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Chapter 4 FLYING CONTROLS

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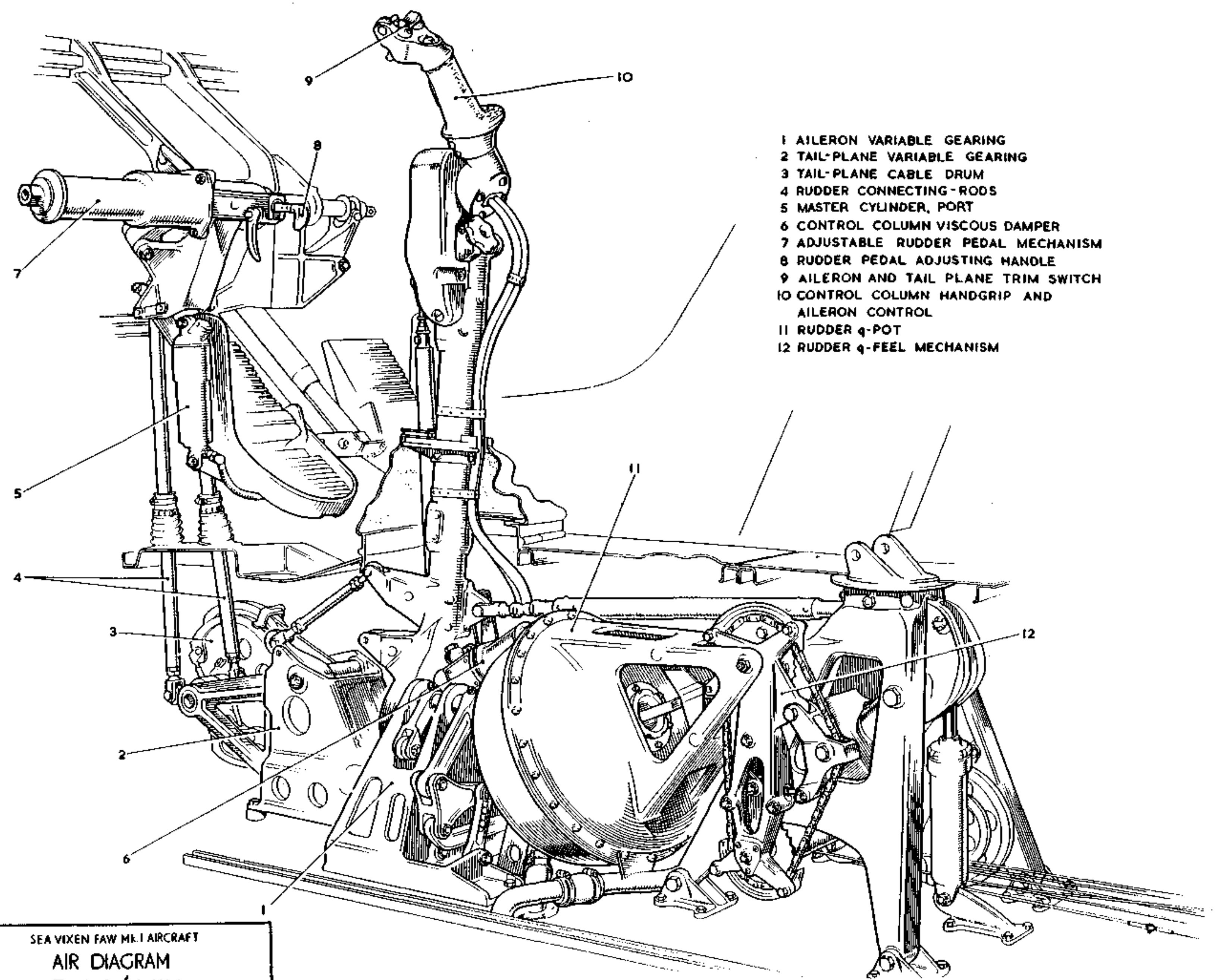

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Fig.1 Flying controls in cockpit, port side view

◄Key amended►

SEA VIXEN FAW Mk.1 AIRCRAFT

AIR DIAGRAM

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a short drop link, to the manually controlled gear change mechanism at the column head and from there, by means of a connecting-rod, to the arm of a torque shaft pivoted within the column base.

7. Movement of the torque shaft is directed aft, through a universal joint, to the universal fork lever, variable gearing and cable drum. These items are mounted, together with the control column, on a common pedestal casting attached to the cabin floor. The cable drum and lever are pivoted coaxially one behind the other with the gearing mechanism located to port and between them.

8. From the cable drum, a pair of cables continue the drive aft under the pilot's seat and pass through the floor beam pressure seals at station No. 148, the port cable passing round a pulley mounted on the q-feel cylinder head support bracket, and the starboard cable passing around two pulleys, one mounted on the rear of the pedestal casting and the other pivoted on the inside of the seat mounting.

9. After leaving the pressure seals, the two cables travel aft under the cabin rear floor to separate pulleys bracketed to the base of the front spar and situated to port of the aircraft centre line, the starboard cable crossing over the port cable between the pressure seal and individual pulley positions.

10. From these pulley positions, the cables are diverted outboard, one to port and one to starboard, both passing through the leading edges of the wing centre section, to the aft side of the Teleflex tension regulators; the regulators form one half of the drive transfer mechanism and are located on the outboard face of rib No. 4 at the wing fold.

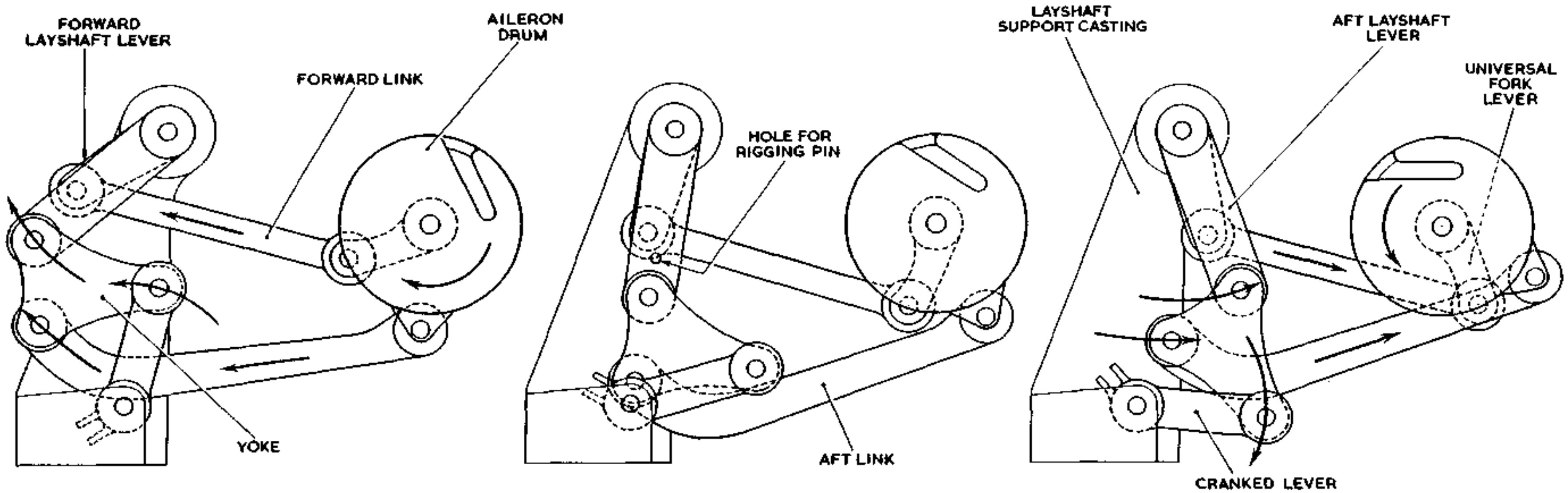
11. The routing of the cables is controlled on the port side by two pulley positions, one on the forward face of the front spar outboard of main rib No. 0A and the second on the forward face of the front spar between nose rib No. 2 and 3.

12. Routing of the cable in the starboard side is similar with the addition of a further pulley positioned on the base of the front spar, slightly to starboard of the aircraft centre line.

13. A balance cable, connecting the forward sides of the port and starboard quadrants of the Teleflex tension regulators, completes the cable circuit. Routing of this cable is carried out by pulleys mounted on the same pulleys brackets as the drive cable pulleys. An additional pulley is located on a bracket attached to the inboard face of the pylon mounting at rib No. 4 to ensure correct alignment of the cable to the tension regulators.

14. As mentioned in para. 10, the Teleflex cable tension regulators at rib No. 4 represent one half of each of the drive transfer mechanisms; the other half is composed of a Teleflex bell-crank compensator fitted to the inboard face of rib No. 4A on the extension wing, port and starboard. With the extension wings *spread* the rollers, mounted on the cable tension regulators, mate with the roller tracks on the bell-crank compensators and transfer the drive across the wing fold. The drive, so transferred, is passed on by a compression strut, attached at its inboard end to the bell-crank compensator, to three connecting-rods linked together in series, and operating on swinging arms mounted horizontally in the extension wing leading edge structure. The extreme outboard end of the line of three connecting-rods terminates at the attachment to the bell-crank lever of the spring-feel unit located on the forward face of the front spar between nose rib No. 9A and 10.

15. Motion from the spring-feel units, port and starboard, is transferred aft by connecting-rods which pass through the front spar. On the port side, the aft end of the rod connects to the inboard end of a lever, which is free to pivot within a double lever assembly *(fig. 5)* attached to the autopilot mechanism, and from thence by another connecting-rod, attached at its forward end to the outboard end of the pivoted lever, to the servo control valve lever.



Control column handle fully port. Neutral. Control column handle fully starboard.

Fig.4 Aileron gearing mechanism

16. The starboard side is similar in its method of operation, with the exception, that, interposed between the spring-feel unit and the autopilot lever assembly, is a further lever assembly and an additional connecting-rod; the purpose of these is to provide an opposite movement, through the linkage, to the servo control valve lever which, in turn, provides an opposite movement of the ailerons. Part of this interposed lever assembly also carries the outer trim lever, the inboard end of which is attached to the rams of the electrically-controlled trim actuator; the body of the actuator is anchored at a point on the structure outboard of rib No.9 and aft of the front spar.

17. The aileron servo control units, in both port and starboard wings, have their ram ends anchored to a bracket on the rear face of the main spar extension, and the body ends attached to the ailerons at the base of their inboard hinge brackets. Operation of the servo control valves, by the method described, allows hydraulic pressure to be supplied and relieved on appropriate sides of the servo control unit pistons, causing extension or retraction of the servo control unit rams and the subsequent up or down movement of the aileron. Further information regarding the servo control units and their hydraulic systems will be found in Sect.3, Chap.6.

Aileron variable gearing mechanism
(fig.4)

18. The variable gearing mechanism is designed to give maximum lateral control for minimum movement of the control column handle. Its action depends upon the differential motion of two inter-connected levers, due to the component connecting them being also connected to a third lever. The gearing itself consists of a universal fork shaft mounted in ball races situated in the main casting. The shaft occupies a position directly aft of, and in line with, the torque shaft located in the base of the control column, and is coupled to it by a universal joint.

19. A short lever, splined to the fork end shaft and protruding downwards from it, carries at its free end the forward link lever; the purpose of the link lever being to transfer movement of the fork end shaft to the layshaft which lies outboard of and parallel to it. The layshaft, in common with the fork end shaft, rotates in its own ball races and also has splined to it a short vertical lever. The free end of this lever is occupied by the outboard end of the forward link lever. Thus, rotation of the fork end shaft, derived from movement of the control handle, produces an angular rotation of the layshaft and this in turn causes an oscillating movement of the aft layshaft lever.

20. For the purpose of this text, the aft layshaft lever may be looked upon as the first of the three levers upon which the main differential motion is dependent. It is inclined to the vertical and occupies a position at the extreme aft end of the layshaft, with its upper end rigidly attached to it. The lower end of this lever is attached to a triangular double-sided yoke which is free to pivot about its attachment point. Reference to fig. 4 will make it clear that the yoke can be compared to an isosceles triangle, which has one attachment hole at each of its three corners. The triangle, when the control column handle is in the *neutral* position, lies on its side with the apex inboard and the base inclined outboard, the layshaft lower end being connected to the uppermost hole in the triangle.

21. The lower outboard hole in the triangle is the attachment point of the aft link lever. This lever is the second of the two interconnected levers mentioned in para. 18. The purpose of this lever is to pass to the aileron drum movement transferred from the yoke, when the yoke is actuated by the oscillation of the aft layshaft lever, and its path of travel controlled by a third lever. This third lever is the U-shaped cranked lever located on and pivoting about a pair of bolts anchoring it to individual webs which are part of the base of the layshaft mounting casting; the bolts pass through each of the sides of the lever at its closed end.

22. The triangular yoke occupies a position inside the cranked lever, with the free ends of the lever attached one to each side of the yoke at its apex (extreme inboard end).

23. The aileron drum is located at the aft end of the universal fork shaft; the nut and retaining plate, at the end of the shaft, hold in position a ball race upon which the drum is free to rotate; the drum is completely divorced from the universal fork shaft and its rotation is dictated entirely by the travel of the aft link lever.

24. When the yoke and its attendant levers are sited correctly, the yoke occupies a position inside the cranked lever with the aft link occupying a position inside the yoke. Thus, in their respective paths of travel, which is governed by the arc described by the lower end of the aft layshaft lever and the cranked lever, the yoke passes through the cranked lever and the aft link passes between the two sides of the yoke.

25. By the foregoing arrangements a movement of the control column handle will set up rotation in the universal fork, also a rotation of the aileron drum, but at a different rate, the angle of rotation of the drum being less than that of the universal fork shaft owing to the operation of the differential linkage. As the control column handle is moved closed to either of the full travel positions, the rotation of the yoke diminishes and the motion lost between the universal fork and the aileron drum decreases. Thus, the ratio of aileron drum to universal fork movement, and consequently to that of the control column handle, becomes progressively greater as the handle is moved from *neutral* to either of the full travel positions.

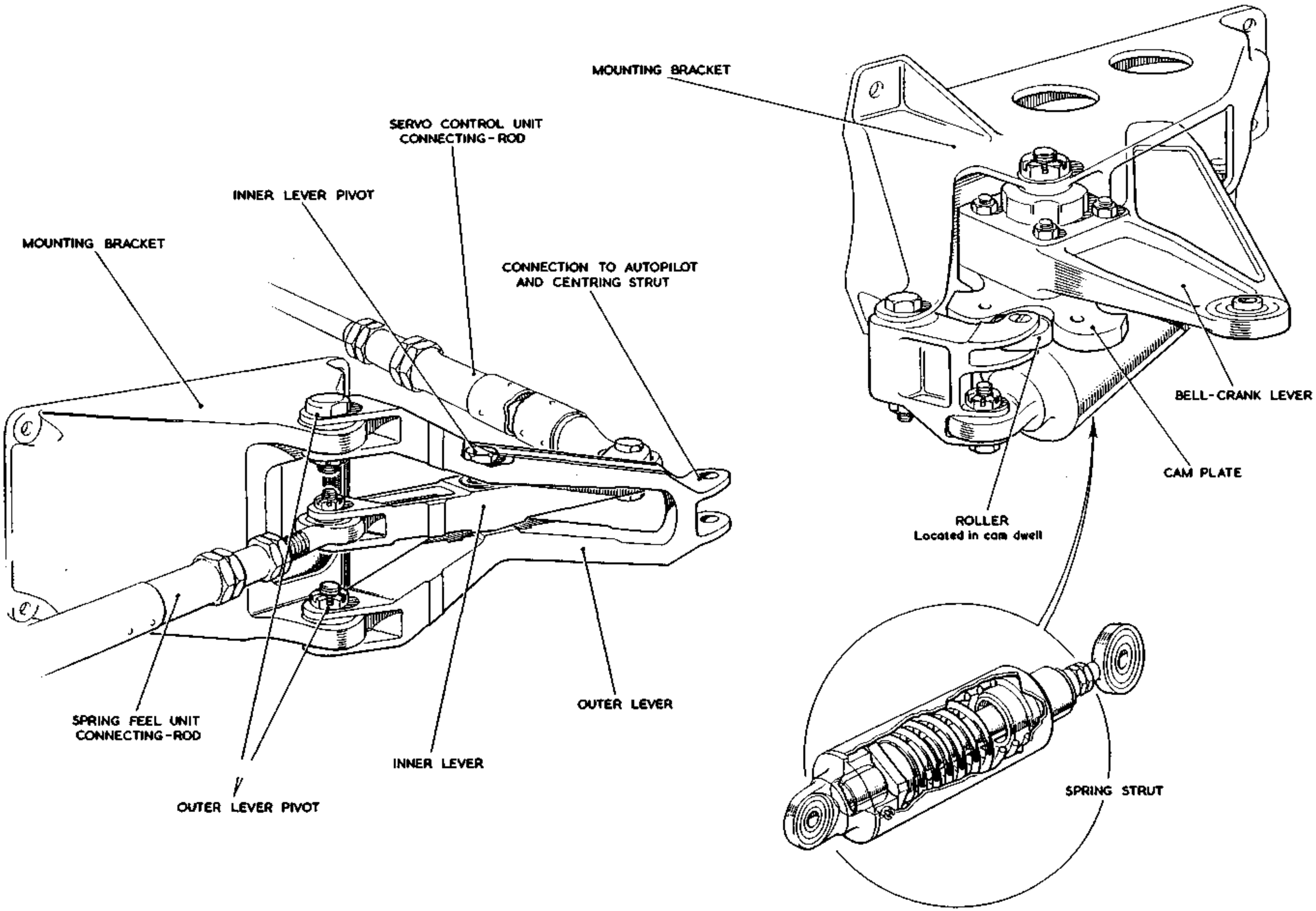


Fig. 5 Aileron autopilot lever assembly and spring-feel unit

Aileron spring-feel mechanism (fig. 5)

26. As the name implies, the spring feel mechanisms are designed to simulate, at the control column handle, the lateral loads normally felt by the pilot when flying an aircraft which is not fitted with power-operated control surfaces.

27. Each unit is composed of one large bell-crank lever, one smaller double-sided bell-crank lever and a spring strut, all mounted on a common casting. Both of the levers are mounted in the same plane on the casting and are free to pivot at their respective attachment points, the smaller lever being situated below and to one side of the larger lever. The spring strut has its body attached to the casting and its ram shaft eye end connected to one arm of the smaller lever. The other arm of this lever carries, at its free end, a roller which engages on the face of a double-lobed cam secured coaxially to the under side of the larger lever. The roller is spring-loaded to the cam face by the action of the spring strut and, in neutral position, the roller engages centrally in the dwell located between the lobes of the cam.

28. The large bell-crank lever pivots about its attachment point and its two free ends are connected (1) to the extreme end of the connecting-rod linkage in the extension wing leading edge, and (2) to the forward end of the connecting-rod, which joins the spring-feel unit to the lever assembly, leading to the autopilot and the servo control unit connecting-rod.

29. By this arrangement, with the wings spread and the Yellow or Blue hydraulic systems pressurised, any movement of the control column handle will cause the cam to rotate and the roller to ride up the lobes of the cam, thus compressing the spring and providing an increasing resistance to the movement of the control column handle. Similarly, if the control column handle is released from any out of neutral position under the conditions mentioned, the spring-feel strut will cause the cam to rotate and return the roller to the dwell of the cam, thus returning the control column handle to neutral.

30. With the wings folded, the self-centring action of each spring-feel mechanism is confined, by the disengagement of the drive transfer mechanisms, to its respective outer wing section of the control system, but, due to the gravitational effect on the ailerons and the connecting-rod linkage and providing that the hydraulic system to the servo control unit is not exhausted, the entire aileron system will be out of phase.

31. Since the friction loading of the cabin and centre section of the control system is relatively insignificant, in the event of the control column handle being operated and left out of neutral after the wings have been folded, when the wings are next spread, and assuming that the hydraulic system has been exhausted, the ailerons will be out of phase. No harm will come to the system under these conditions however, as, when the drive transfer mechanisms engage at the wing fold, the compression strut from the bell-crank compensator to the connecting-rod linkage will compensate for this out of phase condition, and subsequent recharging of the hydraulic system will return the ailerons to neutral and alleviate the load borne by the compression strut.

Aileron trim mechanism (fig. 3)

32. Provision is made for lateral trim correction by an electrically-operated actuator incorporated in the starboard aileron circuit and con◀trolled by a double toggle switch on the control column.▶ As stated in para. 29, the action of the spring struts incorporated in the spring-feel units will, with the hydraulic system fully operational, cause the aileron control column handle to return to neutral and hold this position with hands off the controls.

33. With the aircraft in level flight under the conditions stated, correction of lateral trim is achieved by selecting the required trim on the switch by moving it to port or starboard. Selection on the switch causes the actuator ram end to extend or

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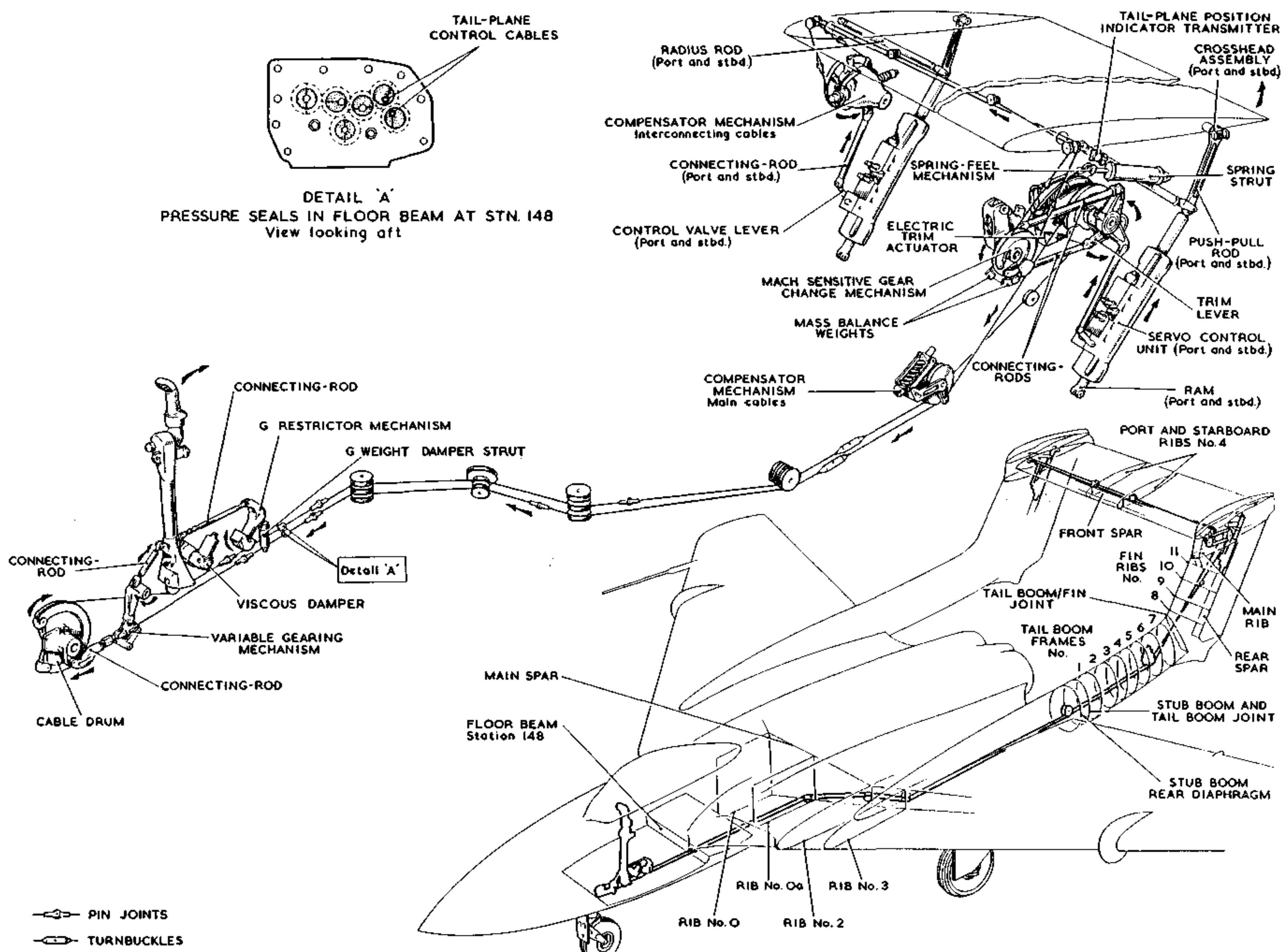

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Fig. 6 Tail-plane control circuit

◀ Annotations amended ▶

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retract and operate the intermediate and control valve connecting-rods via the double lever assemblies. Owing to the construction of the lever assemblies, operation of the actuator affects none of the starboard aileron linkage forward of the trim actuator lever assembly.

34. An inductor type transmitter connected between the body and the ram of the actuator transmits, to a visual indicator mounted adjacent to the switch, the degree and direction of the applied trim.

35. Further information regarding the actuator, the transmitter and the indicator, and their electrical circuits will be found in Sect.5, Chap.1 and 2.

Autopilot mechanisms *(fig.3 and 5)*

36. These mechanisms are incorporated to provide a simple means of using part of the main control system for autopilot operation of the ailerons, so that the surfaces may be moved to give automatic pitch and roll control without transmitting motion back to the column handle.

37. Each mechanism comprises a dual lever assembly consisting of a plain inner lever centrally pivoted between the arms of a forked outer lever, whose inboard and outboard ends are connected to the adjacent spring-feel mechanism and servo unit.

38. The two inboard ends of the outer lever are anchored to individual brackets on the front face of the main spar extension, whilst the single outboard end is connected via an electro-hydraulic actuator to the front face of the main spar extension, and, via a spring-centring strut which carries a rocker-operated micro switch, to the rear face of the front spar.

39. When the column handle is operated under autopilot OFF conditions, the inner lever of each assembly pivots centrally within the outer lever which remains stationary.

40. With the autopilot switched ON, any deviation of the aircraft from its pre-determined course is detected by the gyro unit. This passes on electrical impulses which open and close appropriate ports in the actuator causing it to extend or retract accordingly.

41. In consequence, the inner and outer levers of the mechanism now pivot simultaneously about their inboard attachment points, and independently of the part of the system between those points and the column handle. The control valves and hence the servo units and ailerons can thus move in the same direction or in opposite directions and, by this arrangement, the surfaces now perform the function of elevons.

42. The spring centring struts return the autopilot actuators to *neutral* after sufficient corrective extension or retraction has taken place. The rocker-operated micro switch, controlled by a flanged disc on the strut plunger, is provided for ground testing the autopilot as described in Sect.5, Chap.2.

43. Further information regarding the autopilot actuators, the micro switches and their electrical circuits will be found in Sect.5, Chap.2.

Note...
On those aircraft in which an autopilot is not fitted, the electro-hydraulic actuators are omitted and replaced by connecting-rods.

Aileron manual gear change

44. The manually-controlled gear change provides a means of varying control column handle lateral movements for a given aileron displacement. Its use is confined mainly to low air speeds such as those required during landing approach, particularly under turbulent air conditions.

45. The method of operation relies on variation in relative movement of a connecting-rod and a drop link connected to individual attachment points on a common lever, when the distance from the drop link to the lever fulcrum is increased or decreased.

46. A longitudinally slotted lever is positioned on the port side of the column head, pivoting transversely on

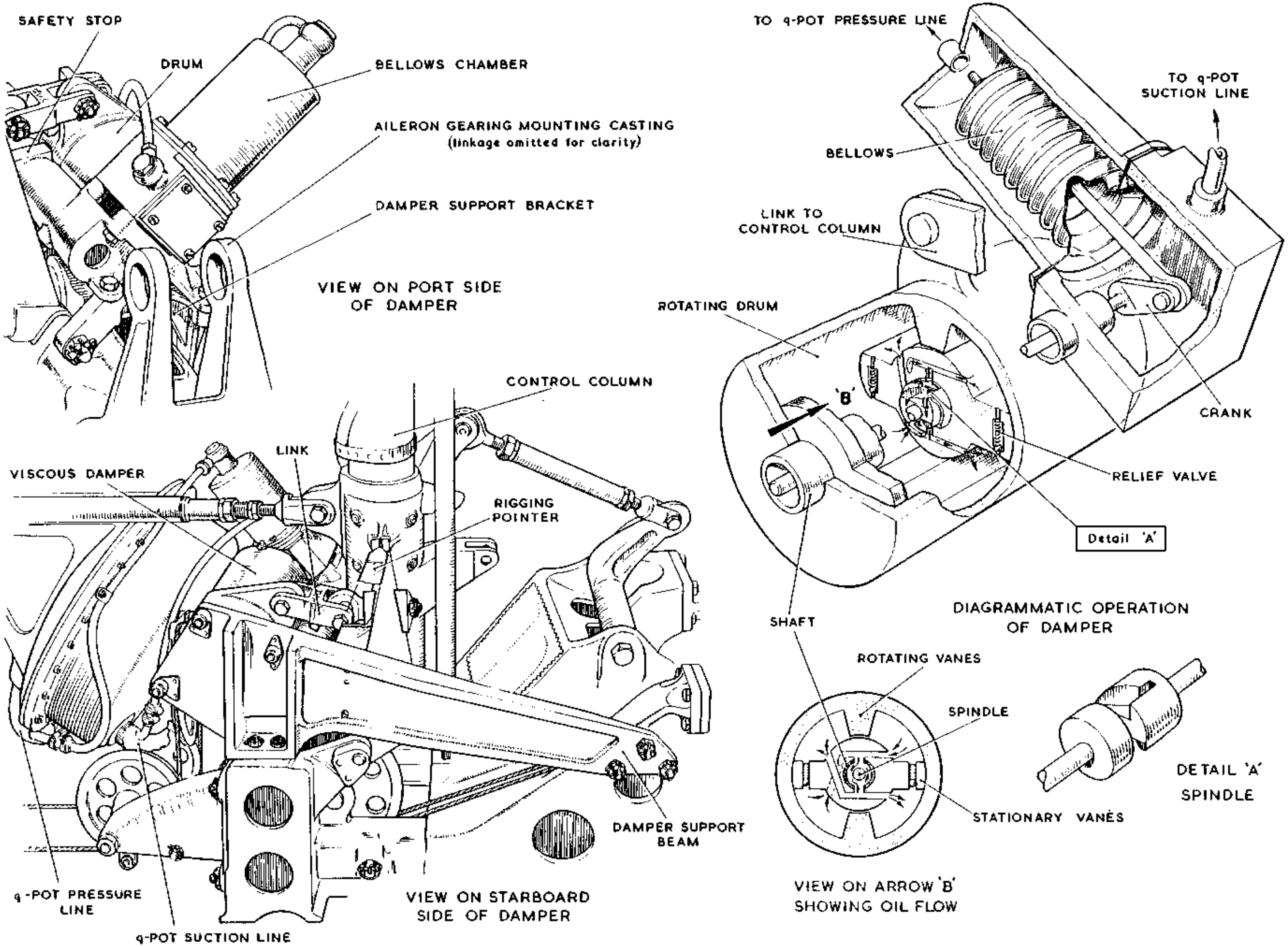

Fig.7 Control column viscous damper

the rear face of the control column. The slot in the lever carries a rectangular block which is threaded internally to receive the threaded forward end of an operating shaft. This shaft, carried by a bearing in the lever spindle, is located forward of the bearing, by a shoulder formed between the bearing surface at its after end and the threaded portion at its forward end. The serrated after end of the shaft protrudes from the bearing and has mounted on it a gear operating hand wheel. Rotation of the hand wheel will cause the block to slide backwards or forwards in the lever slot.

