Chapter 4 FLYING CONTROLS

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Introduction

1. This chapter contains a description of the flying controls, together with control surface adjustment, lubrication and the servicing information necessary to maintain the controls in an efficient condition. For a description of the hydraulic components, hydro-boosters, Desynn transmitters and indicators, together with information on their operation and servicing, reference should be made to A.P.1803D, Vol. 1, A.P.4601, Vol. 1, and A.P.1275A, Vol. 1 respectively.

DESCRIPTION

General

2. Normal stick and rudder bar type flying controls with push-pull tube transmission are installed in this aircraft and in addition, the tail plane incidence may be varied by an electric actuator. Booster jacks, operated by the aircraft hydraulic system *(Sect. 3, Chap. 6)*, are provided to fully augment the pilot's effort when operating the ailerons and elevators. Selection of Power ON or OFF for ailerons and elevator is made by the operation of switches in the cabin. They are disconnected, automatically, in the event of hydraulic system failure. With the switches in the OFF position the booster jacks function as normal control tubes, thus enabling

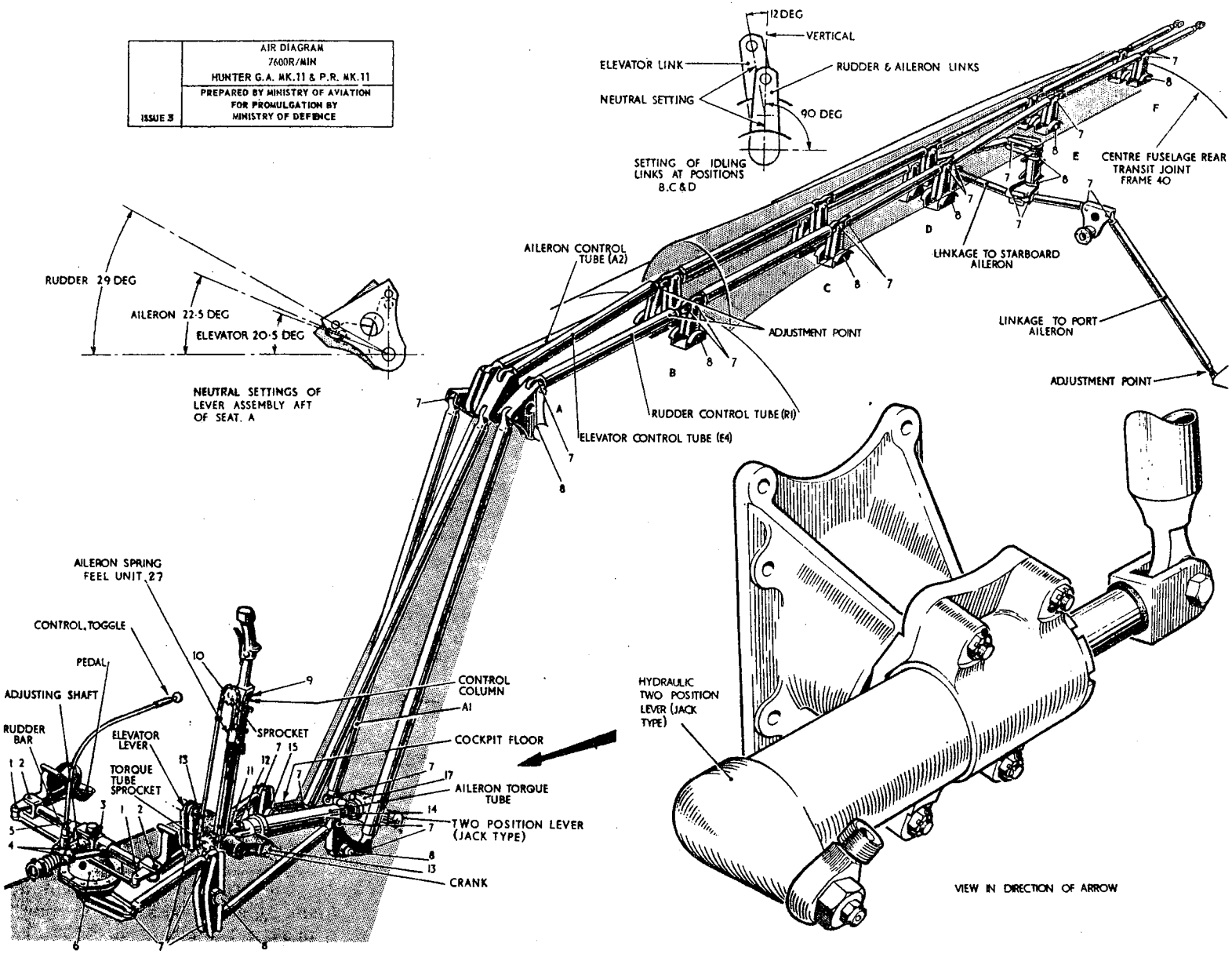

Fig.1 Flying controls with lubrication points (1)

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KEY TO FIG. 1, 2 and 3

Flying Controls, with Lubrication Points

1	Rudder bar connecting link pins	OIL OX-14
3	Rudder bar centre bearings	
4	Rudder bar adjustment link pins	
10	Chains and sprockets	
18	Trim tab hinge pin	
20	Trim tab actuator pin	
21	Trim tab lever	
24	Elevator feel unit anchorages	
31	Spring unit upper end shackle pin	
32	Connecting rod shackle pin	
33	Forward link upper end connection, microswitch lever pivot pin and stop pin	
34	Forward link lower end connection	
35	Actuator upper pivot pin	
36	Actuator lower end pivot bolt	
37	Aft link upper and lower end connections	
40	Transmitter lever shackle pin	
42	Limit switch rod shackle pins	
45	Desynn transmitter rod shackle pins	
46	Aileron hydraulic booster linkage pins	
2	Rudder bar pedal bolts.	GREASE XG–287
12	Torque tube universal joint pins	
16	Aileron spring feel unit bearings and gears	
19	Hydraulic booster jack ram	
23	Pivot pin for input and output levers	
25	Tail plane actuator pivots	
26	Rudder hinges	
27	Tail plane pivot	
28	Spring unit (flying tail) spindle	
30	Elevator spring feel unit spindle	
38	Spring unit lower end	
39	Elevator universal joint	
43	Servo motor unit rear bearing	
44	Elevator inner hinge	
6	Rudder bar pedestal bearings	Packed with grease on assembly. Further lubrication not required, but where accessible, remove any moisture which may have accumulated.
7	Control tube bearings	
8	Control link and lever bearings	
9	Control column head joint	
11	Control column bearings	
13	Crank bearings	
14	Torque tube bearings	
15	Elevator shaft bearings	
17	Hydraulic two-position lever (jack type) bearings	
22	Aileron bearings	
29	Elevator outer hinge	
5	Rudder bar adjustment cables	GREASE XG-273
41	Rudder tab Desynn transmitter Bowden cable Aileron tab Desynn transmitter Bowden cable	

Note . . .

On re-assembly of flying control and idling links incorporating shielded bearings, care must be taken to ensure that these bearings are free from sealing compound and are well packed with grease. For lubrication of flap controls refer to Sect. 3, Chap. 2, fig. 15, 16, 17 and 18.

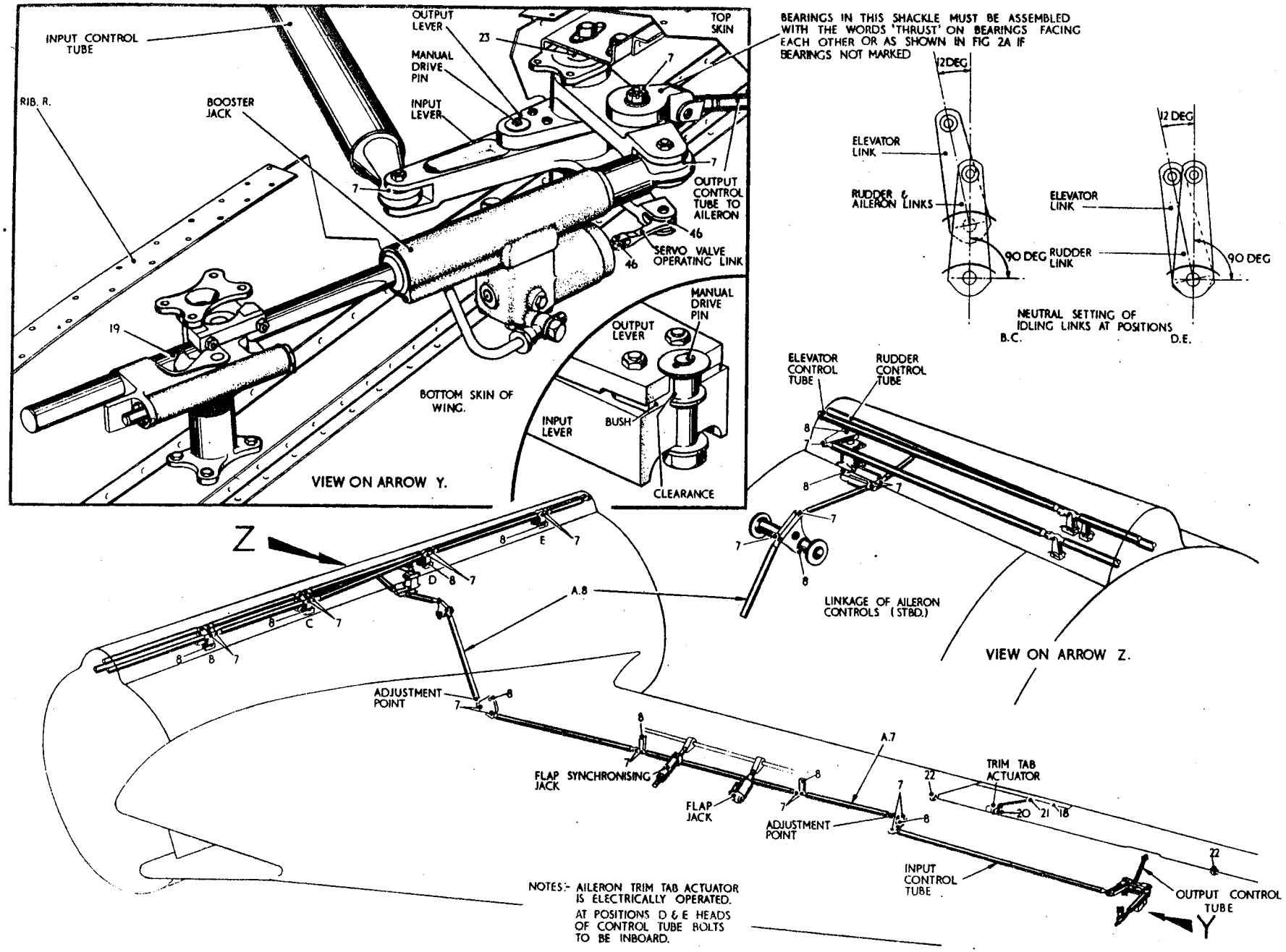

Fig.2 Flying controls with lubrication points (2)

(Shackle bearings note amended)

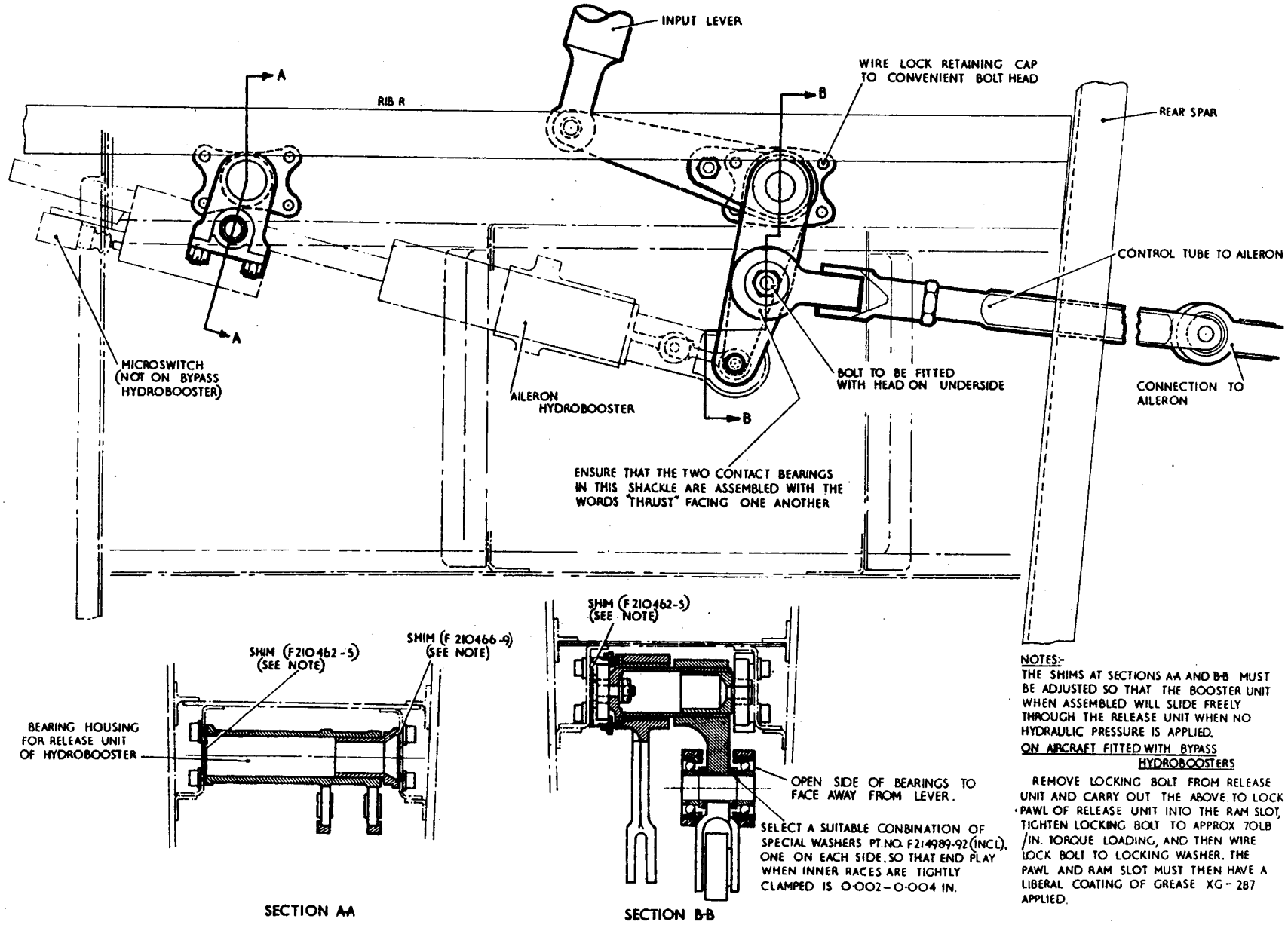

Fig.2A Assembly of aileron levers at rib R

◀ (Section B–B amended) ▶

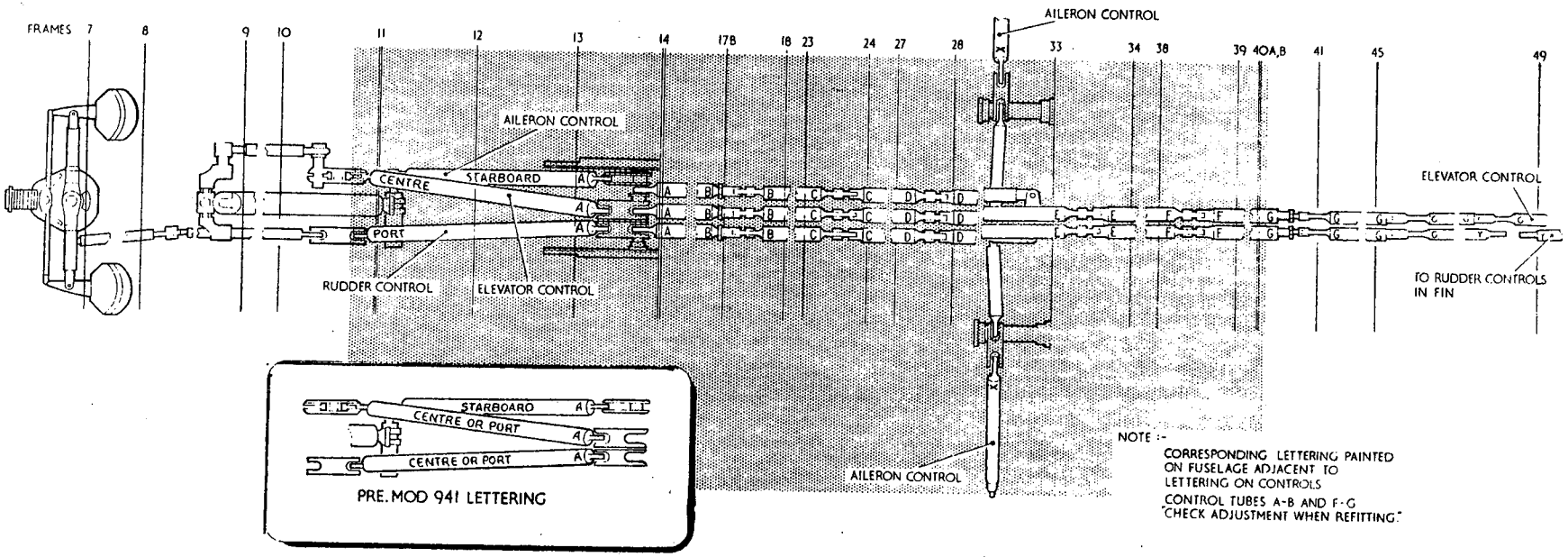

Fig. 2b Identification lettering on flying control tubes in fuselage

manual operation of the control surfaces to be effected. An electrically-operated flying tail is provided consisting of an interconnection of the elevator with the tail plane trimming actuator. The rudder and port aileron are provided with small electrically-operated trimming tabs. Conventional split trailing edge landing flaps are provided on the undersurface of each outer wing and a hydraulically-operated air brake is hinged to the undersurface of the rear fuselage. A braking parachute is accommodated in a stowage which is located above the tail cone.

Control column and linkage *(fig. 1)*

3. The control column has a pivoted upper portion which moves laterally and independently to control the ailerons, while both portions move as one complete unit fore and aft to control the elevators. The upper portion carries a handgrip which accommodates the gun firing, camera and other control switches, together with the wheel brake lever. A sprocket is attached to the upper portion, at the knuckle joint, to transmit the lateral movement to an aileron torque sprocket at the bottom of the column via a chain and link system enclosed in a guard on the forward face of the column. The chain and link system incorporates an adjustable spring feel unit *(fig. 1 and 5)* which is described in para. 7. The lower portion of the control column incorporates the aileron control stops *(fig. 6)* and is terminated by an inverted tee-shaped plug-end bolted to two cranks which are themselves bolted to small torque shafts carried in bearings at both sides of the fuselage keel member below the cabin floor. The starboard shaft is longer than that on the port side and carries a lever which is connected to a control tube extending aft to a further lever system located in bearings on the starboard side of the keel member between frames 10 and 11; from this point the control tubes extend upwards behind the seat and aft to the elevators. The lower portion of the control column also incorporates the aileron torque tube sprocket which is carried at the forward end of a shaft passing through the tee-shaped plug-end and connected to the aileron torque tube by a universal joint. The aileron torque tube is carried in bearings attached to the underside of the cabin floor and frame 11. Assembled to the aileron torque tube is a two-position hydraulic jack which acts as the lever to transmit the motion of the torque tube to further control tubes which extend upwards behind the seat and aft to the ailerons. The jack is spring-loaded so that it is fully extended against the spring by hydraulic pressure when the ailerons are in power, but is automatically retracted by the pressure of the spring when the ailerons are in manual and hydraulic power is not available at the boosters. It also retracts automatically in the event of hydraulic failure. Thus, aileron control in manual is effected through a shortened lever *(jack retracted)* to reduce the effort required from the pilot to operate them and, consequently, the range of movement of the ailerons in manual will be considerably less than the range of movement obtained when the ailerons are in power. The elevator spring feel unit *(para. 8)* is fitted in the dorsal fin, but whereas it is similar in principle to that of the aileron feel unit, it is not adjustable in flight.

