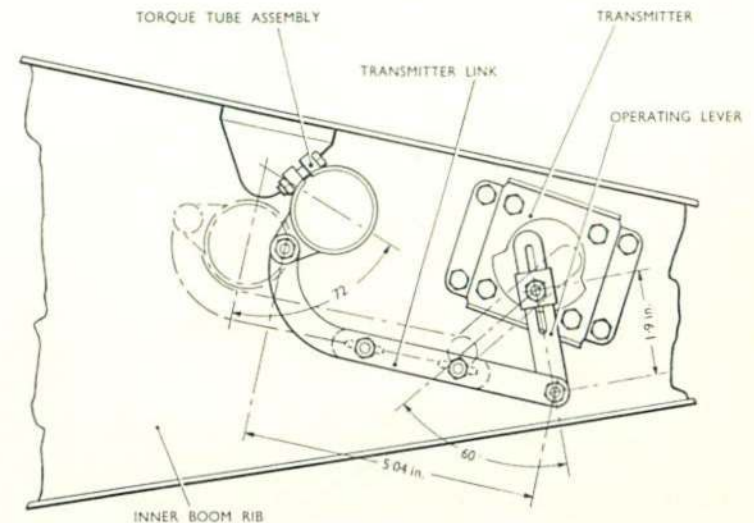


Fig. 9 Transmitter for flap position indicator

NOTE...

It may subsequently be necessary to rig the tab either slightly up or down, so that the aircraft will cruise with the indicator in the cabin reading zero.

(5) Operate the hand wheel in the cabin and check that the movement of the tab is free and that its travel conforms with Fig. 13. The tab should move upwards when the control wheel is rotated clockwise. Check the 2nd pilot's hand wheel for synchronization.