47. A threaded stud, located on the outboard side of the sliding block, is connected via a short drop link to a lever formed on the port side of the control column handle, whilst a ball race at the forward end of the slotted lever provides an attachment for a vertical connecting-rod which runs down the forward face of the control column, joining it to the arm of a torque shaft pivoted horizontally fore and aft within the column base.

48. With the sliding block screwed fully forward the gearing is in *normal* position; clockwise rotation of the operating hand wheel will cause the block to move aft until the gearing is in the *high* position. This *high* position increases the ratio of torque shaft (and aileron) to column handle movement. For normal flight the hand wheel should be left in a fully anti-clockwise position.

Tail-plane control circuit *(fig.6)*

49. Forward or backward movement of the control column transmits drive, to a pair of cables via the variable gearing cable drum. These cables are routed aft, under the variable gearing assemblies and the pilot's seat mounting, and through pressure seals in the floor beam at station No.148 to pulley positions at the base of the main spar where they turn outboard and pass into the port wheel well. Changing direction again, the cables travel aft through the boom to the cable compensator mechanism located at frame No.5 at the foot of the port fin, and are then diverted upwards through the port fin to terminate at the cable drum of the tail-plane trim unit located in the fin head.

50. The tail-plane trim unit, which combines the tail-plane trim and spring feel mechanism, is located below and slightly aft of the tail plane pivot point. It is mounted vertically and pivots about its horizontal attachment bolt; movement set up in the cable run causes the unit to pivot on its axis.

51. Mounted ahead of the trim unit is the Mach sensitive gear change mechanism this occupies a position below and slightly forward of the tail plane pivot point, is mounted in a manner similar to the trim unit, and is also free to pivot on its attachment bolt. The two units are joined by two connecting-rods, one below and one above pivot point.

52. Rotation imparted to the trim unit by movement of the cables sets up a similar rotation of the gear change unit via the lower connecting-rod, whilst, at the same time, the upper connecting-rod conveys the movement back to a bell-crank lever pivoting about the outboard end of the trim unit assembly.

53. A further connecting-rod attached to the lower arm of the bell-crank lever passes down the fin and connects at its lower end to the control valve lever of the servo control unit. Thus movement of the control column governs the movement of the control valve lever and completes the port control circuit.

54. To operate the servo control unit in the starboard fin, an interconnecting cable run is introduced into the existing control circuit. A cable drum, cast integrally with the Mach gear change mechanism, operates a pair of cables which pass upwards to pulleys adjacent to the centre of the hollow tail-plane pivot, then pass through the pivot casting, across the interior of the tail plane, to emerge via a similar pulley assembly at the starboard fin head, from which they pass downwards and connect to the segments of a cable compensator mechanism located in the fin.

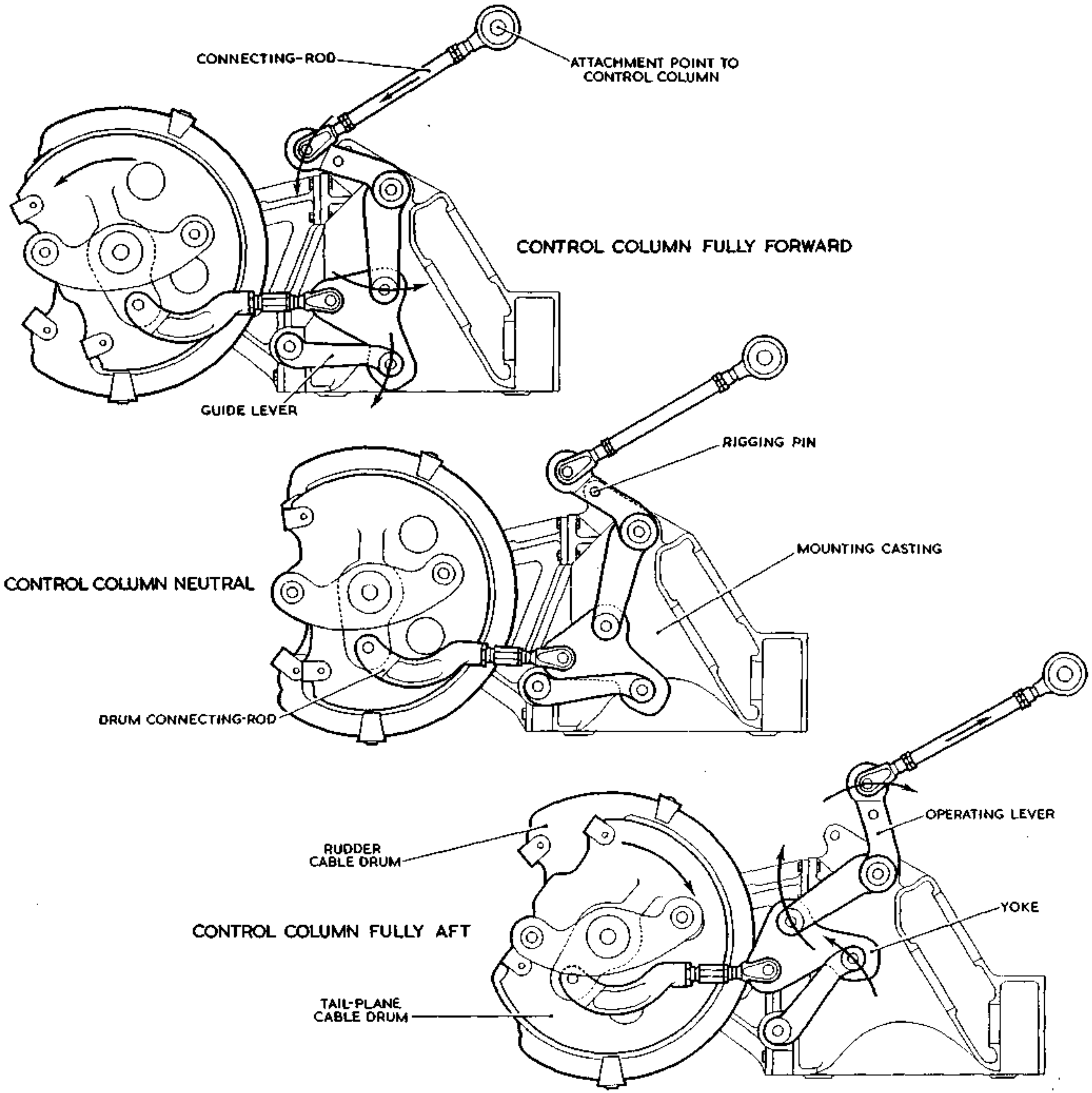

Fig. 8. Movement of tail-plane variable gearing

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55. This compensator mechanism is mounted vertically and pivots about its attachment bolt in a similar manner to the units in the port fin; a lever, which is cast integrally with the compensator spool, projects downwards and has a connecting-rod joining it to the control valve lever of the servo control unit. Any movement of the units in the port fin is transmitted instantaneously so that the control levers of both the servo control units operate simultaneously.

56. Each servo control unit is mounted with the eye end of its ram anchored to a bracket located on the front face of the fin rear spar, the eye end of the body being connected by a radius rod to the tail plane pivot bearing and by a push-pull lever to a cross head assembly at the rear attachment to the tail plane. The cross head assembly and the eye end of the servo unit body run in guide rails built into the fin structure, their alignment being maintained by the radius rod.

57. Operation of the servo control unit valves supplies and relieves hydraulic pressure to the appropriate sides of the servo pistons causing extension or retraction of the unit and subsequent upward or downward movement of the tail plane.

58. A large tab hinged from the tail plane trailing edge is entirely dependent upon flap operation for its initial movement and is embodied to maintain trim and assist control of the aircraft under take-off and landing approach conditions. An induced nose heaviness, introduced by the lowering of the flaps, is counteracted by the movement of the tab in an upward direction. In flaps down conditions, any subsequent upward movement of the tail plane from *neutral* will cause a proportionally larger movement of the tab in the same direction. With the flaps *retracted*, the tab automatically takes up an in-line position with the tail plane where it remains throughout the entire range of control column movement. Further information regarding the tab will be found in information on the flaps and their operation. Further information regarding the servo units and their hydraulic systems will be found in Sect.3, Chap.6.

Control column viscous damper *(fig.7)*

59. In order to prevent pilot induced oscillations of the tail plane and too rapid operation of the control column, a viscous damper is mounted between supports on the control column mounting casting. The main body of the damper consists of a revolving outer drum, link-connected to the column, and a fixed inner hub, both parts being mounted on a common shaft. The drum and the hub both have a pair of diametrically opposed vanes, thus dividing the interior of the drum into four oil-filled compartments. When the column is moved, the drum is rotated, one pair of compartments is enlarged and the other pair compressed, so that oil is forced from one pair to the other, through oil-ways in the hub and a small port in the shaft. The size of the port is governed by a spindle which lies inside the shaft and co-axial with it, rotation of the spindle either opening or closing the port. At one end of the spindle is a crank, which is connected by a rod to the top of a bellows assembly, housed in a cylinder at right angles to the drum but offset from it. The space around the bellows is connected by a pipe to the pressure line from the q-feel pressure head *(para.125)* and the space inside the bellows is connected to the suction line. As the difference between pressure and suction changes with air speed, so the bellows are compressed or extended and the spindle is rotated. The amount of damping is thus dependent upon air speed, being small at low speeds but increasing sharply above 400 knots.

Tail plane variable gearing mechanism *(fig.8)*

60. The variable gearing incorporated in the tail plane control circuit is in many ways similar to that previously described in the aileron circuit, and is obtained in an identical manner, i.e., by means of two interconnected levers influencing the movement of a third lever due to all three being joined by a common moveable component. The mechanism is built into a separate casting secured to the cockpit floor, directly forward of the aileron gearing mounting, and comprises an operating lever, guide lever, yoke and connecting-rod.

61. The cranked operating lever is mounted on ball races and pivots on a bolt in the head of the casting, it has two radially disposed arms, one projecting above the attachment point and one below it. The connecting-rod has its aft end attached to a bracket on the control column, its forward end being connected to the upper arm of the cranked lever. The lower arm of the lever passes downwards, inside the casting body, and terminates at one of the holes in the triangular yoke situated below it. With the controls *neutral* this hole is the uppermost one.

62. The yoke is located vertically in a similar manner to the yoke in the aileron gearing, and the oscillatory movement, given to it by the operating lever when the control column is moved, is controlled by the guide lever, this lever has its free (aft) end attached to the after attachment hole in the yoke and its anchored end pivots upon ball races located in the casting base. The forward attachment hole in the yoke is connected to the fork end of a connecting-rod which passes movement of the yoke to the tail-plane cable drum to which it is attached at its forward end.

63. By the foregoing arrangement, it will be seen that the operating lever and the guide lever control the move-

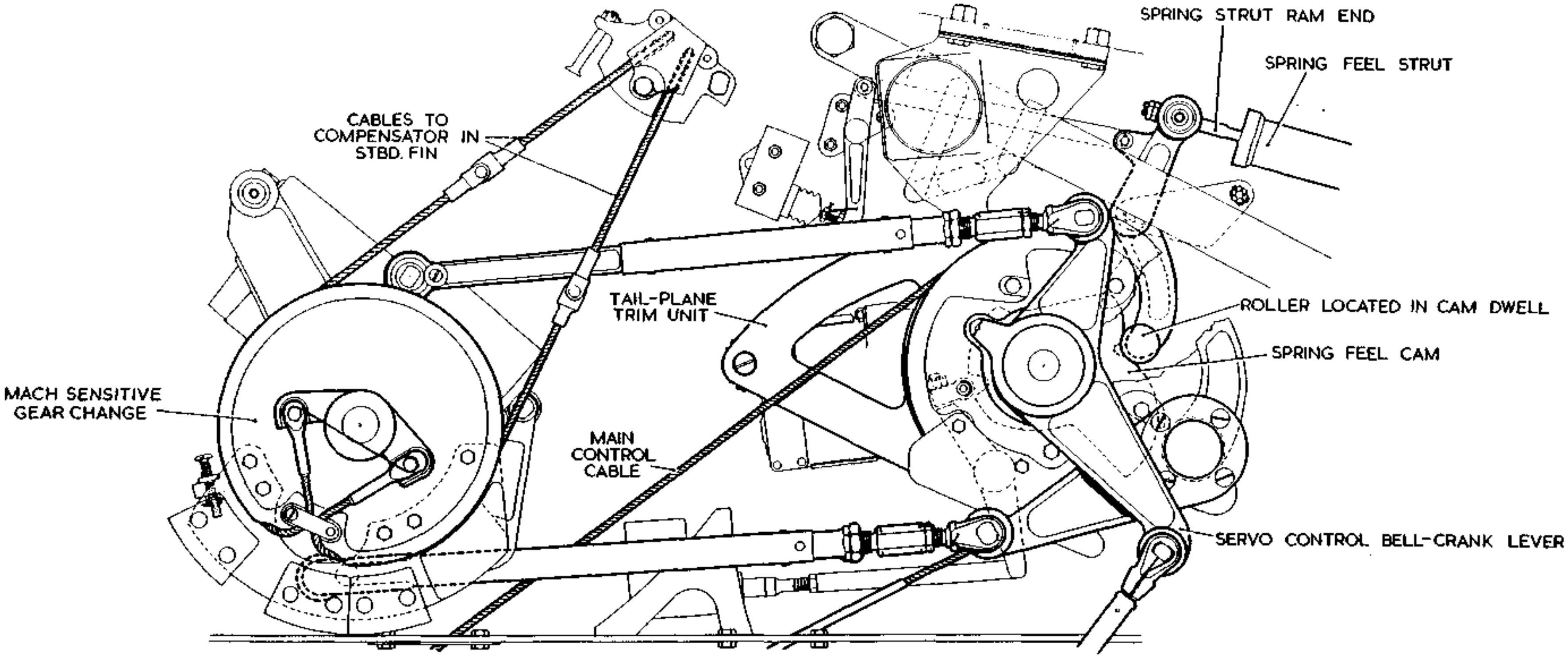

Fig. 9 Spring-feel mechanism in port fin head

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ment of the connecting-rod. A rotation of the operating lever will set up a rotation of the tail-plane cable drum but at a different rate, the angle of rotation of the drum being less than that of the operating lever.

64. As the control column is moved closer to either of its full travel positions, the rotation of the yoke diminishes and the motion lost between the operating lever and the cable drum decreases; thus the ratio of tail-plane cable drum to column movement becomes progressively greater as the column is moved from neutral to either full travel position.

Tail-plane spring feel (fig. 9)

65. In the tail plane circuit, simulated 'feel' is achieved by combining a spring feel mechanism with the trim unit in the port fin head. A bellcrank lever, located above and slightly aft of the axis of the trim unit, pivots vertically about its attachment point on the inboard fin skin; its upper arm connects to the plunger of a spring strut anchored by its body to the rear of the fin structure, whilst a roller, located at the extreme end of the lower arm, tracks on the face of a double lobed cam.

66. The cam is secured coaxially to the inboard side of the trim unit, and pressure from the spring strut holds the roller firmly in contact with the cam face. In the neutral position, the roller lies securely in the dwell of the cam, but, when the control column is moved, rotation of the trim unit causes the roller to ride up one or other of the cam lobes. Resistance to movement of the controls, set up by loading of the strut, becomes increasingly greater as the control column moves towards either full travel position. Should the control column be released at any out-of-neutral position, the pressure of the roller lever on the cam face will cause rotation of the trim unit and operation of the servo control units until, with the roller resting in the cam dwell, the control column and tail plane return to neutral.

Tail-plane trim mechanism (fig. 10)

67. The tail-plane trim mechanism is situated in the port fin head and consists essentially of an electrically-controlled two-speed actuator, a solenoid-operated cam locking lever assembly and a rocker-operated micro switch.

68. The actuator is carried within the framework of the trim unit, with its body trunnion attached to the forward end of the frame and its ram end facing aft and connecting to the upper arm of a bell-crank lever, which, under slow trim conditions pivots about its attachment to the lower aft corner of the unit; the lower arm of this lever is joined by a connecting-rod to the Mach gear change unit.

69. The solenoid is mounted on a bracket carried on the upper face of the fin main rib and is located between the trim and gear change units, while the cam locking lever pivots on the inboard fin skin below and forward of the spring-feel cam axis.

70. The microswitch and its rocker lever are mounted on the inboard fin skin, just above and forward of the cam axis, with the operating rod from the rocker lever passing aft to connect to a side web of the spring-feel bell-crank lever. With the spring feel cam in neutral the roller of this bell-crank lever rests in the dwell of the cam and the operating rod is pulled fully aft to depress the microswitch. Movement of the control column causes the roller to ride over one or other of the cam faces and release the microswitch; normally closed contacts in the switch then complete the electrical circuit to the actuator.

◄ **71. The system gives fast or slow trimming using the two-speed actuator, which is controlled by a double toggle switch on the control column handle and by a SLOW/FAST switch on panel G. For fast or slow trimming, the SLOW/FAST switch is selected to the appropriate position, and movement of the double toggle switch will operate the slow or fast trim circuit, as selected.** ►

72. With the actuator in its neutral position, the actuator ram is almost fully extended in order that a greater

range of trim 'NOSE UP' than 'NOSE DOWN' is available, and the cam locking lever is held away from the forward face of the spring-feel cam by the spring loading of the solenoid.

73. In flight, high speed trim is applied by moving the control column backward or forward from *neutral* until the desired aircraft position is obtained, then, with the AUTO STOP/ ISOLATE switch on panel H set to AUTO STOP, the pilot operates the toggle switch on the column handle in the required direction until the trimmed flight attitude is achieved.

74. By this method, the trim unit is rotated, first in one direction as dictated by the pilot's movement of the control column, and then, with the actuator circuit energized, in the opposite direction by the thrust or pull of the actuator ram end against the upper arm of the bell-crank trim lever; the lever remains stationary about its pivot point whilst the trim unit rotates under the ram thrust. During this operation, the control column and trim unit return to their normal *neutral* position, but the tail plane remains trimmed to its pre-selected angle.

75. When *neutral* is reached, the roller of the spring-feel unit will

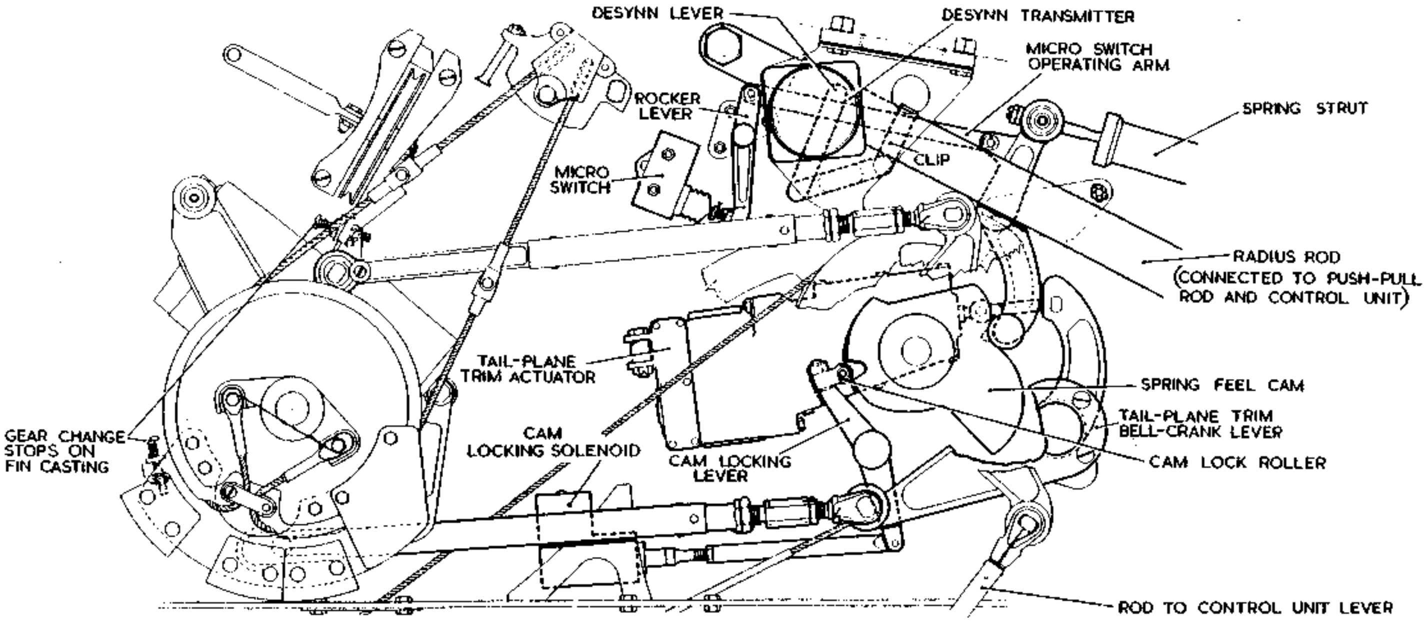

Fig. 10 Tailplane trim mechanism in port fin head

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fin head, is incorporated in the tail plane circuit in order to provide a variable ratio of tail plane to control column movement under differing air speed conditions. The essentials of the mechanism include the main casting, (comprising the cable drum, hub and arms) an electrically-controlled actuator, and a bell-crank lever.

88. Reference to fig.12 will show how two double arms, radially disposed about the inboard side of the casting, are held away from the cable drum on the outboard side by the cylindrical hub upon which the entire unit pivots. The actuator lies between the upper arms of the casting with its body trunnion attached to the extreme end, while the eye end of the actuator connects to the upper arm of the bell-crank lever. The bell-crank lever is located between the two lower arms of the casting and pivots about its single fixing bolt, the forward end being attached to a connecting-rod which passes aft and terminates at the tail plane trim unit. (It will be noted that three weights are mounted below the cable drum, their purpose is to achieve a static balance of the entire assembly prior to installation in the aircraft).

89. Operation of the mechanism is controlled from a switch on starboard panel H, which has three positions labelled AUTO, OFF and LAND, and with the system energized the following set of operations take place at each given selection.

OFF The system remains in whatever gearing was previously selected.

AUTO In this position the gearing is dependent upon the position of the alighting gear selector lever micro switch at low speeds or upon the contacting machmeter at high speed.

With the alighting gear selector lever down, the micro switch below it is depressed; and energizing of the circuit to the actuator will cause the actuator ram to take up a semi-extended position, pivot the bell-crank lever and so bring the forward end of the lever (and consequently the forward end of the connecting-rod) closer to the axis of the unit, giving a medium control column to tail-plane gearing (RESTRICTED COARSE). After take-off, the alighting gear will be raised and the movement of the selector lever will cause the micro switch contacts to be released. The actuator will again function, causing its ram end to fully retract and consequently carry the forward end of the bell-crank lever away from the axis of the unit to give a lower control column to tail-plane gearing (NORMAL). When a pre-determined air speed is reached, the machmeter causes a further set of electrical contacts to function and these cause the actuator ram to fully extend and pivot the bell-crank lever full travel towards the unit axis, thus giving a high surface to column gearing (COARSE).

LAND In the event of a failure of the AUTO electrical circuit, operation of the switch to LAND will give the medium gearing necessary for landing purposes. Failure of the entire electrical system to the actuator will result in the ram remaining at the last selected gearing. Further information regarding the actuator, contacting machmeter and their electrical circuits will be found in Sect.5, Chap.1 and 2.

Crosshead mechanism *(fig.13)*

90. This mechanism located on both port and starboard rear tail-plane attachment castings, is composed of a crosshead block, two spherical bushes and a pair of rectangular slide blocks running in flanged guide rails.

91. The crosshead block lies horizontally in the fork end of the rear attachment casting, and is held in position by a pivot bolt which passes vertically through the fork. The spherical bushes pivot on journals machined at either end of the crosshead block with the sliding blocks assembled over the spherical bushes.

92. The sliding blocks are fitted inside the parallel guide rails and movement of the tail plane through its full travel causes the rear attachment casting to describe an arc about the tail-plane pivot. As the guide rails are straight the arc described is compensated for by the pivoting of the

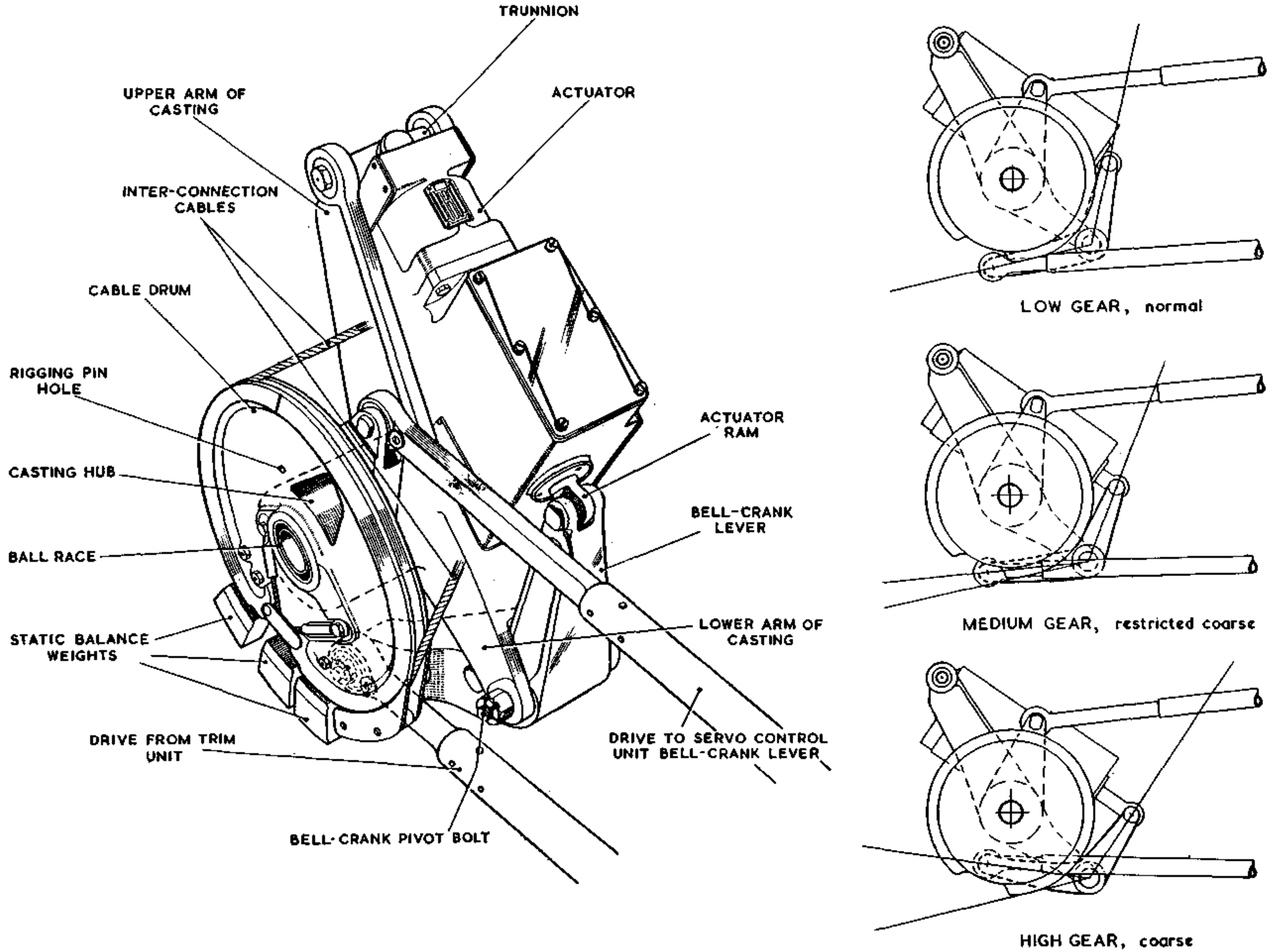

Fig.12 Mach sensitive gear change unit

fin head, is incorporated in the tail plane circuit in order to provide a variable ratio of tail plane to control column movement under differing air speed conditions. The essentials of the mechanism include the main casting, (comprising the cable drum, hub and arms) an electrically-controlled actuator, and a bell-crank lever.

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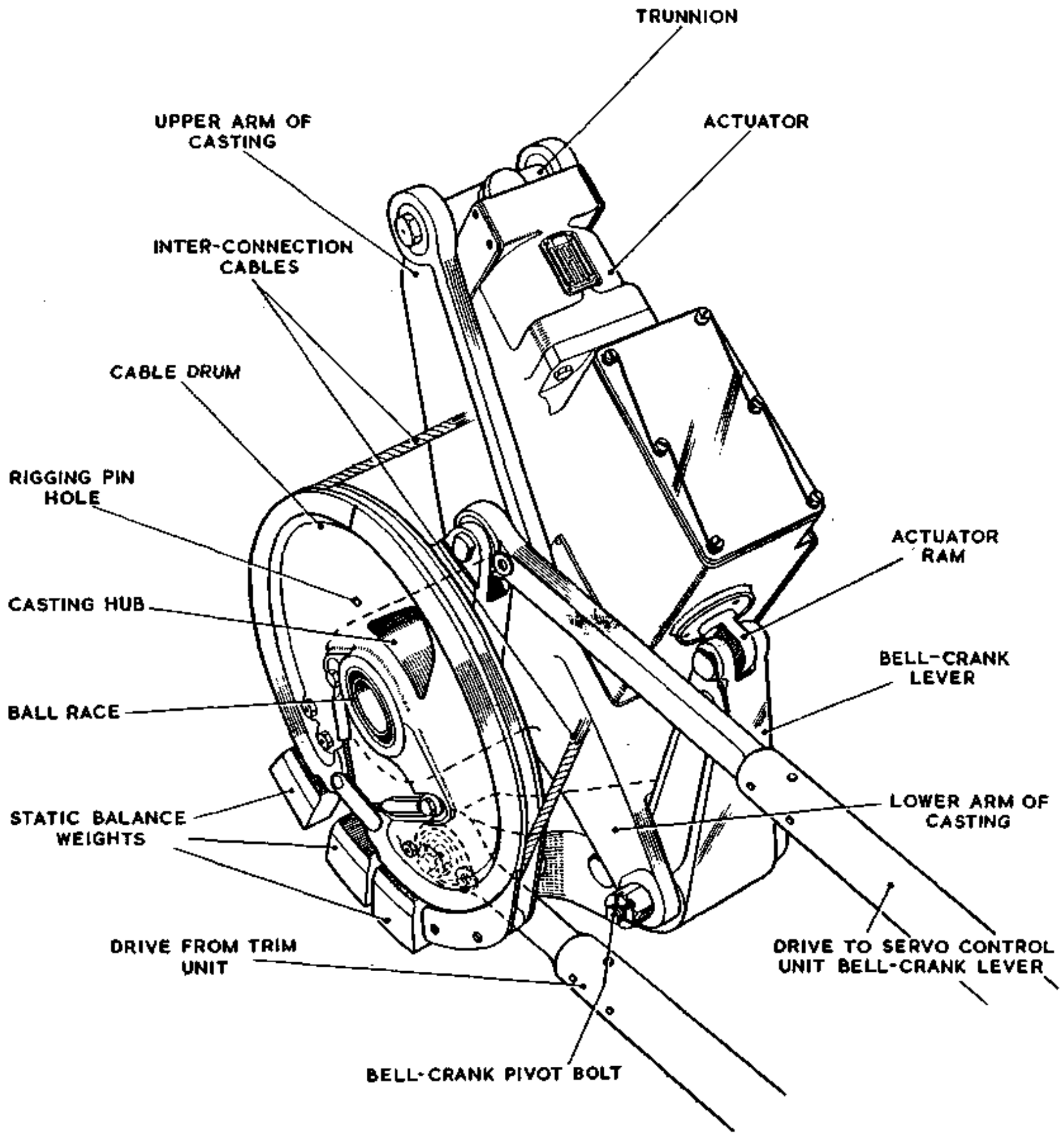


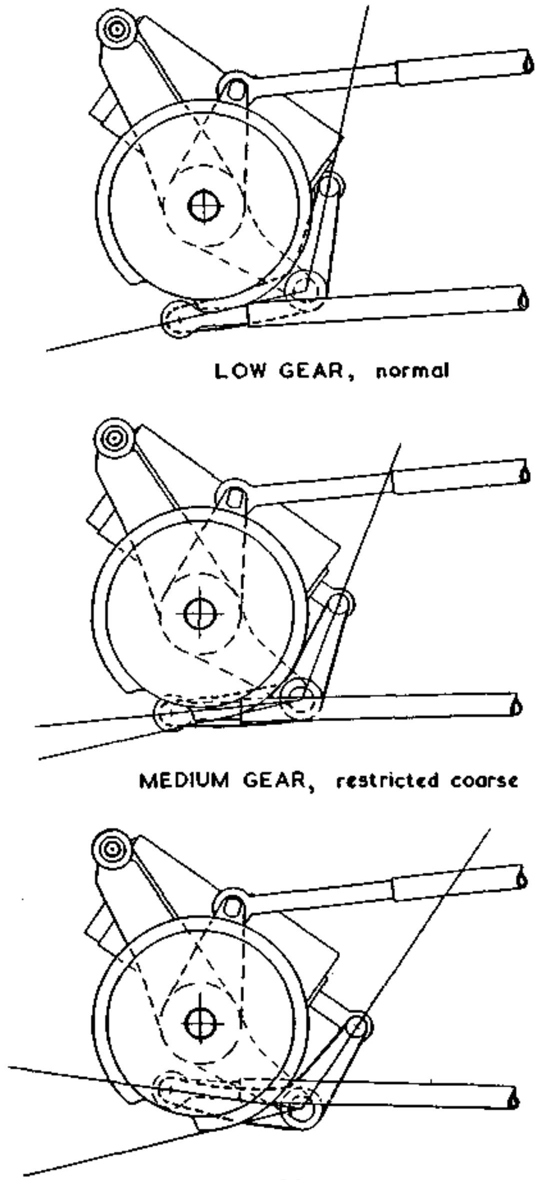


Fig.12 Mach sensitive gear change unit

bushes inside the sliding blocks and the rotation of the bushes about the journals of the crosshead block.

g **restrictor mechanism** *(fig.2)*

93. This mechanism is designed to prevent the inadvertent application of excessive g to the aircraft which would result, for example, from a too rapid recovery from a high speed dive. It also balances the stick forces during a catapult take-off.