Rudder bar *(fig. 1)*

4. The rudder bar is mounted on a vertical spindle which is free to rotate in a pedestal casting secured to the cabin floor. The spindle incorporates an adjustable stop *(fig. 10)* which protrudes through a slot in the pedestal and so limits the rudder bar movement. The rudder bar consists of two separate arms with a fork at each end, the inboard forks interlacing to fit over the spindle, while the outboard forks carry the foot pedals. A rudder bar adjusting shaft is splined to the top of the spindle, between the inboard forks of the rudder bar arms, and carries a slide with a spring-loaded plunger which engages with one of a number of holes in the adjusting shaft. This slide is attached to each rudder bar arm by a short link, and a spring is located between the slide and a stop on the forward end of the adjusting shaft. The rudder pedals, which consist of light alloy stampings, are provided with bearings to fit the outboard forks of the rudder bar, and each pedal extends forward to form a lever which is connected by a link rod to a support plate projecting forward from the pedestal. These link rods are provided to maintain the pedals in the same angular position relative to each other when the rudder is operated. Movement of the rudder pedals is transmitted to the operating lever at the bottom of the spindle through the short links, slide and adjusting shaft.

5. The rudder bar is adjusted for leg reach by means of a control lever in the cabin. The lever is connected to the spring-loaded plunger in the slide on the adjusting shaft by a Bowden cable. Operation of the lever disengages the plunger from its hole in the adjusting shaft, thus permitting the rudder bar arms to be swung forwards against the pressure of the spring, or swung backwards by the spring. When adjustment is completed, the lever is released to allow the plunger to engage with the nearest hole in the adjusting shaft, thus locking the rudder bar in the desired position.

Control tubes

6. Apart from the lateral movement of the control column, which is transmitted to the aileron torque tube below the cabin floor by means of a sprocket and chain system, all movement of the control column and rudder bar is transmitted to the control surfaces by a series of control tubes carried on idling links which are hinged to the aircraft structure. The run of the control tubes is illustrated in fig. 1, 2, 3 and 4.

Spring feel units

7. The aileron and elevator control systems are each provided with a spring feel unit to give artificial feel to the controls when they are operated in power. The aileron spring feel unit *(fig. 1 and 5)* consists of a cylindrical casing which contains a spring-loaded spindle, the spring when assembled, being adjusted to

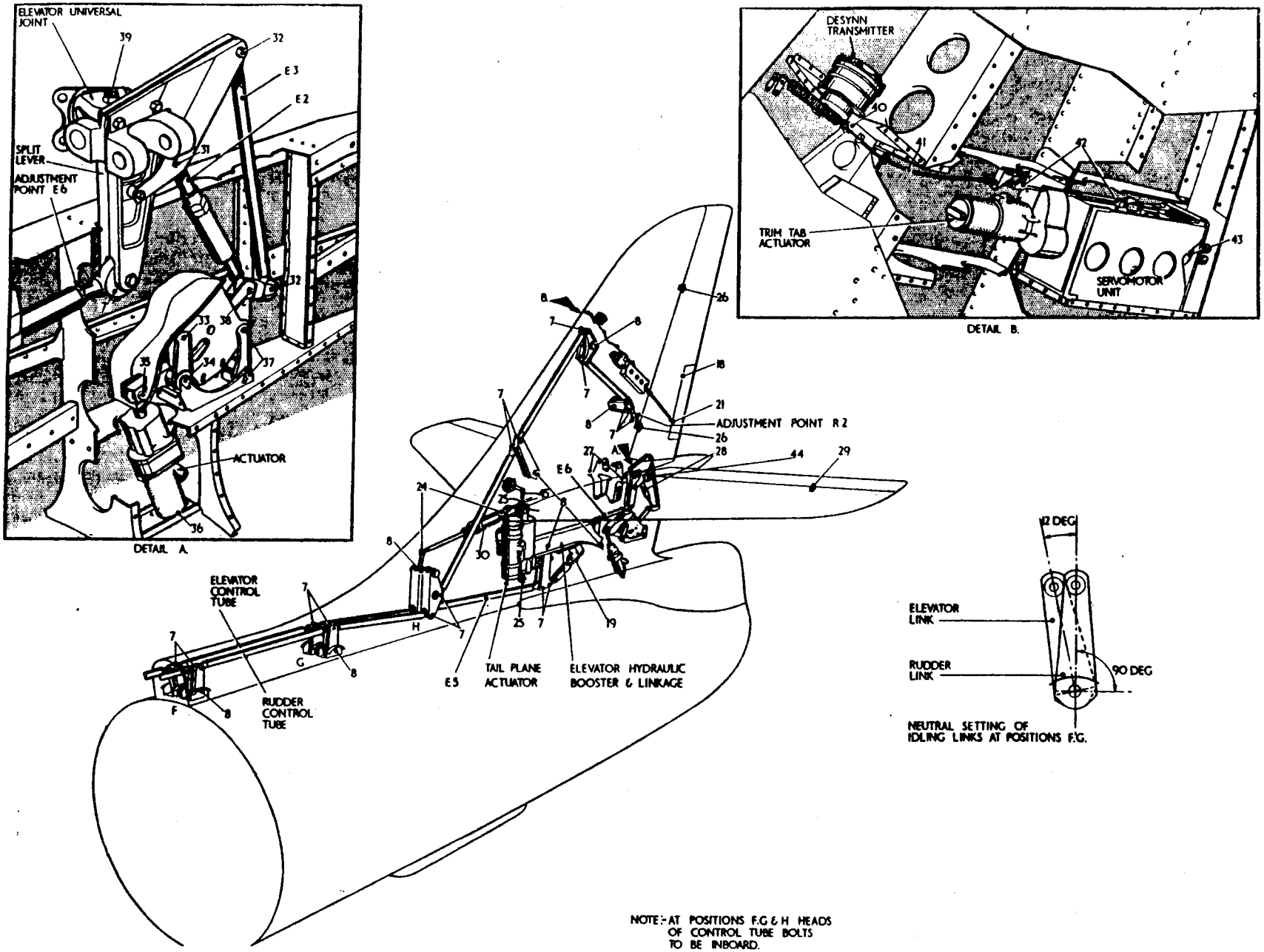

Fig. 3 Flying controls with lubrication points (3)

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a nominal load of 7 lb by means of an adjuster nut on the lower end of the spindle. The spindle is free to move in either direction in the casing against the spring, and the unit is mounted on the lower portion of the control column in such a manner that the spring-loaded spindle of the unit forms part of the chain and link system between the upper and lower sprockets of the column, while the cylindrical casing is anchored to the mounting by which the unit is attached to the column itself. Thus, while the casing remains fixed in relation to the column, the spindle is free to move against the spring to give artificial feel to the controls when the ailerons are being operated in power. Since the anchorage of the spring feel unit casing to the mounting on the column is in the form of a screw thread, it follows that the datum point will be dependent upon the amount the unit is screwed into the mounting, and this has been utilized to form a means of adjusting the datum point to which the control column and ailerons are centred. Adjustment is by means of a control spindle which is fitted parallel to the spring feel unit in its mounting. Turning a knob at the top of the spindle rotates the spindle together with an integral pinion at its base which, being in mesh with an integral gear on the outer periphery of the spring casing, rotates the casing in the threaded bore of the mounting, thus varying the datum point to suit individual requirements in flight. The unit is initially adjusted so that, when the spring is at its nominal load of 7 lb, the control knob is in the neutral position *(i.e., the dowel in the housing registering in the depression on the top face of the pinion at the base of the spindle)* and the white *(neutral)* line on the top of the control knob facing forward.

8. The elevator spring feel unit (*fig. 3 and 13*) is fitted in the dorsal fin between the flying controls idling links in the region of frame 49 and a lever assembly which is linked to the junction of the tail plane actuator and tail plane lever. In principle, the elevator spring feel unit is similar to that for the ailerons, but incorporates an additional spring at either end of the unit, these permitting limited movement of the centre column before the main spring comes into action, thus ensuring a smooth take over at the neutral point. Unlike the aileron feel unit, the elevator feel unit is not adjustable in flight.

Tail plane incidence control (Normal) (*fig. 3 and 4*)

9. To enable the incidence of the tail plane to be varied in flight, it is hinged at the rear spar to a pivot at the top of frame 55 and a projection on its leading edge picks up with the operating rod of an electrically-operated actuator mounted in the dorsal fin below the tail plane between frames 51 and 52. The actuator incorporates non-adjustable limit switches to control its range of movement, and is provided with a standby motor to maintain operation should the main motor or the main electrical circuit fail. The main motor is controlled by a switch on the control column handgrip, and the standby motor by a separate control circuit energized by a switch under a guard cover on the cabin port shelf. Raising this cover fully enables the standby switch to be used and trips the circuit breaker of the tail plane actuator main motor. A switch is provided to select normal operation, or operation automatically in conjunction with the elevator to form an electrically-operated flying tail. The incidence of the tail plane is shown on an indicator in the cabin. The operation and circuit of the electrical actuator and indicator is described in Sect. 5, Chap. 1.

Electrically-operated flying tail (*fig. 4*)

10. The electrically-operated flying tail consists essentially of the interconnection of the elevator with the tail plane trimming actuator, the interconnection being in the form of a follow-up linkage so that a given control column displacement provides a predetermined amount of tail plane and elevator movement in the manner described in the following paragraphs.

11. A pantograph type of linkage, housed in the dorsal fin aft of the booster unit and below the tail plane, is attached to the elevator and carries a switch arm which has one end floating between two opposed microswitches in a special mounting. Movement of the elevator relative to the tail plane causes the switch arm to contact and operate one of the microswitches which, in turn, energizes the tail plane actuator to move the tail plane and also return the switch arm to its position central between the two microswitches, leaving the elevator deflected relative to the new position of the tail plane. As long as the switches remain in the same location, there is, therefore, a definite relationship between the tail plane and elevator angle for all positions of the control column. If the switches are moved to a different position, however, the relationship is changed and made to suit the requirements of flight at any given speed. The switch mounting is linked so as to vary the ratio between the tail plane and elevator travel for a given control column movement. In order to prevent a continual hunting of the tail plane actuator, the elevator has a range of movement of approximately 1¾ deg through which it can move without operating the switches.

12. The pantograph type of linkage attached to the elevator incorporates a spring unit in the form of a telescopic strut (*fig. 14*), so that a full and unrestricted control column travel can be obtained when either of the microswitches are fully depressed, which condition can arise when either the control column is moved faster than the rate at which the tail plane can follow up, or the tail plane reaches the end of its travel.

13. Trimming for hands-off flight is accomplished by means of a small electrical actuator,

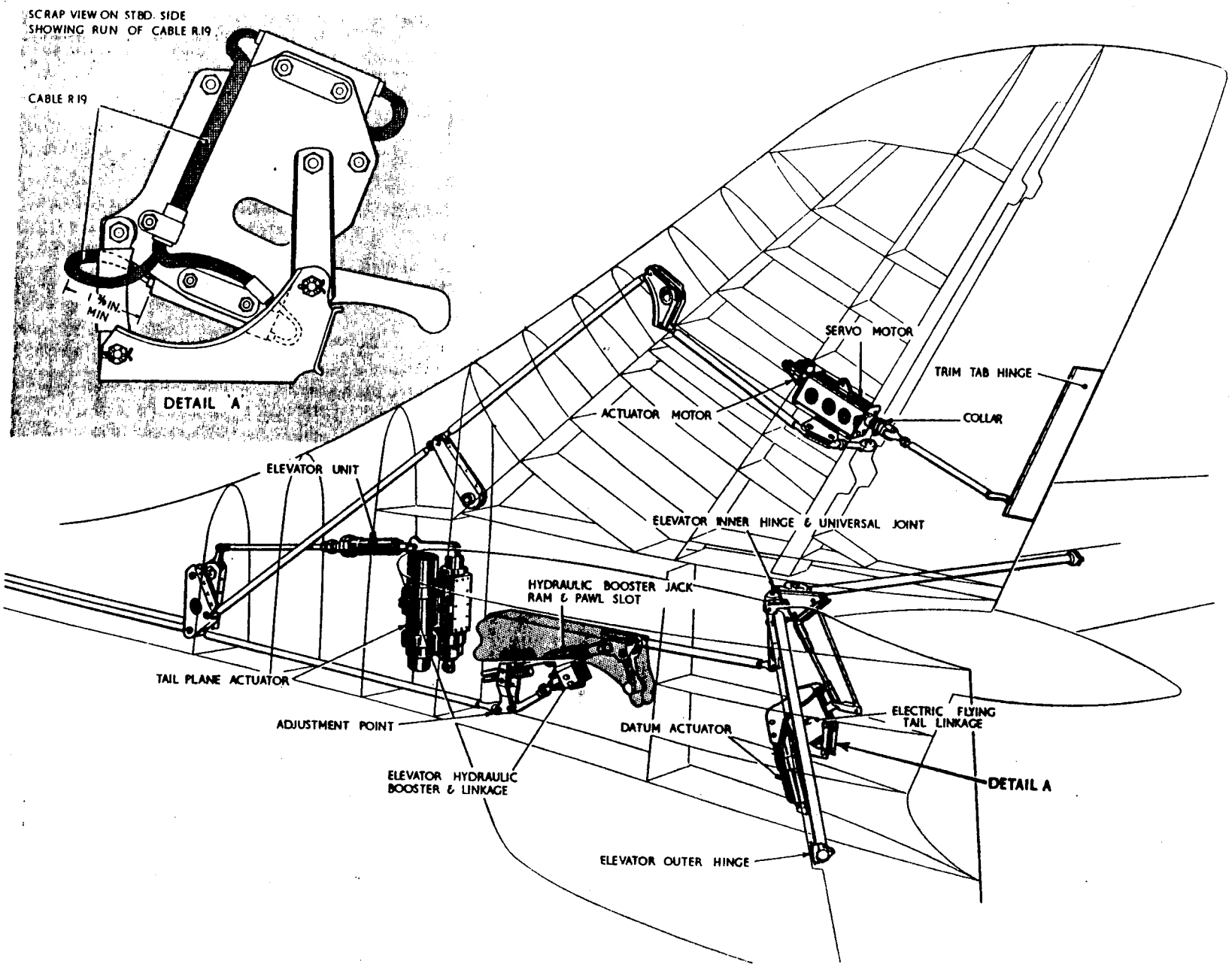


Fig. 4 Controls in tail plane, fin and rudder

one end of which is anchored to structure below the switch carrier, the other end being anchored to the switch carrier itself, operation of the actuator varying the position of the switch carrier for a given tail plane position. When selection of flying tail is made (*by operation of a switch in the cabin*) operation of a thumb switch (*para.* 9), on the control column handgrip, moves the tail plane actuator simultaneously with the switch carrier actuator, the movement of the latter being such that it maintains the switch arm central between the two microswitches with the elevator trailing as the tail plane moves to its trim position. While trimming, the microswitches serve as limit switches to maintain the two actuators in step.

14. Artificial feel is provided for by a spring feel unit (*para.* 8) which provides a control column force dependent upon elevator movement relative to the tail plane, the spring feel unit being anchored to the tail plane, and not to the main (*fixed*) structure of the air frame. Therefore, for any given tail plane angle, elevator deflection relative to the tail plane necessitates deflection of the spring of the spring feel unit.

15. A switch in the cabin (*para.* 13) is provided to cut out the electrical flying tail linkage in order to permit reversion to normal full power elevator control with trimmable tail plane. The interconnection can be used with manual elevator if desired, but the interconnection does not function when the standby electrical tail trimmer is in use.

15A. The locations of the electrically operated flying tail components in the fin are illustrated in fig. 5a, which also contains a diagram of the tail plane and elevator control system, and cross references to associated illustrations and servicing information. The flying tail switch gear is illustrated in fig. 14a. When the tail-plane main control selector switch is selected to ON the tailplane automatically follows the elevator movement when the control column is moved, and this action is described in fig. 5b. Trimming the tailplane with the main control selector switch selected to ON or OFF is described in fig. 5c. Trimming the tailplane when the cover of the standby control switch is lifted and the standby trim switch operated is described in fig. 5d.

Elevator hydraulic booster controls *(fig.3 and 4)*

16. The elevator hydraulic booster jack and linkage system is located between frames 52 and 55 just below the tail plane. The assembly is carried in a channel-sectioned beam bolted to cast brackets mounted on the frames and consists of a hydraulic booster jack, locked release unit, servo valve and operating link, together with an input and output lever. The release unit pawl is permanently locked in engagement and the booster body is provided with an internal by-pass, containing a simple spring loaded valve, which connects either side of the jack piston. A two-position switch in the cabin is provided for selection of power ON or OFF and an indicator—operated by a pressure switch in the hydraulic system—show that, after selecting power ON, power is, in fact, available at the hydro-boosters. The elevator control tube from the control column is connected to the extreme end of the input lever, and the control tube from the elevator is connected to the output lever.

17. In the event of hydraulic failure, a hydraulic accumulator in the circuit provides sufficient power to give a limited number of control column reversals, and when the accumulator is exhausted, control of the elevator automatically reverts to manual. The operation and circuit of the switch and indicator is described in Sect. 5, Chap. 1.

Aileron hydraulic booster controls

18. Each aileron hydraulic booster jack and linkage system is located in its respective outer wing in a bay formed by ribs R and S, a diaphragm and the rear spar (*Sect.* 3, *Chap.* 2, *fig.* 1), the assembly being carried on two sets of mountings bolted to a beam attached to the skin and the outboard face of rib R. Apart from the hydraulic booster unit, the linkage consists of an input and output lever assembly on one set of mountings and a locked release unit assembly, which supports the booster unit, carried on the second set of mountings. The input and output levers, although fitted on the same bearings in the mountings, are not directly connected, and interconnection for the purpose of manual operation in the event of hydraulic failure, is derived from a manual drive pin protruding upwards from the input lever into an integral bush on the output lever. There is a diametrical clearance between the pin and bush to provide for lost motion for valve operation. The aileron control tube from the control column is connected to the extreme end of the input lever and the control rod to the aileron is connected by a fork-end to a shackle approximately mid-way along the output lever. ***It should be noted that the angular-contact bearings in this shackle must be assembled as shown in fig.2A.*** The servo is operated by a link attached to a subsidiary lever integral with the input lever.

19. The method of selection of the hydraulic power and the emergency operation by means of an accumulator is similar to that described for the elevator control in para. 16 and 17.