Setting the rudder control

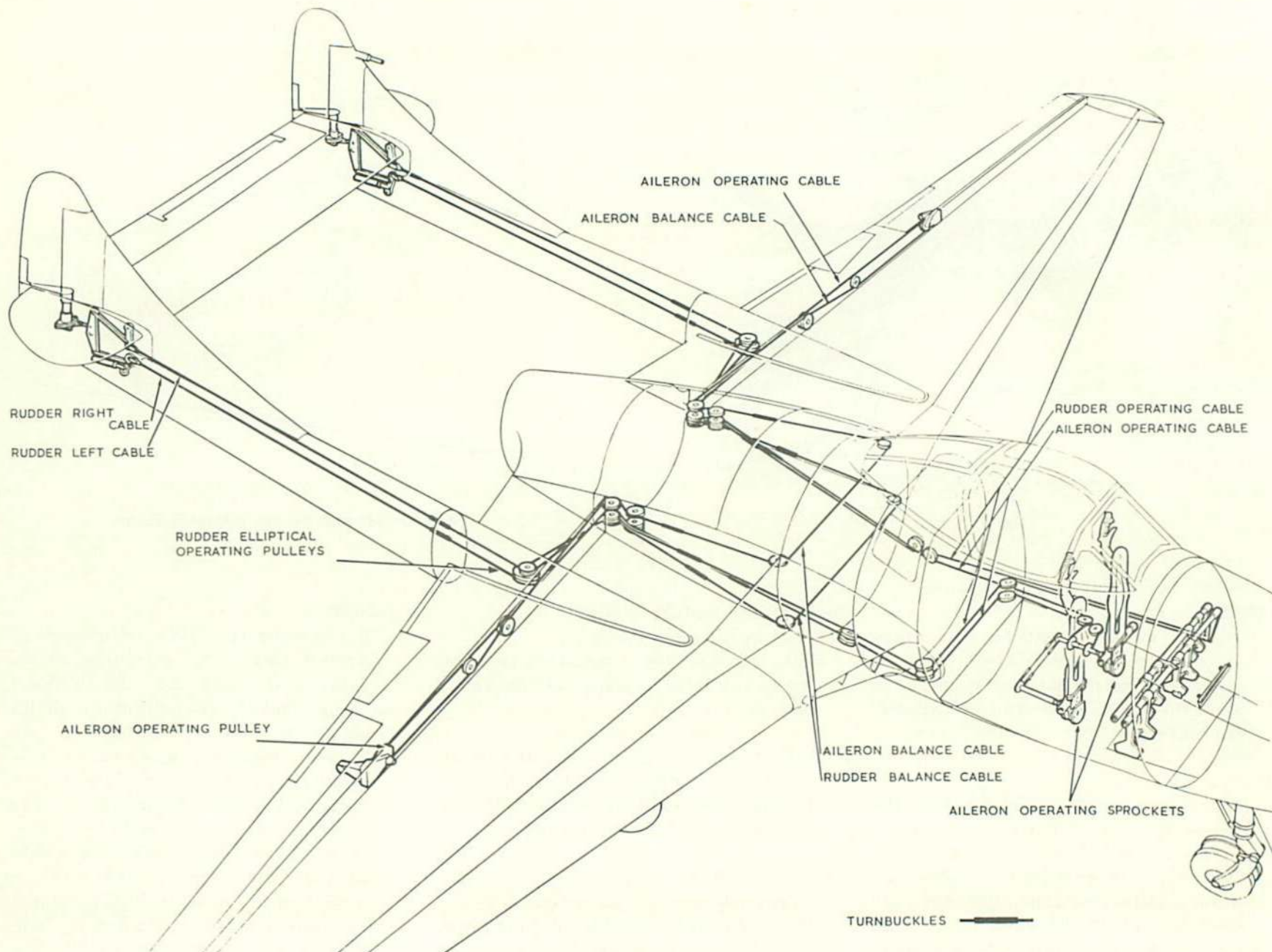
11. Proceed as follows :-

- (1) Set the rudder pedals to neutral using the locking plate as shown in Fig. 12.
- (2) Lock the elliptical pulleys at the forward end of each boom and tension the cables between these pulleys and the rudder pedals.
- (3) Lock the control levers at the rear end of each boom and tension the cables between the intermediate control levers and the elliptical pulleys.

NOTE...

It is important that both sets of cables should be tensioned at the same rate and that the tension, using a Mk. 5 tensionmeter, should be 80 lb. \pm 10 lb. on the 25 cwt. scale. When fitting a cable, a tolerance of \pm 20 lb. is allowed up to the first minor inspection. The tensionmeter is applied to the cables in the flap shroud. The ideal temperature for checking cable tensions is 60 deg. F. and the following corrections should be applied to compensate for other temperature conditions :-

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Fig. 10 Aileron and rudder control circuits

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Add 4 lb. to the required cable tension for each 10 deg. above 60 deg. F. Deduct 4 lb. from the required cable tension for each 10 deg. below 60 deg. F. Whenever practicable, the cable tensions should be checked under conditions of even temperature, i. e., in an enclosed space.

(4) Adjust the connecting rods until the rudders are central. These rods project through the rear diaphragm of each tail boom on to the rudder posts (Fig. 15).

(5) Remove the locking plate and locking pins which should come away freely and set the travel of the rudder to conform with Fig. 13, operating the rudder pedals in each direction. To obtain the correct movement, adjust the appropriate lever stop on the rear diaphragm of each tail boom, and tighten and wire-lock the stop bolt locknuts (Fig. 15).

(6) Check the rudders for full and free movement (Fig. 13).

(7) With full right rudder, adjust the stop bolts on the rear face of No. 1 bulkhead, so that there is a clearance of 0.20 in. Make a similar adjustment with a full left rudder (Fig. 14).

(8) Check that the rudders centralize in the neutral position under the influence of the spring dampers; if necessary, adjust the eye-bolt at the rear end of the damper (Fig. 15).

NOTE...

If desired, offset rudder positions can be obtained by further adjustment of the eye-bolt.

Setting the rudder trim tab

12. Adjustment of the rudder tab is effected by slackening the bolt at the base of each tab and applying the trim equally. After re-tightening the bolt, secure with 20 S.W.G. locking wire.

Flap adjustment (Fig. 8)

13. Proceed as follows:-

(1) Adjust the fork-end of the jack piston-rod so that the trailing edge of the outer flap makes a firm contact with the buffer strip on the flap shroud when the jack is fully retracted. The full travel of the piston within the cylinder governs the range of movement of the flaps. Re-lock the fork-end after this adjustment.