94. The component parts of the mechanism consist of a *g* weight lever, *g* weight, connecting-rod and spring-loaded strut. The *g* weight lever is bell-cranked and pivots transversely between the sides of the pilot's seat casting; its lower arm carries the *g* weight and its upper arm is joined by the connecting-rod to an attachment lug on the lower aft face of the control column.

95. The spring strut is located vertically between the two rear legs of the seat casting, with its body end anchored to a lug on the cockpit floor and its ram end connected to the upper arm of the *g* weight lever, the ram shaft locating in a recess in the arm.

96. Under normal level flight conditions (with the control column *neutral* or nearly so), the spring strut is compressed to such an extent that the *g* weight and spring strut are in equilibrium and gentle man-

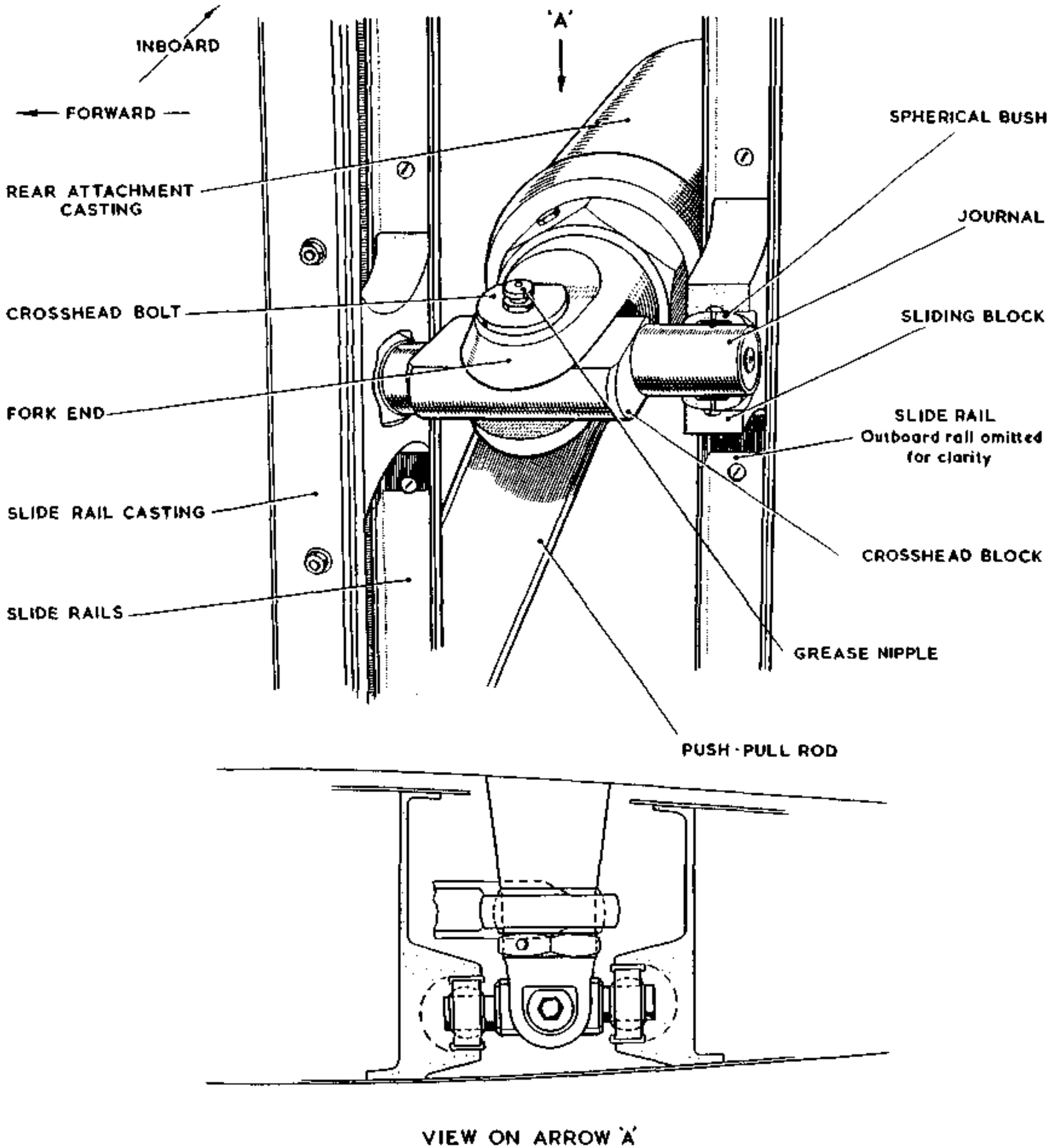
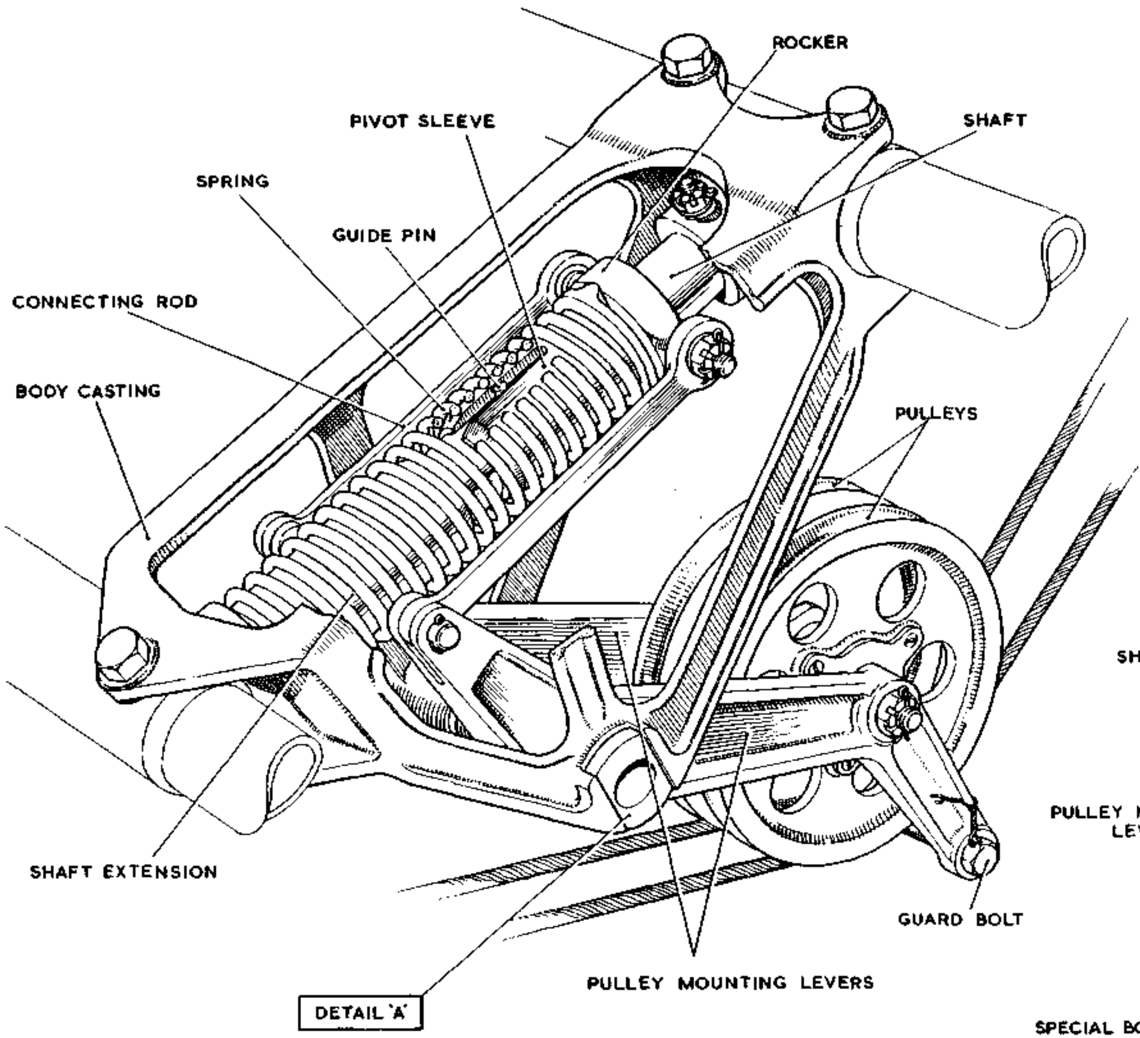
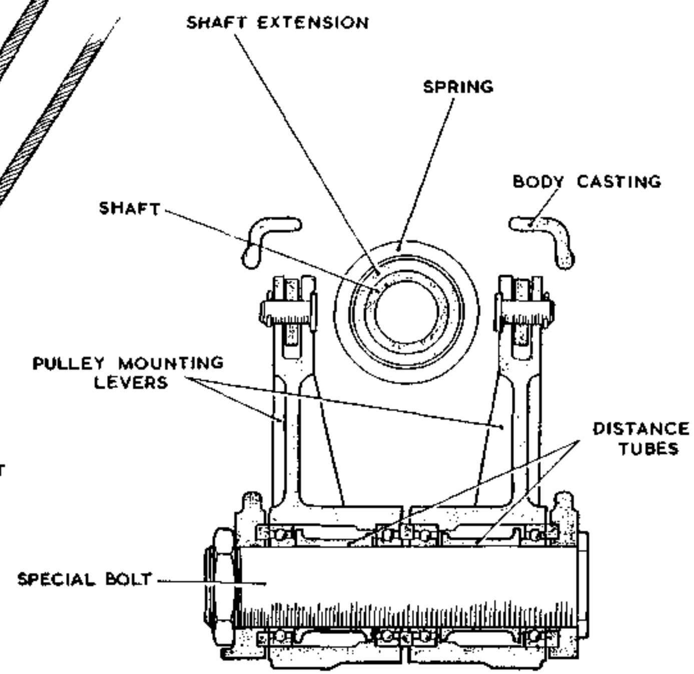


Fig.13 Crosshead mechanism





DETAIL 'A'
SECTION THROUGH PULLEY MOUNTING LEVERS

Fig. 14 Cable compensator-main cables

oeuvres cause but little restriction to control column movement. A manoeuvre, such as recovery from a high speed dive, however, will result in an increase in aircraft normal acceleration and cause the g-weight to produce a stick force in opposition to the pilot's efforts. The spring strut contribution to stick force, under these conditions, is negligible when compared with the forces produced by the g-weight.

97. During catapult take-off under the action of considerable horizontal acceleration, the g-forces acting on both the control column and the g-weight are brought into opposition and cancel each other out.

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Cable compensator mechanism - main cables (fig. 14).

◄98. This mechanism, located at frame No. 5 in the port tail boom, is incorporated in the tail plane main cable circuit to compensate for variation in cable tension due to structural flexing.

99. A triangular U-section casting carries secured within it a hollow shaft, around which is fitted a shaft extension, a coil spring, a pivot sleeve and a circular sliding rocker. The coil spring is positioned between the flanges formed on the ends of the sleeve and shaft extension. Pressure of the sleeve protrusions against indentations in the face of the rocker holds the spring compressed.

100. A pair of pulley mounting levers, mounted parallel to each other within the casting, pivot independently about a common fixing bolt passing through the sides of the casting. The lower arm of each lever carries a cable pulley, while the upper arms are linked by individual tie-rods to each side of the rocker. Equal pressure against each pulley allows the rocker to slide freely on the shaft.

101. A guide pin located in a longitudinal slot in the pivot sleeve prevents rotation of the sleeve on the shaft, and ensures the location of the protrusions in the indentations in the rocker.

102. Any change in cable tension, due to structural flexing, will in this manner be compensated for by extension or compression of the spring, but the normal increase of tension in one cable only, due to control column movement, will cause the rocker to tilt on the protrusions and lock on to the shaft. ►

Rudder control circuit (fig. 15)

103. An adjustable rudder pedal mechanism, attached to the forward cockpit bulkhead, conveys movement of the rudder operating pedals to a rudder cable drum through two vertical connecting rods and a bell-crank lever. Both the cable drum and the bell-crank lever are positioned vertically on a horizontal layshaft, which is mounted athwartship, ahead of the tail-plane variable gearing mechanism.

104. Two cables, attached to the forward side of the cable drum (9 in fig. 2), pass aft beneath the control column and variable gearing castings, to terminate at attachment points on a layshaft mounted cable drum which is part of the q-feel mechanism.

105. A further pair of cables pass aft from the layshaft cable drum, through the pressure seals in the floor beam at Stn. No. 148, under the cockpit rear floor and through the semi-bulkhead at Stn. No. 197. 45.

106. Aft of this bulkhead the cables separate, the port cable continuing aft to a pulley assembly located on the base of the main spar in the port centre section, while the starboard cable traverses the aft face of the semi-bulkhead before again turning aft to a similar pulley assembly on the base of the main spar in the starboard centre section.

107. From each of these pulley assemblies the individual cables turn outboard and pass into the port and starboard wheel wells where, after traversing the forward faces of the wells, they again change direction and travel aft, being routed by various pulleys through the stub and tail booms into the fins.

108. In each fin, the cable terminates at its attachment point to the inboard arm of a triple-armed bell-crank lever; these bell-crank levers pivot transversely on mounting beam cast-

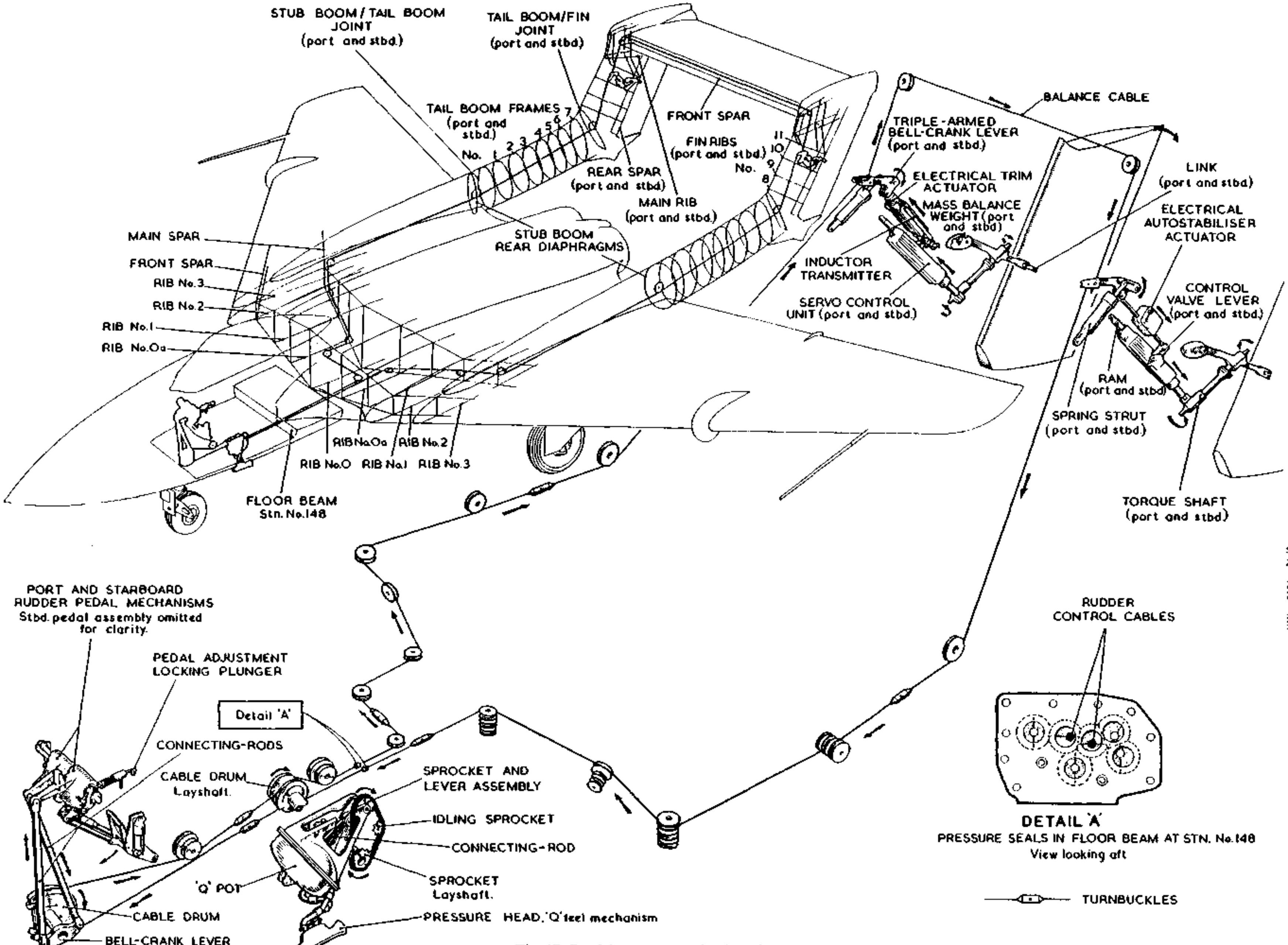

Fig.15 Rudder control circuit

◄Balance cable annotation added►

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ings which are located between fin ribs No. 10 and 11. Reference to fig. 15 indicates how the inboard arms of both bell-crank levers are interconnected by a balance cable routed upwards through the fin head and horizontally through the tail plane, the cable entering the tail plane through semi-circular slots cut in the outboard end ribs just forward of the taillplane pivot.

109. The rudder operating mechanism in each fin and rudder comprises a spring strut, the above mentioned bell-crank lever, an electric actuator, a hydraulic servo control unit, a torque shaft and mass balance weight assembly, and an operating link.

110. Located below and outboard of the bell-crank lever, the spring strut in positioned with its body end anchored to fin rib No. 10 and the eye-end of its plunger connected to the outboard arm of the bell-crank lever; the third arm of this lever is joined to the servo control valve lever by an electrical linear actuator which is in effect an extensible strut.

111. The torque shaft, located in the after part of the fin, passes diagonally through the fin spar; its lower attachment is to a bearing mounted at fin rib No. 10 and its upper attachment to a bearing located in the middle (datum) rudder hinge bracket mounted on the aft face of the fin spar.

112. The mass balance weight arm projects forward of the torque shaft, the weights operating in apertures cut in the inboard and outboard fin skins. ◀ Mod. 700 introduces stops which are bolted to the fin structure aft of each aperture to prevent damage to the skin. The rear half of the mass balance arm passes through the fin and rudder spars and is connected to the operating link fitted to diaphragms located between rudder ribs No.7 and 8. ▶

113. The final item of the mechanism, the hydraulic servo control unit, is located forward of the torque shaft and at right angles to it, the body end of the control unit being attached to an operating arm facing inboard at the bottom of the torque shaft, while the ram end is anchored to an attachment bolt held in the mounting beam.

114. Operation of the rudder pedals causes rotation of the cable drum and, through the cable circuit, operation of the servo control unit valve levers in opposite directions. Thus extension of the ram of the servo control unit in the port fin is matched by a simultaneous retraction of the ram in the starboard servo control unit. Since, however, the operating arms of both the port and starboard torque shafts face inboard, the resultant directional movement of the rudders will be the same.

115. Although the drive from the bell-crank levers to the servo control valve levers is in each instance via an electric actuator, it must be pointed out that the function carried out by each actuator is different. The starboard actuator is connected with the rudder trim, whereas the port actuator acts in the capacity of an auto-stabilizer. Further information regarding these actuators will be found under rudder trim and anti-yaw mechanisms (paras. 128 and 131).

116. Further information regarding the servo control units and their hydraulic systems will be found in Sect. 3, Chap. 6.

Rudder pedal adjustment mechanism (fig. 15, 16 and 17).

117. Two rudder pedal pivot castings, the hub of the starboard operating within the hub of the port, are co-axially mounted on a common sleeve held in the mechanism framework.

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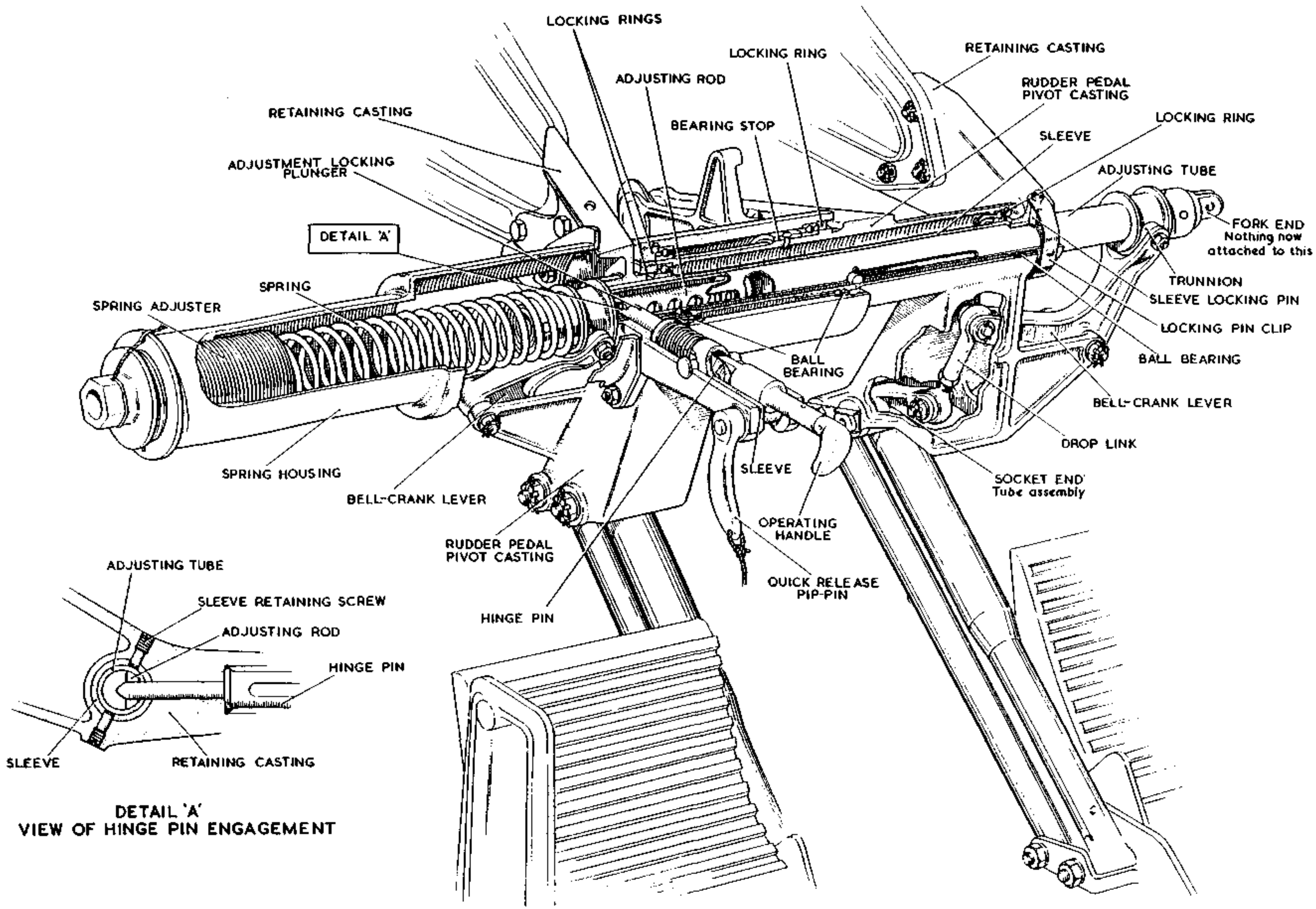

Fig.16 Rudder pedal adjustment mechanism

◄Support tubes altered►

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118. Each pivot casting has an upper lever projecting forward of the mechanism, to which is attached one of the connecting-rods operating the bell-crank lever of the rudder cable drum *(para. 99)*. The lever travel is governed by non-adjustable stops which form an integral part of each lever.

119. Attached also to each rudder pedal pivot-casting are a pair of tubular struts carrying the rudder pedals, comprising a toe-operated brake pedal, a heel support and bracket and a small hydraulic unit for the toe-operated brakes. These items are arranged with the upper ends of the struts anchored, one behind the other, to the rudder pedal pivot castings from whence they project downwards towards the cockpit floor and terminate with the heel support bracket bolted to their lower ends.

120. Integrally cast lugs, protruding outboard of each rudder pedal pivot casting, carry small centrally-pivoted bell-crank levers, each of which is connected by a drop link to further lugs formed at each upper end of the rear struts. On the starboard strut the lug formed at its upper end extends aft above the strut axis, while on the port strut the leg extends forward and below the strut axis.

121. The upper arm of each of the bell-crank levers is trunnion-attached between the flanges of individual collars which are pinned to either end of an adjusting tube; this tube is a sliding fit inside the sleeve upon which the rudder pedal pivot castings are mounted.

122. The adjusting tube is loaded to starboard by a coil spring housed in the port side of the mechanism with a spring adjuster screwed into the port end of the spring housing.

123. A guide pin, set in two diametrically opposed horizontal slots, prevents rotation of the adjusting tube, while a slot in the aft port side of the tube allows access to 6 holes in an adjusting rod insert which provides location points for a spring-loaded adjustment locking plunger. The plunger is manually operated from a handle located on the aft side of the mechanism.

124. Adjustment of the rudder pedals, to any one of six available positions, is achieved by pulling the operating handle until the adjustment locking plunger is disengaged from the locking hole in the adjusting tube. With the operating handle held aft, the pedals are pushed (by the feet) or pulled (by the spring-loading of the adjusting tube) to the desired operating position and the operating handle released allowing the adjustment locking plunger to return under its spring-loading to the hole in the adjusting tube which is closest to the preselected operating position. The operating handle is hinged to allow removal of the instrument panel. It is retained in its normal operating position by a pip-pin.

q-feel mechanism *(fig. 1, 2 and 18)*

125. The q-feel mechanism applies a centralizing effort and artificial feel from the q-pot to the rudder control system, the q-pot exerts a load proportional to the square of the air speed large enough to minimise over-control at high Mach numbers. The details comprising the mechanism include a cable drum layshaft and sprocket assembly, an adjustable idling sprocket and mounting bracket, a sprocket and lever assembly, a layshaft mounting bracket, a q-pot assembly and an endless chain.

126. With the exception of the q-pot assembly, all components of the q-feel mechanism are located on the pilot's seat mounting, the layshaft mounting bracket occupying a position on the port outboard side. The layshaft is placed athwartship in a horizontal position below the pilot's seat, its sprocket end rotating in a bearing at the bottom of the layshaft mounting bracket and its starboard end held in a bearing in a side web of the seat mounting.

127. The sprocket and lever assembly pivots between bearings located at the top of the layshaft mounting bracket and the port front leg of the seat mounting, the free end of the lever being attached to the after end of a connecting-rod which is part of the q-pot assembly. The upper arm of the idling sprocket mounting bracket pivots on a lug formed on the aft side of the layshaft mounting bracket, while the lower arm is anchored through a chain tension adjuster to a further lug formed inside the layshaft mounting bracket; the endless chain runs around the three sprockets and is maintained at correct tension by the chain adjuster.

128. The q-pot assembly consists of a large piston operating within a sealed cylindrical chamber and linked to the chain and sprocket assembly by the connecting-rod *(para.123)*. The q pot itself is secured by a lug formed on its cylinder head to a bracket on the cockpit floor and by a pair of triangular frames formed integrally with its base to the pivot bolt of the sprocket and lever assembly.

129. The q-pot piston is carried on a tubular ram which passes through the centre of the piston and is supported fore and aft by a set of three guide rollers located in the head and base of the q-pot. A flexible rubber seal, attached to the outer rim of the piston and sandwiched between the flanges of the q-pot head and base, isolates the chambers formed above and below the piston.