Operation of booster jacks

20. The operation of the aileron and elevator booster jacks is similar and is fully described in the relative equipment manual.

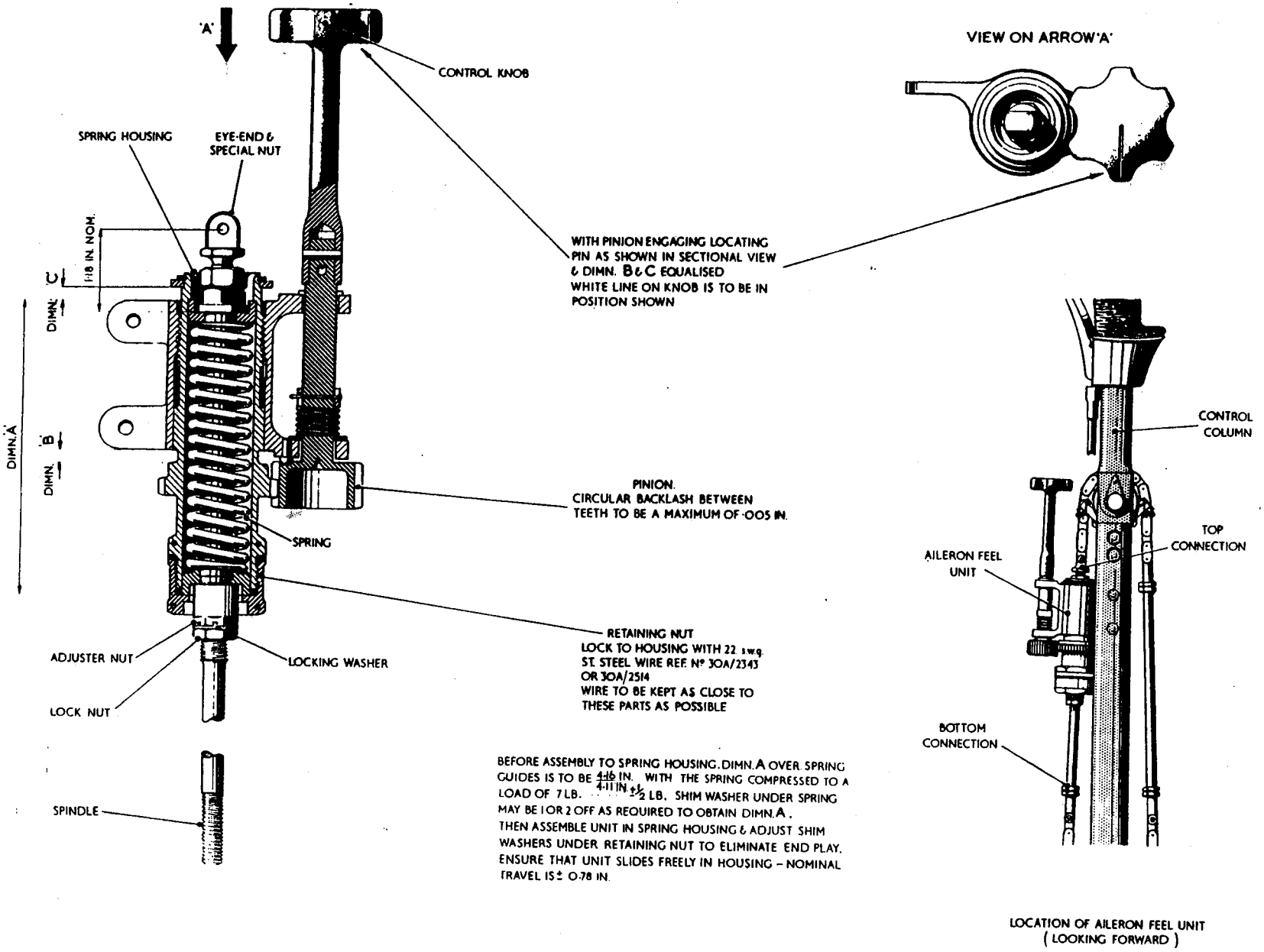
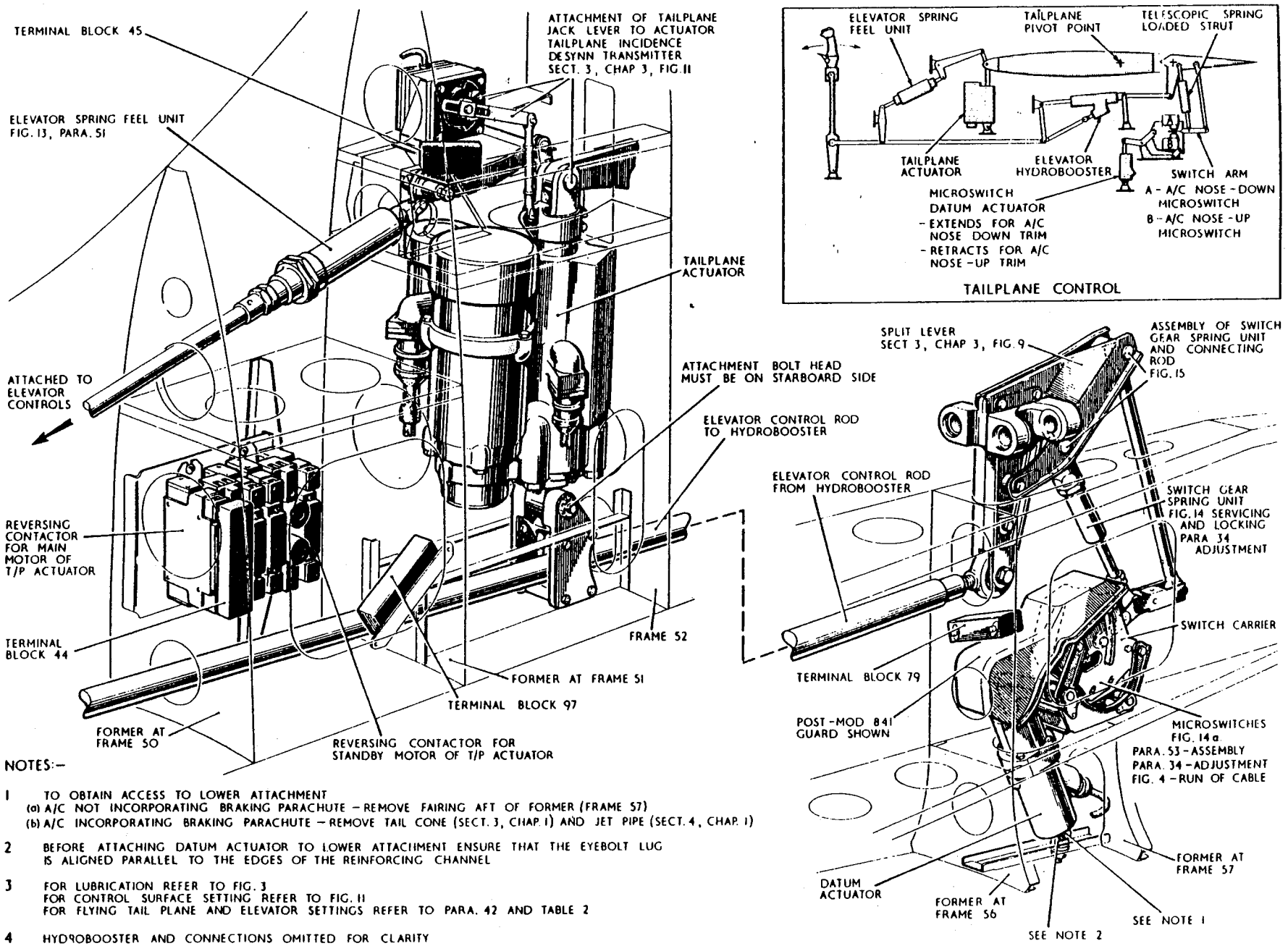


Fig. 5 Aileron feel unit



NOTES:-

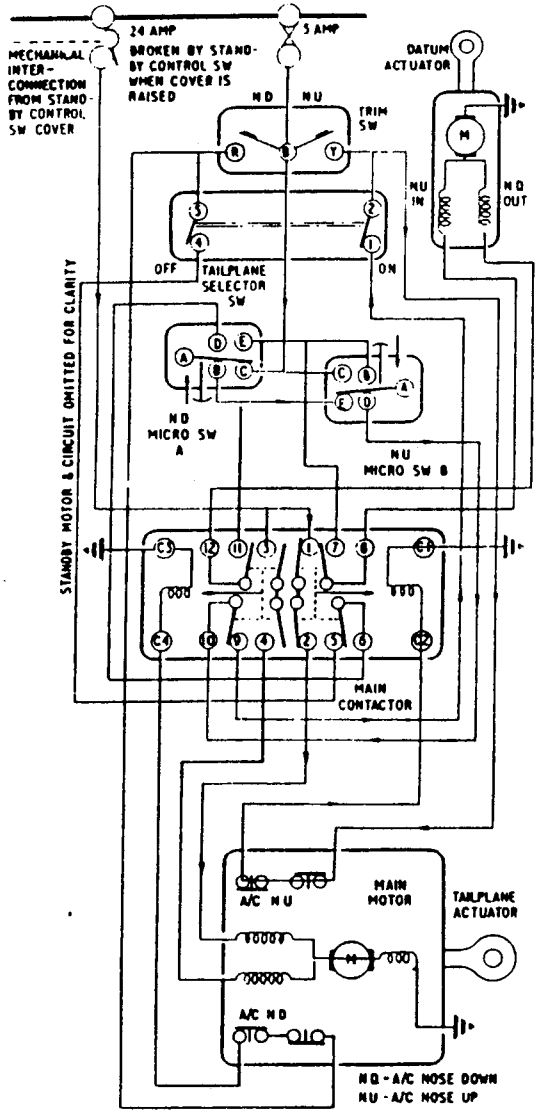
1 TO OBTAIN ACCESS TO LOWER ATTACHMENT
(a) A/C NOT INCORPORATING BRAKING PARACHUTE - REMOVE FAIRING AFT OF FORMER (FRAME 57)
(b) A/C INCORPORATING BRAKING PARACHUTE - REMOVE TAIL CONE (SECT. 3, CHAP. 1) AND JET PIPE (SECT. 4, CHAP. 1)

2 BEFORE ATTACHING DATUM ACTUATOR TO LOWER ATTACHMENT ENSURE THAT THE EYEBOLT LUG IS ALIGNED PARALLEL TO THE EDGES OF THE REINFORCING CHANNEL

3 FOR LUBRICATION REFER TO FIG. 3
FOR CONTROL SURFACE SETTING REFER TO FIG. 11
FOR FLYING TAIL PLANE AND ELEVATOR SETTINGS REFER TO PARA. 42 AND TABLE 2

4 HYDROBOOSTER AND CONNECTIONS OMITTED FOR CLARITY

Fig. 5a Tailplane control

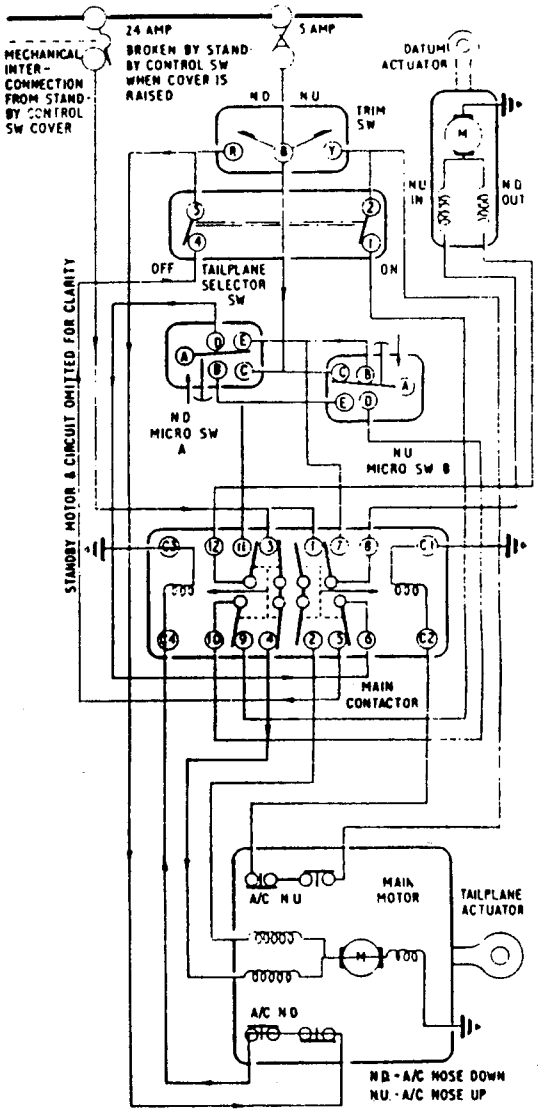


(1) Control column being pulled back from neutral.

KEY TO FIG. 5b (Tail-plane selector switch ON)

In (1), the elevator, by moving upwards, has carried the switch arm up causing it to pivot about its pivot point and depress the 'B' microswitch plunger so making contacts D and E. Thus completing an electrical circuit from the main power supply via a 5 amp. fuse, the contacts of 'A' microswitch, the contacts of the main contactor, the tail-plane selector switch and the nose up limit switch of the tail-plane actuator main motor to the coil of the main contactor. The contactor is thus energized and pulls in contacts 1 and 2 so completing a circuit from the 24 amp. circuit breaker to the tail-plane actuator main motor, which retracts to decrease the tail-plane incidence until either the switch arm is again in a neutral position between the microswitches or the internal limit switch in the tail-plane actuator motor is tripped.

In (2) the downward movement of the elevator causes the switch arm to depress the 'A' microswitch and make contacts D and E. Thus completing an electrical circuit, in a similar manner to (1), to the coil of the main contactor which pulls in contacts 3 and 4, so completing a circuit from the 24 amp. circuit breaker to the tail-plane actuator main motor which extends to increase the tailplane incidence until either the switch arm is again in a neutral position between the microswitches or the internal limit switch in the tail-plane actuator motor is tripped.



(2) Control column being pushed forward from neutral.

Fig. 5b Tail-plane selector switch selected to ON—tailplane follow up

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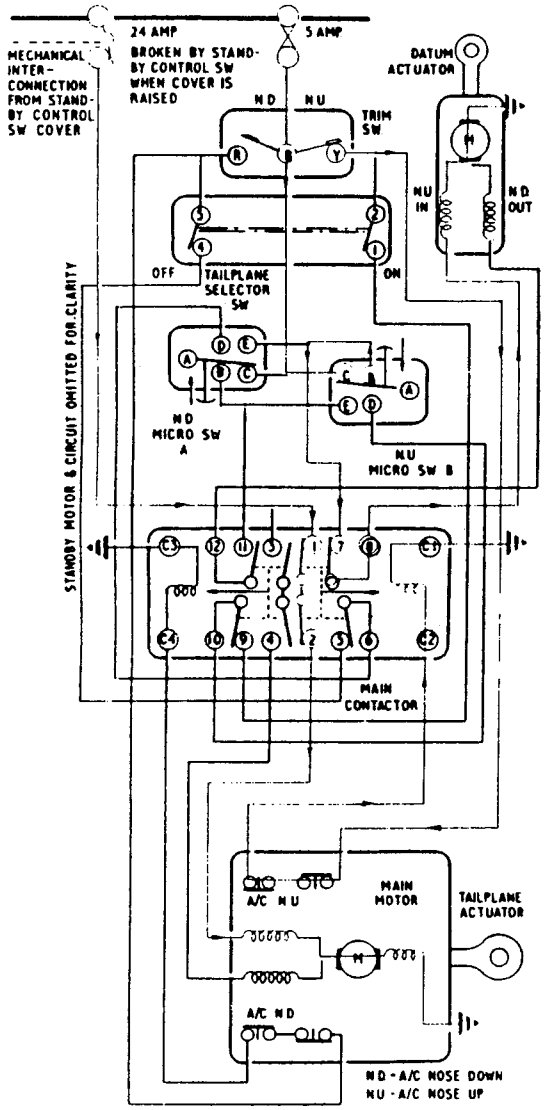
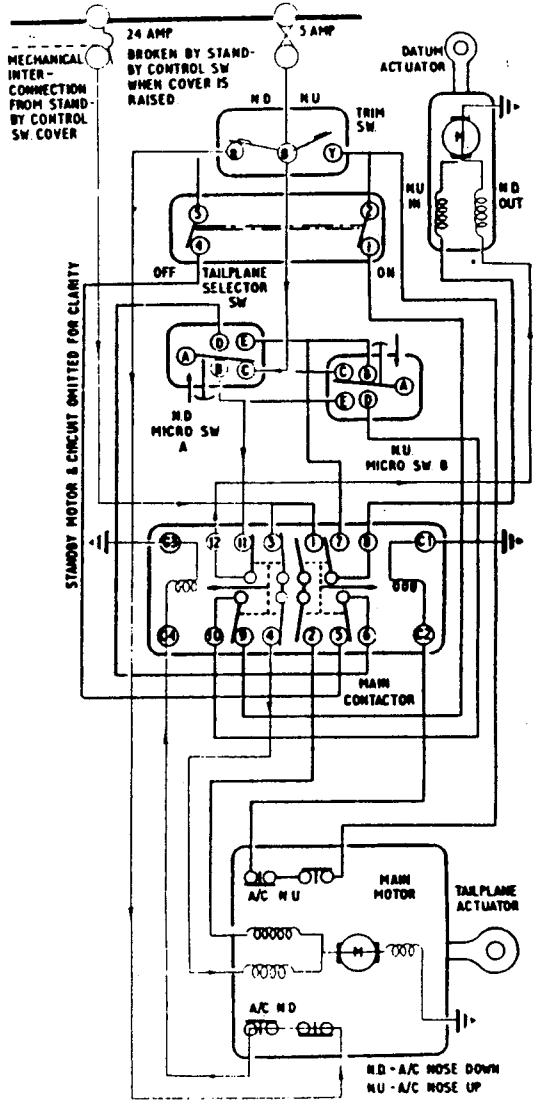


(1) Trimming nose up.

KEY TO FIG. 5c (Tail-plane selector switch ON or OFF)

In (1), moving the trim switch on the control column to the NOSE UP position completes an electrical circuit from the main power supply through a 5 amp. fuse, the nose up limit switch of the tail-plane actuator main motor, to the coil of the main contactor, which pulls in contacts 1, 7 and 2. Contacts 1 and 2 complete a circuit from the 24 amp. circuit breaker to the tail-plane main motor, which retracts to decrease the tailplane incidence until either the trim switch is released or the tail-plane actuator limit switch is tripped. At the same time a circuit from the main power supply through the 5 amp. fuse, contacts C and B of 'B' micro-switch and contact 7 of the main contactor has energized the datum actuator, which retracts and moves the switch gear carrier to keep the switch arm in the neutral position between the microswitches. Because the datum actuator moves the switch gear carrier faster than the tail plane is moving the switch arm, the datum actuator causes the switch arm to depress the 'B' microswitch plunger and break the circuit to the datum actuator, which is thus immobilized until the movement of the tail plane results in the switch arm moving off the 'B' microswitch plunger when the datum actuator starts to retract again to maintain the switch arm neutral. In addition, as the tail plane moves, the elevator is forced to follow the tail plane through the centring action of the elevator spring feel unit which acts through the input control to the hydrobooster so that the elevator is maintained neutral with the tail plane.