(2) Adjust the connecting rods between the torque tube and the inner and outer flaps, so as to obtain a similar condition on the inner flap when it is in the fully up position.

(3) Lower the flaps and check that the full travel conforms with the dimension given in Fig. 13.

NOTE...

The clearance between the outboard edge of the outer flap and the dive brake must be within the limits of 0.05 in. to 0.15 in. Either or both

components may be trimmed if necessary.

Adjusting the transmitter for the flap position indicator

14. Proceed as follows:-

(1) With the flaps up, adjust the length of the transmitter link (Fig. 9) so that the position indicator reads zero.

(2) Fully lower the flaps and check that the indicator reads 80 deg. Should the angular reading fall short of this figure, decrease the length of the operating lever (Fig. 9); should it read more than 80 deg. increase the length of this lever.

Dive brake adjustment

15. Adjust the fork-end of the jack piston-rod, so that the leading edge of the dive brakes makes a firm contact with the underside of the wing. Lower the dive brakes and check that the travel conforms with the dimension given in Fig. 13.

NOTE...

In order to lower the dive brakes with the hand pump, it is necessary to hold open the non-return valve on the hydraulic panel in the gun bay (Sect. 3, Chap. 6). As in the case of the flaps, the full travel of the piston within the cylinder will govern the range of movement of the dive brakes, consequently no adjustments to this range can be made. Refer to the Note in para. 13.