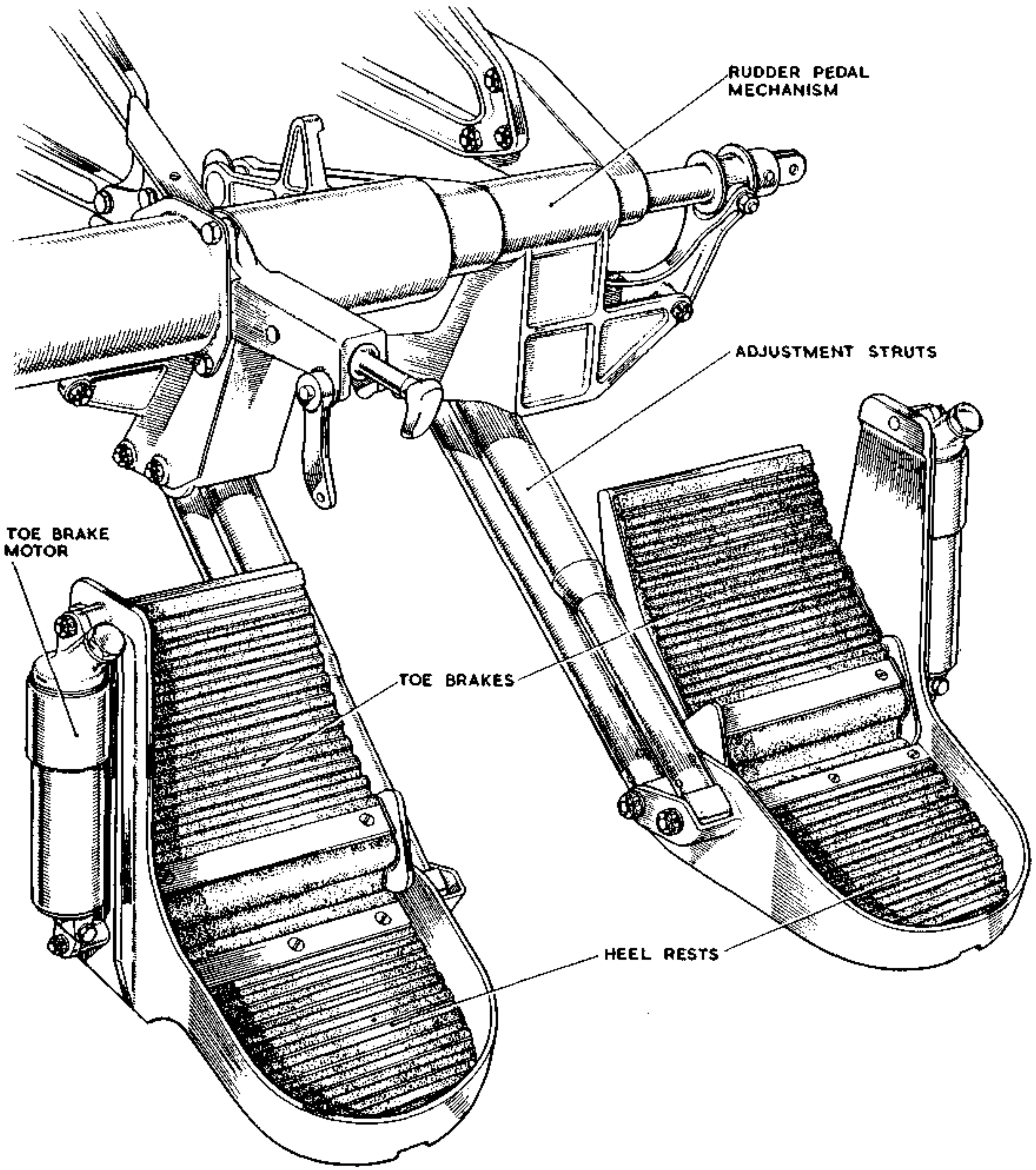

Fig.17 Rudder pedals

130. The mechanism is controlled by a pressure head fitted to the underside of the fuselage on the port side; it is constructed of two curved pipes, enclosed in a common fairing, which point directly into and out of the airstream and are connected one to each half of the q pot; the pressure pipe is connected to the rear half of the q pot. The pressure head is electrically heated to prevent icing.

131. With the rudder control system in *neutral*, the piston is positioned fully forward by the connecting-rod (T.D.C.); subsequent movement of the rudder pedals causes a rotation of the layshaft and sprocket assembly and a consequent movement of the piston away from T.D.C. When the aircraft is stationary, the physical effort required to operate the pedals is governed only by the friction and spring strut loading of the rudder circuit; in flight, however, air pressure built up in the after part of the q pot assisted by suction created forward of the piston by the venturi effect of the airstream on the pressure head, tends to keep the piston pushed fully forward and, through the q feel mechanism, the rudders *neutral*.

Rudder trim mechanism *(fig.19)*

132. This mechanism, which is provided for the correction of directional trim under level flight conditions, consists of an electrically-operated actuator built into the rudder mechanism in the starboard fin and energized by movement of an instinctive multi-way switch located on the port console panel.

133. Appropriate movement of the switch causes the actuator ram to extend or retract and operate the servo control unit valve lever independently of the remainder of the system, thus moving the starboard rudder to port or starboard.

134. An inductor type transmitter, connected between the ram and body of the actuator, passes the degree and direction of the trim applied to an indicator mounted near the control switch on the port console. Further information regarding the actuator, the transmitter and their electrical circuits will be found in Book 2, Sect. 5, Chap.1 and 2.

Anti-yaw mechanism

135. This mechanism, incorporated in the port fin rudder mechanism, consists solely of an electric auto-stabilizer actuator controlled from a rate gyro embodied in the autopilot gyro unit. The autopilot gyro unit is positioned on the radome hinge bracket, and is operated from a three-way switch which is part of the cockpit autopilot switching unit on panel C. With the auto-stabilizer switched ON, any yaw on the part of the aircraft is corrected automatically.

136. Further information regarding rate gyro, autopilot, auto-stabilizer actuator and their electrical circuits will be found in Book 2, Sect.5, Chap. 2, Group D.

Flap control circuit *(fig.20 and 21)*

137. A selector lever, operating within a gate marked, UP - 20^{0} - DOWN, protrudes from the rear face of the throttle box and provides control of the flaps position; the forward end of the lever is joined by a connecting-rod to a cable drum located within the throttle box, and movement of the lever to either of the three positions in the gate causes a rotation of the drum.

138. From the cable drum, the drive is transmitted by a pair of cables *(No.19 and 20)* down through the interior of the throttle box and aft along the port side of the cockpit to a pulley assembly located at the rear pressure bulkhead. Passing around the pulleys the cables change their direction and traverse the forward face of the bulkhead to a further pulley assembly located on the starboard side of the cockpit, here they again change direction around the pulleys and travel aft through a pressure seal and fairlead assembly in the bulkhead to terminate at a terminal pulley situated on the upper part of rib No.0 in the port engine bay.

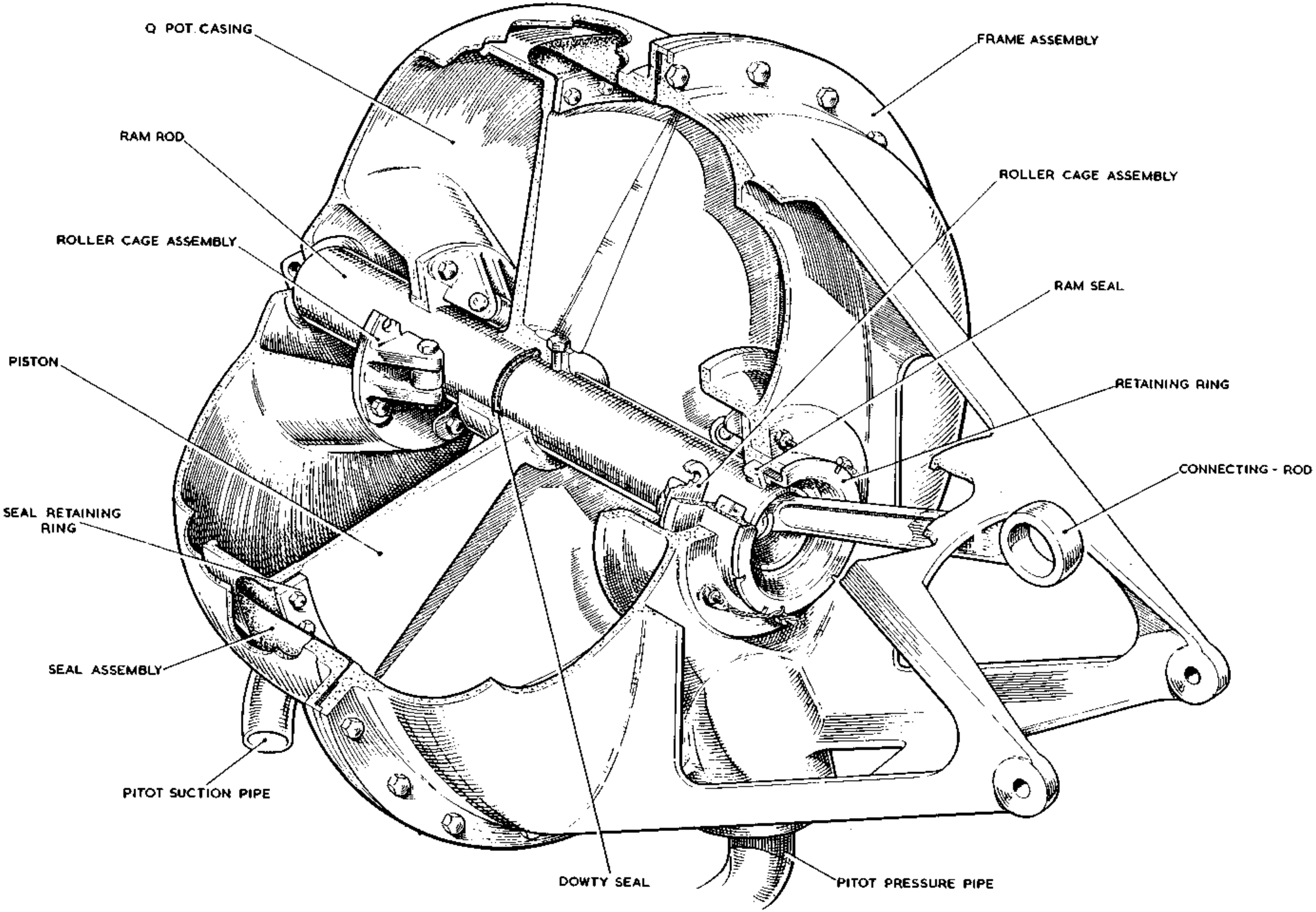

Fig. 18 Rudder q pot mechanism

139. Movement set up in the terminal pulley is next conveyed aft by a spring strut; this strut has its forward end attached to a lug offset from the pulley axis and its after end attached to a short lever positioned at the port end of a drive shaft. The drive shaft is carried between a bearing at the top of rib No.0 and another bearing carried on a false web built outboard of the aft starboard end of rib No.0.

140. A further lever, attached to the drive shaft on the starboard side of rib No.0, projects downwards inside the rectangular cavity formed by rib No.0 and the false web *(fig.21)*, and connects at its free end to an adjustable link joining it to the control valve of a hydraulic servo control unit.

141. The servo control unit occupies a diagonal position immediately below the drive shaft, with its ram end anchored to a bracket at the aft end of rib No.0 and its body end held by a common bolt passing through the fork end of the body, the lower end of a radius rod and the aft end of a spring-loaded connecting-rod. The upper end of the radius rod is anchored by a pivot bolt passing through a bearing in rib No.0, located just below the spring strut, and another bearing attached to the inboard face of the false web.

142. Similarly mounted, between rib No.0 and the false web, a torque shaft carries a large double grooved cable drum and a splined crank; the drum is bolted to the port end of the torque shaft and rotates on the port side of rib No.0, while the crank is spline-attached to the torque shaft on the starboard side of rib No.0 with the forward end of the spring-loaded connecting-rod attached between the jaws of the crank.

143. With the necessary hydraulic systems in operation, movement of the cockpit flap selector lever results in a rotation of the terminal pulley and a movement, fore or aft, of the spring strut, coupled with an extension or compression of the strut. The spring strut is incorporated in the circuit to enable the pilot to make a direct instead of a progressive flap selection; this direct movement of the selector lever is faster than the follow on of the servo control unit and, although the control valve is operated immediately the selector lever is moved, part of the linkage movement is temporarily absorbed by the spring strut. Hydraulic pressure is applied and relieved on the appropriate sides of the servo piston causing the servo control unit to extend or retract as required; meanwhile the spring strut completes the movement of the linkage and eventually returns to its neutral length.

144. Extension or retraction of the servo control unit transmits movement via the connecting-rod and crank, to the double grooved cable drum, while the radius rod governs the path of travel of the connecting-rod and servo control unit.

145. From a common attachment lug on the rim of the double grooved cable drum, two 45 cwt. and two 25 cwt. cables pass around the upper and lower cable grooves, respectively, to a group of pulleys mounted on the forward face of the spectacle beam. From the pulleys the cables are diverted outboard, one dissimilar pair to port and the other pair to starboard.

146. Each pair of cables is routed, by pulleys located below the port and starboard jet pipe apertures in the spectacle beam, to rib No.1 and forward along the rib, through individual guard tubes which pass through the rib, to attach to the ends of a length of chain disposed around the inboard sprocket of a gearbox No.1 which is bracketed to the outboard side of rib No.1 and to the forward face of the rear spar. In this way, the drive from the power-operated double grooved cable drum is transmitted to identical flap operating mechanisms in the port and starboard wings.

147. From No.1 gearbox the drive is taken outboard by a single torque shaft to No.2 gearbox which is bracketed to the inboard side of rib No.3

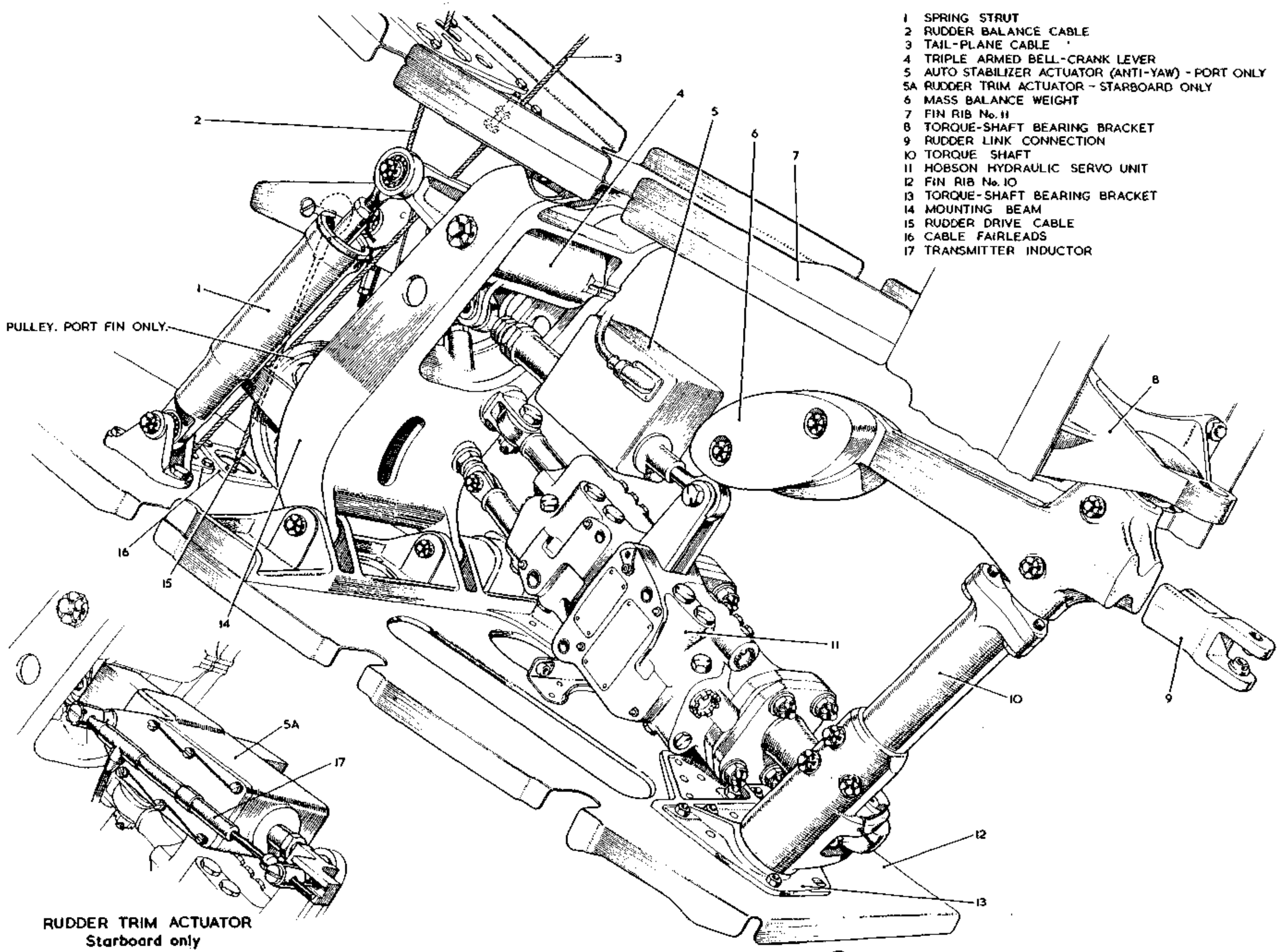

Fig. 19 Rudder mechanism in fins

and the forward face of the rear spar, and then from No.2 gearbox by two torque shafts, positioned one above the other, which extend outboard to rib No.4. The lower of these two torque shafts is supported at its centre by a bracket located on the forward face of the rear spar, and at its outboard end by a bearing casting secured to the inboard side of rib No.4; the upper torque shaft is supported at its outboard end only by an adjustable mounting which is pivoted on the support bearing for the lower shaft.

148. Endless chains, operating around sprockets fitted to the outboard ends of the torque shafts, convey the drive aft to sprockets on two shorter torque shafts positioned one above the other inboard of rib No.4; the upper chain run is direct, whereas the lower chain passes around one jockey sprocket and one adjustable sprocket in its upper length before reaching the after sprocket.

149. The upper of the two short torque shafts is known as the high speed shaft and the lower, the low speed shaft. The upper shaft passes through rib No.4 and imparts the drive by a female dog mechanism, located at its outboard end, through a male dog mechanism, inboard of rib No.4A, to gearbox No.3 which is located outboard of rib No.4A; the dog mechanism is incorporated in the circuit to allow a break in the drive mechanism when the wings are folded. The lower shaft conveys the drive, by a sprocket at its outboard end, to a chain assembly at flap track No.3A.

WARNING *The override plunger must never be used when spreading the wings without first ensuring that all flaps* (inner, centre and outer) *are mechanically locked in the* up *position and that the locking slider* (fig.29, Sect.3, Chap.2) *on rib No.4A has sprung fully out. Failure to observe this precaution when using the override plunger may result in structural damage to the flap high speed shaft assembly.*

150. A further torque shaft connected to the outboard side of gearbox No.3 transmits the drive outboard to gearbox No.4 which is positioned inboard of rib No.7 in the outer wing.

151. Three interconnected Fowler type flaps, located at the centre and outer wing trailing edges, extend from rib No.1 to the inboard side of the stub boom (inner), from the outboard side of the stub boom to rib No.4 (centre), and from rib No.4A to rib No.7 (outer), respectively. The inner and centre flaps are joined by a panel shaped to fit below the stub boom when the flaps are in the *up* position, while the centre and outer flaps are connected, when the wings are spread, by interlocking corner fittings embodied in the adjacent ends of their trailing edges.

152. The flaps are carried on bogies which are ball-jointed to individual arms located on either side of their leading edges, the bogies running in tracks built into the shroud structure. The tracks are numbered 1, 2, 3, 3A, 4A and 4. No.1 and 2 are positioned on either side of the inner flap, No.3 and 3A on either side of the centre flap and No.4A and 4 on either side of the outer flap.

153. A sprocket on each of the four gearboxes and on the upper shaft of each pair of torque shafts imparts the drive by chains to the bogies. The chains are attached to each end of the bogies and pass fore and aft along the bogie tracks; the aft part of each chain passes around an idling sprocket mounted in the structure at the rear of each track before completing its circuit back to the gearbox sprocket.

154. Two additional tracks are fitted in order that the correct downward movement of the trailing edge of the flaps be achieved when DOWN or 20° is selected; one track is fitted to the shroud structure immediately below track No.2 while the other occupies a similar position below track No.3. Each of these tracks carries a free-running bogie which is held by a ball-jointed arm to the same flap arm casting as that which carries the chain-driven bogie above it.

155. Operation of the mechanism described causes a retraction or extension

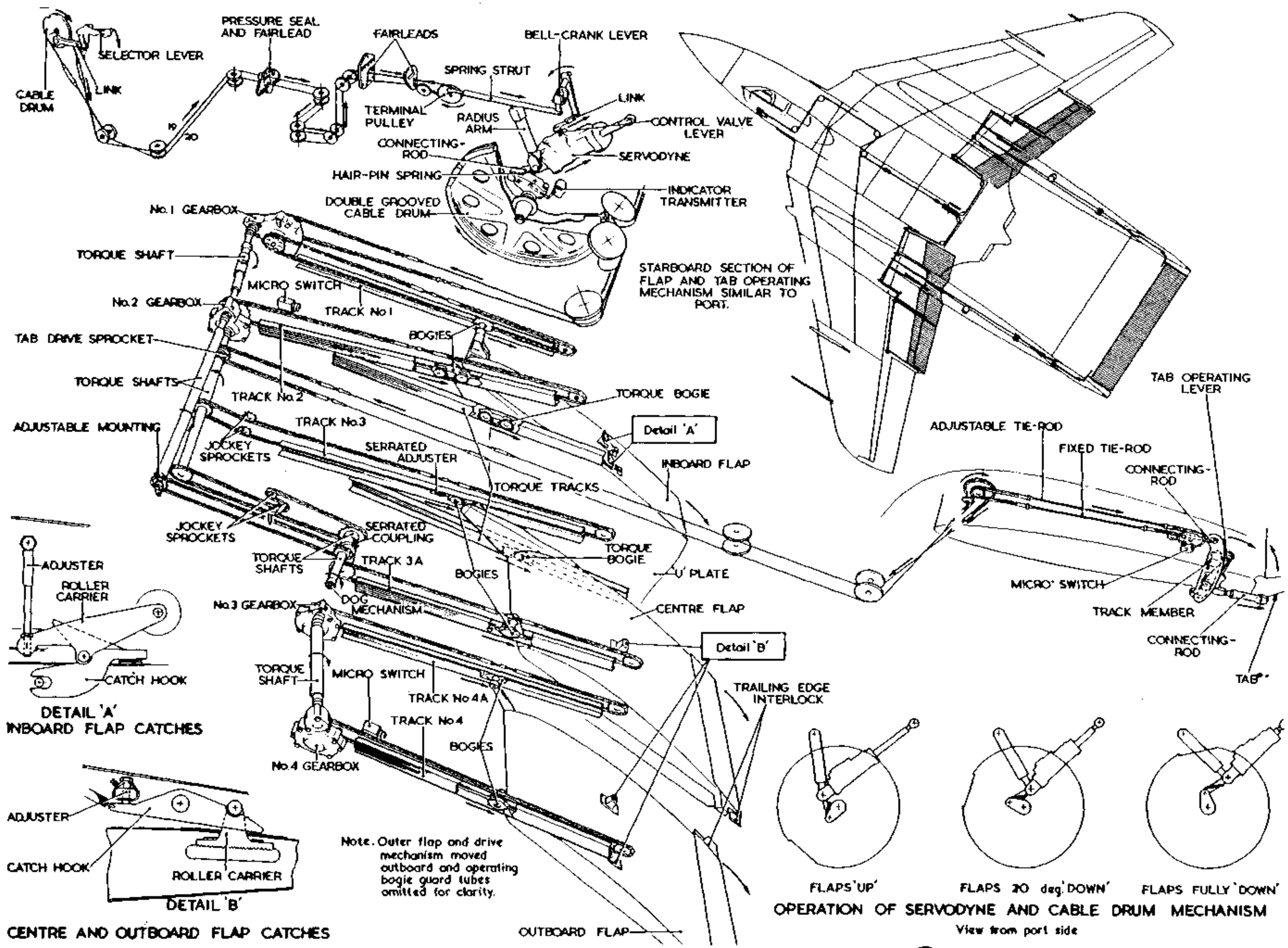

Fig.20 Flap control circuit

Flaps shown 20 deg. down with tail plane neutral and the forward face of the rear spar, and then from No.2 gearbox by two torque shafts, positioned one above the other, which extend outboard to rib No.4. The lower of these two torque shafts is supported at its centre by a bracket located on the forward face of the rear spar, and at its outboard end by a bearing casting secured to the inboard side of rib No.4; the upper torque shaft is supported at its outboard end only by an adjustable mounting which is pivoted on the support bearing for the lower shaft.

148. Endless chains, operating around sprockets fitted to the outboard ends of the torque shafts, convey the drive aft to sprockets on two shorter torque shafts positioned one above the other inboard of rib No.4; the upper chain run is direct, whereas the lower chain passes around one jockey sprocket and one adjustable sprocket in its upper length before reaching the after sprocket.

149. The upper of the two short torque shafts is known as the high speed shaft and the lower, the low speed shaft. The upper shaft passes through rib No.4 and imparts the drive by a female dog mechanism, located at its outboard end, through a male dog mechanism, inboard of rib No.4A, to gearbox No.3 which is located outboard of rib No.4A; the dog mechanism is incorporated in the circuit to allow a break in the drive mechanism when the wings are folded. The lower shaft conveys the drive, by a sprocket at its outboard end, to a chain assembly at flap track No.3A.

WARNING *The override plunger must never be used when spreading the wings without first ensuring that all flaps* (inner, centre and outer) *are mechanically locked in the* up *position and that the locking slider* (fig.29, Sect.3, Chap.2) *on rib No.4A has sprung fully out. Failure to observe this precaution when using the override plunger may result in structural damage to the flap high speed shaft assembly.*

150. A further torque shaft connected to the outboard side of gearbox No.3 transmits the drive outboard to gearbox No.4 which is positioned inboard of rib No.7 in the outer wing.

151. Three interconnected Fowler type flaps, located at the centre and outer wing trailing edges, extend from rib No.1 to the inboard side of the stub boom (inner), from the outboard side of the stub boom to rib No.4 (centre), and from rib No.4A to rib No.7 (outer), respectively. The inner and centre flaps are joined by a panel shaped to fit below the stub boom when the flaps are in the *up* position, while the centre and outer flaps are connected, when the wings are spread, by interlocking corner fittings embodied in the adjacent ends of their trailing edges.

152. The flaps are carried on bogies which are ball-jointed to individual arms located on either side of their leading edges, the bogies running in tracks built into the shroud structure. The tracks are numbered 1, 2, 3, 3A, 4A and 4. No.1 and 2 are positioned on either side of the inner flap, No.3 and 3A on either side of the centre flap and No.4A and 4 on either side of the outer flap.

153. A sprocket on each of the four gearboxes and on the upper shaft of each pair of torque shafts imparts the drive by chains to the bogies. The chains are attached to each end of the bogies and pass fore and aft along the bogie tracks; the aft part of each chain passes around an idling sprocket mounted in the structure at the rear of each track before completing its circuit back to the gearbox sprocket.

154. Two additional tracks are fitted in order that the correct downward movement of the trailing edge of the flaps be achieved when DOWN or 20° is selected; one track is fitted to the shroud structure immediately below track No.2 while the other occupies a similar position below track No.3. Each of these tracks carries a free-running bogie which is held by a ball-jointed arm to the same flap arm casting as that which carries the chain-driven bogie above it.

155. Operation of the mechanism described causes a retraction or extension

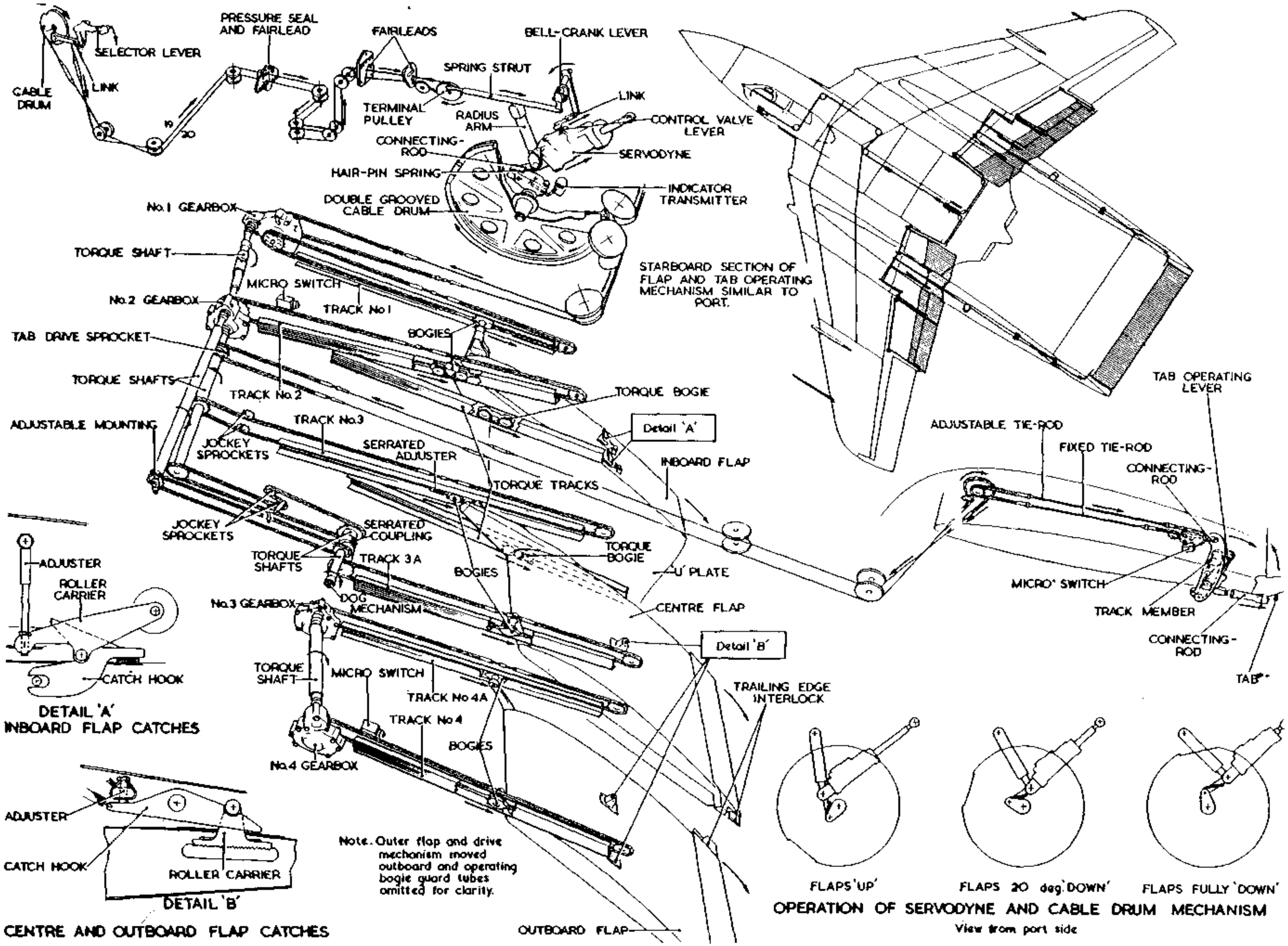

Fig.20 Flap control circuit

Flaps shown 20 deg. down with tail plane neutral of the servo control unit and a fore or aft movement of the flaps; also since the centre and inner flaps are controlled in their travel by the driving and torque bogies operating in divergent tracks, an upward or downward movement of their trailing edges results.

156. Two rollers on the outer and one roller on the centre flaps engage on catch-hooks built into the flap shrouds, while two catch-hooks on the inner flap engage with roller carriers attached to the trailing edge wing structure, to secure the flaps in the UP position. A two-way micro switch, located in the outer flap shroud, shows by illuminating the port undercarriage warning lamp, when the flaps are not fully closed, and, in conjunction with a further micro switch located on the inner flap shroud, prevents operation of the wing-fold selector lever. (Four micro switches in all, two in the port wing and two in the starboard wing).

157. The position of the flaps is indicated to the pilot by a graduated instrument fitted to the main instrument panel; operation of this indicator is by a Desynn transmitter mounted in the inside of the false web on the starboard side of rib No.0. The spindle of the transmitter is link connected to an arm fitted to the starboard end of the torque shaft which rotates the double grooved cable drum.