In (2), operation of the trim switch on the control column to the NOSE DOWN position results in the tail-plane actuator extending, the datum actuator extending intermittently and the elevator following the tailplane in a similar manner to (1). So increasing the tailplane incidence, the datum actuator maintaining the switch arm neutral between the microswitches and the elevator remaining neutral with the tailplane. In this action main contactor contacts 3, 4 and 11 are made, contacts C and B of 'A' micro-switch are broken to interrupt the supply to the datum actuator and the maximum movement of the tail-plane actuator is controlled by the nose down limit switch.



(2) Trimming nose down.

Fig. 5c Tail-plane selector switch ON or OFF—trimming

KEY TO FIG. 5d (Standby trim switch cover lifted)

When the tail plane standby trim switch cover is fully lifted, it trips the 24 amp. circuit breaker and cuts off all supplies to the tail-plane actuator main motor. Then, when the standby trim switch is selected to NOSE UP or NOSE DOWN position, an electrical circuit is completed from the main power supply through a 2·5 amp. fuse, through the limit switch of the standby motor of the tail-plane actuator, to the coil of the standby contactor. Thus the contactor is energized and pulls in the appropriate contacts to complete a circuit from the main power supply, through a 20 amp. fuse, to the tail-plane actuator standby motor, which is energized to either extend or retract the tail-plane actuator but at a lower speed than the main motor. The red circuit shows the circuit in use when NOSE UP trim is selected and the blue circuit shows the circuit in use when NOSE DOWN trim is selected. In each case, as the tail plane moves to the trim position, the elevator is forced to follow the tail plane through the centring action of the elevator spring feel unit, which acts through the input control rod to the hydro-booster so that the elevator is maintained neutral with the tail plane.

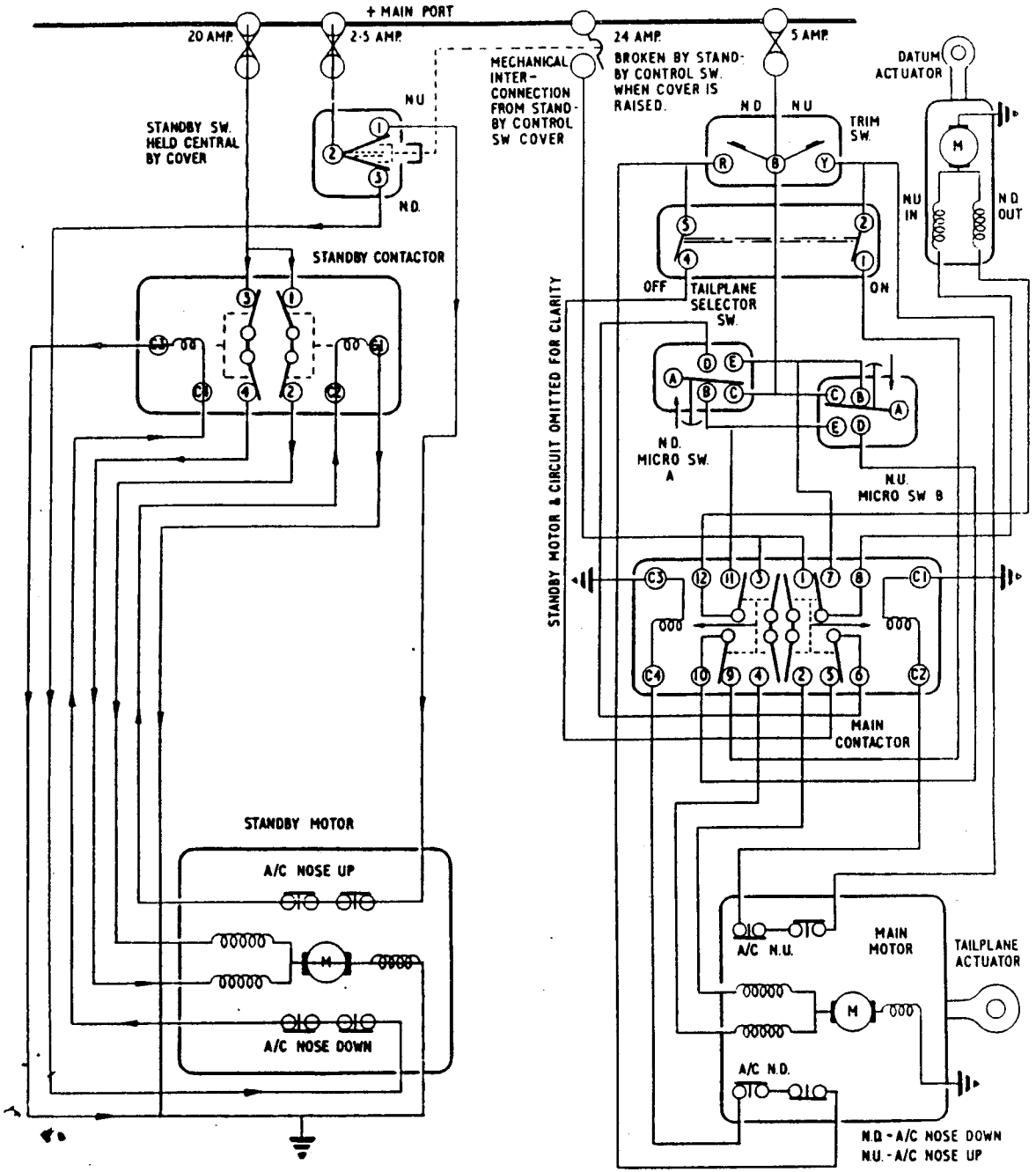


Fig. 5d Tail-plane standby trim switch cover lifted

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Rudder trimming tab *(fig. 3 & 4)*

21. The rudder trimming tab is located in the trailing edge at the bottom of the rudder and is controlled by a small electrically-operated actuator in the fin. The actuator is controlled by a combined aileron and rudder trim switch in the cabin and a shaft within the rudder transmits the movement to a small lever attached to the rudder trimming tab. The tab position is shown on a combined aileron and rudder tab position indicator located adjacent to the trim switch in the cabin. The rudder portion of this indicator is operated by a Desynn transmitter in the leading edge of the fin, the transmitter being actuated by a Bowden cable attached to a lug on the slave unit servo motor. The operation and circuit of the actuator assembly is described in Sect. 5, Chap. 1 and that of the Desynn system in Sect. 5, Chap. 2.

Aileron trimming tab *(fig. 2)*

22. A small tab to enable fine adjustments of lateral trim to be made in flight is provided in the inboard trailing edge of the port aileron. The tab is controlled by a small electrically-operated actuator bolted to the forward face of the aileron spar between nose ribs 2 and 3. An operating rod, within the aileron, transmits the movement via an eccentric driven by the actuator, to a small lever attached to the tab. The actuator is controlled by the combined aileron and rudder trim switch in the cabin. The trim switch control knob may be locked by a pivoted lever carried on a mounting bracket attached to the switch. This lever is shaped in such a manner that, when locked in position, it grips the control knob spindle to prevent sideways movement. Thus, the lock does not interfere with the rotation of the knob for rudder control, as it is only intended to prevent inadvertent operation of the aileron tab when flying in power. The lever is retained in the locked or unlocked position by a spring-loaded plunger which is carried on the mounting and engages with holes in the lever. The setting of the tab is shown on the combined aileron and rudder tab position indicator, located adjacent to the control switch, the aileron portion of which is actuated by a Desynn transmitter located adjacent to the actuator and operated by a Bowden cable attached to a lever on the actuator. The operation and circuit of the actuator and Desynn system is described in Sect. 5, Chap. 1.

Landing flaps *(fig. 2)*

23. Hydraulically-operated landing flaps *(Sect. 3, Chap. 2)*, extend along the undersurface of each outer wing from the wing root to just inboard of the ailerons and are controlled by a lever type selector switch in the cabin. This switch energizes an electro-hydraulic control valve in the port wheel bay, via a follow-up drum switch situated in the port wing root. A flap position indicator, situated close to the selector switch, is operated by a Desynn transmitter situated in the port wheel bay and connected to the flap and follow-up gear by a Bowden cable. The flaps are synchronized by a hydraulic interconnection which is described in Sect. 3, Chap. 6, and the operation of the flap control gear, together with circuit details, is given in Sect. 5, Chap. 1. The operation of the flaps in an emergency is given in Sect. 1, Chap. 3.

Air brake

24. A hydraulically-operated air brake flap *(Sect. 3, Chap. 1)* is mounted on the underside of the rear fuselage by two extended hinges pivoted in channel fittings situated one on each side of the fuselage between frames 45 and 46. The flap, which is designed so that it embraces the underside of the fuselage when in the raised position, is extended and retracted by a hydraulic jack housed in a sealed off cut-away extending from frame 47 to frame 50 in the bottom of the rear fuselage.

25. The installation is controlled by a thumb switch incorporated in the end of the throttle twist grip, which operates two electro-hydraulic solenoid valves located in the rear fuselage adjacent to frame 50. A magnetic indicator, in the cabin, controlled by a microswitch situated on frame 47, is provided to indicate when the air brake is extended. To prevent damage due to limited ground clearance, the air brake control circuit is electrically interconnected with the undercarriage circuit in such a manner that it is impossible to extend the air brake while the undercarriage is down. If undercarriage DOWN is selected while the air brake is extended, this interconnection will immediately retract the air brake. The same condition is also obtained should the undercarriage emergency air lowering system be used by the action of a microswitch operated by the undercarriage emergency air valve. It should be noted that air brake IN must not normally be obtained by selecting undercarriage DOWN.

26. To enable the installation to be tested on the ground with the undercarriage down, a spring return test switch is provided in the cabin. Operation of this switch permits partial extension of the air brake and operation of the indicator by means of a microswitch located adjacent to the air brake port hinge to show that the installation is operating satisfactorily. The operation of the air brake hydraulic circuit is described in Sect. 3, Chap. 6, and a description of the electrical control circuit will be found in Sect. 5, Chap. 1.

SERVICING

General

26A. When carrying out any servicing of the flying controls, absolute cleanliness must be observed. In particular, the hydro-boosters provided for operation of the ailerons and elevators must be kept scrupulously clean. When disconnected during servicing, all pipe ends and unions on the units must be blanked off immediately to prevent the ingress of dirt or moisture. After servicing, the booster system must be primed and bled as described in Sect. 3, Chap. 6.

Note . . .

On Pre-mod. 895 aircraft it is important that at all times after landing in power, 'Manual' be selected before engine shut down, as otherwise the hydraulic handpump will be rendered ineffective (Sect. 3, Chap. 6).

Lubrication

27. The lubrication points for the flying controls are indicated by numerals on fig. 1, 2 and 3, and in Sect. 3, Chap. 2, fig. 15, 16, 17 and 18, the type of lubricant to be used at each point is given on the key to the illustrations. All shielded ball bearings are packed with anti-freeze grease before assembly and apart from the removal of any moisture that may have collected, they should not require further attention.

Shackles connecting control tubes to ailerons.

28. Periodically examine for cracks all around the part between the two bearings using a strong light and mirror. Where there is any indication of a crack proceed as follows:–

(1) Remove both shackles

(2) Remove any paint from the shackle surface using an approved chemical paint remover. Do not use anything to assist in the removal of the paint which will mark the surface of the shackle, and ensure that no paint remover gets into the shackle bearings.

(3) Using an approved dye penetrant technique, examine the surface of each shackle for cracks. Where there is any indication of marking, reject the shackle.

(4) Clean and dry the surface of each shackle. Check both bearings on each shackle for freedom of movement and smoothness of operation. Where a bearing is found to be stiff or rough in operation, apply a small amount of oil OX–14 to the bearing with a soft brush; and then check again for freedom of movement and smoothness of operation. If the bearing is still stiff or rough in operation, reject the shackle.

(5) Remove any surplus oil from the shackles and apply two coats of Paint, priming, etching (Ref.No. 33B/9429196) and one coat of Light Aircraft Grey, BX.29 (Ref. No.33B/2201108) or DTD.5555 (Ref.No. 33B/2204750).

(6) Refit the shackles to the aileron control tube and the aileron on both the port and starboard main plane using the bolts, nuts and washers removed. Tighten the nuts and fit new split pins.

Note . . .

The bolt and nut connecting the shackle to the aileron control tube are different from those connecting the shackle to the aileron. Ensure that the correct bolts and nuts are fitted in each position.

(7) Functionally test the controls

(8) Fulfil independent control checks.

Functioning checks for power controls and flying tail

29. To ensure that the power controls and flying tail are operating satisfactorily, the aircraft should be jacked up to rigging position, with its wheels clear of the ground *(Sect. 2, Chap. 4)* and tests, as described in the subsequent paragraphs, carried out, preferably after the main hydraulic functioning tests. The following points should, however, be noted :—

(1) The alignment of the booster jacks with their respective release units should be checked, on assembly to the aircraft, by unscrewing the release unit locking bolt and ensuring that the ram slides freely through the release unit. On completion of this check, screw in the locking bolt to a torque loading of 70 lb in., at the same time ensuring that the pawl is properly seated in the ram slot. Wire lock the bolt.

(2) During routine servicing and whenever any item in the flying tail linkage has been disturbed, the linkage must be checked for freedom of movement by carrying out functioning tests of the tail trim and flying tail circuits with 24 volts input to the aircraft. *(This is solely a test of the free operation of the switch carrier linkage, actuators are to be tested in accordance with A.P.4343).* Failure to operate freely will necessitate investigation into the cause and its rectification. Stiffness in the linkage may be due to lack of lubrication and/or mal-alignment of the switch carrier assembly and/or connecting rod. During re-assembly the spring unit and connecting rod should be aligned with the switch carrier lever as described on fig. 15.

(3) To avoid damage, it is essential that manual adjustments be carried out before hydraulic power is applied.

(4) The operations described in the following paragraphs are grouped for convenience under their various systems and do not, therefore, necessarily constitute the order in which they are to be carried out. The sequence to be followed will be determined by the stage of servicing being effected and local instructions.

MANUAL ADJUSTMENTS

Ailerons

30. The procedure for the manual adjustment of the ailerons is as follows:—

(1) With the two-position aileron jack retracted *(i.e. in MANUAL)*, disconnect control tube A.206734 *(fig. 1, item A1)* from the jack.

(2) Adjust the chain connecting rod of the control column to take up backlash but not too tight to cause stiffness in the control column movement, as checked throughout the full range of the aileron spring feel unit. Ensure that the chain rod is in safety and tighten the locknuts.

Note . . .

The universal fork, to which the lower chain sprocket is keyed, is set at 4½ deg ± ½ deg from the vertical, measured clockwise looking forward, with the control column handgrip in the neutral position.

(3) Lock the handgrip of the control column in the neutral position, using Rigging Fixture Ref. 26FX/95144 and set the aileron spring feel unit to its neutral position. *(White line on knob pointing forward).*

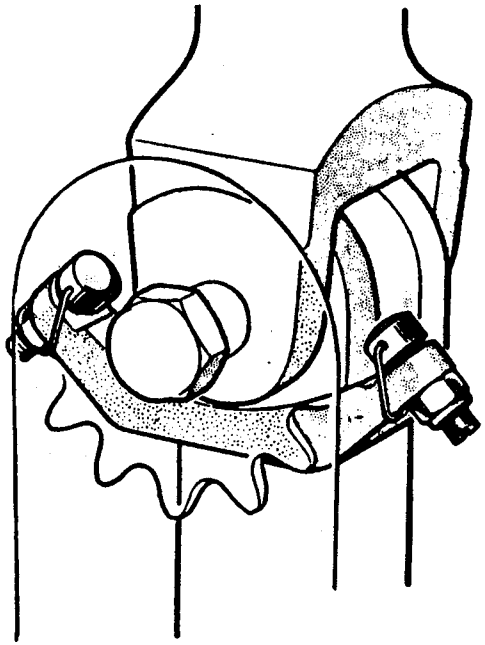


Fig. 6 Aileron control stops

(4) Fit the Aileron Rigging Lock Ref. 26FX/95307 on the aileron idling link and control tube between frames 23 and 24 and adjust the aileron control tube A.209620 *(fig. 1, item A2—first horizontal control tube aft of the cabin)* as necessary to allow the control tube A.206734 *(fig. 1, item A1)* to be reconnected to the two-position jack.

(5) The idling links and levers in the wings are set in the neutral positions during initial assembly by the manufacturer, using special tools and adjustment of control tube A.191584 *(fig. 2, item A7)*, any subsequent change of this control tube must therefore be made by setting the replacement tube to the exact pin centre length of the tube being replaced.

(6) Set the aileron booster units in the neutral position by aligning the rear face of the valve body with a straight-edge placed across the faces marked 'B' of the neutral setting rigging plates. With the input control tubes to the boosters connected, adjust the sloping control tubes A.169525 *(fig. 2, item A8)*, between frames 32 and 33, as necessary to connect to the levers in the wings.

(7) Adjust the booster output control tubes to the ailerons so that the trailing edge has approximately 0·2 in. up float.

(8) Remove the Rigging Fixture from the control column and check that the back lash at the top of the control column, when it is moved without force *(by one finger on the top of the control column)*, is not more than $\frac{3}{32}$ in.

(9) Remove the Rigging Lock from the controls between frames 23 and 24 and check that the load at the middle of the control column handgrip to just move it in either direction from neutral is less than 9 lb. If it exceeds this value, disconnect the input control tube to the booster assembly and check that the load required to just move the control column in either direction is now less than 1½ lb. Check for friction at the aileron hinges by ensuring that, with the output control tube to the aileron lever disconnected, the ailerons readily up-float. Re-connect control tubes.

(10) Adjust the control column stops so that *(temporarily)* 6 deg up and down aileron movement is obtained.

WARNING

When making adjustments to the elevator servo valve, spanners must only be used on the eye-end flats and the lock-nut, NOT on the flats of the valve spindle.

▶ ◀

Elevator

31. The procedure for the manual adjustment of the elevators is as follows:—

(1) Disconnect the elevator spring feel unit *(fig. 3, item 30)* at the forward end and tie up clear of the lever. Disconnect the upper ends of the flying tail switch gear spring unit *(fig. 3, item E2)* and connecting rod *(fig. 3, item E3)* and tie clear of the elevator lever.

(2) The tailplane selector switch in the cabin should be OFF.

(3) Fit the Elevator Rigging Lock Ref. 26FX/95306 to the elevator idling link and control tube between frames 23 and 24 and adjust the elevator control tube *(fig. 1, item E4)*, just aft of the cabin, to set the control column in the neutral position.

(4) Disconnect the input control tube to the booster assembly lever and centre the booster by aligning the forward face of the blanking plugs on the booster body with the neutral setting marker plate on the channel.

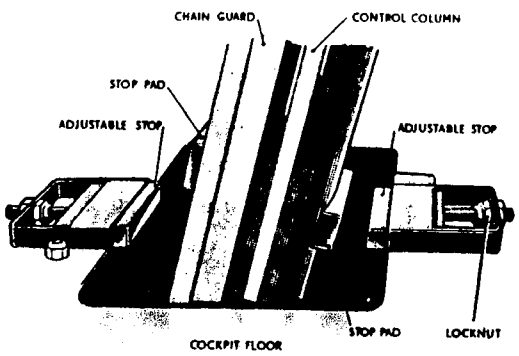


Fig. 7 Elevator control stops

(5) Adjust as necessary and re-connect the input control tube *(fig. 3, item E5)* to the booster assembly.