Lubrication Symbols
for Key refer to
Section 2, Chapter 4

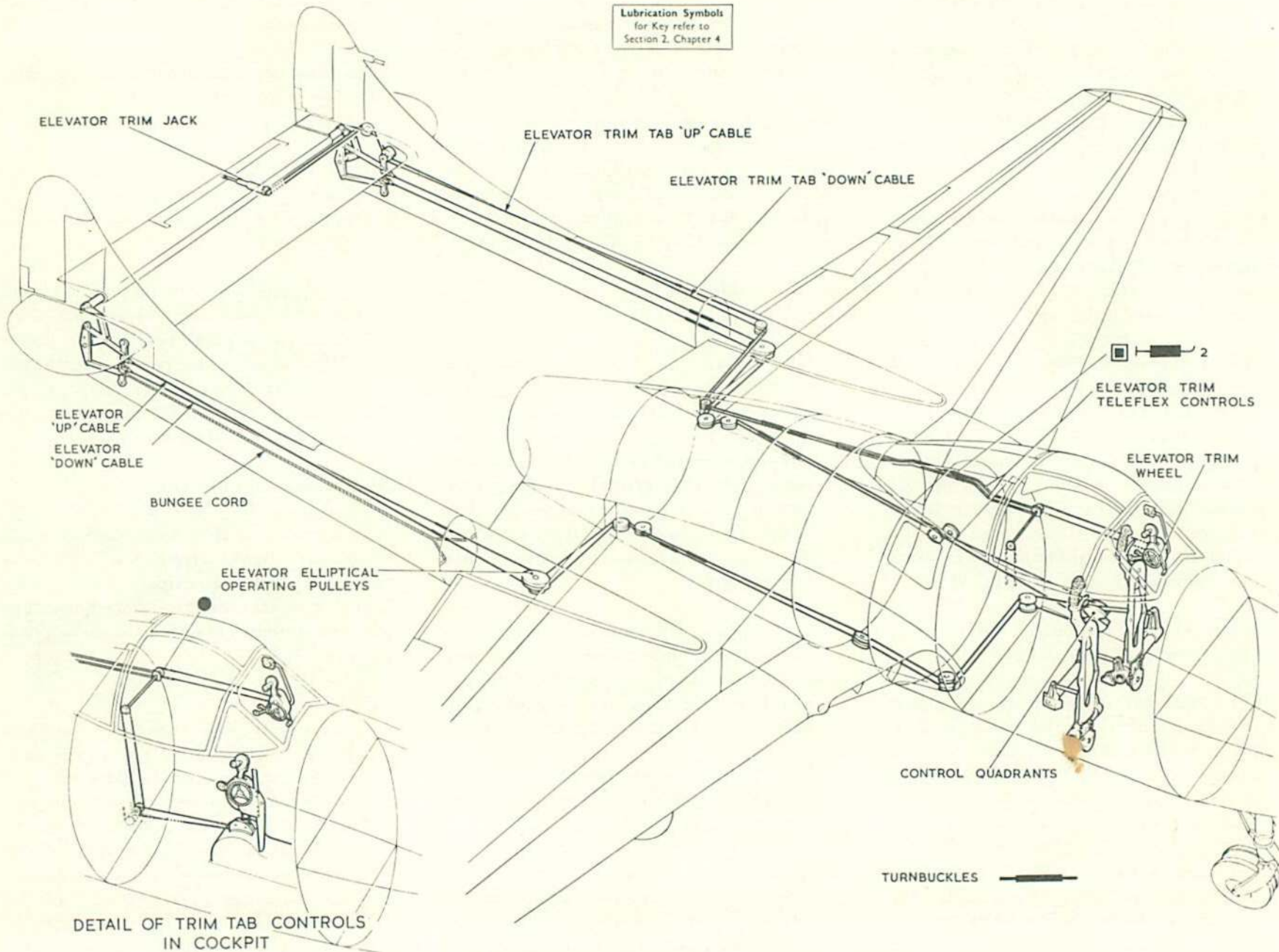
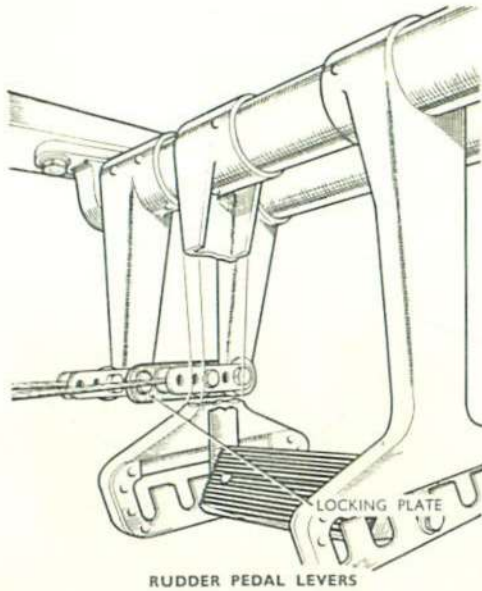
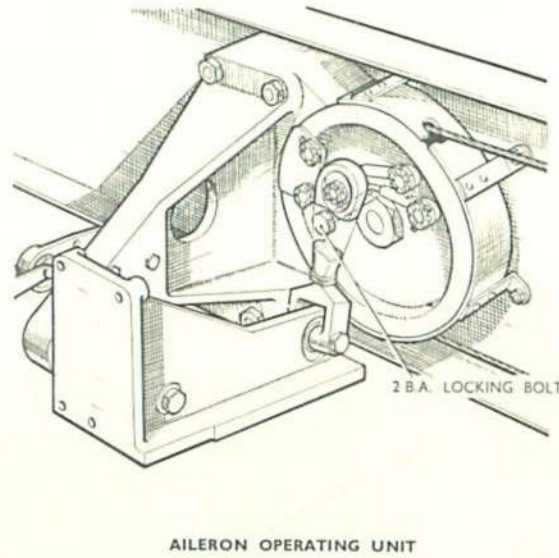


Fig.11 Elevator control and elevator trim tab control

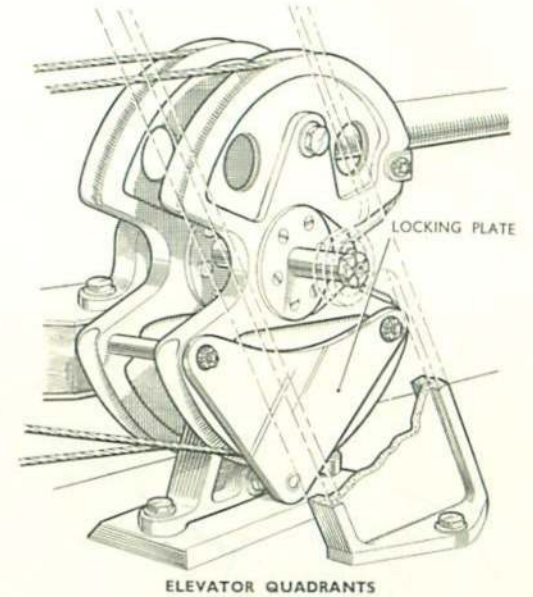
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RUDDER PEDAL LEVERS