158. Detailed illustrations of the flaps, flap tracks and flap removal and replacement will be found in Sect. 3, Chap.2. Information regarding the flap hydraulic systems will be found in Sect.3, Chap.6, and information regarding the flap electrical systems will be found in Vol.1, Book 2, Sect. 5, Chap.1.

Tail-plane tab (elevator) control circuit *(fig.20 and 22)*

159. Operation of the tail-plane tab is effected by a chain and cable run which is an off-shoot of the flap control circuit. In some volumes, the tail-plane tab is referred to as an elevator.

160. A chain passes around a sprocket which is mounted on the lower of the torque shafts positioned outboard of gearbox No.2 *(para.148)*, and travels aft through the rear spar into the stub boom where the upper and lower ends of the chain are joined to a pair of 20 cwt. cables. The cables continue aft through the booms until, upon reaching a pulley assembly at the foot of the fin, they are diverted upwards through the leading edge of the fin. Just prior to reaching the fin head upper rib, the cables again join to the ends of a secondary chain which passes around a layshaft double sprocket assembly located in the forward fin head.

161. A smaller sprocket, formed integrally with the secondary chain sprocket, operates the forward end of a chain and tie-rod drive assembly, which passes aft through the fin-head to a crank sprocket assembly mounted on the aft fin head rib.

162. Rotation of the crank sprocket conveys movement aft by a connecting-rod, the forward end of which is offset to the sprocket axis, to the top of a vertical track member. The top end of the track member operates in a longitudinal slot in the upper fin head rib, from whence it passes down inside the fin, and pivots about a fixing bolt held in a bracket secured to the aft face of the fin head rear diaphragm.

163. The inboard side of the track member is provided with a kidney-shaped slot in which operates a spherical bronze roller; the roller is attached to a journal on the outboard end of a tail-plane tab operating lever, the inboard end of which pivots in a bearing housing in the tail plane. A short lever, an integral part of the tail-plane operating lever, projects aft and connects to the fork end of a track member connecting-rod and upwards to a bracketed bearing on the outboard side of the tail-plane tab hinge casting; the aft end of the track member connecting-rod attaches to the outboard tab hinge.

164. With the flaps in the locked *up* position, the crank sprocket is pos-

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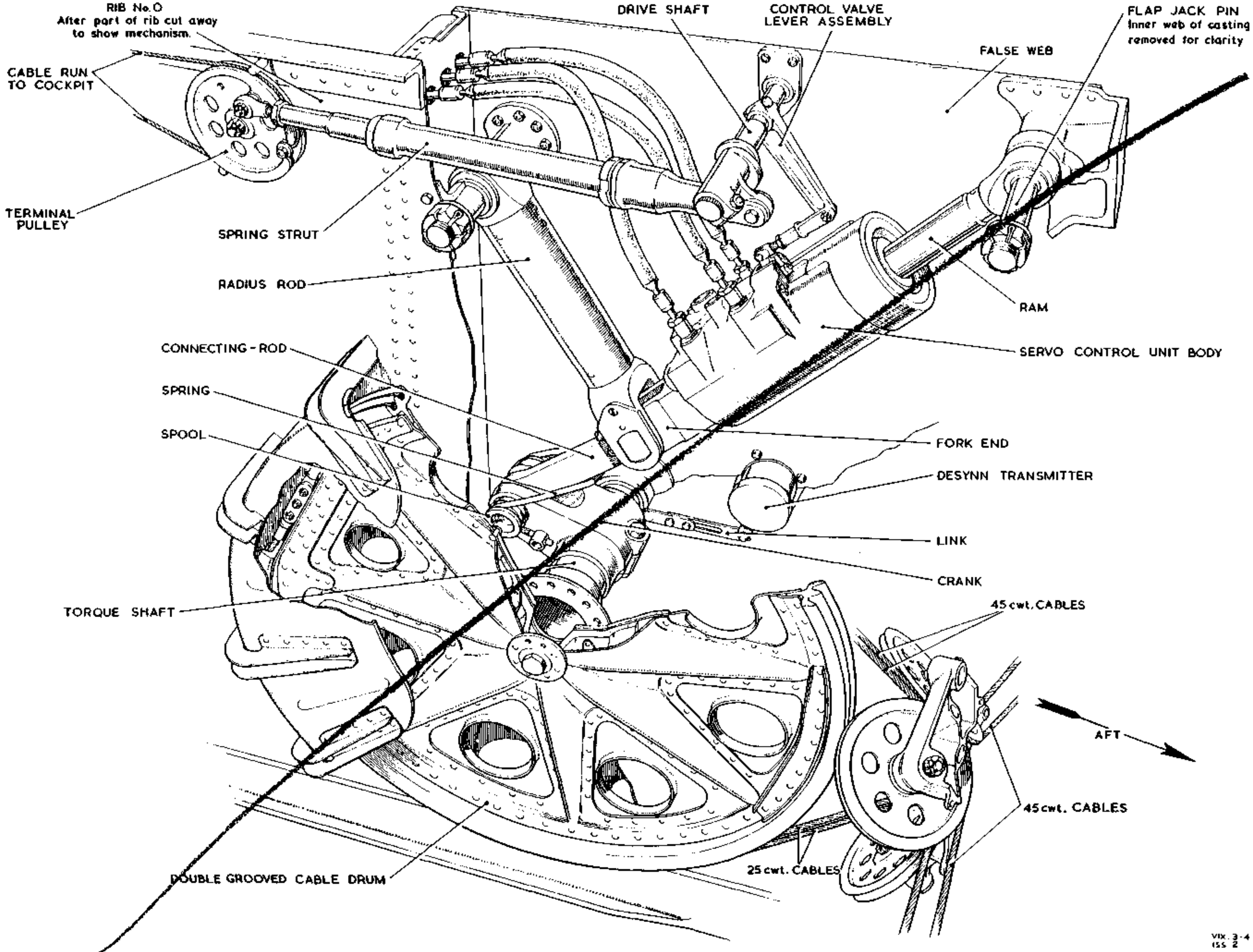

Fig.21 Flap operating mechanism at rib No.O

◀ Hose connections corrected ▶

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◀ of the Servodyne and a fore or aft ▶ movement of the flaps; also since the centre and inner flaps are controlled in their travel by the driving and torque bogies operating in divergent tracks, an upward or downward movement of their trailing edges results.

156. Two rollers on the outer and one roller on the centre flaps engage on catch-hooks built into the flap shrouds, while two catch-hooks on the inner flap engage with roller carriers attached to the trailing edge wing structure, to secure the flaps in the UP position. A two-way microswitch, located in the outer flap shroud, shows by illuminating the port undercarriage warning lamp when the flaps are not fully closed and, in conjunction with a further microswitch located on the inner flap shroud, prevents operation of the wing-fold selector lever. (Four microswitches in all, two in the port wing and two in the starboard wing).

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157. The position of the flaps is indicated to the pilot by a graduated instrument fitted to the main instrument panel; operation of this indicator is by a Desynn transmitter mounted in the inside of the false web on the starboard side of rib No. 0. The spindle of the transmitter is link connected to an arm fitted to the starboard end of the torque shaft which rotates the double grooved cable drum.

158. Detailed illustrations of the flaps, flap tracks and flap removal ◀ and installation will be found in Sect. ▶ 3, Chap. 2. Information regarding the flap hydraulic systems will be found in Sect. 3, Chap. 6, and information regarding the flap electrical systems will be found in Vol. 1, Book 2, Cover 1, Sect. 5, Chap. 1.

Tail-plane tab (elevator) control circuit (fig. 20 and 22).

159. Operation of the tail-plane tab is effected by a chain and cable run which is an off-shoot of the flap ◀ control circuit. The tail-plane tab is sometimes referred to as an elevator. ▶

160. A chain passes around a sprocket which is mounted on the lower of the torque shafts positioned outboard of gearbox No. 2 (para. 148), and travels aft through the rear spar into the stub boom where the upper and lower ends of the chain are joined to a pair of 20 cwt. cables. The cables continue aft through the booms until, upon reaching a pulley assembly at the foot of the fin, they are diverted upward through the leading edge of the fin. Just prior to reaching the fin head upper rib, the cables again join to the ends of a secondary chain which passes around a layshaft double sprocket assembly located in the forward fin head.

161. A smaller sprocket, formed integrally with the secondary chain sprocket, operates the forward end of a chain and tie-rod drive assembly, which passes aft through the finhead to a crank sprocket assembly mounted on the aft fin head rib.

162. Rotation of the crank sprocket conveys movement aft by a connecting-rod, the forward end of which is offset to the sprocket axis, to the top of a vertical track member. The top end of the track member operates in a longitudinal slot in the upper fin head rib, from whence it passes down inside the fin, and pivots about a fixing bolt held in a bracket secured to the aft face of the fin head rear diaphragm.

163. The inboard side of the track member is provided with a kidney-shaped slot in which operates a spherical bronze roller; the roller is attached to a journal on the outboard end of a tail-plane tab operating lever, the inboard end of which pivots in a bearing housing in the tail plane. A short lever, an integral part of the tail-plane operating lever, projects aft and connects to the fork-end of a track member connecting-rod and upward to a bracketed bearing on the outboard side of the tail-plane tab hinge casting; the aft end of the track member connecting-rod attaches to the outboard tab hinge.

164. With the flaps in the locked up position, the crank sprocket is pos-

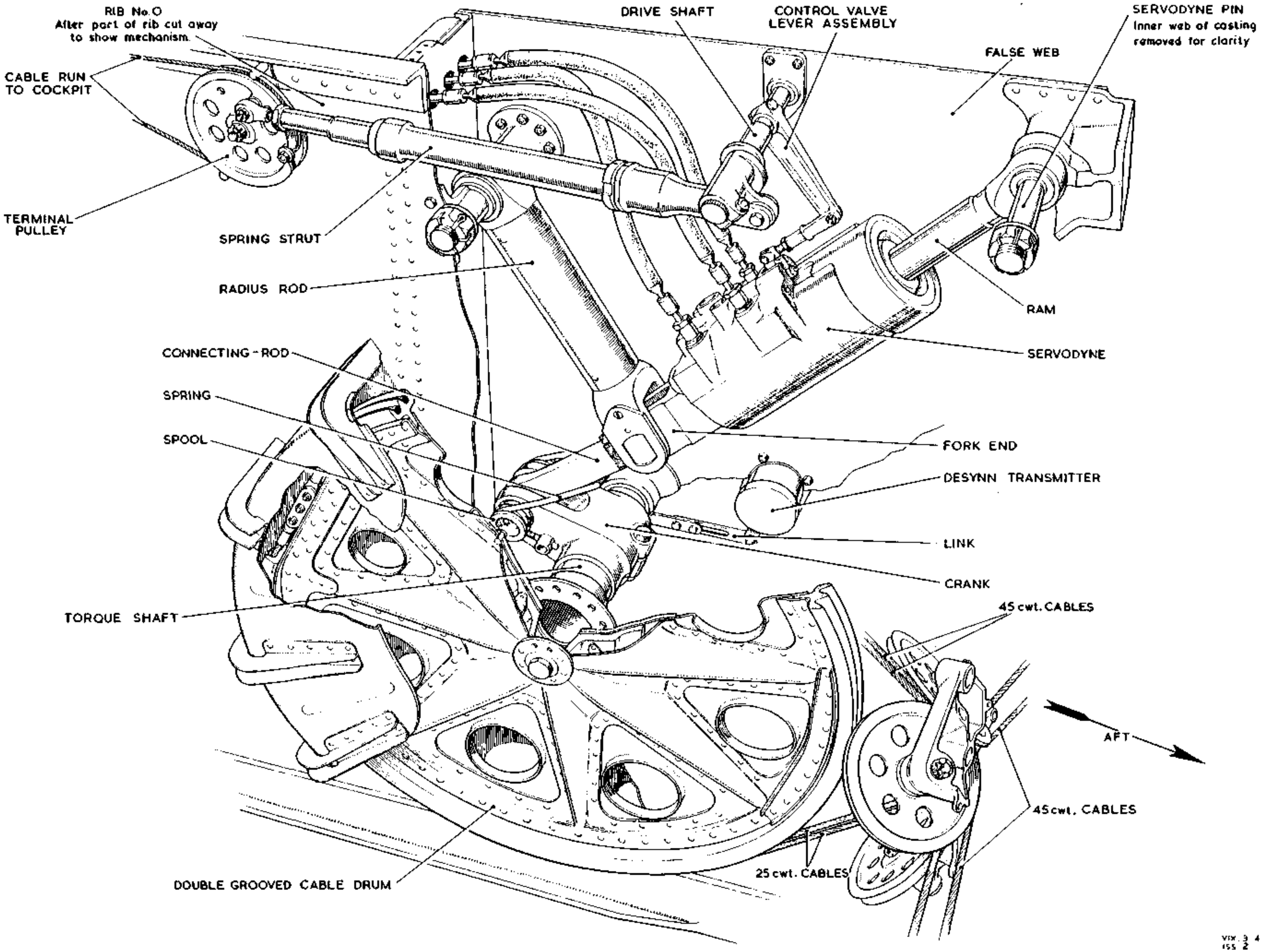

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Fig.21 Flap operating mechanism at rib No.O

◄ Hose connections corrected ►

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◀ of the Servodyne and a fore or aft ▶ movement of the flaps; also since the centre and inner flaps are controlled in their travel by the driving and torque bogies operating in divergent tracks, an upward or downward movement of their trailing edges results.

156. Two rollers on the outer and one roller on the centre flaps engage on catch-hooks built into the flap shrouds, while two catch-hooks on the inner flap engage with roller carriers attached to the trailing edge wing structure, to secure the flaps in the UP position. A two-way microswitch, located in the outer flap shroud, shows by illuminating the port undercarriage warning lamp when the flaps are not fully closed and, in conjunction with a further microswitch located on the inner flap shroud, prevents operation of the wing-fold selector lever. (Four microswitches in all, two in the port wing and two in the starboard wing).

157. The position of the flaps is indicated to the pilot by a graduated instrument fitted to the main instrument panel; operation of this indicator is by a Desynn transmitter mounted in the inside of the false web on the starboard side of rib No. 0. The spindle of the transmitter is link connected to an arm fitted to the starboard end of the torque shaft which rotates the double grooved cable drum.

158. Detailed illustrations of the flaps, flap tracks and flap removal ◀ and installation will be found in Sect. ▶ 3, Chap.2. Information regarding the flap hydraulic systems will be found in Sect.3, Chap.6, and information regarding the flap electrical systems will be found in Vol.1, Book 2, Cover 1, Sect.5, Chap. 1.

Tail-plane tab (elevator) control circuit (fig.20 and 22).

159. Operation of the tail-plane tab is effected by a chain and cable run which is an off-shoot of the flap ◀ control circuit. The tail-plane tab is sometimes referred to as an elevator. ▶

160. A chain passes around a sprocket which is mounted on the lower of the torque shafts positioned outboard of gearbox No.2 (para.148), and travels aft through the rear spar into the stub boom where the upper and lower ends of the chain are joined to a pair of 20 cwt. cables. The cables continue aft through the booms until, upon reaching a pulley assembly at the foot of the fin, they are diverted upward through the leading edge of the fin. Just prior to reaching the fin head upper rib, the cables again join to the ends of a secondary chain which passes around a layshaft double sprocket assembly located in the forward fin head.

161. A smaller sprocket, formed integrally with the secondary chain sprocket, operates the forward end of a chain and tie-rod drive assembly, which passes aft through the finhead to a crank sprocket assembly mounted on the aft fin head rib.

162. Rotation of the crank sprocket conveys movement aft by a connecting-rod, the forward end of which is offset to the sprocket axis, to the top of a vertical track member. The top end of the track member operates in a longitudinal slot in the upper fin head rib, from whence it passes down inside the fin, and pivots about a fixing bolt held in a bracket secured to the aft face of the fin head rear diaphragm.

163. The inboard side of the track member is provided with a kidney-shaped slot in which operates a spherical bronze roller; the roller is attached to a journal on the outboard end of a tail-plane tab operating lever, the inboard end of which pivots in a bearing housing in the tail plane. A short lever, an integral part of the tail-plane operating lever, projects aft and connects to the fork-end of a track member connecting-rod and upward to a bracketed bearing on the outboard side of the tail-plane tab hinge casting; the aft end of the track member connecting-rod attaches to the outboard tab hinge.

164. With the flaps in the locked up position, the crank sprocket is pos-

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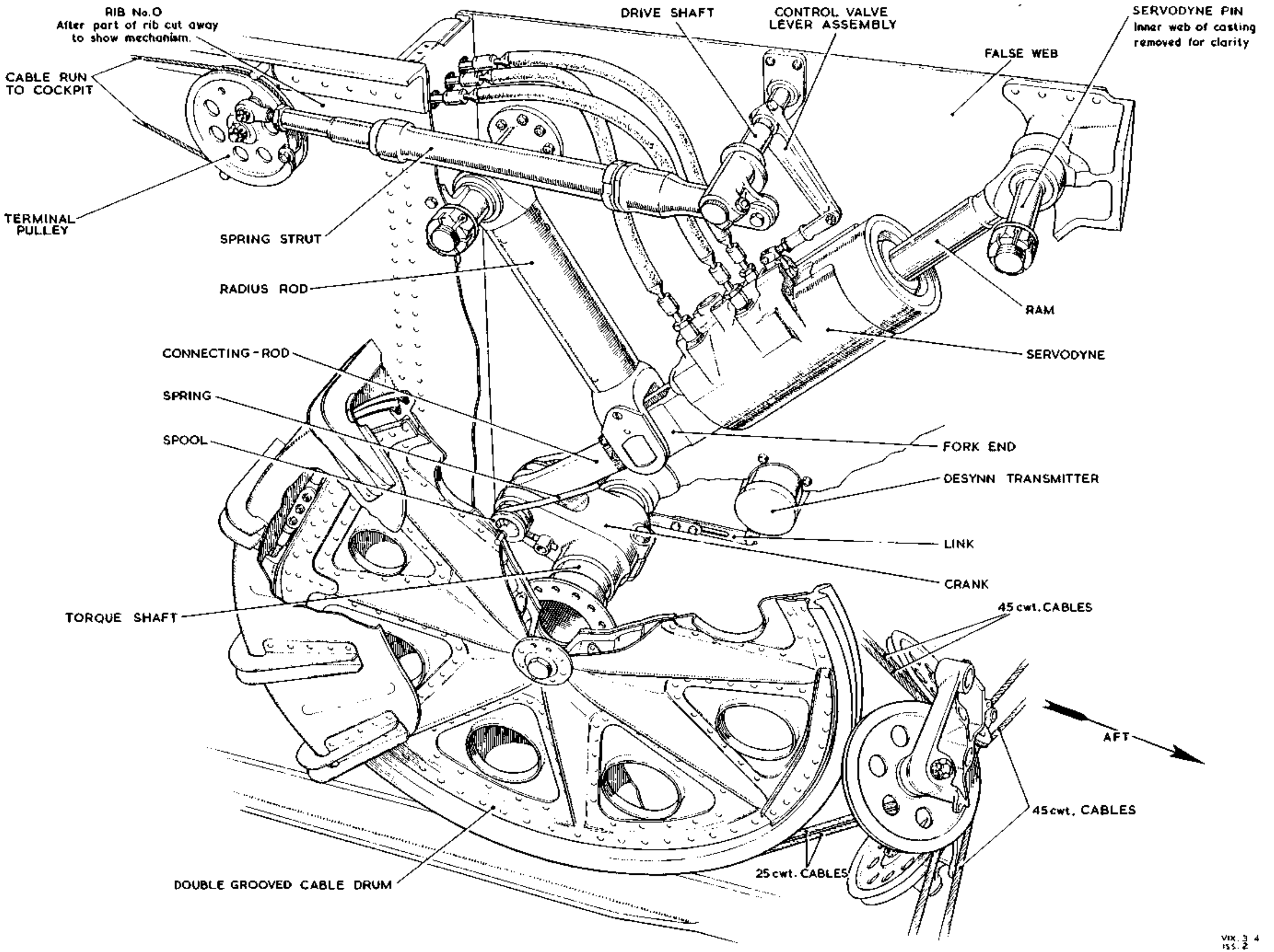

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Fig.21 Flap operating mechanism at rib No.O

◄ Hose connections corrected ►

itioned fully anti-clockwise with the crank connecting-rod holding the top end of the track member fully forward. In this position, the arc which forms the centre line of the kidney slot in the track member is concentric with the tail-plane axis, and up or down movement of the tail plane will in no way effect the neutral position of the tab.

165. Movement of the flap selector lever in the cockpit to either 20° (take-off) or fully DOWN sets up a rotation of the gearbox torque shaft, movement of the cable drive to the fin head and a subsequent clockwise rotation of the crank sprocket which, in turn, thrusts the top end of the track member aft.

166. With the tail plane in neutral and flaps selected to 20° (take-off) the movement aft of the track member will cause an upward movement of the trailing edge of the tab to approximately 4 deg. and will also nullify the concentricity of the centre-line of the kidney slot relative to the tail-plane axis.

167. As the centre-line of the kidney slot is no longer concentric to the tail-plane axis, any movement of the control column aft, causing an upward movement of the tail-plane trailing edge, will also result in a greater upward movement of the tab, due to the roller thrusting against the forward face of the track, pivoting the tail-plane tab operating lever and, through the track member connecting-rod, pivoting the tab upwards on the tab hinges.

168. With the flaps selected fully DOWN, the track member is moved fully aft in the fin rib slot, and the eccentricity of the centre-line of the kidney slot relative to the tail-plane axis is increased to such an extent that a movement of the selector lever directly from flaps UP to flaps DOWN, with the tail plane *neutral*, will give double the amount of upward tab movement relative to that of the tab when 20° is selected (i.e. 8 deg. upward movement).

169. With the control column held aft when the flaps are selected DOWN, the tab will be deflected upward immediately to the same position it would have occupied had the flaps been lowered prior to the movement aft of the control column. In this manner the induced nose heaviness occasioned by the lowering of the flaps is counteracted by the upward movement of the tab.

Note...

(1) *Under no circumstances is the tab centre-line deflected below that of the tail plane.*

(2) *The tab cannot be operated in any manner other than in conjunction with the movement of the flaps.*

170. A micro switch, located below and outboard of the crank sprocket, is operated by the bolt holding the track member connecting-rod to the inboard side of the sprocket. The switch is wired in parallel with the flap up lock micro switches and indicates by operating the port undercarriage warning lamp, when the tab is out of its *neutral* position. The tab operating mechanism described is identical in both port and starboard wings, booms and fins. Further information regarding the electrical circuit will be found in Book 2, Sect.5, Chap.1, Group C.15.

Air brake control circuit *(fig.23)*

171. A large air brake, inset in the bottom of the fuselage immediately aft of the nose undercarriage, is hinged at its forward edge from a pair of brackets located on the rear face of the gun beam at Stn. No.131.75; it is operated by a hydraulic jack which has its ram end trunnion-attached to a bracket on the inner side of the brake surface, and its body end anchored to a lug on the base of rib No.0 between the front and main spars.

172. Extension or retraction of the jack ram is controlled by a toggle switch positioned on the inboard end of the starboard throttle handle. This switch is spring-loaded to the mid-way position from which it can be operated/locked either fore or aft to energize an electro-hydraulic selector valve powered by the Green hydraulic system;

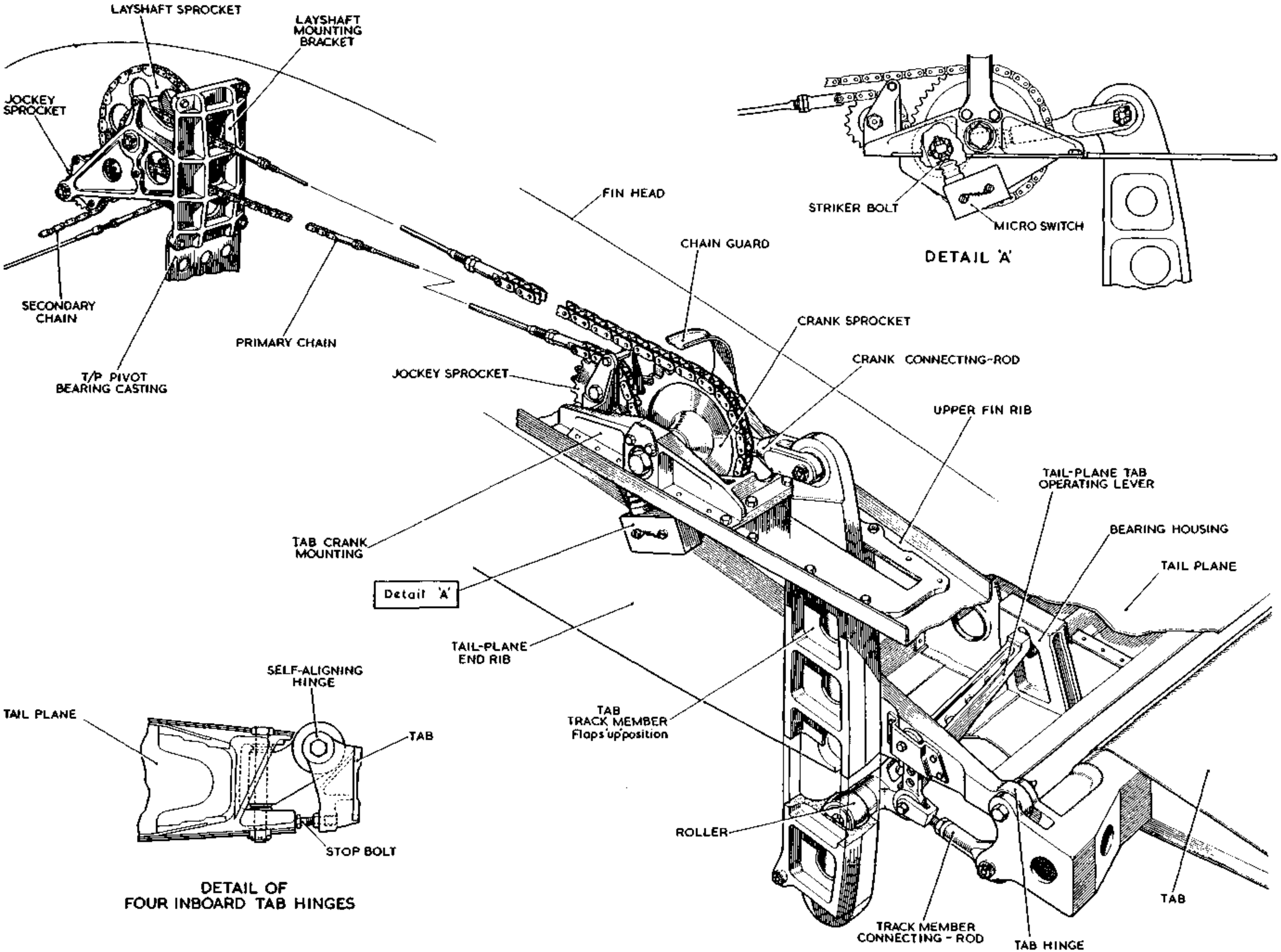

Fig. 22 Tail-plane tab operating mechanism

◀forward movement of the switch causes the ram to retract and closes the air brake, and an aft movement of the switch produces an extension of the ram and lowers the air brake. The operation of the switch in either direction can produce a progressive movement of the air brake, and any degree up to the maximum of 50 deg. can be selected in flight.

173. A graduated indicator at the bottom of the pilot's main instrument panel shows the position of the air brake between IN and OUT. The indicator is operated by a Desynn transmitter which is mounted on the port air brake hinge bracket (fig. 23).

174. In addition to the throttle toggle switch, the following switches also govern the movement of the air brake :-

(1) A GROUND/FLIGHT switch fitted on the port side of the aft face of the beam at Stn. No. 131.1.

(2) Two travel limiting microswitches attached to the roof of the air brake bay above the port hinge of the air brake (fig. 23, detail 'A').

(3) The nose undercarriage leg lock and change-over microswitches which also operate the undercarriage position indicator.

(4) A microswitch in the pilot's port console operated by the air brake emergency SHUT selector lever.

(5) On pre mod. 1030 aircraft, a 50/60 deg. switch mounted on the small panel to the port of the main instrument panel. This switch is locked in the 50 deg. position.

175. When the aircraft is ready for flight, the ground/flight switch is moved to the FLIGHT position by an insulated pad on the air brake access door, which contacts the switch when the door is closed.

176. The pilot has no control over the air brake until the nose undercarriage is retracted, and the air brake electrical relay is de-energized. The full travel is then available and is limited to 50 deg. by the 50 deg. limit microswitch.

177. When the nose undercarriage is lowered, the air brake will automatically be shut if already extended, and will remain shut irrespective of any movement of the throttle switch.

178. On the ground, to gain access to the air brake bay, the nose undercarriage microswitches can be bypassed by moving the ground/flight switch to GROUND. The throttle switch will then lower the air brake to the position controlled by the 29 deg. limit microswitch. The ground/flight switch must be moved to FLIGHT to close the air brake.

179. Because the air brake will close immediately the ground/flight switch is moved to FLIGHT, if hydraulic power is available, it is vital to fit a ground lock pin (Item A2, Sect. 2, Chap. 4) to the ground/flight switch (Sect. 3, Chap. 1) to prevent movement to FLIGHT. This will also prevent inadvertent extension to 50 deg., which could occur if the aircraft was jacked and the nose undercarriage retracted. A safety sleeve (Item A1, Sect. 2, Chap. 4) must also be fitted to the air brake jack ram whenever servicing is being done in the air brake bay with the air brake extended.

180. If the air brake is to be fully extended, ensure that the aircraft is jacked sufficiently high for the air brake to clear the ground.

181. If the electrical system fails, the air brake can be closed by moving the air brake emergency lever on the port console to the SHUT position. From the lever a 5 cwt. cable, No. 21, is routed down to a pulley at Stn. No. 131·0, then aft through a fairlead on the port side of the semi-bulkhead at Stn. No. 197·45 to another pulley on the port wall of the fuselage at Stn. No. 213·15, to terminate at the upper end of a bell-crank lever (figs. 28, 29, 30 and 33).