(6) Adjust the output control tube *(fig. 3, item E6)* to the elevator lever to bring the elevator to the neutral position.

(7) Remove the Rigging Lock from the elevator controls between frames 23 and 24.

(8) Adjust the elevator stops on the control column to their outer limit and check that the clearance between the control column and the instrument panel *(with switch guards up)* is not less than $\frac{3}{32}$ in. Adjust the control column neutral setting, if necessary, to obtain this clearance.

(9) Lock the input circuit at the booster and check that the back lash at the top of the control column, when moved without force, does not exceed $\frac{3}{32}$ in.

(10) Remove the lock from the input circuit and lock the elevator in the neutral position at the trailing edge. The movement at the top of the control column must not exceed $\frac{3}{4}$ in.

(11) Remove the lock from one elevator and check the movement in the elevator universal joint. This must not exceed 0·20 in. as measured at the trailing edge of the elevator.

(12) Check that the load measured at the middle of the handgrip to move the control column is less than 9 lb for elevator down and less than 7 lb for elevator up. Any excess friction must be eliminated. The control column load with the linkage disconnected at the booster input must not exceed 2 lb for control column moved forward and for control column moved aft.

(13) Adjust the control column stops to give *(temporarily)* 8 deg down and 20 deg up elevator movement.

POWER ADJUSTMENT

General

32. When making power adjustments to the aileron and elevator controls, the following procedure should be adopted:—

(1) All hydraulic oil supplied to any of the power-operated control circuits *must* be passed through a Micronic filter element. *A dirty system may cause excessive control column loads.*

(2) All hydraulic pipelines must be flushed out with clean hydraulic fluid prior to being connected to the booster units, the oil used for the purpose afterwards being discarded.

(3) Ensure that the controls are free.

(4) Ensure that the booster jacks have been checked for alignment–(*See para.* 29.)

(5) Before any valve adjustments, etc. are made, any air that may exist in the system must be expelled by repeated functioning.

Ailerons

33. After the operations described in para. 30 have been completed, the booster unit servo valves must be brought into adjustment with their respective lost motion bush assemblies. This adjustment is made at the servo valve spindles while the valves are under hydraulic pressure maintained by an external supply rig. The procedure for the adjustment of the servo valves and power adjustment of the ailerons is as follows:—

Preliminaries

(1) Open the tab washers and unscrew the locknuts of the port wing servo valve units and attach a dial spanner and indicator *(Part No. A.227530 and A.214536 respectively)* to the servo valve spindle and threaded eye-end respectively *(fig. 8)*.

(2) The spring feel unit must be operating normally and the control column must be free in manual for the full range between the lateral stops on the control column.

(3) Switch on the hydraulic rig. If the system is maladjusted to the extent that the control column will not operate the ailerons in power, make temporary adjustments at the valve spindles to render operation possible.

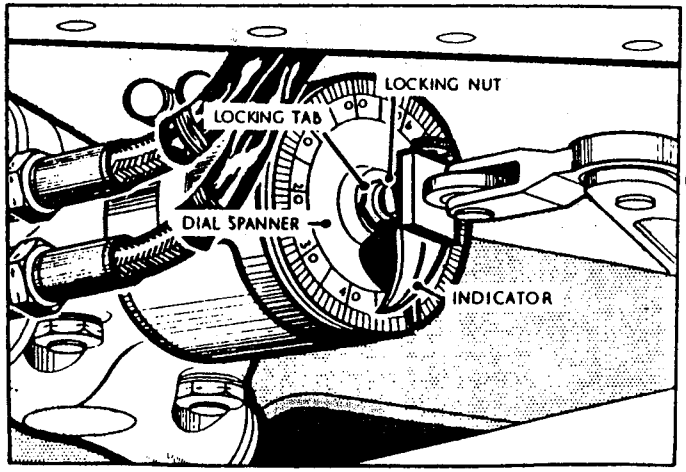


Fig. 8 Ajusting aileron booster units

(4) Operate the ailerons through 20 full reversals to expel any air that may exist in the circuit.

Adjustments

(1) Turn the dial anti-clockwise, causing the aileron concerned to rise. When the aileron trailing edge is about 2½ in. above its neutral position, halt it by a small clockwise movement of the dial.

(2) Turn the dial anti-clockwise again until the aileron begins to creep up slowly. While it is still creeeping, read the dial and record in Column A of a form such as that shown in Table 1.

(3) By means of a small clockwise movement of dial, return the aileron to the position of 2½ in. above the neutral seting and repeat operations (1) and (2) until a series of three readings within 0·03 of a turn are obtained. *(Inconsistent readings indicate that the aileron is being allowed to creep at different speeds, or that air is still present in the system.)* Record the readings and enter the average figure at the foot of Column A.

(4) Once again halt the aileron 2½ in. above the neutral position and then turn the dial clockwise a little until the aileron creeps *down* towards the neutral position, at the same time ensuring that the same creep speed is maintained throughout the operation. Read and record in Column B. Repeat to obtain consistent readings and enter the average reading at the foot of Column B.

(5) Calculate the mid-point between Columns A and B and record in the panel below them.

(6) Rotate the dial clockwise through approximately 2½ turns. *(The aileron will come down to neutral in the first half-turn.)* Halt the aileron about 2½ in. *below* neutral and repeat operations (2) to (4) for this position in the lower sector. *(While turning clockwise, 100 must be added to the reading each time the 'zero' passes the indicator.)* Calculate the mid-point between Columns C and D and record in the panel below them.

(7) Finally calculate the mid-point between the final figures obtained in operations (5) and (6). *(The difference between the mid-point of Columns A and B and the mid-point of Columns C and D should be between 230 and 290.)* Record at the foot of the form. Check the figure by adding up Columns A, B, C and D and dividing by four. Turn the dial back *(anti-clockwise)*, about 1¼ turns, *on to this reading*. Tighten the locknut but do not clinch the tab washer at this stage.

(8) Transfer the dial spanner and indicator to the other *(starboard)* wing and repeat operations (1) to (7).

Final setting

(1) Obtain full aileron movement by adjusting the control column stops: this should be 13 deg. up and 13 deg. down.

(2) Ensure that the jacks do not bottom. This can be observed by a stickiness on moving control column from extreme position.

(3) Put control column neutral, do not lock in position, adjust the ailerons to neutral on the output links. Acceptable limits for neutral on each aileron are:— UP, ¼ deg. DOWN, 0 deg. *(i.e. no downfloat is permissible)*.

(4) Check control surface movements, the full amount as in sub-para. (1) should be obtained.

(5) Lock servo valve tab washer on both units by clinching 3 tabs on to the flats of the servo valve spindle and the remaining 4 tabs on the flats of the locknut.

(6) Check controls for ease of movement: load to just move control from the central position in either direction to be 3 lb maximum.

(7) Select Manual and ensure that 7 deg. *(2·54 in.)* minimum up and down aileron movement is obtained.

(8) The maximum allowable difference between Port and Starboard movement is 1 deg. The maximum allowable difference between up and down is also 1 deg.

TABLE 1

Aileron adjustments

ADJUSTMENT OF SERVO-VALVE SPINDLE

A/C No.....

PORT WING

Aileron in UPPER SECTOR		Aileron in LOWER SECTOR	
Spindle turned Anti-clockwise (PANEL) A	Spindle turned Clock-wise (PANEL) B	Spindle turned Anti-clockwise (PANEL) C	Spindle turned Clock-wise (PANEL) D
MID-POINT OF ABOVE 2 SETS OF READINGS		MID-POINT OF ABOVE 2 SETS OF READINGS	
MID-POINT OF ABOVE TWO READINGS (i.e. FINAL SETTING OF ADJUSTMENT)			
DATE.....		.....	

ADJUSTMENT OF SERVO-VALVE SPINDLE

A/C No.....

STARBOARD WING

Aileron in UPPER SECTOR		Aileron in LOWER SECTOR	
Spindle turned Anti-clockwise (PANEL) A	Spindle turned Clock-wise (PANEL) B	Spindle turned Anti-clockwise (PANEL) C	Spindle turned Clock-wise (PANEL) D
MID-POINT OF ABOVE 2 SETS OF READINGS		MID-POINT OF ABOVE 2 SETS OF READINGS	
MID-POINT OF ABOVE TWO READINGS (i.e. FINAL SETTING OF ADJUSTMENT)			
DATE.....		.....	

Elevator

34. The procedure for adjusting the elevator in power is as follows:—

(1) Ensure that the booster jack has been checked for alignment with its release unit. *(See para. 29).*

(2) Check that the servo valve eye-end is screwed in sufficiently to register in the safety hole. *(See warning at para. 31).*

(3) With the tail plane at zero incidence hold control column neutral using rigging lock (Ref.No.26FX/95306), and check that the booster and elevator are neutral; if necessary, re-adjust on the input and/or output links. Then remove rigging lock.

(4) Check the controls for ease of movement : load to just move elevator to be a maximum of 2 lb in either direction.

(5) Ensure that there is no free movement between the eye-ends of the elevator spring feel unit. Adjust its length to suit attachment positions with elevator neutral and tail plane at zero incidence. Re-attach spring feel unit, but do not lock.

(6) Adjust the control column stops to give elevator movements as shown in fig. 11.

(7) On completion of adjustments, lock servo valve tab washer.

(8) Check all moving parts of the flying tail switch gear for full and free movement and correct lubrication.

(9) Re-attach the switch gear spring unit and connecting rod to the elevator lever. *(Disconnected during "Manual Adjustments"). (See fig. 15).*

(10) Disconnect the aircraft electrical supply to the datum trim actuator and connect a separate supply. The tail plane selector switch should be OFF, the elevator booster switch at OFF, and the tail plane at neutral.

(11) Lift the standby control switch cover to trip the tail plane actuator main circuit breaker. Fully extend datum trim actuator.

(12) With the control column held at neutral by the spring feel unit, contact E on the upper microswitch will be made [*a lamp (1) connected from terminal D to earth should be on*] and contact E on the lower microswitch broken [*a lamp (2) between D and earth should be off*]. Connections may be made at T.B.79, terminals 5 and 4 respectively (or terminals 7 and 8 of T.B.97, whichever is more convenient). Raise elevator by hand until the upper microswitch just opens [*lamp (1) off*] and read elevator angle. Raise elevator further until the lower microswitch just closes [*lamp (2) on*] and read elevator angle. Adjust microswitch adjusting screw F.211420 to make the difference in reading 1¾ deg of elevator movement. [*For setting of lower microswitch refer to para. 53 (17)*].

(13) Move the tailplane selector switch to ON, select elevator power ON and, by moving control column, re-check the elevator angular movement in both directions between the opening of one microswitch and the closing of the other. The difference in readings must be 1¾ ± ¼ deg of elevator movement. If these limits are exceeded repeat the operations in sub-para. 12, re-check and lock the adjusting bolt.

(14) Re-connect the datum trim actuator aircraft supply and, with control column free and tail plane selector switch ON, re-engage the tail plane actuator main motor circuit breaker. Ensure that the elevator remains neutral relative to the tail plane. Check that the tail plane moves to fully positive incidence and remains there. If the tail plane stops short of fully positive, shorten spring unit as required.

(15) Move control column aft and check that the tail plane actuator begins to retract before the elevator angle is + 2 deg to + 3 deg relative to the tail plane. If the angle exceeds this value, lengthen the spring unit as required.

(16) Trim to fully negative incidence, control column free. Ensure that the elevator remains neutral. Check that the tail plane remains in this position when the trim switch is released. If fully negative incidence is not obtained, lengthen spring unit as far as possible consistent with obtaining fully positive incidence. Secure spring unit lock nut.

(17) Move the tail plane selector switch to OFF and, with control column neutral, check that full tail plane movement is obtainable on operating the trim switch.

(18) Move the tail plane selector switch to ON, control column free, and note any tail plane movement that occurs. Re-select OFF and inch the actuator by operating control column trim switch sharply without disturbing the control column; then, with control column free, select ON and note any tail plane movement. Repeat this cycle six times. The greatest tail plane movement that occurs on a selection of ON, must not exceed fifteen minutes of arc.

(19) At neutral trim, and with tail plane selector switch and elevator power switch OFF, raise the elevator by hand until the upper microswitch is open; then lower slowly and check that when the switch closes there is a clearance of at least 0·015 in. between the stop pin F.219509 and the upper edge of the hole in the switch carrier side plate A.220794.

INSTALLATION TESTS

Power OFF

35. Prior to these tests, the aircraft should first be adjusted as described in para. 29 to 34 inclusive. The aircraft should be jacked up *(Sect. 2, Chap. 4)* and these tests should preferably commence following the main hydraulic functioning tests. The procedure for installation testing with power off, is as follows:—

(1) Disconnect the elevator spring feel unit at the forward end and tie up clear of the elevator feel connecting lever.

(2) With the tail plane neutral and tail plane selector switch OFF, lock the elevator input linkage at the valve and check that the backlash at the control column is a maximum of 3/32 in. Remove lock from input linkage.

(3) Measure elevator movement up and down. Measure aileron movement up and down, port and starboard.

(4) Measure force in pounds at control column handgrip to just move the elevator from the neutral position, up and down. This should be a maximum of 8 lb up and down. Measure force in pounds at control column handgrip to just move the ailerons from the neutral position, port and starboard. This should be a maximum of 9 lb.

(5) On aircraft in which modification 895 has been embodied, select aileron and elevator power ON, switch off the electrical supply, operate the aileron and elevator manual selection push buttons and check that hydraulic pressure can be built up to 3 000 lb/in² with the handpump.

Power ON

36. For these tests, the hydraulic rig should be run at a speed equivalent to 1 350 pump rev/min. Check that the accumulators are fully charged *(Sect. 2, Chap. 2)*. The main hydraulic pressure should not fall below 2 700 lb/in² when functioning the controls normally. The procedure for testing the controls in power, following the tests with power off *(described in para. 35)* is as follows:—

(1) With the rig pump running, select aileron power ON and check that the ailerons cannot be moved by hand when the control column is held. Check for correct operation of the aileron indicator.

(2) Select elevator power ON and check that the elevator cannot be moved by hand when the control column is held. Check for correct operation of the elevator indicator throughout the operations.

(3) Select aileron and elevator power ON and measure the force in pounds at the control column handgrip to just move the elevator from the neutral position up and down (maximum 1lb for elevator down and 3 lb for elevator up). Measure the force in pounds to just move the ailerons from the neutral position, port and starboard (maximum 3 lb). Ensure that the control column loads for full aileron deflection, port and starboard, are within 3 lb of each other.

(4) With the controls in power, disconnect the electrical ground supply and check that both ailerons and elevator remain in power. Re-connect electrical ground supply. Measure aileron movement up and down, port and starboard. Check that, with control column neutral, there is no aileron downfloat and not more than ½ deg upfloat. Check the operation of the 2-position jack by selecting power ON and OFF.

(5) Turn the aileron spring feel control knob fully clockwise and check aileron angles, control column free *(port down and starboard up, 3½ deg minimum)*. Repeat with control turned fully anti-clockwise. Centralize spring feel control knob.

(6) Stop hydraulic pump, dissipate main system pressure by selecting flaps and, after one minute, check that the ailerons complete 2½ full cycles before pressure failure indicator operates. Repeat for elevator circuit (1¼ *cycles*). A full cycle consists of neutral to one extreme, back through neutral to the other extreme, and then back to neutral. For the elevator, commence by moving the control column forward from neutral. Check that the change over to manual takes place smoothly.

(7) Re-start pump, check for system stability by jerking the control column and then letting go; the control column should come to rest and not oscillate. This test should be carried out independently for ailerons and elevator.

(8) Check the controls for ease of movement in all directions. Check that the system is free from any sluggishness, jerky movements or other undesirable effects. Check the aileron controls over the full range of the aileron spring feel trimmer.

(9) Check that the aileron spring feel unit centres the control column accurately when the control column is deflected $\frac{1}{2}$ in. from the centre and then released.

(10) Repeat operation (8) after rest periods of one, three and five minutes, then check that:—

(a) the initial control column load does not increase after one minute rest.

(b) the control column load does not exceed a maximum of 6 lb after a rest period of five minutes.

Re-attach the elevator spring feel unit.

(11) Check that the elevator spring feel unit returns the control column to within 0·3 in of neutral, after deflecting it with one finger on the top of the control column handgrip.

(12) Check that the elevator angles relative to the tail plane, do not exceed the following, with the tail plane neutral. fully positive and fully negative:—
Neutral: 21 deg up., $9\frac{1}{2}$ deg down
Fully positive: 25 deg up, 6 deg down
Fully negative: $18\frac{3}{4}$ deg up, 13 deg down

(13) Move the tail plane selector switch to ON and with neutral trim, measure the tail plane and elevator angles with the control column fully forward and fully aft.

(14) Push the control column switch up without biasing the column, until extreme *(full positive)* trim is obtained. Move the control column aft until the tailplane just moves and check that the elevator is $\frac{1}{2}$ deg $\pm \frac{1}{8}$ deg up. If it is not, trim slightly down and fully up again until this angle is obtained.

(15) Measure the tailplane and elevator angles, moving the control column in the following sequence:—

(a) Fully forward.

(b) Moved aft until the tailplane just moves.

(c) Moved aft until the tailplane is at zero incidence.

(d) Fully aft.

(e) Moved forward until tailplane just moves.

(f) Moved forward until tailplane is at zero incidence.

Check that the difference between the elevator readings at (c) and (f) is $1\frac{1}{2}$ deg to 2 deg.

(16) Push the trim switch down without biasing the control column until extreme trim *(full negative)* is obtained. Measure tailplane and elevator angles at (15) *(a)*, *(b)*, *(d)* and *(e)*.

(17) Trim neutral and check for smooth operation over the control column range of movement, moving the column at a constant speed giving a time of operation from stop to stop of approximately $3\frac{1}{2}$ seconds. Check the system for stability by jerking the control column and then letting go.

(18) Move the tail plane selector switch to OFF and ensure that the tail plane remains locked during elevator movement.

(19) Run the hydraulic rig at a speed corresponding to 1950 pump rev/min. Move controls at approximately one stir per two seconds *(a stir is a circular movement of the top of the control column combining extreme travel of both ailerons and elevators)* while making the following selections:—

(a) Undercarriage down
(b) Undercarriage up.
(c) Undercarriage up, flaps up.
(d) With undercarriage and flaps up, air brake out and in.

Hydraulic pressure at all these conditions must not fall below 1 100 lb/in².

(20) The tail plane and elevator angles with the tail plane selector switch and elevator power switch ON should be as shown in Table 2.