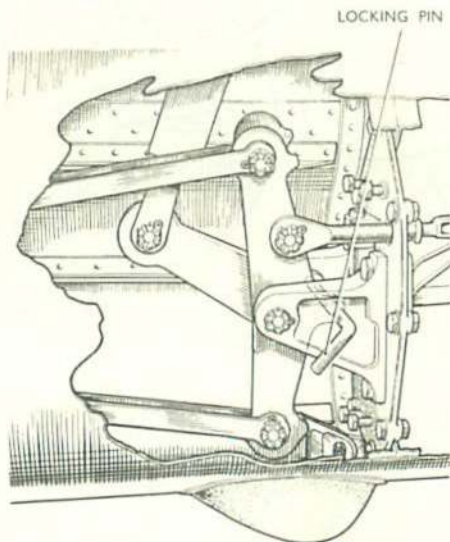
AILERON OPERATING UNIT



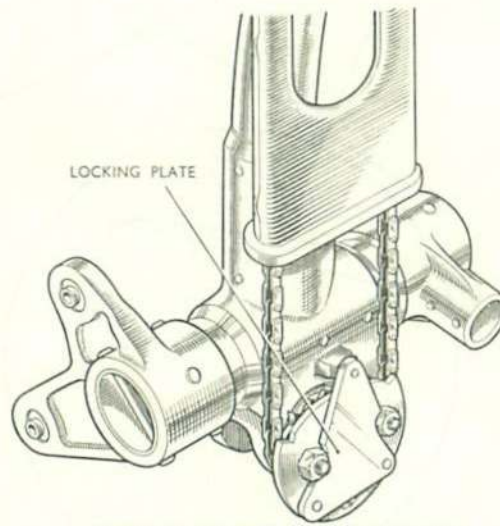
ELEVATOR QUADRANTS

Note: The part numbers of the locking devices are given in Table I, Sect. 2, Chap. 4.

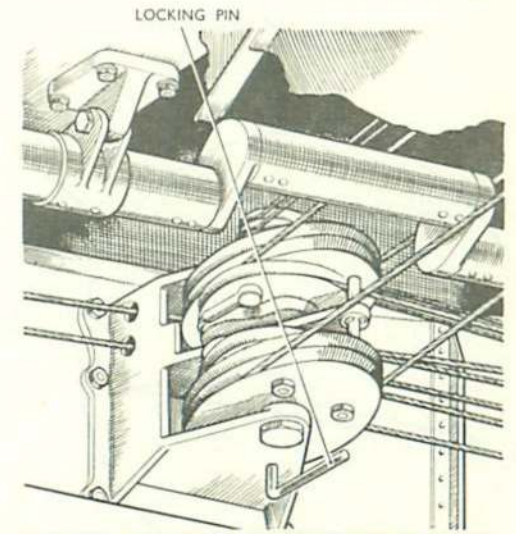
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CONTROLS IN REAR ENDS OF BOOMS