182. The lower end of the bell-crank lever is attached to the forward end of a small spring strut located below the selector valve. The aft end of the spring strut pivots on an anchorage▶

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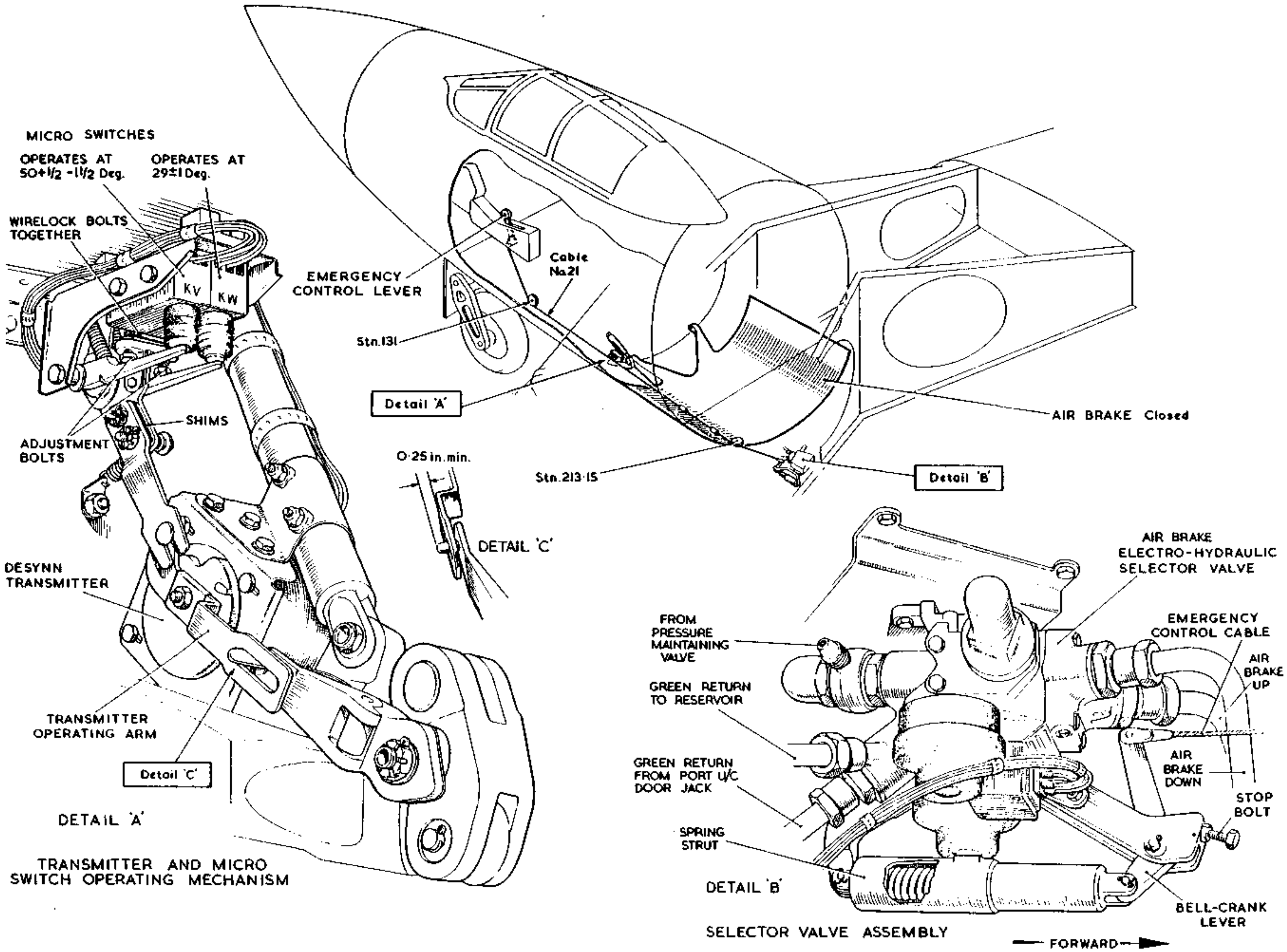

Fig.23 Air brake control circuit diagram

◄Additional annotation►

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◀ point on the valve assembly.

183. The movement of the emergency lever to SHUT compresses the spring strut and deflects it upward to depress the solenoid 'B' and allows hydraulic pressure to close the air brake.

184. The emergency lever also operates a microswitch in the port console to cut off the electrical supply to the selector valve when the lever is SHUT.

185. If the hydraulic pressure fails, the spring loaded slide valve automatically takes a position to connect the extend side of the jack to the hydraulic return line, and the airflow will partially close the air brake.

186. If the air brake is not fully closed when the nose undercarriage is locked down (GREEN light showing), the nose undercarriage RED light will also be lit.

187. Information on the air brake hydraulic system is given in Book 1, Cover 2, Sect. 3, Chap. 6, and on the electrical system in Book 2, Cover 1, Sect. 5, Chap. 1, Group D2. ▶

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(continued overleaf)

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Auxiliary Control Circuits

188. Information on the auxiliary control circuits is contained in Table 1 and figs. 24 to 26, as follows :-

(1) Table 1 is a rapid reference table which shows :-

(a) The cable run number.

(b) The cable tension.

(c) The figure number of the circuit diagram.

(d) The section, chapter and figure number containing the description and rigging details of the particular circuit.

(2) Figs. 24 to 27, with their keys, give the cable part numbers, reference numbers, and a brief description of the circuit.

(3) Fig. 28 shows the disposition of the pulley assemblies, which are identified alphabetically.

(4) Figs. 29 to 35 show the alphabetically referenced pulley assemblies in detail, and, with the key below each assembly, enable the cable runs to be traced through the aircraft.

TABLE 1

RAPID REFERENCE TABLE FOR AUXILIARY CABLE RUNS

CABLE RUN NO.	CABLE TENSION	DESCRIPTION	FIG. No. for circuit diagram	FURTHER INFORMATION
1	20 lb.	Fuel, cross-feed	25	Sect. 4, Chap. 2, Fig. 4
2	20 lb.	Fuel, cross-feed	25	" " "
3	20 lb.	L.P. fuel - starboard	24	" " "
4	20 lb.	L.P. fuel - starboard	24	" " "
5	20 lb.	L.P. fuel - port	24	" " "
6	20 lb.	L.P. fuel - port	24	" " "
7	20 lb.	Air shut off	25	Sect. 3, Chap. 8, Fig. 6
8	20 lb.	Air shut off	25	" " "
9	20 lb.	Air temperature	25	" " "
10	20 lb.	Air temperature	25	" " "
11	20 lb.	Ram air	25	" " "
12	20 lb.	Ram air	25	" " "
13	30 lb.	Port throttle	24	Sect. 4, Chap. 1, Fig. 4
14	30 lb.	Port throttle	24	" " "
15	30 lb.	Starboard throttle	24	" " "
16	30 lb.	Starboard throttle	24	" " "
17	20 lb.	Undercarriage	24	Sect. 3, Chap. 5, Fig. 17

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CABLE RUN NO.	CABLE TENSION	DESCRIPTION	FIG. No. for circuit diagram	FURTHER INFORMATION
18	20 lb.	Undercarriage	24	Sect. 3, Chap. 5, Fig. 17
19	20 lb.	Flap	24	Sect. 3, Chap. 4, Fig. 20
20	20 lb.	Flap	24	" " "
21	25 lb.	Air brake (emergency)	25	" " Fig. 23
22				
23	20 lb.	Arrester hook	25	Sect. 3, Chap. 5, Fig. 18
24	20 lb.	Arrester hook	25	" "
25	20 lb.	Wing lock - Port	26	Sect. 3, Chap. 2, Fig. 13
26	20 lb.	Wing lock - Port	26	" " "
27	20 lb.	Wing lock - Starboard	26	" " "
28	20 lb.	Wing lock - Starboard	26	" " "
29	20 lb.	Wing fold	26	" " "
30	20 lb.	Wing fold	26	" " "
31	-	Emergency hydraulic pump (pre Mod. 216)	26	Sect. 3, Chap. 6, Fig. 8
32		" " " (post Mod. 216)	26	" " Fig. 10
33				
34	-	Parking brake	26	Sect. 3, Chap. 6, Fig. 52
35				
36	-	Nose wheel steering	27	Sect. 3, Chap. 5, Fig. 8
37	-	Nose wheel steering	27	" " "

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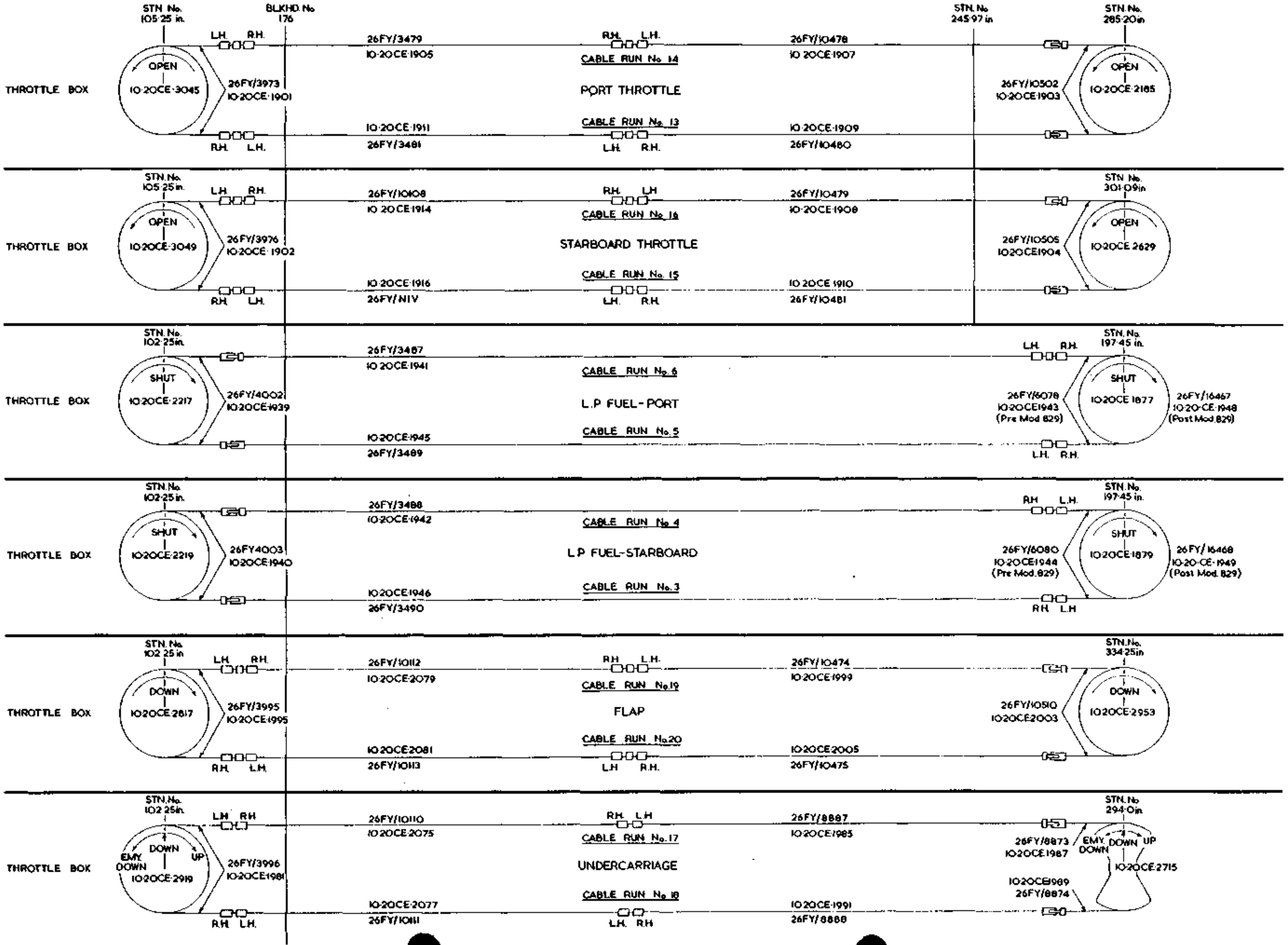

Fig.24 Diagrams of auxiliary control cable runs (1)

Cable runs No.13 and 14 PORT THROTTLE

From pulley in throttle box to throttle operating pulley at Stn.No.285.2. Cable 10.20CE-1901 is joined in the lower part of the throttle box to cables 10.20CE-1905 and 10.20CE-1911. These cables travel aft along the port side of the aircraft as shown on diagrams A,D,G,P,R and S. Prior to reaching the pulley assembly at Stn.No.226.41 (S), cable 10.20CE-1911 is joined to a cable 10.20CE-1909; cable 10.20CE-1905, however, passes over the same pulley assembly (S) before joining to a further cable 10.20CE-1907. The two additional cables continue the runs aft to the throttle operating pulley at Stn.No.285.2, passing, en route, over a pair of pulleys bracketed to the front firewall and through a fairlead on the firewall itself. Just prior to reaching the throttle operating pulley the cables are joined to cable 10.20CE-1903, with cable run No.13 occupying the inboard position.

Cable runs No.15 and 16 STARBOARD THROTTLE

From pulley in throttle box to throttle operating pulley at lower rib No.0 starboard at Stn.No.301.09. Cable 10.20CE-1902 is joined in the lower part of the throttle box to cables 10.20CE-1914 and 10.20CE-1916. These two cables travel aft as shown on diagrams A,D and F. Passing around the port outboard side of the pulleys (F) at Stn.No.176 the cables turn inboard and traverse the forward face of the pressure bulkhead to a pulley assembly on the starboard side (H). Here the cables again turn aft and are routed as shown on diagrams H,I,J and K. At Stn.No.225.0 (K) both cables turn inboard and cable 10.20CE-1914 is joined to cable 10.20CE-1908. The runs continue inboard and pass around the pulleys at Stn.No.228.7 on the lower boom of rib No.0 (U). Aft of these pulleys and forward of the front firewall, cable 10.20CE-1916 is joined to cable 10.20CE-1910. The cables continue aft through the firewall (V) and travel along the lower starboard rib No.0. Here both the cables join up to the ends of cable 10.20CE-1904 which completes the run to the throttle operating pulley at Stn.No.301.09.

Cable runs No.5 and 6 L.P. FUEL, PORT

From control pulley in throttle box to L.P. fuel cock pulleys aft of semi-bulkhead at Stn.No.197.45.
Cable 10.20CE-1939 is joined below throttle box to cables 10.20CE-1941 and 10.20CE-1945. These two cables form a simple unbroken run aft via pulleys, seals and fairleads as shown in diagrams A,D,G and P. At Stn.No.197.45 the cables pass around the outboard side of the pulleys (P) and turn inboard to join up to the ends of cable 10.20.CE-1943 (pre Mod.829), 10.20CE-1948 (post Mod.829) which is attached to the port L.P. fuel cock pulley as shown on diagram (Q).

Cable runs No.3 and 4 L.P. FUEL, STARBOARD

From control pulley in throttle box to L.P. fuel cock pulley aft of semi-bulkhead at Stn.No.197.45.
Cable 10.20CE-1940 is joined below throttle box to cables 10.20CE-1942 and 10.20CE-1946. These latter cables pass in an unbroken run aft via pulleys, seals and fairleads as shown on diagrams A,D,G and P. At Stn.No.197.45 the cables pass around the outboard side of the pulleys (P) and turn inboard to join up to the ends of cable 10.20CE-1944 (pre Mod.829), 10.20CE-1949 (post Mod.829) which is attached to the starboard L.P. fuel cock pulley as shown on diagram (Q).

Cable runs No.19 and 20 FLAP

From control pulley in throttle box to flap terminal pulley on the port side of rib No.0. Cable 10.20CE.1995 is joined below the throttle box to cables 10.20CE-2079 and 10.20CE-2081. These latter cables travel aft via the pulleys, seals and fairleads as shown on diagrams A.D and F. Passing around the outboard side of the pulley at Stn.No.176.0 the cables traverse the forward face of the pressure bulkhead to a pulley assembly at Stn.No.173.42 on the starboard side of the cockpit. Here they again turn aft and are routed as shown on diagrams H,I,J,K and U. Aft of the pulleys at Stn.No.224.65 (U) cables 10.20CE-2079 and 10.20CE-2081 are joined to cables 10.20CE-1999 and 10.20CE-2005 respectively. These cables continue the runs aft as shown on diagrams V,W and X; aft of Stn.No.271.7 (X) they pass along the top of rib No.0 and join to the two ends of cable 10.20CE-2003 which is attached to the flap terminal pulley. Cable run No.20 is diverted by a jockey sprocket to the lower side of the terminal pulley.

Cable runs No.17 and 18 UNDERCARRIAGE

From control pulley in throttle box to undercarriage operating pulley located at Stn.No.294 on the outboard side of rib No.1 in the starboard centre section. Cable No.10.20CE-1981 is joined below the throttle box to cables 10.20CE-2075 and 10.20CE-2077; these cables travel aft via pulleys, seals and fairleads as shown on diagrams A,D and F. Passing around the outboard side of the pulleys at Stn.No.176 the cables traverse the rear pressure bulkhead to a pulley assembly at the rear starboard side of the cockpit (H). Turning aft again the cables are routed as shown on diagrams H, I and J. Aft of Stn.No.197.45 (J) cables 10.20CE-2075 and 10.20CE-2077 are joined to cables 10.20CE-1985 and 10.20CE-1991 respectively. These latter cables pass around the inboard side of the pulleys at Stn.No.232.34 (K) and turn outboard to a pulley assembly at the junction of rib No.1 and the main spar in the starboard centre section. Turning aft again the cables pass along rib No.1 and join to cables 10.20CE-1987 (on run No.17) and 10.20CE-1989 which are attached to the undercarriage selector quadrant at Stn.No.294.

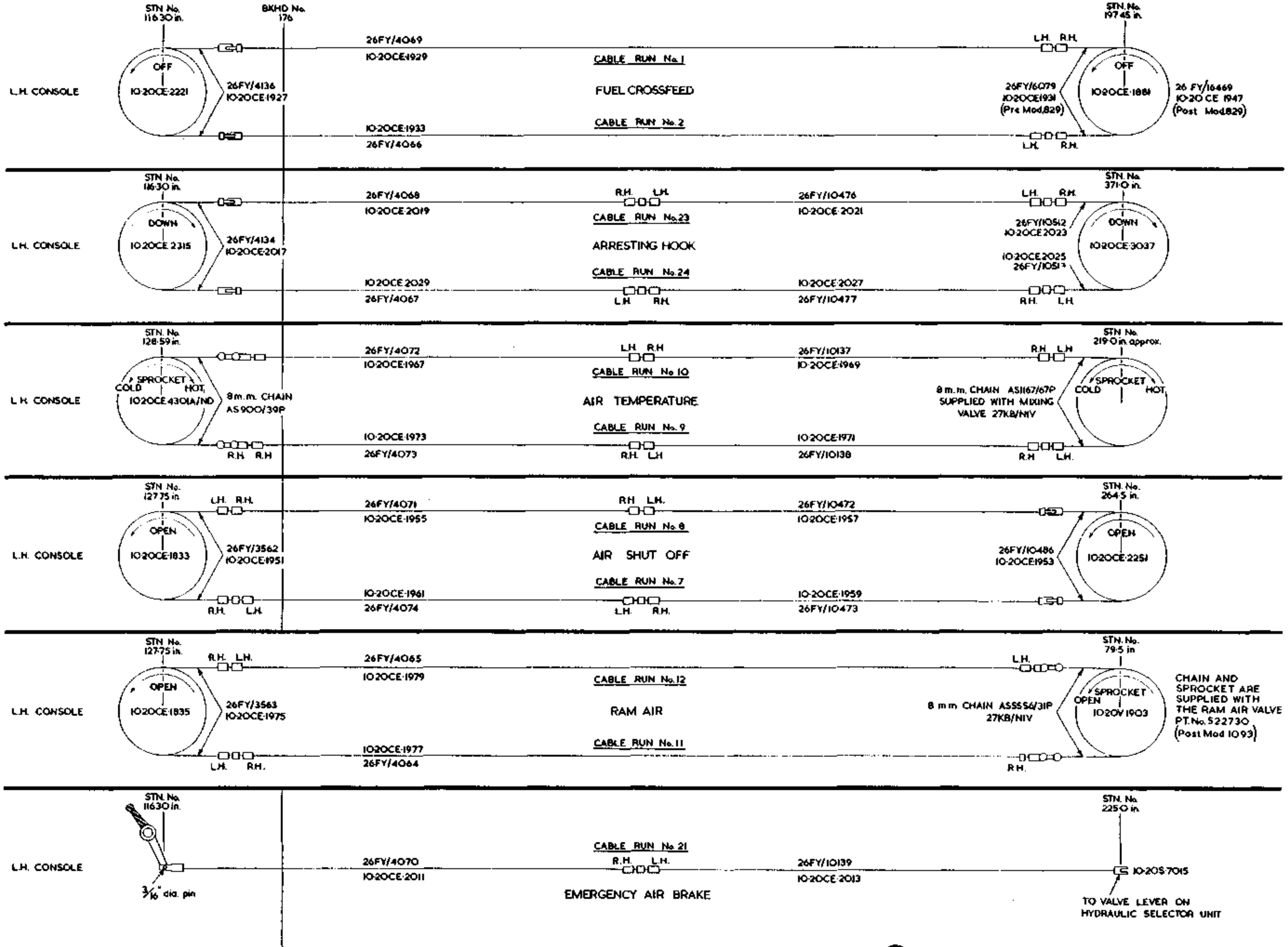

Fig.25 Diagrams of auxiliary control cable runs (2)

◄ Additions to fuel cross-feed and ram air ►

Cable runs No.1 and 2 FUEL CROSSFEED

From pulley located below L.H. console to fuel crossfeed pulley positioned on L.P. fuel gallery aft of the semi-bulkhead at Stn.No. 197.45. Cable 10.20CE-1927 is joined below the L.H. console to cables 10.20CE-1929 and 10.20CE-1933. These latter cables pass aft via pulleys, seals and fairleads as shown on diagrams B,D,E,G and P. Passing around the outboard side of the pulleys (P) the cables turn inboard and are routed below a pair of jockey pulleys mounted vertically on the aft face of the semi-bulkhead; cable run No.1 passes below the forward jockey pulley and cable run No.2 below the aft jockey pulley. Inboard of the jockey pulleys the cables have their ends joined, one to each end of a further cable 10.20CE-1931 (pre Mod.829), 10.20CE-1947 (post Mod.829) which is attached to the fuel cross-feed pulley, cable run No.1 going to the top and cable run No.2 to the bottom of this pulley (Q).

Cable runs No.23 and 24 ARRESTER HOOK

From pulley located below L.H. console to selector valve operating pulley at Stn.No.371. aft of the spectacle beam.
Cable No.10.20CE-2017 is joined below the L.H. console to cables 10.20CE-2019 and 10.20CE-2029. These cables pass aft along the port side of the fuselage via pulleys, seals and fairleads as shown on diagrams B,D,E,G,P and R. Passing around the outboard side of the top two pulleys (R) the cables turn inboard and are joined to a further pair of cables; cable No.10.20CE-2019 being joined to cable 10.20CE-2021 and cable 10.20CE-2029 to cable 10.20CE-2027. These latter cables continue the runs aft as shown on diagrams U,V,W and X, from whence they travel along the top port side of rib No.0 to a pair of pulleys aft of the spectacle beam. Below these pulleys cables 10.20CE-2021 and 10.20CE-2027 are joined to cables 10.20CE-2023 and 10.20CE-2025 respectively. These cables complete the run by attaching to the selector valve operating pulley at Stn.No.371.0, aft of the spectacle beam.

Cable runs 9 and 10 AIR TEMPERATURE

From control on L.H. console to Normalair atmosphere control unit located on aft face of main spar (Stn.219 approx.). From 8 m m chain ends located below L.H. console a pair of cables, 10.20CE-1967 and 10.20CE-1973, are routed aft via pulleys, seals and fairleads as shown on diagrams B,E,G,P,R and S. Cable 10.20CE-1967 is joined to cable 10.20CE-1969 forward of the semi-bulkhead at Stn.No.197.45, while cable 10.20CE-1973 is joined to cable 10.20CE-1971 aft of the semi-bulkhead at Stn.No.197.45. At pulleys located below port side main spar Stn.228.18 the cables are diverted upwards and join on to the ends of an 8 m.m. chain which passes over the sprocket attached to the atmosphere control unit.

Cable runs No 7 and 8 AIR SHUT-OFF

From control lever pulley in L.H. console to air shut-off pulley located on the port side of rib No.0 at Stn.No.264.5.
Cable 10.20CE-1951 from control lever pulley is joined below the L.H. console to cables 10.20CE-1955 and 10.20CE-1961. These two cables are routed aft via pulleys, seals and fairleads as shown on diagrams B,E,G,P and R. Aft of pulleys at Stn. No.213.15 (R) cables 10.20CE-1955 and 10.20CE-1961 are joined to cables 10.20CE-1957 and 10.20CE-1959 respectively. These latter cables continue the runs aft as shown on diagrams U,V and W. after passing below pulleys at Stn.No.264.5 (W) the cables turn upward and join on to each end of cable 10.20CE-1953 with cable run No.7 occupying the forward position on the air shut-off pulley.

Cable runs No.11 and 12 RAM AIR

From control lever pulley at rear of L.H. console to ram air valve located at Stn.No.79.5.
Cable 10.20CE-1975 is joined below the L.H. console to cables 10.20CE-1979 and 10.20CE-1977. These two cables are routed forward to the ram air valve driving chain by passing below a pair of pulleys located at Stn.No.120.0 and through a fairlead in the frame at Stn.No.96.0. Forward of Stn.No.96.0 the cables join to each end of the 8 m.m. chain which passes around a sprocket operating the ram air valve. Cable run No.12 occupies the outboard position throughout the runs.

Cable run No.21 EMERGENCY AIR BRAKE

From emergency air brake lever on L.H. console to valve operating lever on hydraulic selector unit positioned at Stn.No.225.0. Cable No.10.20CE-2011 is routed aft via pulleys, seals and fairleads as shown on diagrams B,E,G and P. Aft of the semi-bulkhead at Stn.No.197.45 cable 10.20CE-2011 is joined to cable 10.20CE-2013 and this latter cable continues the run aft via a pulley assembly at Stn.No.213.15 (R) to the valve operating lever on the hydraulic selector unit.

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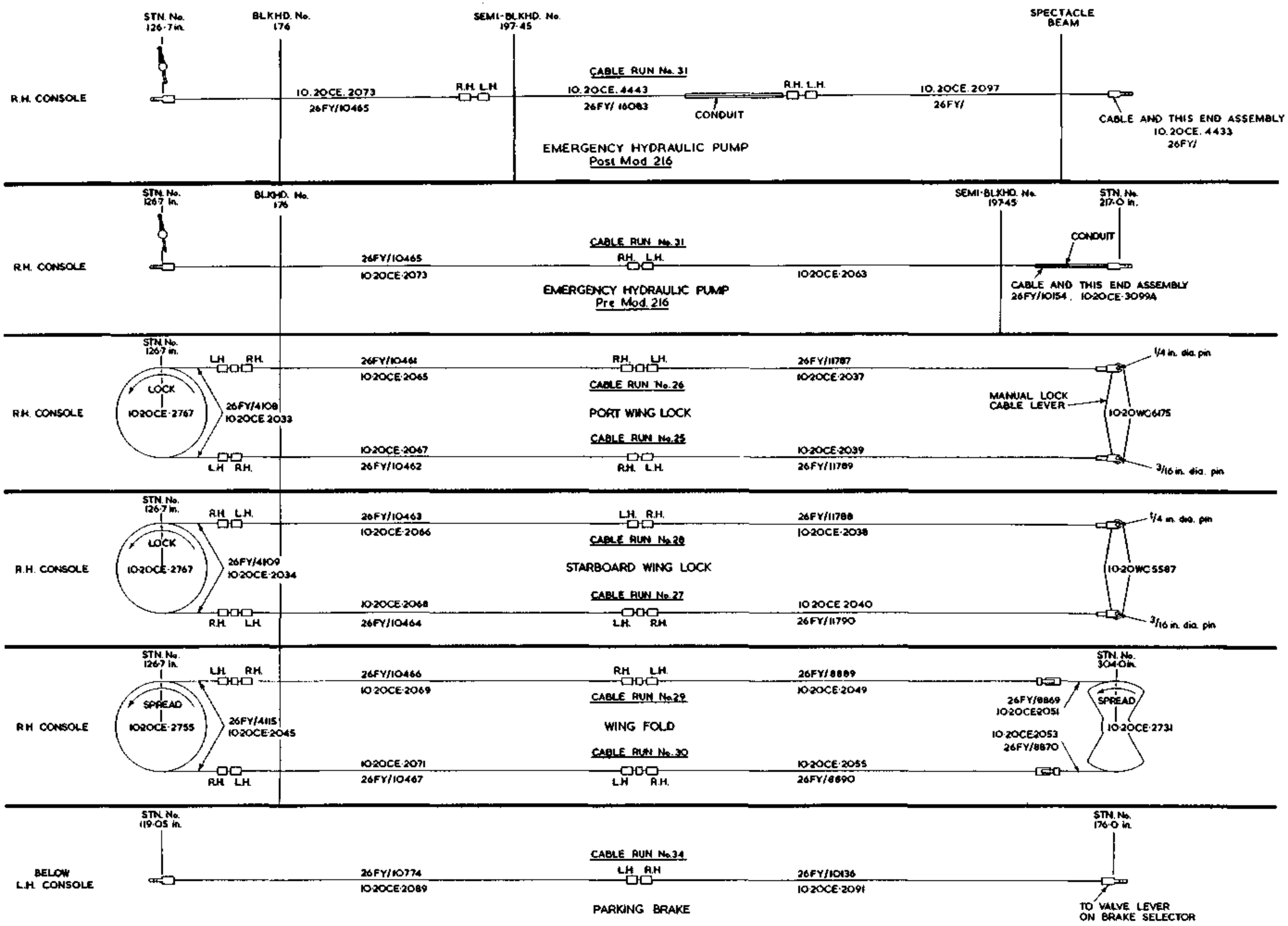

Fig.26 Diagrams of auxiliary control cable runs (3)

Cable run No.31 EMERGENCY HYDRAULIC PUMP (post Mod.216)

From control lever on R.H. console to emergency hydraulic pump release mechanism at Stn.No.388.0 (approx.)
Cable No.10.20CE-2073 is routed via a jockey pulley below control lever and pulley assemblies, seals and fairleads as shown on diagrams C, L, M, N, O, I and J. Forward of the semi-bulkhead at Stn.No.197.45, cable No.10.20CE-2073 is joined to cable No.10.20CE-4443. This cable passes via the fairleads (J) and a conduit to a position forward of the front firewall where cable No.10.20CE-4443 is joined to a further cable, No.10.20CE-2097. This latter cable is routed downwards by two pulleys on the rear face of the spectacle beam and then aft to the emergency hydraulic pump release mechanism. Cable No.10.20CE-2097 and the pump release mechanism are supplied complete as Part No.10.20CE-4433.

Cable run No.31 EMERGENCY HYDRAULIC PUMP (pre Mod.216)

From control lever on R.H. console to emergency hydraulic pump release mechanism located at Stn.No.217.0.
Cable No.10.20CE-2073 is routed via a jockey pulley below control lever and pulley assemblies, seals and fairleads as shown on diagrams C,L,M,N,O,I and J. Cable No.10.20CE-2073 is joined to cable 10.20CE-2063 forward of semi-bulkhead No.197.45. Cable 10.20CE-2053, conduit and release trip mechanism are supplied complete as part No.10.20CE-3099A.

Cable runs No.25 and 26 PORT WING LOCK

From control lever on R.H. console to manual lock cable lever on wing rib No.4. Cable 10.20CE-2033 is joined in console to cables 10.20CE-2065 and 10.20CE-2067; these two cables pass into the leading edge of the port centre section via pulleys and seals as shown on diagrams C,L,M,T and G. At Stn.No.176 the cables pass around the inboard side of a pair of pulleys located on the aft side of the seals and turn outboard to a pair of pulleys at nose rib No.2 in the port centre section leading edge. In the leading edge cables 10.20CE-2065 and 10.20CE-2067 are joined to cables 10.20CE-2037 and 10.20CE-2039 respectively. These two cables pass outboard to a pair of pulleys bracketed to the front spar at rib No.4 Passing around the forward side of the pulleys (run No. 26 uppermost), the cables turn aft along the outboard side of rib No.4 and terminate at the manual lock cable lever.