TABLE 2

Tailplane and elevator angles

Trim	Control Column Position	Tailplane Incidence Max.	Tailplane Incidence Min.	Elevator Angle Rel. to Tailplane Max.	Elevator Angle Rel. to Tailplane Min.
Neutral	Neutral	Zero	Zero	Zero	Zero
	Fully forward	2 deg. 43 min	2 deg 13 min	7 deg down	5½ deg down
	Fully aft	Fully negative t/p control OFF *		19½ deg up	18 deg up
Full Positive	(a) Fully forward	Fully positive t/p control OFF *		6 deg down	4½ deg down
	(b) Moved aft until tailplane just moves.	As reading above +0, —2 min		⅛ deg. up	⅜ deg up
	(c) Moved aft to tailplane zero.	Zero	Zero	9½ deg up	8½ deg up
	(d) Fully aft	—1 deg 35 min	—1 deg 55 min	20 deg up	18⅜ deg up
	(e) Moved forward until tailplane just moves	As reading above +2 , —0 min		18 deg up	16½ deg up
	(f) Moved forward to tailplane zero	Zero	Zero	7½ deg up	6½ deg up
Full Negative	(a) Fully forward	+36 min	+16 min	8½ deg down	7½ deg down
	(b) Moved aft until tailplane just moves	As reading above +0, —2 min		7½ deg down	6½ deg down
	(d) Fully aft	Fully negative t/p control OFF *		19½ deg up	18 deg up
	(e) Moved forward until tailplane just moves	As reading above +2 , —0 min		1½ deg down	½ deg down

* These figures should be identical with those obtained when checking in accordance with instructions laid down in para. 42, sub-para. (3) and (4).

Power control stability check

37. A stability check of the power controls should be made after any adjustment of the hydraulic booster units or control runs have been made. A simple method of carrying out this check is as follows:—

(1) Connect a hydraulic ground rig to the aircraft's external test connections and, with the ground pump running at a speed equivalent to the engine idling speed, select power operation for the ailerons and elevators.

(2) Hit the control column *hard* over in all directions.

(3) Stable operation will be indicated by the control column returning smoothly to neutral with no tendency to travel through its full range.

(4) Instability will be immediately apparent by the behaviour of the aircraft, which will vibrate with a noise similar to that of a knocking water pipe.

(5) In the case of instability switch off the power immediately and investigate the cause by re-adjustment of the hydraulic booster units.

(6) Check the controls for ease of movement in all directions. Check that the system is free from any sluggishness or jerky movements, or other undesirable effects.

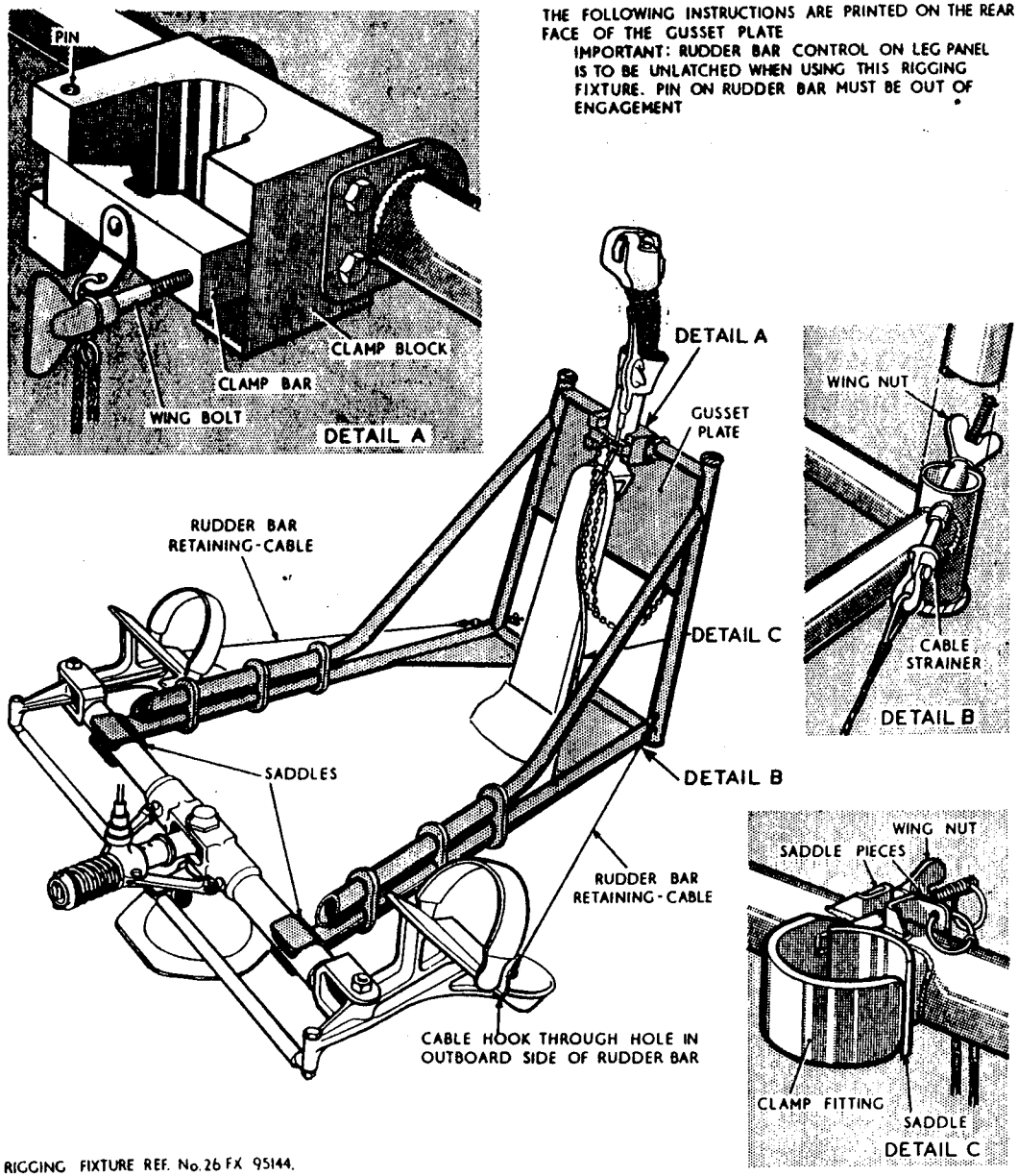


Fig.9 Rigging fixture

Control surface settings

38. The angular and linear ranges of the control surfaces and tabs, together with their tolerances, are given in fig. 11. After any adjustment of the controls, care must be taken to ensure that there is no excessive friction at any point as the presence of such will impair the handling qualities of the aircraft. Static friction figures for the ailerons and elevators are given in para. 35.

Rudder

39. To adjust the setting of the rudder and rudder bar , proceed as follows :—

(1) Fit the flying control rigging fixture (fig. 9) to the controls.

(2) Disconnect the adjustable end of the first horizontal rudder control tube (fig. 1, item R1), behind the cabin and fit the rigging lock (Part No. A.201031) to the rudder controls between frames 23 and 24 in the fuselage spine.

(3) Adjust the eye-end (fig. 3, item R2) connected to the rudder lever to bring the rudder to the neutral position.

(4) Adjust the control tube disconnected in sub-para. (2), as necessary, to enable it to be reconnected.

(5) Remove the rigging lock from the rudder controls in the spine, check the rudder for neutral and remove the flying control rigging fixture

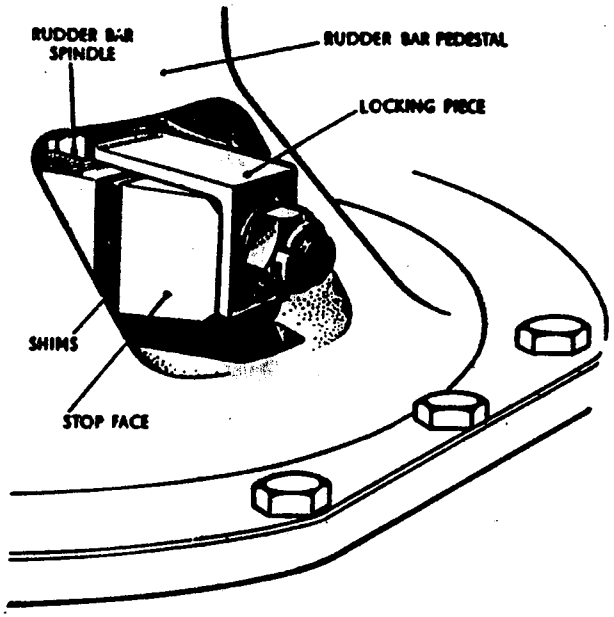


Fig. 10. Rudder control stops

(6) Check the rudder bar for full range of movement as given in fig. 11. Shim the stops (fig. 10) on the rudder bar pedestal, as necessary, to achieve the correct movement.

(7) Check that the rudder pedals are clear of the surrounding structure, with full rudder bar movement to port and starboard when the pedals are in the extreme forward and aft positions.

(8) Check all control tubes for security, safety and locking and check for full range of rudder movement.

Rudder trimming tab

40. The rudder trimming tab is adjusted after the test flight to the correct tab angle to give neutral handling in the air with the cabin indicator set to neutral, and this angle is quoted in the aircraft servicing form. Normally, no further adjustment should be necessary, but the normal operation of tab movement should be checked as follows:—

(1) Set the rudder bar in the neutral position by means of the rigging fixture (*fig. 9*).

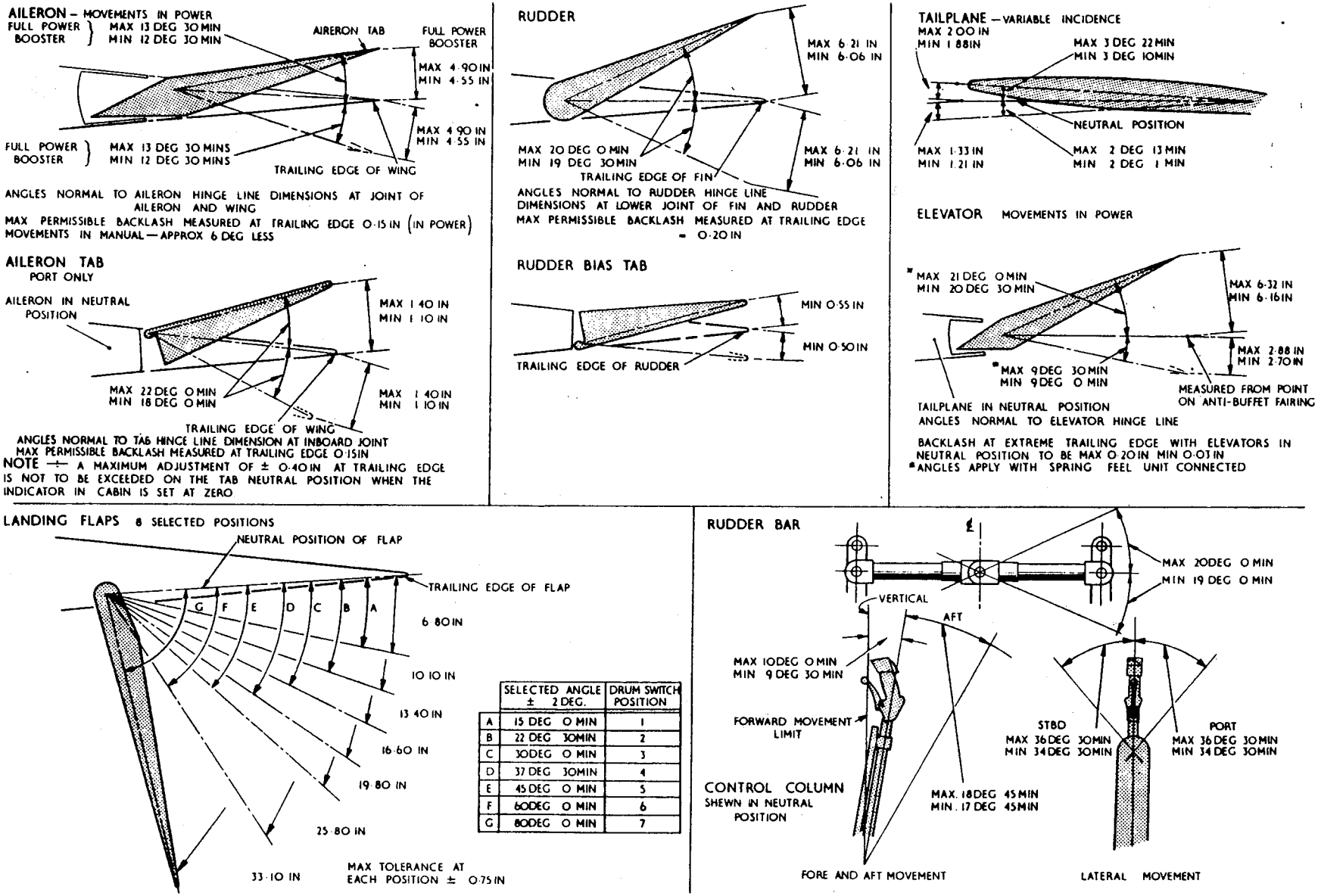
(2) Connect an external electrical supply (*Sect. 5, Chap. 1*) to operate the tab without discharging the aircraft's batteries.

(3) Operate the trim tab to port and check that its travel corresponds with the figure given in fig. 11.

(4) Operate the trim tab to starboard and check that its travel corresponds with the figure given in fig. 11.

(5) Set the tab to the angular position as given in the aircraft servicing form , using the cabin control, and check that neutral is registered on the indicator in the cabin. If the indicator is in error, refer to A.P.1275A, Vol. 1 for details of adjustment.

(6) Disconnect the external electrical s and remove the rigging fixture.



	SELECTED ANGLE ± 2 DEG.	DRUM SWITCH POSITION
A	15 DEG 0 MIN	1
B	22 DEG 30 MIN	2
C	30 DEG 0 MIN	3
D	37 DEG 30 MIN	4
E	45 DEG 0 MIN	5
F	60 DEG 0 MIN	6
G	80 DEG 0 MIN	7

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Fig. 11 Control Surface Setting

RESTRICTED

Aileron trimming tab

41. The trimming tab in the trailing edge of the port aileron is adjusted after the test flight to the angle noted by the pilot to give neutral handling in the air with the cabin indicator set to neutral, and this angle is quoted in the aircraft servicing form. Normally, no further adjustment should be necessary, but the operation should be checked as follows:—

(1) Set the control column at neutral with the aid of the rigging fixture *(fig. 9)*.

(2) Connect an external electrical supply *(Sect. 5, Chap. 1)* to operate the tab actuator without discharging the aircraft's batteries.

(3) Operate the tab to the UP position and check that its travel corresponds to the figure given in fig. 11.

(4) Operate the tab to the DOWN position and check that its travel corresponds to the figure given in fig. 11.

(5) Using the cabin control, trim the tab until the Desynn indicator in the cabin reads zero and check that the trim tab is set to the correct angular position as given on the aircraft servicing form. If it is not, adjust the control rod connected to the trim tab until the correct setting is obtained.

Repeat these procedures wherever an aileron trimming tab is replaced or if any adjustment is made to the aileron trim circuit. If a new indicator is fitted, ensure that the needle is at zero with the trimming tab at the basic setting.

WARNING

When setting the Desynn Indicator to neutral, the trim tab must not exceed the limits of $\pm 0{\cdot}40$ *in. from neutral with the aileron at its neutral setting.*

Replacement of safety catch for Aileron/Rudder trim switch

41A. On fitment of a replacement safety catch for the aileron trim movement of the Aileron/Rudder trim switch, the assembly should be checked to ensure that full movement of the safety catch is possible without any fouling of the boss of the trim switch and that the operating knob of the switch is free to return after selection of trim. Where the operation of the safety catch is found to be unsatisfactory the 'cut-out' of the catch should be filed locally to give a minimum satisfactory clearance.

Tail plane incidence

42. The tail plane actuator is designed to give the required range of travel for incidence control and, as internal limit switches are incorporated, no further adjustment may be made. The following operational checks, however, should be carried out to ensure that the correct travel is obtained:—

(1) Jack the aircraft with the wheels off the ground as shown in Sect. 2, Chap. 4, and rig the tail plane to the neutral position.

(2) With the tail plane selector switch OFF, connect an external electrical supply *(Sect. 5, Chap. 1)* to operate the tail plane by means of cabin controls without discharging the aircraft's batteries.

(3) Operate the control column switch to increase incidence to the upper limit and check that the tail plane position corresponds to the figure given in fig. 11.

(4) Operate the control column switch to decrease the incidence to the lower limit and check that the tail plane position corresponds to the figure given in fig. 11.

(5) Operate the control column switch to set the tail plane in the neutral position and check that the Desynn indicator in the cabin registers neutral.

(6) Raise the guard from over the emergency switch in the cabin and, using this switch, repeat sub-paras. (3), (4) and (5).

Note . . .

If, with the tail plane in the neutral position, the Desynn indicator in the cabin is not registering neutral, remove the actuator access door, slacken the lock-nuts at the fork-ends on the rod connecting the Desynn transmitter to the actuator, and screw the rod in or out of the fork-ends, as required, until the indicator registers neutral. If the indicator does not register the extreme positions correctly, adjustment should be made to the transmitter operating arm and to the connecting rod between the operating arm and the actuator.

Landing flaps

43. Check that the landing flaps open to the dimensions given in fig. 11 and check that they close just as the operating jack pistons reach the limit of their stroke. If necessary, adjust the jack piston rods for length by slackening off the lock-nuts and screwing the eye-bolts in or out as required. After adjustment, tighten the lock-nuts and wire-lock in accordance with A.P.1803D. When making this adjustment, it is also necessary to check the flap synchronizing jacks *(described in para. 44)*. The drum switch and flap position indicator transmitter linkage should also be checked and adjusted *(described in para. 45)*.

Checking flap synchronizing jacks

44. To ensure that the flap synchronizing jacks do not bottom before the flaps are fully up; after the flap operating jacks have been correctly adjusted *(described in para. 43)* and with the flaps fully down, it is necessary to check that the dimension given in fig. 12 is obtained. If not, proceed as follows:—

(1) Disconnect each synchronizing jack from the flap levers.

(2) Fully extend the synchronizing jacks by use of the handpump and check that the dimension given in fig. 12 is obtained between the points indicated.

(3) Slacken off the lock-nuts and adjust the eye-end of each jack piston rod until the holes coincide with the holes in the flap levers. Tighten the lock-nuts and wire-lock in accordance with A.P.1803D.

(4) Re-assemble the jacks to the flap levers.

(5) Provided that the above instructions are correctly carried out, the synchronizing jacks will not bottom before the flap jacks when the flaps are fully up.

Note . . .

If the dimension given in fig. 12 cannot be obtained when the jacks are fully extended, the affected jack or jacks must be removed from the aircraft and replaced with fully serviceable components.

Adjustment of flap position transmitter and drum switch

45. After ensuring that the flap movements are satisfactory, the flap position transmitter and drum switch should be checked and, where necessary, the linkage adjusted. The procedure is as follows:—

(1) Lower the flaps to their fully down position.

(2) Check that the flap position indicator in the cabin is indicating fully down.

(3) If not, adjust the length of the cable between the flap transmitter lever arm and the levers connected to the flap and drum switch, located in the port wing just inboard of tail rib C, until the correct indication is obtained.

(4) With the flaps still fully down, check that the line on the drum switch indicator plate is in line with the figure '3' on the switch cover.