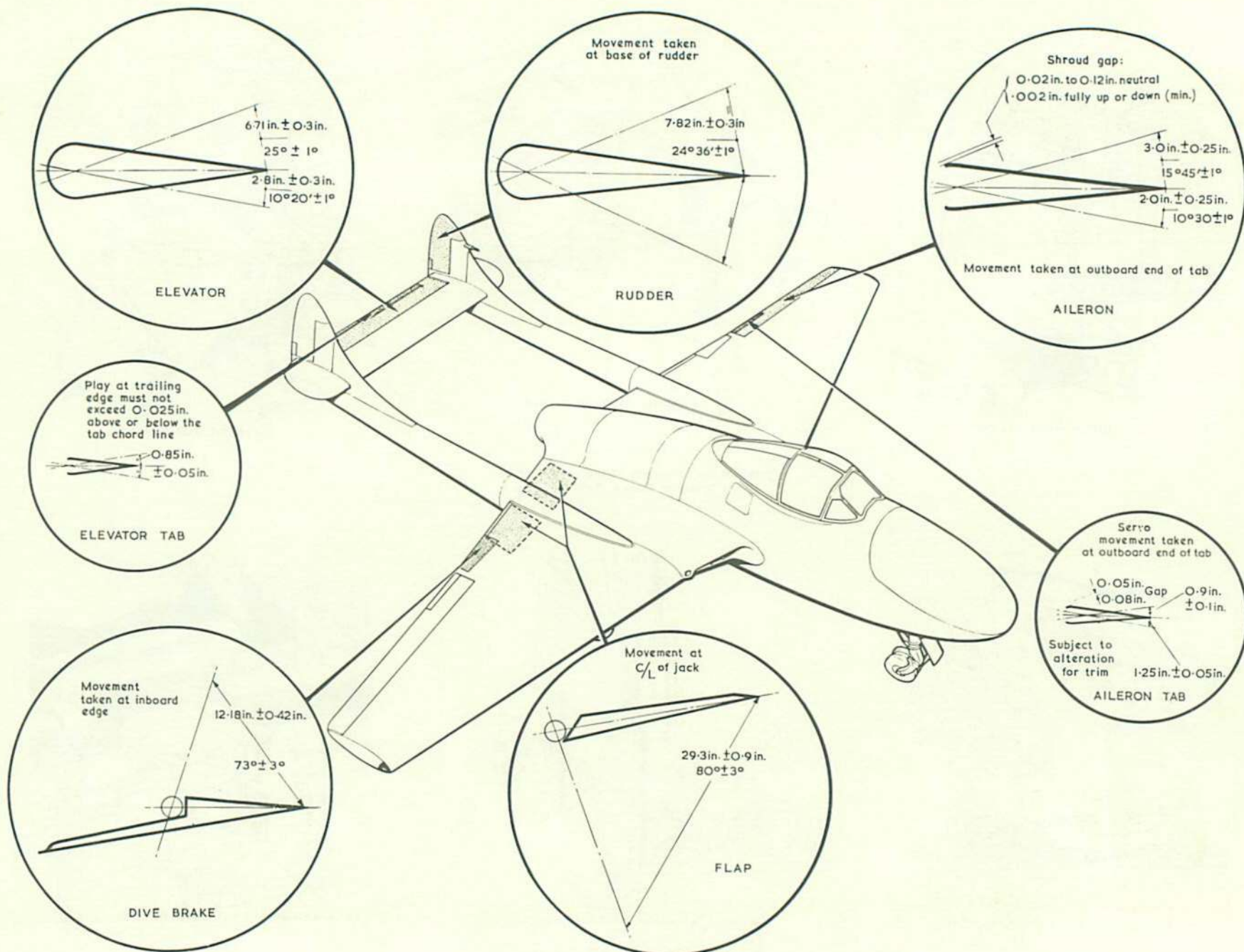
CONTROL COLUMN AILERON SPROCKET



ELLIPTICAL PULLEYS IN FORWARD ENDS OF BOOMS

Fig. 12 Control locking devices

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Fig.13 Control surface movements