Cable runs No.27 and 28 STARBOARD WING LOCK

From control lever on R.H. console to manual lock cable lever on wing rib No.4. Cable 10.20CE-2034 is joined in console to cables 10.20CE-2066 and 10.20CE-2068; these two cables pass into the leading edge of the starboard centre section via pulleys and seals as shown on diagrams C,L,M,N,O and I. At Stn.No.176 the cables pass around the inboard side of a pair of pulleys located on the aft side of the seals and turn outboard to a pair of pulleys at nose rib No.2 in the starboard centre section leading edge. In the leading edge, cables 10.20CE-2066 and 10.20CE-2068 are joined to cables 10.20CE-2038 and 10.20CE-2040 respectively. These two cables pass outboard to a pair of pulleys bracketed to the front spar at rib No.4 passing around the forward side of the pulleys (run No.28 uppermost). The cables turn aft along the outboard side of rib No.4 and terminate at the manual lock cable lever.

Cable runs No.29 and 30 WING FOLD

From control lever on R.H. console to wing fold selector pulley at Stn.No.304.0 on outboard side of rib No.1, starboard.
Cable No.10.20CE-2045 is joined in console to cables No.10.20CE-2069 and 10.20CE-2071, these latter cables are routed via pulleys and seals as shown on diagrams C,L,M,N,O, I and J. Aft of semi-bulkhead at Stn.No.197.45 cables 10.20CE-2069 and 10.20CE-2071 are joined to cables 10.20CE-2049 and 10.20CE-2055 respectively. These two cables continue aft to a pulley assembly as shown on diagram 'K'. Here the cables are diverted outboard to a four pulley assembly located vertically at the junction of the main spar and rib No.1. After passing around the two top pulleys in the assembly, the cables pass aft along the outboard face of rib No.1 and below a pair of jockey pulleys at Stn.No.273.2. Aft of these pulleys cable 10.20CE-2049 is joined to cable 10.20CE-2051 and cable 10.20CE-2055 is joined to cable 10.20CE-2053. These latter cables are routed over the top of a pair of jockey pulleys at Stn.No.296.0 and terminate at the wing fold selector quadrant.

Cable run No.34 PARKING BRAKE

From control lever located below L.H. console to valve lever on hydraulic brake unit located on lower aft face of bulkhead No.176.
Forward end of cable 10.20CE-2089 is connected to brake control lever and passes aft below a single pulley located on the port side of cockpit at Stn.No.133.15. Immediately aft of this pulley, cable 10.20CE-2089 is joined to cable 10.20CE-2091. The latter cable continues aft through a single pressure seal in bulkhead No.176 and is routed to the hydraulic brake unit valve lever via one horizontal and one vertically mounted pulley attached to the aft face of bulkhead No.176 as shown in fig.363b

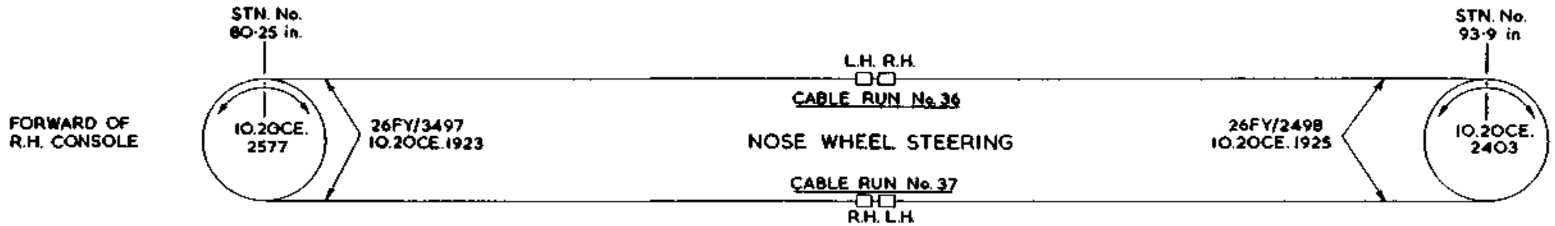

Fig. 27 Diagram of auxiliary control cable run

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Cable runs No.36 and 37 NOSE WHEEL STEERING
From pulley at Stn.No.80.25 on centre-line of aircraft, in forward part of cockpit, to pulley at Stn.No.93.9.
Drive from handwheel control, located forward of R.H. console, to pulley assembly at Stn.No.93.9 is by torque shafts and universal joints. Cable No.10.20CE-1923 is joined to cable No.10.20CE-1925 with cable run No.36 lying to starboard of cable run No.37.

Note. Key letters refer to the detailed pulley assemblies shown in Figs. 29-35

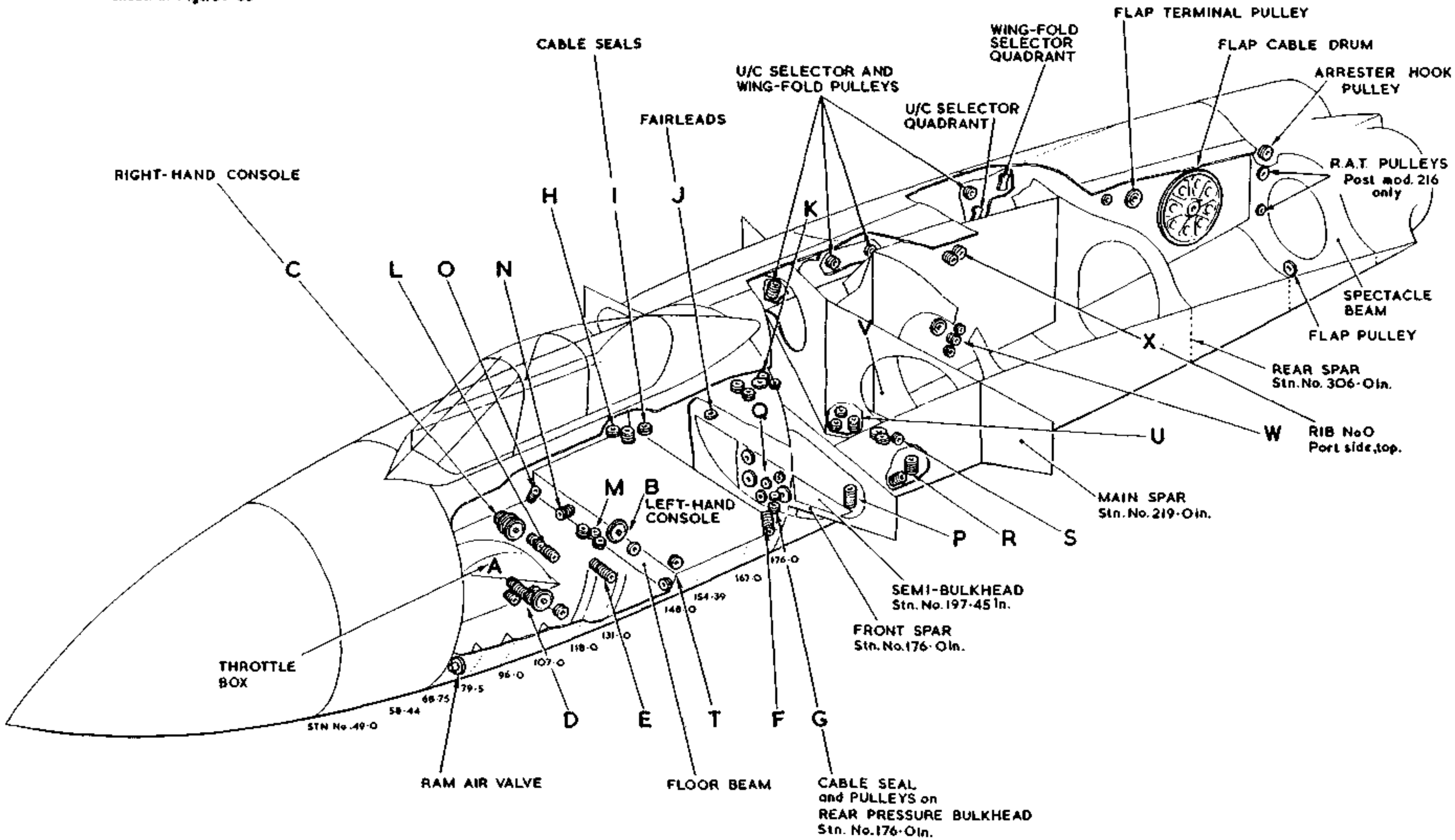
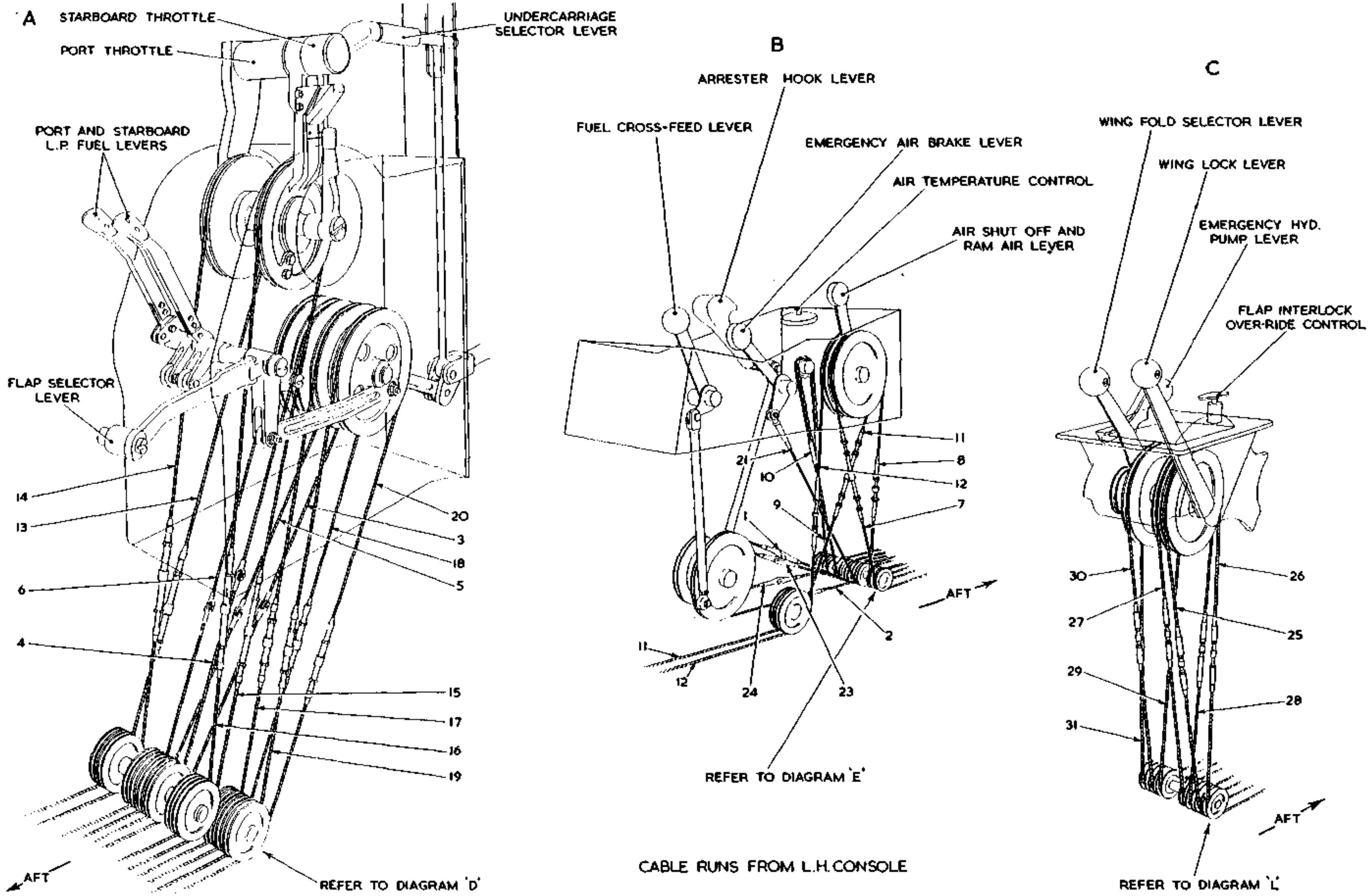


Fig. 28 Disposition of auxiliary control pulleys

◀ U/C and wing-fold selector pulleys added ▶



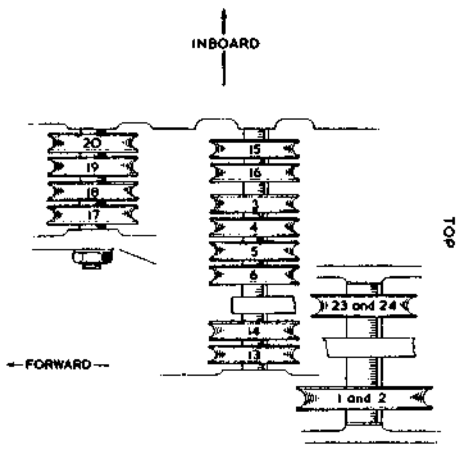
CABLE RUNS FROM THROTTLE BOX

CABLE RUNS FROM L.H. CONSOLE

CABLE RUNS FROM R.H. CONSOLE

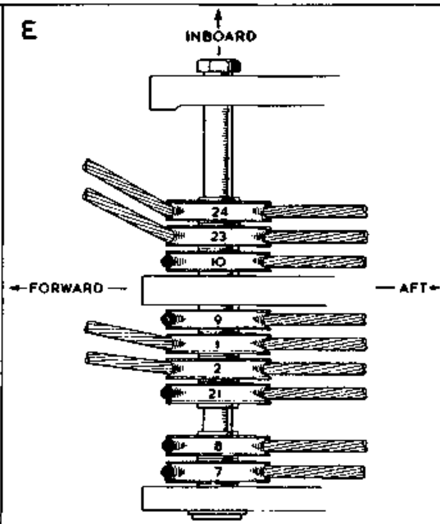
Fig. 29 Auxiliary controls in cockpit

D



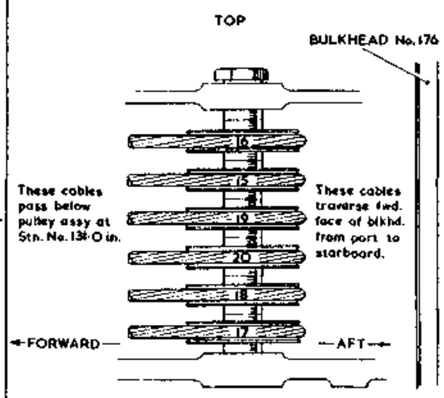
OUTBOARD PORT SIDE FUSELAGE PULLEY ASSEMBLY AT STN. No. 114·5 in.
View from above

E



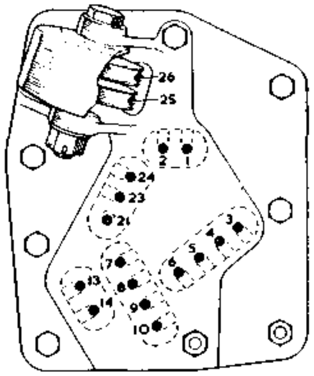
PULLEY ASSEMBLY AT STN. No. 131·0 in.
View from above

F



PULLEY ASSEMBLY AT BULKHEAD STN. No. 176·0 in.
View looking inboard on port side

G



CABLE SEAL AND WING LOCK PULLEYS AT BULKHEAD STN. No. 176·0 in.
View looking forward on aft port side of bulkhead

KEY TO CABLE RUNS (D)

CABLE RUN	
	FORWARD
20, 19, 18, 17, 15, 16, 3, 4, 5, 6, 13, 14	UPWARD TO PULLEY IN THROTTLE BOX. REFER TO DIAGRAM 'A'
23, 24, 1, 2	UPWARD BY CONNECTING-RODS TO CONTROLS ON L.H. CONSOLE. REFER TO DIAGRAM 'B'
	AFT
15, 16, 20, 19, 18, 17	TO PULLEY ASSEMBLY AT STN. No. 176·0 in. FORWARD OF BULKHEAD. REFER TO DIAGRAM 'F'
3, 4, 5, 6, 14, 13	TO CABLE SEALS AT STN. No. 176·0 in. REFER TO DIAGRAM 'G'
23, 24, 1, 2	TO PULLEY ASSEMBLY AT STN. No. 131·0 in. AND THENCE TO CABLE SEALS AT STN. No. 176·0 in. REFER TO DIAGRAMS 'E' AND 'G'

REF. D.H. DRAWING No. 10. 20 CE. 3535 A

KEY TO CABLE RUNS (E)

CABLE RUN	
	FORWARD
24, 23	TO PULLEY ASSEMBLY AT STN. No. 114·5 in.
10 *	UPWARD TO AIR TEMPERATURE CONTROL FWD.
9 *	UPWARD TO AIR TEMPERATURE CONTROL AFT
1, 2	TO PULLEY ASSEMBLY AT STN. No. 114·5 in.
21 *	UPWARD TO EMERGENCY AIR BRAKE CONTROL
8 *	UPWARD TO AIR SHUT-OFF CONTROL AFT
7 *	UPWARD TO AIR SHUT-OFF CONTROL FWD.
	* REFER TO DIAGRAM 'B'
	AFT
24, 23, 10, 9, 1, 2, 21, 8, 7	THROUGH CABLE SEAL AT BULKHEAD STN. No. 176. REFER TO DIAGRAM 'G'

REF. D.H. DRAWING No. 10. 20. CE 839 A

KEY TO CABLE RUNS (F)

CABLE RUN	
	FORWARD
16, 15, 19, 20, 18, 17	TO PULLEY ASSEMBLY AT STN. No. 114·5 in. REFER TO DIAGRAM 'D'
	AFT
16, 15, 19, 20, 18, 17	TO PULLEY ASSEMBLY AT STARBOARD SIDE BULKHEAD STN. No. 176 FWD. REFER TO DIAGRAM 'H'

REF. D.H. DRAWING No. 10. 20. CE 3875

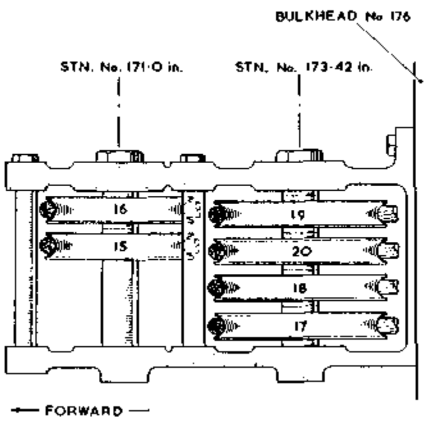
KEY TO CABLE RUNS (G)

CABLE RUN	
	FORWARD
26, 25	TO PAIR OF PULLEYS ON PORT SIDE OF FLOOR BEAM AT STN. No. 148·0 in. REFER TO DIAGRAM 'T'
1, 2, 24, 23, 21, 7, 8, 9, 10	TO PULLEYS AT STN. No. 131·0 in. ON PORT SIDE OF COCKPIT FLOOR. REFER TO DIAGRAM 'E'
13, 14, 3, 4, 5, 6	TO PULLEYS AT STN. No. 114·5 in. ON PORT SIDE OF COCKPIT FLOOR. REFER TO DIAGRAM 'D'
	AFT
25, 26	AROUND INBOARD SIDE OF PULLEYS AFT OF SEALS AND OUTBOARD TO PULLEY ASSY'S. AT NOSE RIB No. 2 AND RIB No. 4 IN STBD. CENTRE SECTION
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 13, 14, 21, 23, 24	TO FAIRLEADS AT SEMI-BULKHEAD AT STN. No. 197·45 in. REFER TO DIAGRAM 'P'

REF. D.H. DRAWING No. 10. 20. CE 3189

Fig.30 Auxiliary controls in fuselage (1)

H



PULLEY ASSEMBLY FORWARD OF BULKHEAD STN. No. 176·0 in. STARBOARD
View looking outboard

KEY TO CABLE RUNS

CABLE RUN — FORWARD SIDE OF PULLEY
REFER TO DIAGRAM 'F'

19, 20, 18, 17, 16, 15 — TO AFT SIDE OF PORT PULLEY ASSEMBLY AT BULKHEAD STATION No. 176·0 in.

AFT SIDE OF PULLEY

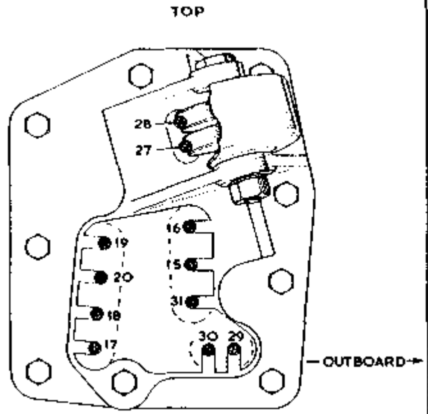
FROM AFT SIDE OF PULLEYS ALL CABLES PASS THROUGH BULKHEAD SEALING PLATES AT STATION Nos. 176·0 in. AND 197·45 in. STBD.

19, 20 — TO PULLEY BRACKET AT STN. No. 226·6 in.
18, 17 — TO PULLEY BRACKET AT STN. No. 232·34 in.
16, 15 — TO PULLEY BRACKET AT STN. No. 225·0 in.

REFER TO DIAGRAMS 'I', 'J' and 'K'

REF. D.H. DRAWING No. 10.20.CE 3875

I



CABLE SEAL AND WING LOCK PULLEYS AT STARBOARD SIDE OF BULKHEAD STN. No. 176·0 in.
View looking fwd. on aft face of blkhd.

KEY TO CABLE RUNS

CABLE RUN — FORWARD OF CABLE SEAL

28, 27, 31, 30, 29 — TO PULLEY ASSEMBLY AT STN. No. 148·0 in. (OUTBOARD OF NAVIGATOR'S SEAT)
REFER TO DIAGRAM 'O'

15, 16, 17, 18, 19, 20 — TO PULLEY ASSEMBLY FORWARD OF BULKHEAD STATION No. 176·0 in.
REFER TO DIAGRAM 'H'

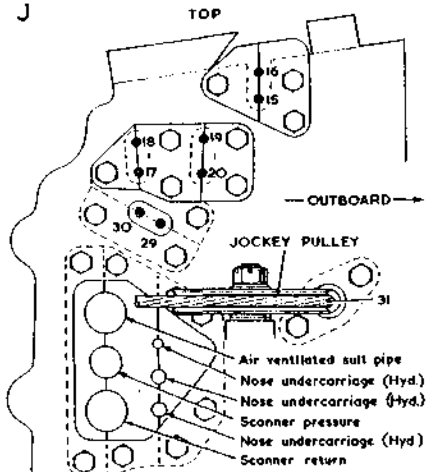
AFT OF CABLE SEAL

28 — TO TOP PULLEY OF PAIR ON PULLEY ASSEMBLY AT NOSE RIB No. 2
27 — TO LOWER PULLEY OF PAIR ON PULLEY ASSEMBLY AT NOSE RIB No. 2
31 — TO EMERGENCY HYDRAULIC PUMP RELEASE VIA FAIRLEAD AND PULLEY AT SEMI-BULKHEAD AT STATION No. 197·45 in.
30, 29 — * TO PULLEY ASSEMBLY AT STN. No. 232·34 in.
15, 16 — * TO PULLEY ASSEMBLY AT STN. No. 225·0 in.
17, 18 — * TO PULLEY ASSEMBLY AT STN. No. 232·34 in.
19, 20 — * TO PULLEY ASSEMBLY AT STN. No. 226·64 in.

* REFER TO DIAGRAMS 'J' and 'K'

REF. D.H. DRAWING No. 10.20.CE 4025

J



FAIRLEADS AT STBD. SIDE OF SEMI-BULKHEAD AT STN. No. 197·45 in.
View looking fwd. on aft face of semi-blkhd.

KEY TO CABLE RUNS

CABLE RUN — FORWARD OF SEMI-BULKHEAD

15, 16 — REFER TO DIAGRAM 'H' STATION No. 171·0 in. AND DIAGRAM 'I' STATION No. 176·0 in.
17, 18, 19, 20 — REFER TO DIAGRAM 'H' STATION No. 173·42 in. AND DIAGRAM 'I' STATION No. 176·0 in.
30, 29, 31 — THROUGH CABLE SEAL AT BLKHD. STATION No. 176·0 in. STBD. TO PULLEY ASSY. AT STN. No. 148·0 in. (OUTBOARD OF NAVIGATOR'S SEAT POSITION)

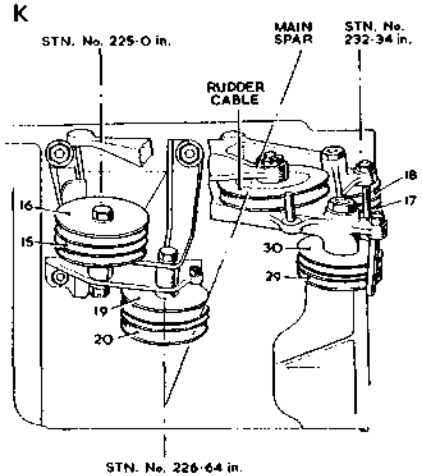
AFT OF SEMI-BULKHEAD

15, 16 — TO STATION No. 225·0 in ON DIAGRAM 'K' (FORWARD OF MAIN SPAR)
19, 20 — TO STATION No. 226·64 in. ON DIAGRAM 'K' (FORWARD OF MAIN SPAR)
17 * — TO BOTTOM PULLEY OF OUTBOARD PAIR AT STN. No. 232·34 in. (BELOW MAIN SPAR)
18 * — TO TOP PULLEY OF OUTBOARD PAIR AT STN. No. 232·34 in. (BELOW MAIN SPAR)
29 * — TO BOTTOM PULLEY OF INBOARD PAIR AT STN. No. 232·34 in. (BELOW MAIN SPAR)
30 * — TO TOP PULLEY OF INBOARD PAIR AT STN. No. 232·34 in. (BELOW MAIN SPAR)
31 — TO OUTBOARD SIDE OF SINGLE PULLEY IMMEDIATELY AFT OF BLKHD. FAIRLEADS

* REFER TO DIAGRAM 'K'

REF. D.H. DRAWING No. 10.20.WC 23223 A

K



PULLEY ASSEMBLIES AT STN. Nos. 225·0 in. 226·64 in. AND 232·34 in.
View looking outboard of ℄ aircraft to starboard

KEY TO CABLE RUNS

CABLE RUN — FORWARD SIDE OF PULLEY

15, 16, 17, 18, 19, 20, 29, 30 — TO AND THROUGH FAIRLEADS AT SEMI-BULKHEAD AT STN. No. 197·45 in.
REFER TO DIAGRAM 'J'

AFT SIDE OF PULLEY

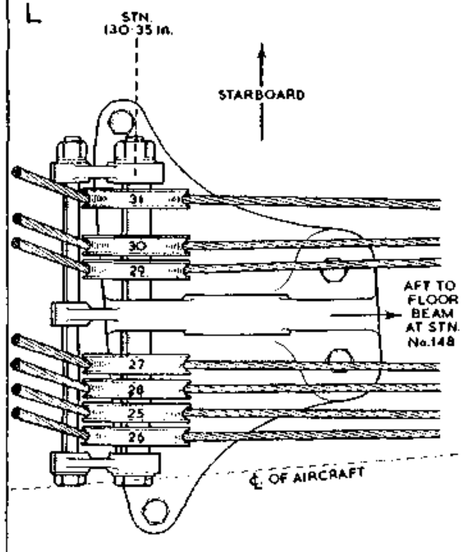
15, 16 — * ROUND OUTBOARD SIDE OF PULLEY AND INBOARD TO PULLEY ASSEMBLY AT STN. No. 228·6 in. LOCATION AT LOWER BOOM OF RIB No. O
19, 20 — * ROUND OUTBOARD SIDE OF PULLEY AND FORWARD OF PULLEY ASSEMBLY AT STN. No. 224·6 in. LOCATION AT LOWER BOOM OF RIB No. O
17, 18, 29, 30 — ROUND INBOARD SIDE OF PULLEYS AND OUTBOARD TO PULLEY ASSEMBLY AT STN. No. 243·54 in. ON OUTBOARD SIDE RIB No. I STARBOARD WING

* REFER TO DIAGRAM 'U'

REF. D.H. DRAWING Nos. 10.20.CE 2901
10.20.CE 3845
10.20.CE 2243

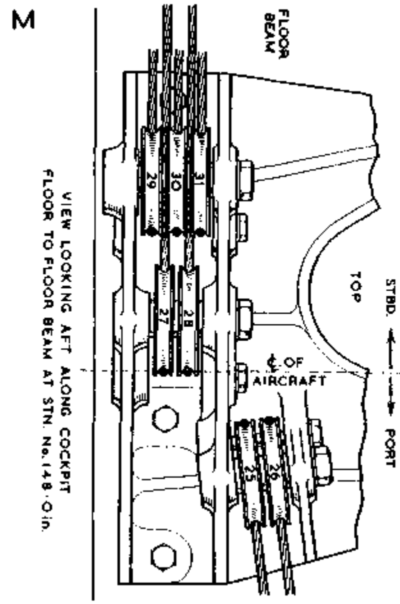
Fig. 31 Auxiliary controls in fuselage (2)

L



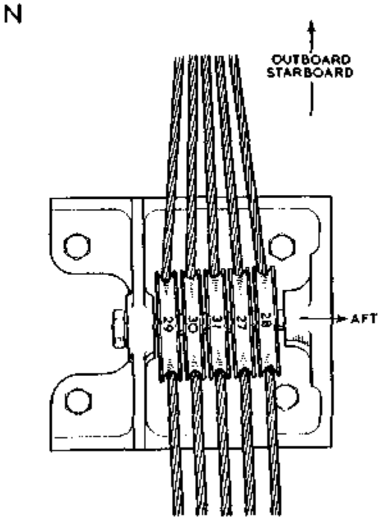
PULLEY ASSY. AT STN. No.130·3 in. ON COCKPIT FLOOR
Viewed from above

M



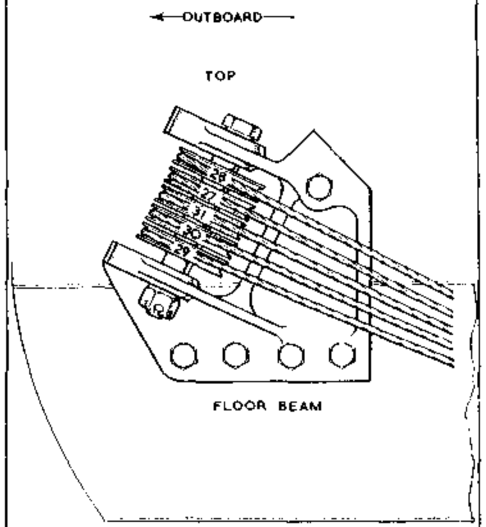
PULLEY ASSY. AT STN. No.148·0in.

N



PULLEY ASSY. AT NAVIGATORS SEAT BRACKET
Viewed from above

O



PULLEY ASSY. AT STBD. END OF FLOOR BEAM STN. No.148·0 in.
View looking aft along cockpit floor

L — KEY TO CABLE RUNS

FORWARD SIDE OF PULLEYS

CABLE RUNS	R.H CONSOLE (REFER TO DIAGRAM C)
31	UPWARD TO EMERGENCY HYD PUMP CONTROL LEVER
29	" TO AFT SIDE OF WING FOLD CONTROL PULLEY
30	" TO FWD. " " " " " "
26	" TO AFT " " PORT WING LOCK " "
25	" TO FWD. " " PORT " " " "
28	" TO AFT " " INNER " " " "
27	" TO FWD " " " " " " "

AFT SIDE OF PULLEYS

31 TO R.H SIDE OF TOP PULLEY IN TRIPLE PULLEY BANK ON FLOOR BEAM AT STN.No.148·0in.

30 TO R.H SIDE OF MIDDLE PULLEY IN TRIPLE PULLEY BANK ON FLOOR BEAM AT STN. No 148·0in.

29 TO R.H. SIDE OF BOTTOM PULLEY IN TRIPLE PULLEY BANK ON FLOOR BEAM AT STN. No.148·0in.

28 TO R.H. SIDE OF TOP PULLEY ON PAIR OF PULLEYS ON ℄ AIRCRAFT ON FLOOR BEAM AT STN No.148 0in.

27 TO R.H. SIDE OF BOTTOM PULLEY ON PAIR OF PULLEYS ON ℄ AIRCRAFT ON FLOOR BEAM AT STN No.148·0in.

26 TO L.H SIDE OF TOP PULLEY ON PAIR OF PULLEYS TO PORT OF ℄ AIRCRAFT ON FLOOR BEAM AT STN.No148·0in.

25 TO L.H. SIDE OF BOTTOM PULLEY ON PAIR OF PULLEYS TO PORT OF ℄ AIRCRAFT ON FLOOR BEAM AT STN. No. 148·0in.

REFER TO DIAGRAM M

REF. D.H. DRAWING Nos 10.20. C.E. 3869. 10.20. C.E. 2997.