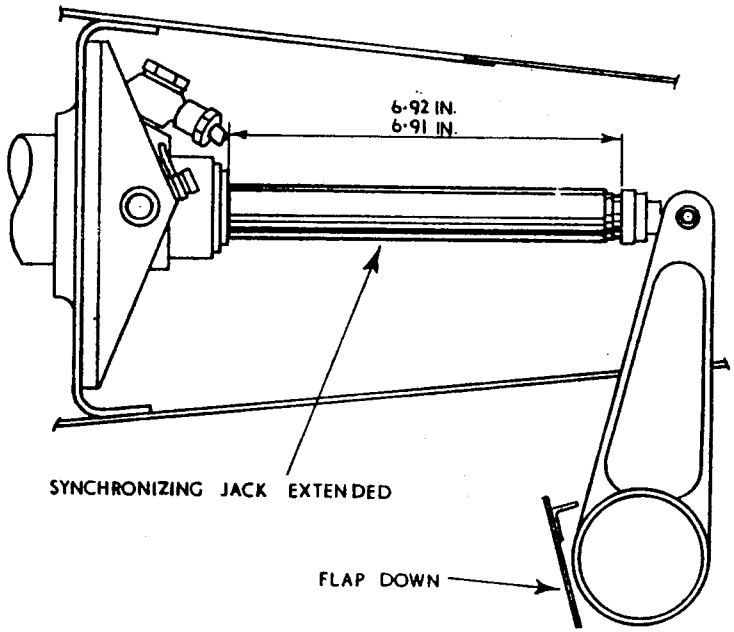


Fig. 12 Flap synchronizing jack adjustment

(5) If not, slacken off the lever on the drum switch spindle and turn the spindle until the indicator line and figure '3' coincide. Re-tighten the lever on the spindle.

(6) Raise the flaps to their fully up position and check that the flap position indicator is registering up.

(7) If not, lengthen or shorten the lever arm of the flap position transmitter until the correct indication is obtained.

Note . . .

It is recommended that the indication obtained in sub-para. (6) is noted as a guide to the adjustment required. If the indicator overshoots the UP position, lengthen the lever arm. If it fails to reach it, shorten the arm.

(8) Check the operation of the flap position indicator and drum switch by lowering the flaps to each position in turn, and, using the information given in fig. 11, check that the flap angle shown on the position indicator agrees with the dimensions obtained.

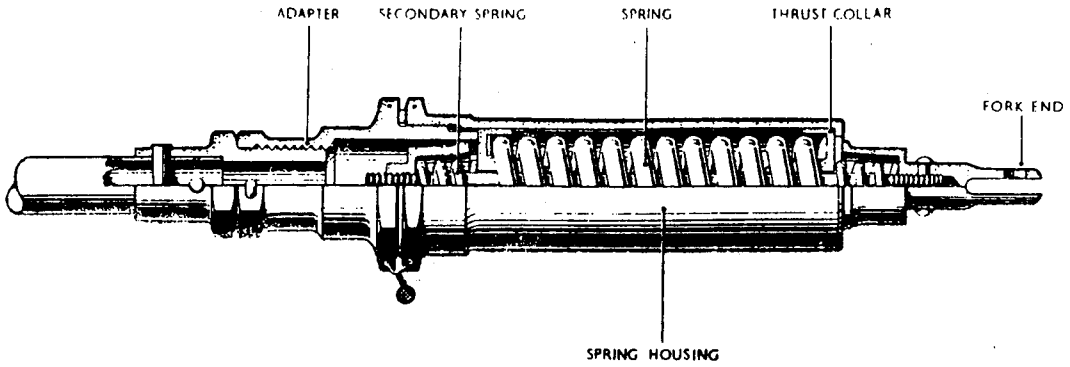


Fig. 13 Elevator feel unit

Air brake, jack adjustment

46. To ensure that the air brake structure is not strained, by contact with the fuselage before the hydraulic operating jack is fully retracted, it is essential that a nominal gap of 0·05 in. is maintained at the nearest point between the air brake and fuselage structure when the jack is fully retracted. This gap is obtained by adjustment of the jack piston rod as follows:—

(1) Jack up the aircraft, as described in Sect. 2, Chap. 4 and retract the undercarriage.

(2) After ensuring that the area below the air brake is free from obstruction, select air brake out by operation of the control on the throttle twist grip and operate the handpump until the air brake is fully extended.

(3) Select airbrake in to release the hydraulic pressure from the jack and slacken off the lock-nut at the bottom of the jack piston rod.

(4) Retract the airbrake by use of the handpump and check that there is a clearance of 0·90 in between the inside of the airbrake skin covering, at the trailing edge, and the undersurface of the fuselage, measured as near the centre line of the airbrake as possible. Adjust the length of the jack piston-rod, as necessary, to obtain this clearance, by rotating the rod in the required direction with a spanner on the spanner grip at the end of the piston-rod.

(5) After adjustment, re-tighten the lock-nut on the jack piston rod, wire-lock in accordance with A.P.1803D. Retract the airbrake, lower the undercarriage and remove the jacks from the aircraft.

In addition, there must be a gap of 0·07 in to 0·12 in. between the leading edge of the airbrake and its fairing. The leading edge may be filed to obtain this clearance but care must be taken to maintain a 30 deg chamfer *(as measured from the vertical)* throughout the length of the leading edge.

Air brake, forward microswitch (ground test)

47. This microswitch is operated by the air brake port hinge via a small lever pivoted to a bracket attached to the port hinge fitting. The switch controls the operation of the air brake when testing the installation on the ground when the undercarriage is down, and permits partial extension of the air brake to check that the installation is functioning satisfactorily. The switch is adjusted on initial assembly so that it operates when the air brake is manually extended six inches, as measured at the trailing edge, this is equivalent to nine inches or 10 deg *(approx.)* under full hydraulic power *(i.e. sufficient to enable the indicator microswitch to operate and give indication in the cabin by means of the magnetic indicator)*. If, when checking the operation of the air brake with the undercarriage down as described in Sect. 3, Chap. 6, these conditions are obtained, no further adjustment of the switch should be necessary.

Air brake, rear microswitch (indicator)

48. This microswitch is operated by a plunger which is supported in a tube attached to the fuselage skin just forward of frame 47. The switch plunger is actuated by a leaf spring riveted to the inside of the air brake structure, which contacts the microswitch when the air brake is in the retracted position. The switch controls the operation of the magnetic indicator in the cabin, which gives a black indication when the air brake is retracted, and white when extended. The switch is mounted in a bracket attached to frame 47 and is adjusted so that, with the air brake closed under full hydraulic pressure and the indicator showing black, the switch plunger can be depressed a further 0·06 in —0·12 in.

Air brake, undercarriage emergency air valve microswitch

49. This microswitch is operated by the lever of the undercarriage emergency air valve. The switch controls the automatic retraction of the air brake should the air brake be in the extended position when the undercarriage emergency lowering system is employed.

Aileron spring feel unit

50. The aileron spring feel unit should be adjusted as described in fig. 5.

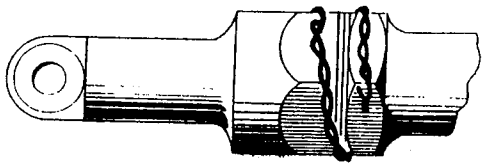
Elevator spring feel unit

51. Dismantling of this unit is not recommended. Should this, however, become necessary, it must be re-assembled *exactly as before* with the same shims between the adapter and spring housing, in order to maintain the original adjustment. The overall length of the unit between pin centres is set to a nominal dimension of 28·25 in, this dimension may vary under load between 27·75 in and 29·25 in and the unit must operate smoothly between these limits.

Flying tail switch gear spring unit

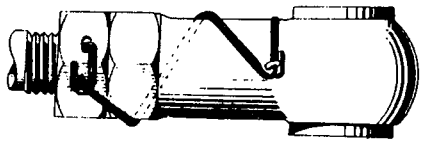
52. The spring unit for the flying tail switch gear should be serviced in accordance with instructions on fig. 14.

METHOD OF LOCKING TOP EYE-END TO SPRING HOUSING WITH DTD. 189 OR 161 22G.ST STEEL LOCKING WIRE



DETAIL 'A'

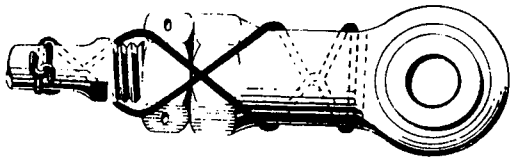
METHOD OF LOCKING EYE-END TO LOCKNUT WITH DTD 189 OR 161 22G. ST. STEEL LOCKING WIRE



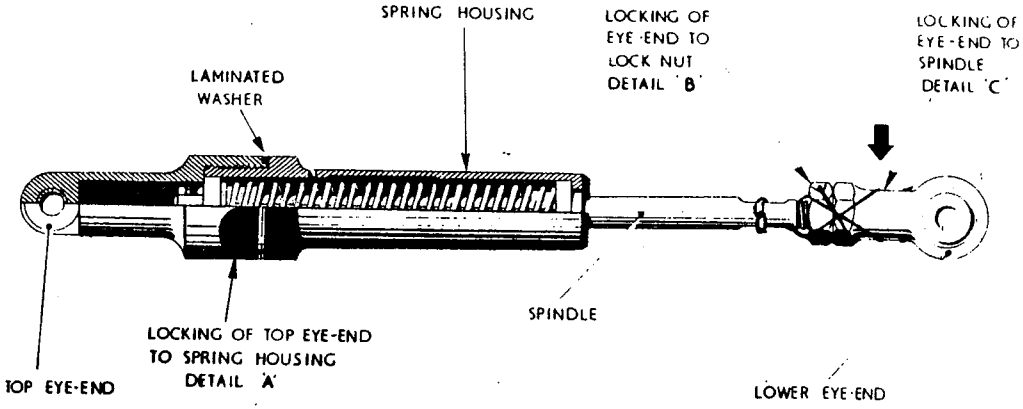
VIEW ON ARROW

DETAIL 'B'

METHOD OF LOCKING EYE-END TO SPINDLE WITH DTD 189 OR 161 22G. ST. STEEL LOCKING WIRE



DETAIL 'C'



SERVICING

THE SPRING UNIT SHOULD BE SERVICED AT THOSE PERIODS LAID DOWN IN THE SERVICING SCHEDULE AS FOLLOWS:—

(1) REMOVE THE SPRING UNIT FROM THE AIRCRAFT

(2) CAREFULLY MEASURE THE DISTANCE BETWEEN THE EYE-END CENTRES OF THE UNIT AND MAKE A NOTE OF THIS FIGURE FOR USE WHEN RE-ASSEMBLING THE UNIT.

(3) REMOVE THE LOCKING WIRE AT DETAIL A, B AND C.

(4) UNSCREW THE LOCKNUT (DETAIL B). REMOVE THE LOWER EYE-END AND LOCKNUT.

(5) UNSCREW TOP EYE-END FROM THE SPRING HOUSING, RETAINING THE LAMINATED WASHER FOR RE-ASSEMBLY. SLIDE THE SPRING UNIT OUT OF THE HOUSING. (NO FURTHER DISMANTLING OF THE UNIT IS PERMITTED).

(6) THOROUGHLY CLEAN THE SPRING UNIT AND HOUSING.

(7) THOROUGHLY GREASE THE SPRING AND SPINDLE WITH GREASE XG-287.

(8) ASSEMBLE THE SPRING UNIT INTO ITS HOUSING AND SCREW ON THE UPPER EYE-END, USING THE LAMINATED WASHER WHICH WAS REMOVED IN OPERATION (5)

(9) REFIT THE LOCKNUT AND EYE-END ON THE LOWER END OF THE SPINDLE AND TIGHTEN UNTIL THE DISTANCE BETWEEN THE TWO EYE-END CENTRES IS THE SAME AS THE FIGURE DETERMINED IN OPERATION (2) ABOVE.

(10) CHECK THAT THE LENGTH BETWEEN EYE-END CENTRES WITH THE UNIT FULLY COMPRESSED AND FULLY EXTENDED IS APPROXIMATELY AS FOLLOWS:— UNIT COMPRESSED 7·7 IN.
UNIT EXTENDED 9·9 IN.

(11) WIRE-LOCK THE UNIT AS SHOWN AT DETAIL A, B AND C.

(12) THE UNIT MAY THEN BE REFITTED TO THE AIRCRAFT FROM WHICH IT WAS REMOVED WITHOUT FURTHER ADJUSTMENT

Fig.14 Spring unit – Flying tail switch gear

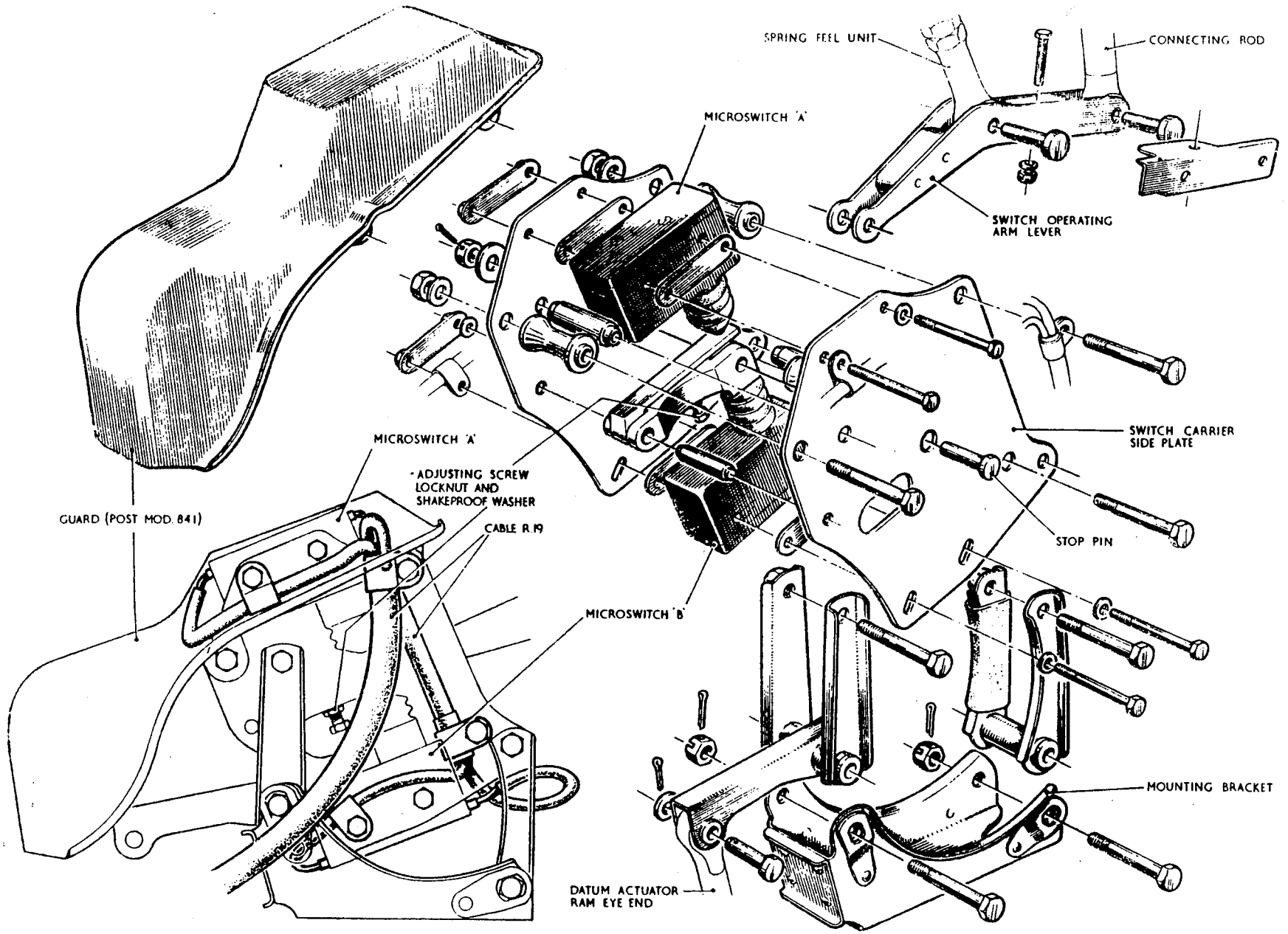


Fig. 14a Flying tail switchgear-microswitches assembly

Replacement of flying tail switch gear microswitches

53. When it is found necessary to change either of the microswitches of the flying tail switch gear, the switch carrier *must* be removed from the aircraft. The procedure for removing the switch carrier and the replacement of the microswitches is as follows:—

(1) Set the tail plane to zero incidence.

(2) *Render the aircraft electrically safe (Sect. 5, Chap. 1).*

(3) Remove the access panel from the port side of the fin beneath the tail plane.

(4) Remove the tail cone *(Sect. 3, Chap. 1).*

(5) Remove the bullet fairing.

(6) Remove the pins securing the upper ends of the spring unit and the connecting rod to the lever on the elevator.

(7) Remove the two bolts securing the guard to the switch carrier and remove the guard.

(8) Remove the pin securing the ram eye-end of the datum actuator to the switch mechanism.

(9) Disconnect the eight leads from the switch carrier at T.B.79 on the rear face of frame 56.

(10) Disconnect the cable assembly R.18 from the datum actuator.

(11) Connect an external electrical supply of 28 volts through a switch to pins A and C of a three-pin socket *(Ref. No. 10H/0560100)* and plug into the datum actuator. Operate the switch to retract the actuator ram fully.

(12) Remove the two bolts securing the switch carrier to the upper ends of the links on the mounting bracket.

(13) Remove the nut and bolt securing the retaining channel and two pins securing the spring unit and connecting rod.

(14) Remove the spring unit and connecting rod.

(15) Remove the switch carrier complete with microswitches.

(16) Replace the defective microswitch.

(17) Set the lower microswitch to make contact when the stop pin is moving towards the switch and is 0·020 in. ± 0·005 in. short of the fully downward position, using locally-manufactured round-section feeler gauges.

(18) Tignten the switch securing bolts and check that the setting of the lower switch is unaltered.

(19) Refit the switch carrier, spring unit and connecting rod to the aircraft and secure. Ensure that the spring unit and connecting rod are correctly aligned with the switch carrier lever by fitting the packing washers on either or both sides of the upper eye-ends of the spring unit and connecting rod *(see fig. 15).*

(20) Connect an external electrical supply of 28 volts to pins A and B and using a switch, fully extend the datum actuator, ensuring that the ram does not foul adjacent parts.

(21) Reconnect the actuator ram eye-end and secure the pin.

(22) Reconnect the eight microswitch leads at T.B.79. Ensure that the cable R.19 is not fouling the stop pin and that it is routed as shown on fig. 4.

(23) Re-attach the guard.

(24) Carry out the operations detailed in para. 34, sub-para. (11) to (19) and para. 36, sub-para. (13) to (20) inclusive. *[See also para. 29, sub-para. (2)].*

(25) Disconnect external rigs.