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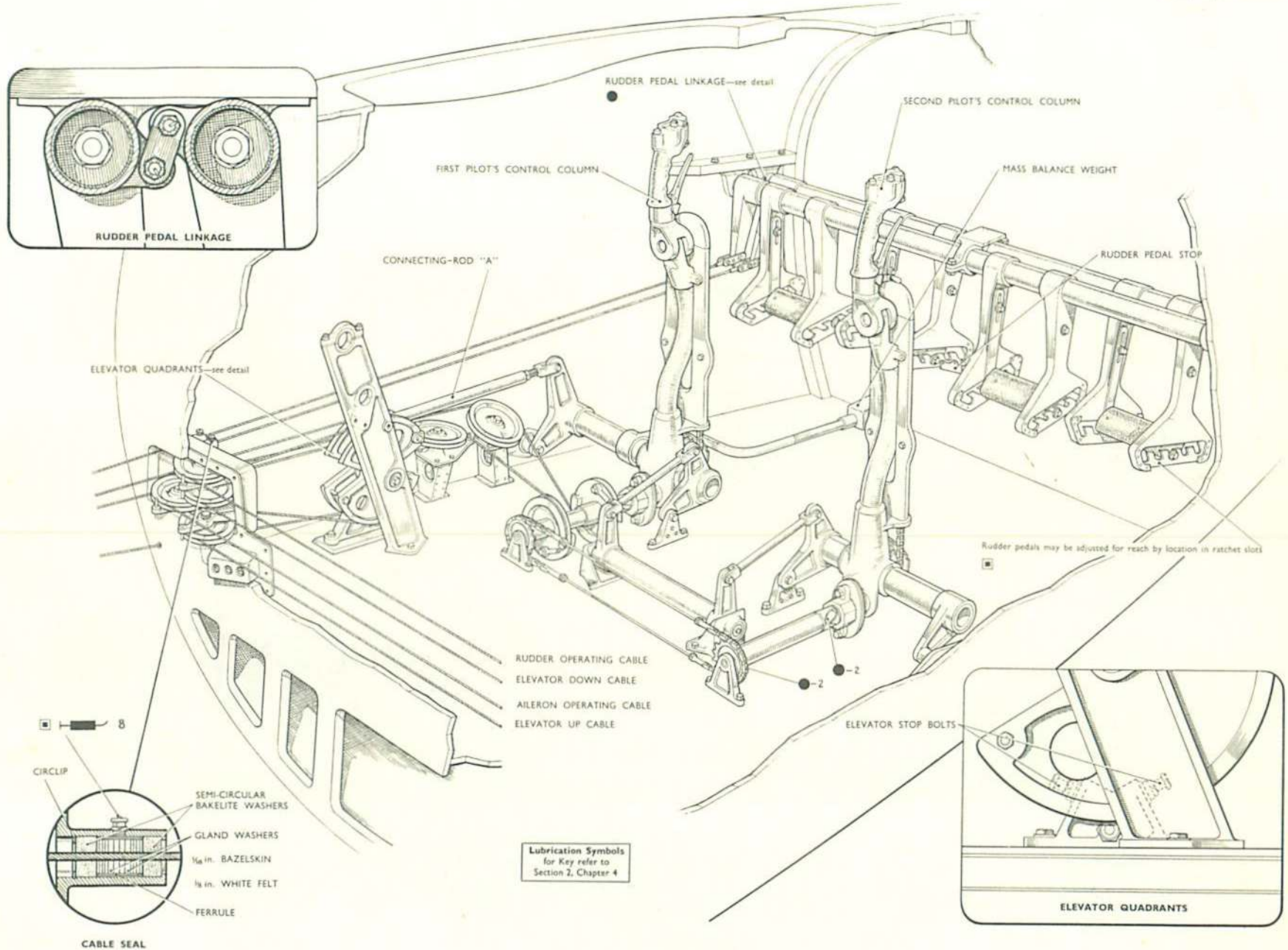
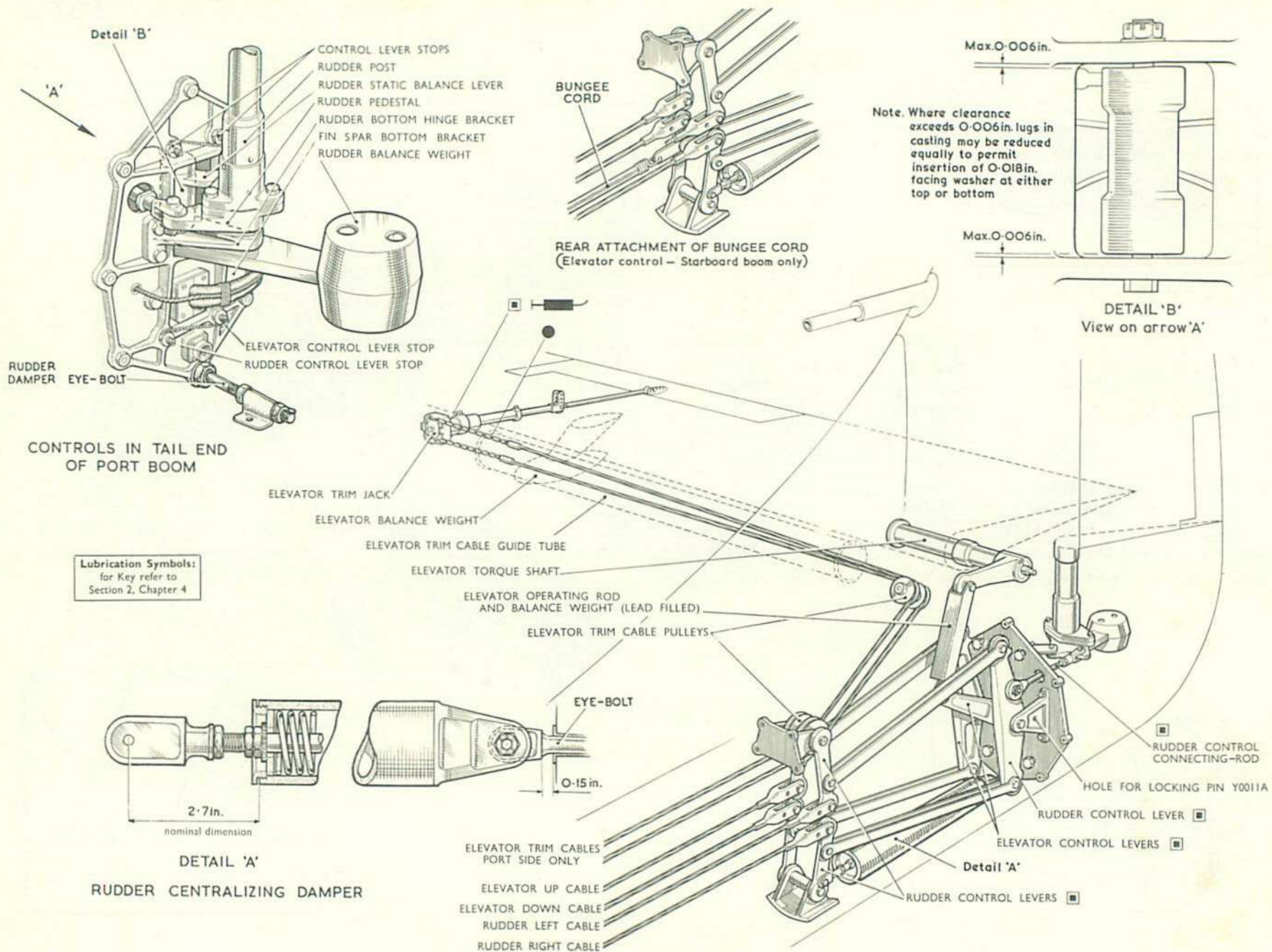


Fig. 14 Controls in cockpit

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Fig. 15 Controls in tail unit

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Lubrication

16. The components requiring periodic lubrication and the location and number of the various points, are shown in certain illustrations. The lubrication table in Sect. 2, Chap. 4, identifies the symbols and lubricants used.

REMOVAL AND INSTALLATION**General**

17. Instructions for the removal and assembly of the various control surfaces are given in the appropriate chapters covering the main plane and tail unit. The method of removing pulleys, control levers and other components relating to the flying controls will be readily apparent when the items are viewed on the aircraft and no detailed instructions for these items will

be given.

Rudder pulleys in booms

18. During normal removal and installation of the rudder elliptical pulleys in the port and starboard booms, the following precautions must be observed :-

On removal :-

(a) Carefully remove all the locking burrs from the threaded end of the bolt (Part No. A.S. 1882/9E) which retains the cables in the pulley grooves.

(b) Unscrew the bolt and examine the threads in the pulley for damage. If any of the threads have been damaged, the pulley must be changed.

On installation :-

(a) Screw in a new bolt (Part No. A. S. 1882/9E) and file down until $1\frac{1}{2}$ threads remain proud of the pulley.

(b) Using a flat punch and supporting the head of the bolt, burr over one side of the bolt. Great care must be taken to avoid damaging the pulley.

NOTE...

When the above procedure has not been adopted in previous servicing of the elliptical pulleys, the bolt must be carefully inspected to ensure that it is firmly installed : if it should be loose or insecurely fitted, the instructions outlined above must be carried out.

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