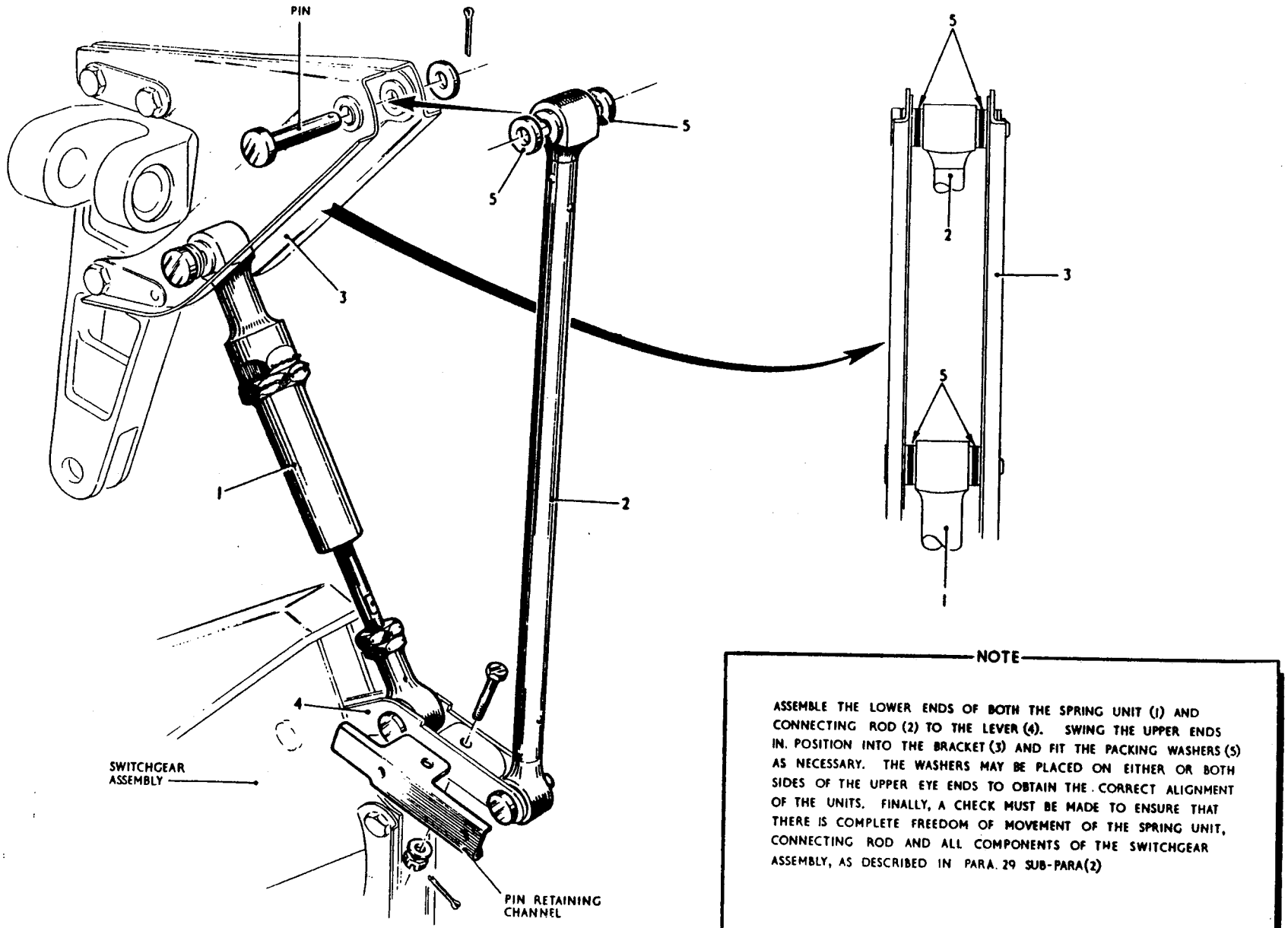
(26) Replace tail cone and bullet fairing.

(27) Restore the aircraft electrical services to normal.

(28) Replace the access panel on the port side of the fin beneath the tail plane and secure.

Braking parachute

54. The E.M. release unit of the braking parachute installation must be serviced in accordance with the instructions given in A.P.1664A, Vol. 2. The removal of the braking parachute is given in Sect. 3, Chap. 1, and the assembly in Sect. 2, Chap. 2.



NOTE

ASSEMBLE THE LOWER ENDS OF BOTH THE SPRING UNIT (1) AND CONNECTING ROD (2) TO THE LEVER (4). SWING THE UPPER ENDS IN. POSITION INTO THE BRACKET (3) AND FIT THE PACKING WASHERS (5) AS NECESSARY. THE WASHERS MAY BE PLACED ON EITHER OR BOTH SIDES OF THE UPPER EYE ENDS TO OBTAIN THE CORRECT ALIGNMENT OF THE UNITS. FINALLY, A CHECK MUST BE MADE TO ENSURE THAT THERE IS COMPLETE FREEDOM OF MOVEMENT OF THE SPRING UNIT, CONNECTING ROD AND ALL COMPONENTS OF THE SWITCHGEAR ASSEMBLY, AS DESCRIBED IN PARA. 29 SUB-PARA(2)

P.14709

Fig. 15 Flying tail switchgear (Assembly of spring unit and connecting rod)

Replacement of aileron trim tab Desynn position transmitter *(fig. 16)*

55. The procedure for the replacement of the aileron trim tab Desynn position transmitter is as follows :—

(1) Render the aircraft electrically safe (*Sect. 5, Chap. 1*).

(2) Remove the port aileron as described in Sect. 3, Chap. 2.

(3) Remove the screws securing the access panel in the aileron leading edge and remove the panel.

(4) Remove the position transmitter return spring.

(5) Disconnect the bowden cable from the position transmitter. Do not allow the lever to fly back uncontrolled as this can cause internal damage to the instrument.

(6) Remove the position transmitter location pin.

(7) Remove the bolt securing the clamp around the position transmitter and partially remove the transmitter. Disconnect the cable from the transmitter and remove the transmitter.

(8) The fitment of the position transmitter is the reverse of sub-para. (1) to (7). Before clamping the position transmitter on the mounting bracket, locate the transmitter, by fitting the location pin in the aft hole in the mounting bracket and the hole in the flange of the transmitter case.

(9) Operate the trim tab and check the function of the indicator.

Replacement of aileron trim tab actuator *(fig. 16)*

56. The procedure for the replacement of the aileron trim tab actuator is as follows :—

(1) Remove the trim tab position transmitter as described in para. 55, sub-para. (1) to (7).

(2) Remove the split pin, washer and shackle pin securing the aileron trim tab control rod to the aileron trim tab. On Post-Mod. 568 aircraft, do not alter the adjustment of the control rod.

(3) Remove the bowden cable from the stop bracket and actuator mounting bracket.

(4) Remove the bolts securing the actuator mounting bracket to the aileron spar and partially remove the mounting bracket, complete with the actuator, from the aileron, so that the end angle can be removed.

(5) Remove the bolts securing the end angle and remove the end angle, then remove the shaft, complete with trim tab control rod and bowden cable, from the actuator.

(6) Remove the actuator and mounting bracket from the aileron and withdraw the cable through the duct.

(7) Remove the bolts securing the actuator to the mounting bracket.

(8) Fit the replacement actuator to the mounting bracket using a new locking plate (*Part No. F.217716*). After tightening the bolts, lock with the tabs of the locking plate and, if necessary, file down the ends of the tabs to ensure that they do not protrude beyond the bolt heads.

Note . . .

Before fitting the replacement actuator, inspect the mounting bracket for signs of cracks or fracture at the attachment lugs.

(9) Position the actuator mounting bracket and actuator in the aileron and thread the actuator cable through the duct.

(10) Connect a 28 volt D.C. supply to the actuator through switches, as illustrated in the actuator equipment manual and motor the actuator to the maximum clockwise position, then disconnect the supply.

(11) With the actuator in the maximum clockwise position, fit the shaft, complete with trim tab control rod and bowden cable, on to the actuator, so that a line through the centre of the actuator shaft and the centre of the shackle pin securing the control rod to the shaft upper lever is in line with the centre pop mark on the reinforcing plate (*See scrap view fig. 16*) on the inside of the mounting bracket.

Note . . .

The head of the shackle pin must be adjacent to the actuator mounting bracket reinforcement plate.

(12) Retain the shaft in the position obtained in sub-para. (11), ensure that the bowden cable is correctly fitted to the shaft lower lever, then fit the end angle on to the shaft and mounting bracket and secure to the mounting bracket with the bolts removed in sub-para. (5).

(13) Fit the actuator mounting bracket on to the aileron spar, whilst easing the control rod through the aileron, then fit the light alloy packing pieces, with the radiused edge on the bend line of the mounting bracket using the bolts removed in sub-para. (4) and secure to the aileron spar.

Note . . .

The special bolt (Pre-Mod. 956) or the long bolt and distance piece (Post-Mod. 956) is/are fitted at the lower inboard attachment hole.

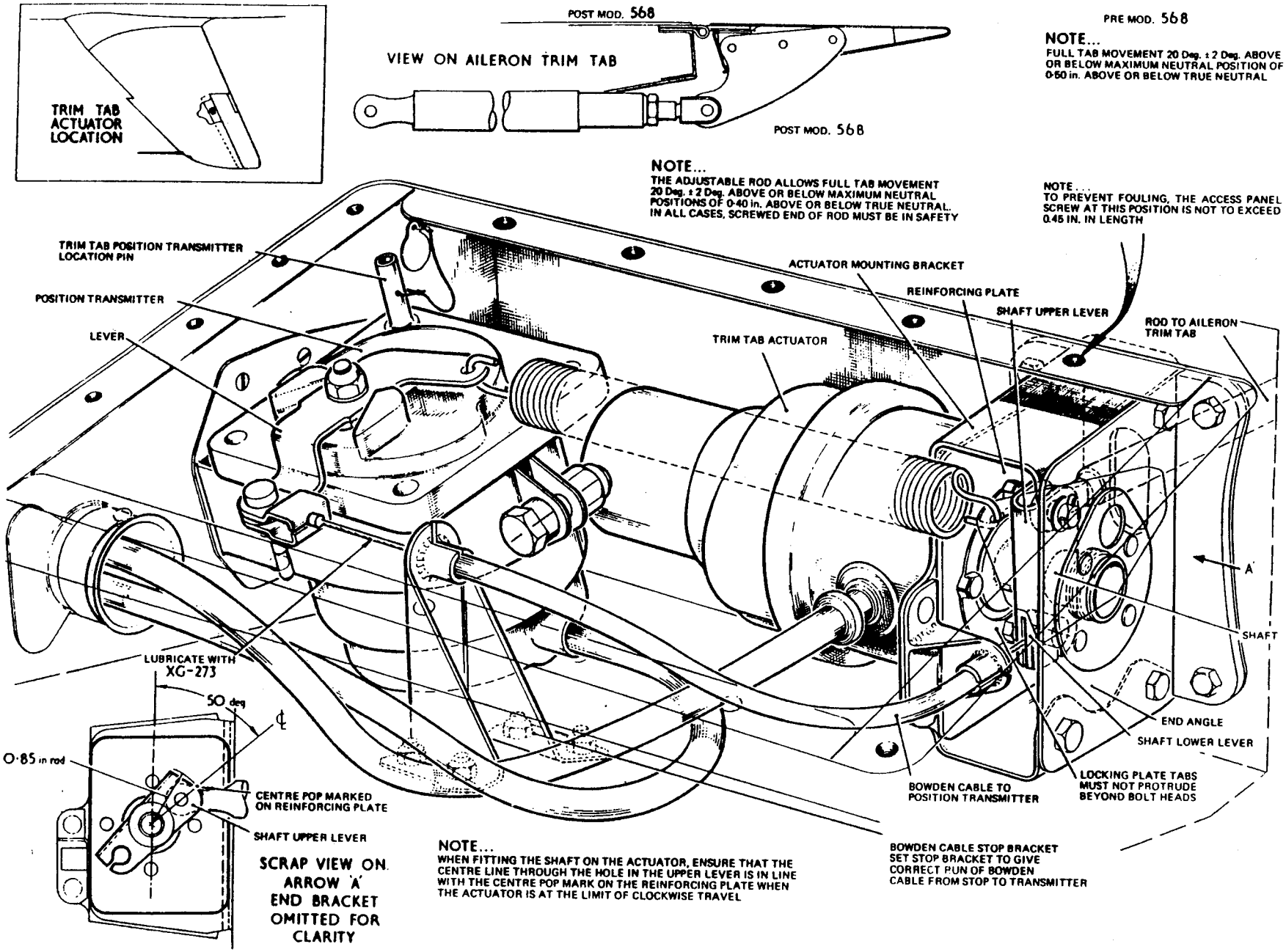


Fig. 16 Fitting of aileron trim tab actuator and desynn position transmitter

◀ (Access panel screw note added) ▶

(14) Reconnect the trim tab control rod to the aileron trim tab using the shackle pin and washer removed in sub-para. (2) and secure with a split pin.

(15) Reconnect the 28 volt D.C. supply (*sub-para. 10*). Ensure that the trim tab is clear of obstruction and motor the actuator until it is in the neutral position i.e., with the shaft halfway between full clockwise and full anti-clockwise positions.

(16) Refit the position transmitter as described in para. 55, sub-para. (8), but leave the access panel off and do not fit the aileron.

(17) Refit the bowden cable to the mounting bracket stop and bowden cable stop bracket. The bowden cable stop bracket should be adjusted to provide the correct run of the cable between the stop bracket and the transmitter lever.

(18) Lubricate the assembly in accordance with fig. 2 and 16.

(19) Ensure that the trim tab is not obstructed and using the 28 volt D.C. supply, operate the actuator and ensure that the assembly functions freely throughout its range. Set the actuator in its neutral position [*sub-para. (15)*] and disconnect the electrical supply.

(20) Refit the access panel, replacing all screws ◀ securely, see note on fig.16. ▶

(21) Refit the aileron as described in Sect. 3, Chap. 2.

(22) Check the operation of the trimming tab in accordance with para. 41.

Adjustment of the aileron trim tab and Desynn position transmitter Post Mod. 568

57. Following the fitment of a replacement position transmitter (*para. 55*) no adjustment is required. Following the replacement of an aileron trim tab actuator (*para. 56*) no adjustment of the trim tab should be necessary provided that the adjustable control rod has not been altered, if it has been altered, adjust the trim tab as follows :–

(1) With the actuator set to neutral [*para. 56, sub-para. (15)*], set the control column to neutral with the aid of the rigging fixture (*fig. 9*).

(2) Slacken the locknut on the aileron trim tab control rod.

(3) Remove the split pin, washer and shackle pin securing the aileron trim tab to the control rod.

(4) Hold the aileron trim tab at the trim neutral position recorded on the aircraft Servicing Form and adjust the control rod for length until the shackle pin can be fitted in the control rod fork end and aileron trim tab. On completion, ensure that the fork end registers in the control rod safety hole.

(5) Fit the shackle pin and washer, and secure with a split pin. Lock the fork end with the locknut.

(6) Check the operation of the trim tab and check that the up and down movement from trim neutral is 20° ± 2° or Max. 1·40 in., Min. 1·10 in.

When a mainplane, aileron, aileron trim tab, or aileron trim tab control rod is replaced the aileron trim tab must be adjusted as follows :–

(7) Set the control column at neutral with the aid of the rigging fixture (*fig. 9*).

(8) With the trim tab actuator set to neutral [*para. 56, sub-para. (15)*], adjust the aileron trim tab control rod to set the trim tab at neutral i.e., with the trailing edge in line with the aileron trailing edge.

(9) Remove the rigging fixture.

(10) Following a test flight, set the control column at neutral with the aid of the rigging fixture. Connect a ground supply and using the aileron trim switch, motor the actuator to set the aileron trim tab position indicator to neutral trim as noted by the Pilot. Measure the trim tab position at the trailing edge relative to the aileron trailing edge and record this measurement. This should not be more than 0.40 in. above or below the aileron trailing edge.

(11) Motor the actuator to set the aileron trim tab at neutral as in sub-para. (8).

(12) Slacken the locknut on the aileron trim tab control rod.

(13) Remove the split pin, washer and shackle pin connecting the trim tab to the trim tab control rod.

(14) Hold the trim tab at the position noted in sub-para. (10) and adjust the trim tab control rod by screwing the fork-end in or out to lengthen or shorten the control rod until the shackle pin can be fitted to the rod fork-end and the trim tab without moving the trim tab. On completion, ensure that the fork-end registers in the control rod safety hole.

(15) Fit the shackle pin and washer and secure with a split pin. Lock the fork-end with the locknut.

(16) Check the operation of the trim tab and check that the up and down movement from the trim neutral position [*sub-para. (10)*] is : 20° ± 2° or Max. 1·40 in., Min. 1·10 in.

(17) Record the trim neutral position [*sub-para. (10)*] in the aircraft Servicing Form.

Adjustment of the aileron trim tab and Desynn position transmitter Pre Mod. 568

58. Following the fitment of a replacement position transmitter (*para. 55*) it will be necessary to check and if necessary reset the position of the indicator pointer (*para. 41*). Following the replacement of an aileron trim tab actuator no adjustment should be necessary. When a mainplane, aileron, aileron trim tab or aileron trim tab control rod is replaced, the aileron trim tab and position indicator must be adjusted as follows :—

(1) Set the control column at neutral with the aid of the rigging fixture (*fig. 9*).

(2) With the trim tab actuator set to neutral [*para. 56, sub-para. (15)*] the trim tab should be approximately neutral. Check the position of the indicator needle; if it is more than a needle width from neutral, reset by removing the needle and refitting it in the neutral position.

(3) Remove the rigging fixture.

(4) Following a test flight, set the control column at neutral with the aid of the rigging fixture. Connect a ground supply and using the aileron trim switch, motor the actuator to set the indicator needle in the position noted by the pilot for neutral trim. Measure the trim tab position at the trailing edge relative to the aileron trailing edge and record this measurement. This should not be more than 0·50 in. above or below the aileron trailing edge.

(5) Motor the actuator to the neutral position on the indicator, thereby ensuring that the actuator is in the neutral position.

(6) Remove the trim tab actuator shaft as described in para. 56, sub-para. (1) to (5). Before removing, mark the lever shaft and actuator shaft. Turn the lever shaft either clockwise or anti-clockwise in order to set the aileron trim tab in the neutral trim position and re-engage the lever shaft with the actuator shaft.

Note . . .

Turning the lever shaft through one seration moves the aileron trim tab approximately 0·30 in. at the trailing edge.

(7) Retain the lever shaft in the new position on the actuator obtained in sub-para. (6), ensure that the bowden cable is correctly fitted to the shaft lower lever, then fit the end angle on to the shaft and mounting bracket. Secure to the mounting bracket with the attachment bolts.

(8) Complete the refitment of the trim tab actuator in accordance with para. 56 sub-para. (13), (14), (16) to (21).

(9) Reposition the indicator needle to neutral, with the trim tab actuator neutral.

(10) Check the operation of the trim tab in accordance with para. 41 and check that the up and down movement from neutral trim is : 20° ± 2° or Max. 1·40 in., Min. 1·10 in.

Aileron neutral position indicator setting

59. A white disc is painted on the instrument panel for alignment of the control column to neutralize the ailerons in the event of an accidental spin. The position of the disc is determined as follows :—

(1) Set the control column neutral with the ailerons in power.

(2) Move the control column forward, ensuring that the ailerons are not displaced from neutral.

(3) Stick a one inch disc of white self-adhesive tape on the instrument panel so that it aligns with the top of the control column when viewed from the pilot's seat, with the control column as at (2).

(4) Adjust the position of the disc until it is visible at the extremes of seat adjustment, with the control column as at (2).

(5) Mark the position obtained, remove the disc and paint the marked position with a one inch disc in matt white paint.

Replacement of aileron control torque shaft, bearing assembly or levers

60. When replacing the aileron control torque shaft, torque shaft bearing assembly or levers, forward of fuselage frame 33 (*centre*), the shim washer between the spool of the lower lever and the lower bearing must be adjusted to ensure an end float on torque shaft of between 0·010 in. and 0·020 in.