M — KEY TO CABLE RUNS

FORWARD SIDE OF PULLEYS

31, 29, 30, 26, 25, 28, 27 } TO PULLEYS ON COCKPIT FLOOR AT STN.No130·3

REFER TO DIAGRAM L

AFT SIDE OF PULLEYS

28, 27, 31, 30, 29 } CABLES PASS OUTBOARD TO STARBOARD TO PULLEY ASSY. AT NAVIGATORS SEAT BRACKET

REFER TO DIAGRAM N

26, 25 } CABLES PASS OUTBOARD TO PULLEY ASSY. AT PORT SIDE OF FLOOR BEAM AT STN. No148.

REFER TO DIAGRAM T

REF. D.H DRAWING No.10.20.C.E.3871.

N — KEY TO CABLE RUNS

OUTBOARD OF PULLEYS STBD.

28, 27, 31, 30, 29 } CABLES PASS OUTBOARD TO PULLEY ASSY. AT STBD. END OF FLOOR BEAM AT STN No.148.

REFER TO DIAGRAM O

INBOARD SIDE OF PULLEYS

28, 27, 31, 30, 29 } CABLES PASS INBOARD TO PULLEY ASSY ON FLOOR BEAM ON ℄ AIRCRAFT AT STN.No.148

REFER TO DIAGRAM M

REF D.H.DRAWING No 10 20.C.E.3871.

O — KEY TO CABLE RUNS

FORWARD SIDE OF PULLEYS

28, 27, 31, 30, 29 } CABLES PASS INBOARD TO PULLEY ASSY. AT THE NAVIGATORS SEAT BRACKET STN. No.148

REFER TO DIAGRAM N

OUTBOARD SIDE OF PULLEYS

28, 27 } AFT THROUGH CABLE SEAL AT BLKHD. No.176 0in. AND AROUND INBOARD SIDE OF PAIR OF PULLEYS LOCATED AT AFT SIDE OF SEALS, FROM AFT SIDE OF PULLEYS CABLES PASS OUTBOARD TO PULLEY ASSY. AT CENTRE WING NOSE RIB No.2 AND PULLEY ASSY AT RIB No 4. STBD.

31 AFT THROUGH CABLE SEAL AT BLKHD. No.176·0in. THROUGH FAIRLEAD AT SEMI-BLKHD.No.197·45in AROUND OUTBOARD SIDE OF PULLEY AND INBOARD TO THE EMERGENCY HYDRAULIC PUMP RELEASE MECHANISM

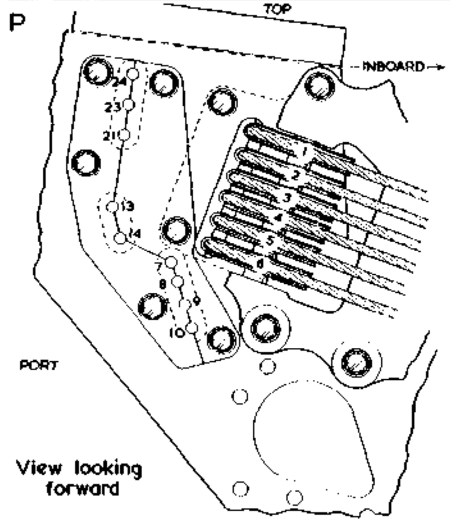
30, 29 } AFT THROUGH CABLE SEAL AT BLKHD. No 176·0in. AND FAIRLEAD AT SEMI-BULKHEAD AT STN No 197·45in. TO PULLEY ASSY. AT STN. No.232·34in. (DIAGRAM K).

REFER TO DIAGRAM (

REF. D.H. DRAWING Nos. 10 20 C.E 3871. 10.20.C.E.4001

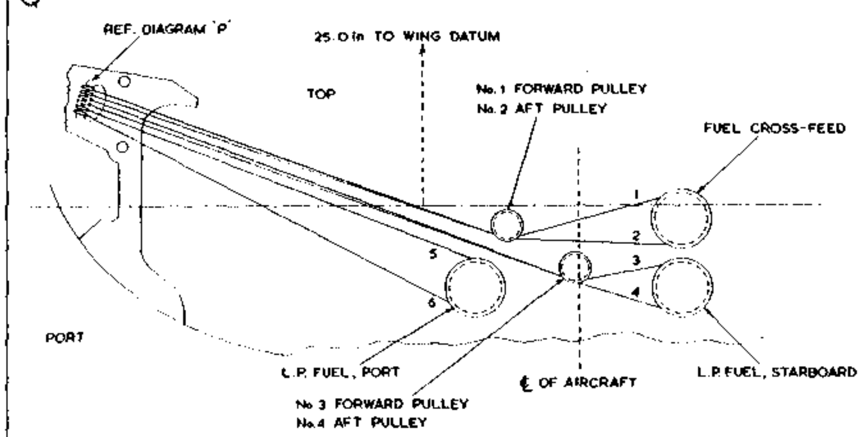
Fig.32 Auxiliary controls in fuselage (3)

RESTRICTED

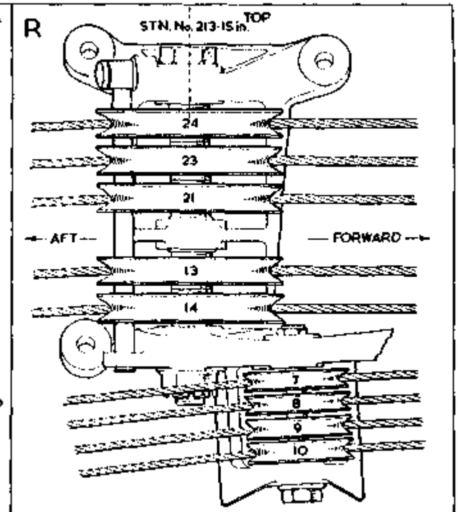


FAIRLEADS AT PORT SIDE OF SEMI-BULKHEAD AT STN. No. 197.45 in.

REF. D.H. DRAWING No. 10-20CE-4001A



FUEL COCK PULLEYS AT SEMI-BULKHEAD, STN. No. 197.45 in.
View looking forward
FUEL COCKS AFT OF PULLEYS HAVE BEEN OMITTED TO CLARIFY CABLE POSITIONS



PULLEY ASSY. AT STN No. 213.15 in ON PORT SIDE OF FUSELAGE
View looking outboard

KEY TO CABLE RUNS

FORWARD OF FAIRLEADS

CABLE RUNS

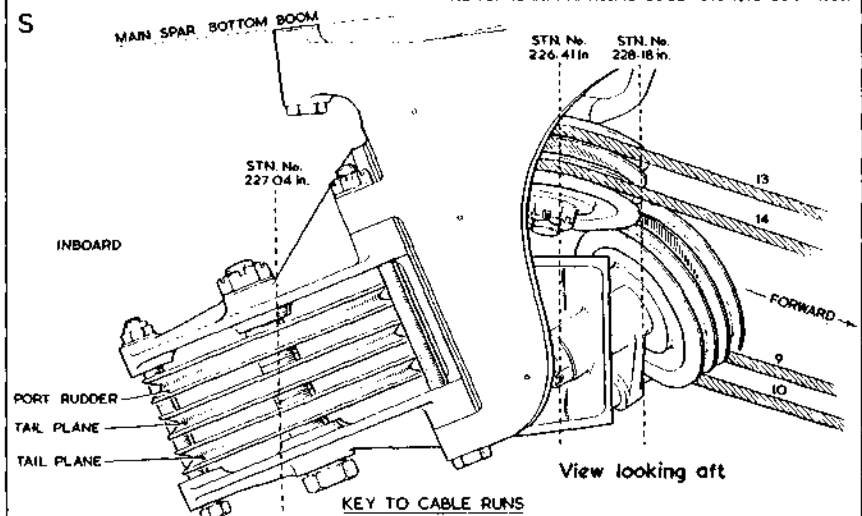
24, 23, 21, 1, 2, 7, 8, 9, 10	TO PULLEY ASSEMBLY AT STN. No. 131.0 in. PORT SIDE COCKPIT FLOOR VIA CABLE SEAL AT STN. No. 176.0 in. REFER TO DIAGRAMS 'G' AND 'E'
3, 4, 5, 6, 13, 14	TO PULLEY ASSEMBLY AT STN No. 114.5 in. PORT SIDE COCKPIT FLOOR REFER TO DIAGRAMS 'G' AND 'D'

AFT OF FAIRLEADS

1, 2, 3, 4, 5, 6	REFER TO DIAGRAM 'Q'
7, 8, 9, 10	AFT TO PULLEY ASSEMBLY AT STN. No. 212.0 in. REFER TO DIAGRAM 'R'
24, 23, 21, 13, 14	AFT TO PULLEY ASSEMBLY AT STN. No. 213.15 in. REFER TO DIAGRAM 'R'

REF: D.H. DRAWING No. 10-20WC-25255A

REF. D.H. DRAWING Nos. 10-20CE-1895A, 10-20CF-1355A



KEY TO CABLE RUNS

FORWARD		AFT	
9, 10, 13, 14	TO PULLEY ASSEMBLY AT STN No. 213.15 in. REFER TO DIAGRAM 'R'	9	UPWARD TO OUTBOARD SIDE OF AIR TEMP. CONTROL SPROCKET
		10	TO INBOARD SIDE OF AIR TEMP. SPROCKET
		13	TO PULLEY ASSEMBLY ON FRONT FIREWALL AT STN. No. 244.0 in.
		14	TO PULLEY ASSEMBLY ON FRONT FIREWALL AT STN. No. 244.87 in.

PULLEY ASSYS AT STN. No. 227.04, 226.41 and 228.18 in.

KEY TO CABLE RUNS

FORWARD

CABLE RUNS

24, 23, 21, 13, 14, 7, 8, 9, 10	TO FAIRLEADS AT SEMI-BULKHEAD AT STN. No. 197.45 in. PORT SIDE REFER TO DIAGRAM 'P'

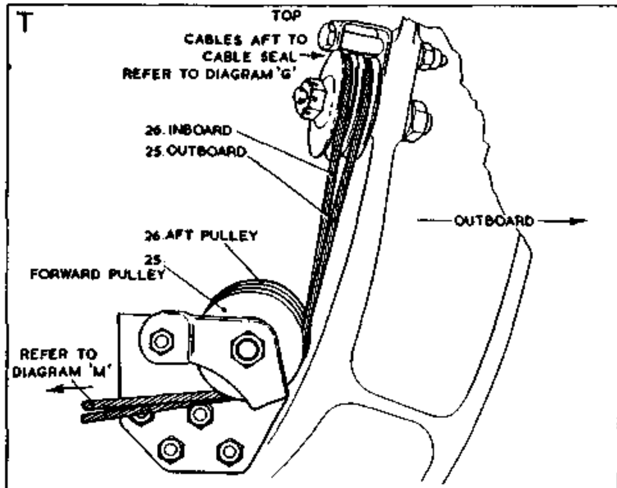
AFT

24, 23, 7, 8	INBOARD TO PULLEY ASSEMBLY AT LOWER BOOM RIB 'O'. REFER TO DIAGRAM 'U'
21	TO AIR BRAKE SELECTOR VALVE LEVER
13, 14	* TO PULLEY ASSEMBLY BELOW MAIN PORT WING SPAR AT STN. No. 226.41 in.
9, 10	* TO PULLEY ASSEMBLY BELOW MAIN PORT WING SPAR AT STN. No. 228.18 in.

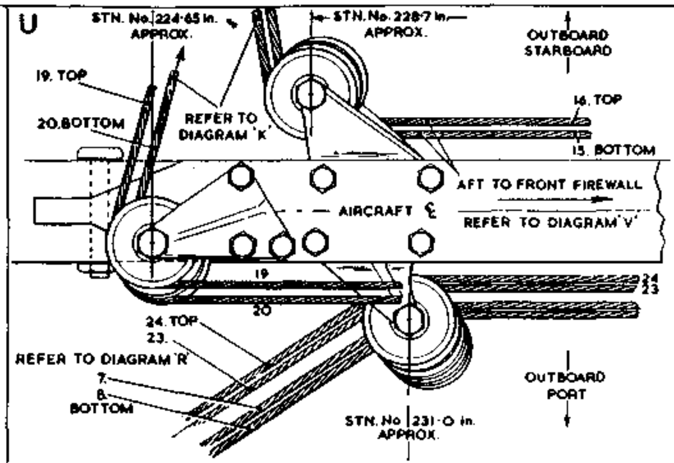
* REFER TO DIAGRAM 'S'

REF. D.H. DRAWING Nos. 10-20CF-1355A, 10-20CE-1095A, 10-20S-7015A

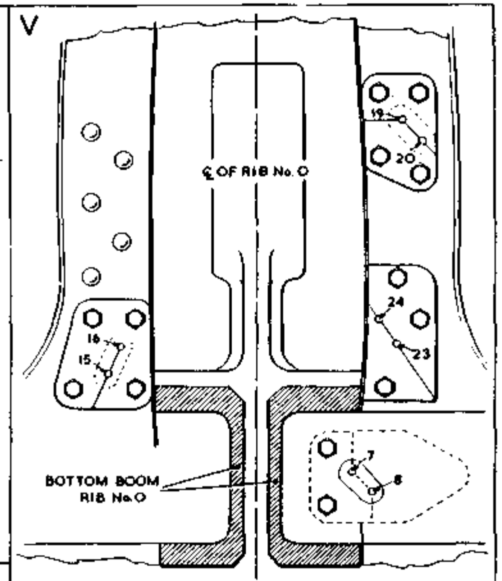
Fig. 33 Auxiliary controls in fuselage (4)



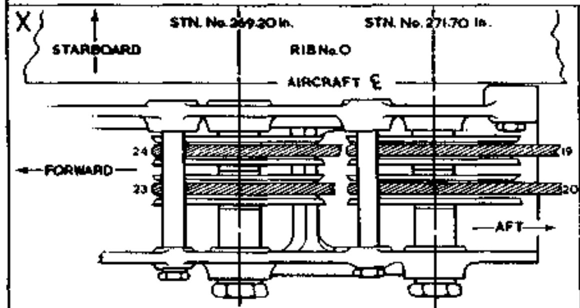
PULLEYS AT PORT SIDE OF CROSS BEAM STN. No.148·0 In.
View looking aft
REF. D.H. DRAWING No. 10·20 CE3871



PULLEY ASSEMBLIES AND CABLE RUNS AT RIB No.0 BOTTOM BOOM
Viewed from above
REF. D.H. DRAWING No. 10·20 CE 2141



CABLE FAIRLEADS ON FRONT FIREWALL
View looking aft on forward face



PULLEY ASSEMBLY AT STN. No. 269·20 in. and No. 271·70 in. PORT SIDE OF RIB No. 0 AFT OF FRONT FIREWALL
Viewed from above

KEY TO CABLE RUNS

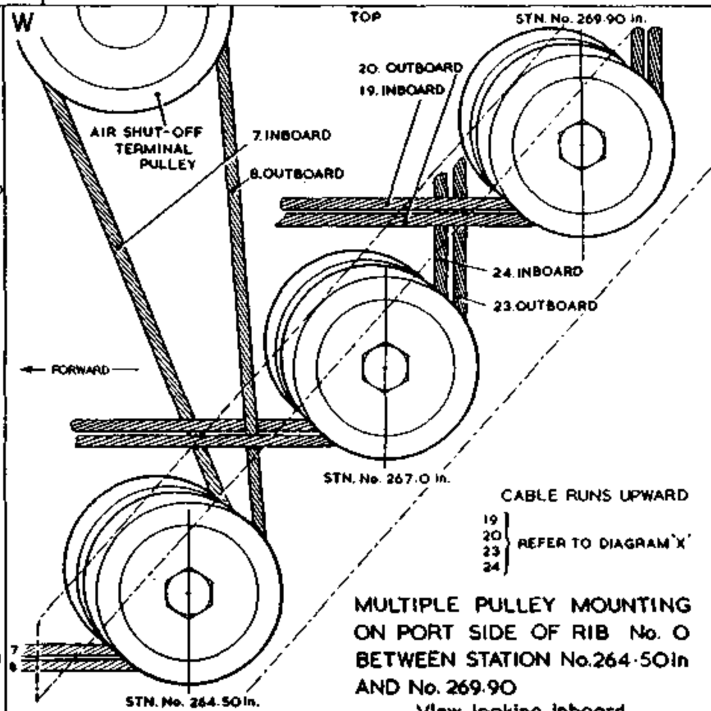
FORWARD

19, 20 } DOWNWARD TO MULTIPLE PULLEY ASSEMBLY AT STATION No. 267·0 in.
23, 24 } DOWNWARD TO MULTIPLE PULLEY ASSEMBLY AT STATION No. 269·0 in. REFER TO DIAGRAM 'W'

AFT

- 19 TO TOP SIDE OF FLAP TERMINAL PULLEY AT STATION No. 334·25 in.
- 20 TO BOTTOM SIDE OF FLAP TERMINAL PULLEY VIA JOCKEY PULLEY AT STATION No. 323·50 in.
- 23 TO AFT SIDE OF ARRESTING HOOK PULLEY AT STATION No. 371·48 in. VIA INBOARD JOCKEY PULLEY AT TOP AFT SIDE OF SPECTACLE BEAM
- 24 TO FORWARD SIDE OF ARRESTING HOOK PULLEY VIA OUTBOARD JOCKEY PULLEY AT TOP AFT SIDE OF SPECTACLE BEAM

REF. D.H. DRAWING No. 10·20 CE 2275



CABLE RUNS UPWARD

19, 20, 23, 24 } REFER TO DIAGRAM 'X'

MULTIPLE PULLEY MOUNTING ON PORT SIDE OF RIB No. 0 BETWEEN STATION No. 264·50 in AND No. 269·90
View looking inboard
REF. D.H. DRAWING No. 10·20 WC 15375

KEY TO CABLE RUNS

CABLE RUN — FORWARD — REFER TO DIAGRAM 'U'

CABLE RUN	
16, 15	TO PULLEY ASSEMBLY ON STARBOARD SIDE OF BOTTOM BOOM RIB No. 0
19, 20	TO FORWARD PULLEY ASSEMBLY ON PORT SIDE OF BOTTOM BOOM RIB No. 0
24	TOP PULLEY } TO PULLEY ASSEMBLY ON PORT SIDE OF BOTTOM BOOM RIB No. 0
23	MIDDLE TOP PULLEY
7	MIDDLE BOTTOM PULLEY
8	BOTTOM PULLEY

STARBOARD AFT SIDE OF RIB No. 0

- 16 TO INBOARD SIDE OF TERMINAL PULLEY, STATION No. 301·0 in. approx. AT STARBOARD SIDE OF RIB No. 0
- 15 VIA INBOARD SIDE OF JOCKEY PULLEY AT STATION No. 297·0 in. TO OUTBOARD SIDE OF TERMINAL PULLEY AT STATION No. 301·0 in. approx.

REF. D.H. DRAWING No. 10 20 CE 2619

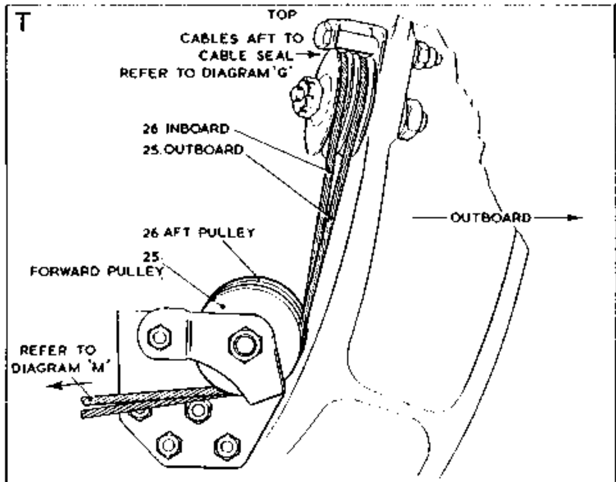
PORT SIDE OF RIB No. 0

19, 20, 24, 23, 7, 8 } TO MULTIPLE PULLEY MOUNTING ON PORT SIDE OF RIB No. 0
REFER TO DIAGRAM 'W'

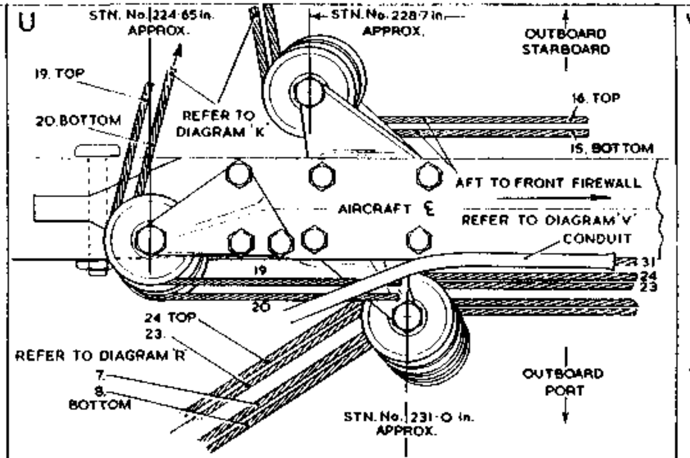
REF. D.H. DRAWING No. 10.20 E 3175

VIX.0304-62/RI

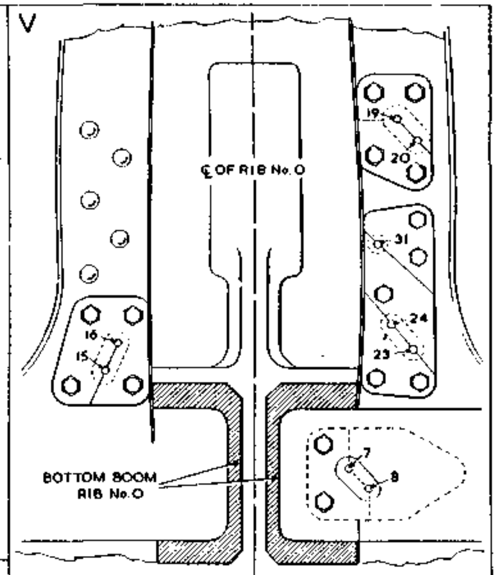
Fig. 34 Auxiliary controls in fuselage (5)
(pre Mod. 216)



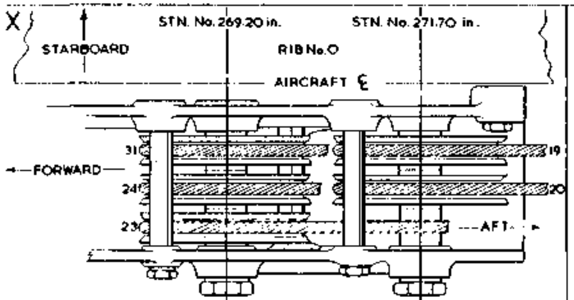
PULLEYS AT PORT SIDE OF CROSS BEAM STN. No. 148·0 in.
View looking aft
REF. D.H. DRAWING No. 10.20 CE3871



PULLEY ASSEMBLIES AND CABLE RUNS AT RIB No. 0 BOTTOM BOOM
Viewed from above
REF. D.H. DRAWING No. 10.20 CE 2141 AND 4573



CABLE FAIRLEADS ON FRONT FIREWALL
View looking aft on forward face



PULLEY ASSEMBLY AT STN. No. 269·20 in. and No. 271·70 in.
PORT SIDE OF RIB No. 0 AFT OF FRONT FIREWALL
Viewed from above

KEY TO CABLE RUNS

FORWARD

19, 20 – DOWNWARD TO MULTIPLE PULLEY ASSEMBLY AT STATION No. 267·0 in.

23, 24, 31 – DOWNWARD TO MULTIPLE PULLEY ASSEMBLY AT STATION No. 269·0 in. REFER TO DIAGRAM 'W'

AFT

19 TO TOP SIDE OF FLAP TERMINAL PULLEY AT STATION No. 334·25 in.

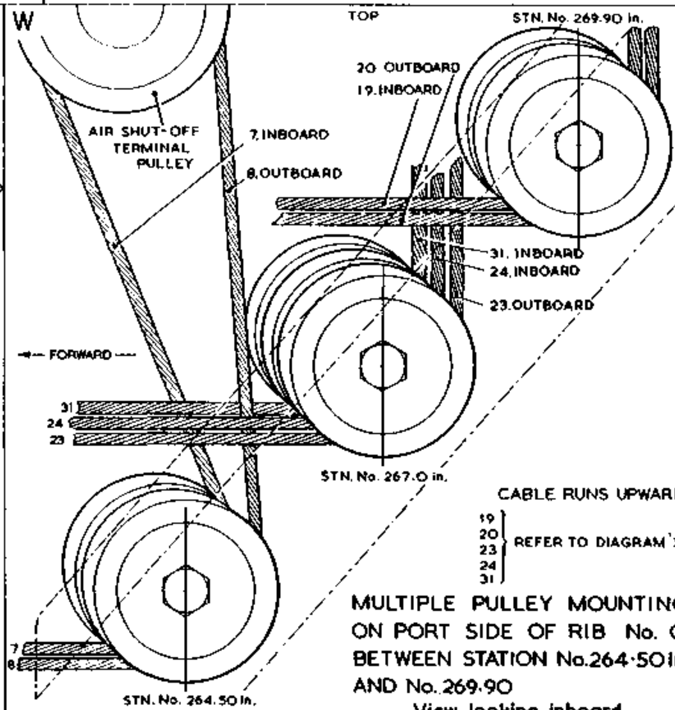
20 TO BOTTOM SIDE OF FLAP TERMINAL PULLEY VIA JOCKEY PULLEY AT STATION No. 323·50 in.

23 TO AFT SIDE OF ARRESTING HOOK PULLEY AT STATION No. 371·48 in. VIA INBOARD JOCKEY PULLEY AT TOP AFT SIDE OF SPECTACLE BEAM

24 TO FORWARD SIDE OF ARRESTING HOOK PULLEY VIA OUTBOARD JOCKEY PULLEY AT TOP AFT SIDE OF SPECTACLE BEAM

31 TO R.A.T. RELEASE MECH., VIA PULLEYS ON AFT SIDE OF SPEC. BEAM

REF. D.H. DRAWING No. 10.20 CE 2275



CABLE RUNS UPWARD

19, 20, 23, 24, 31 – REFER TO DIAGRAM 'X'

MULTIPLE PULLEY MOUNTING ON PORT SIDE OF RIB No. 0 BETWEEN STATION No. 264·50 in. AND No. 269·90
View looking inboard
REF. D.H. DRAWING No. 10.20 WC 15375

KEY TO CABLE RUNS

CABLE RUN	FORWARD REFER TO DIAGRAM 'U'
16, 15	TO PULLEY ASSEMBLY ON STARBOARD SIDE OF BOTTOM BOOM RIB No. 0
19, 20	TO FORWARD PULLEY ASSEMBLY ON PORT SIDE OF BOTTOM BOOM RIB No. 0
24	TOP PULLEY – TO PULLEY ASSEMBLY ON PORT SIDE OF BOTTOM BOOM RIB No. 0
23	MIDDLE TOP PULLEY – TO PULLEY ASSEMBLY ON PORT SIDE OF BOTTOM BOOM RIB No. 0
7	MIDDLE BOTTOM PULLEY – TO PULLEY ASSEMBLY ON PORT SIDE OF BOTTOM BOOM RIB No. 0
8	BOTTOM PULLEY – TO PULLEY ASSEMBLY ON PORT SIDE OF BOTTOM BOOM RIB No. 0
31	FROM CONDUIT – TO PULLEY ASSEMBLY ON PORT SIDE OF BOTTOM BOOM RIB No. 0

STARBOARD AFT SIDE OF RIB No. 0

16 TO INBOARD SIDE OF TERMINAL PULLEY, STATION No. 301·0 in. approx. AT STARBOARD SIDE OF RIB No. 0

15 VIA INBOARD SIDE OF JOCKEY PULLEY AT STATION No. 297·0 in. TO OUTBOARD SIDE OF TERMINAL PULLEY AT STATION No. 301·0 in. approx.

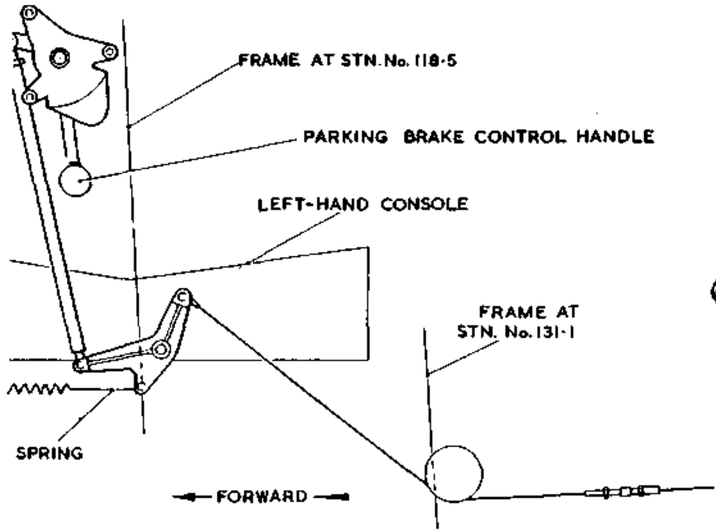
REF. D.H. DRAWING No. 10 20 CE 2619

PORT SIDE OF RIB No. 0

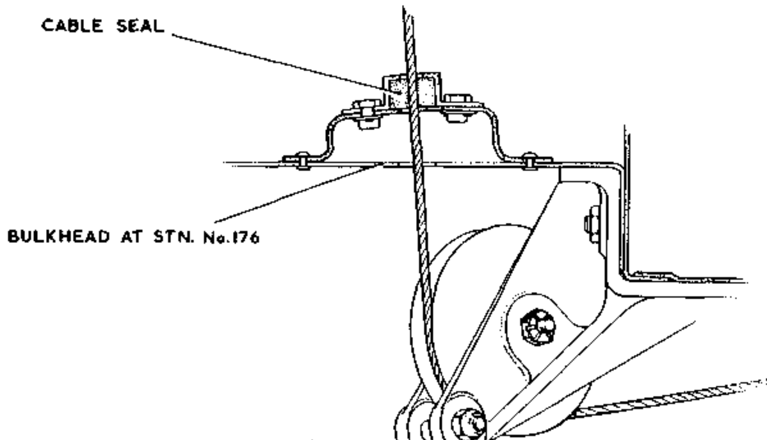
31, 19, 20, 24, 23, 7, 8 – TO MULTIPLE PULLEY MOUNTING ON PORT SIDE OF RIB No. 0
REFER TO DIAGRAM 'W'

REF. D.H. DRAWING No. 10 20 E 5535

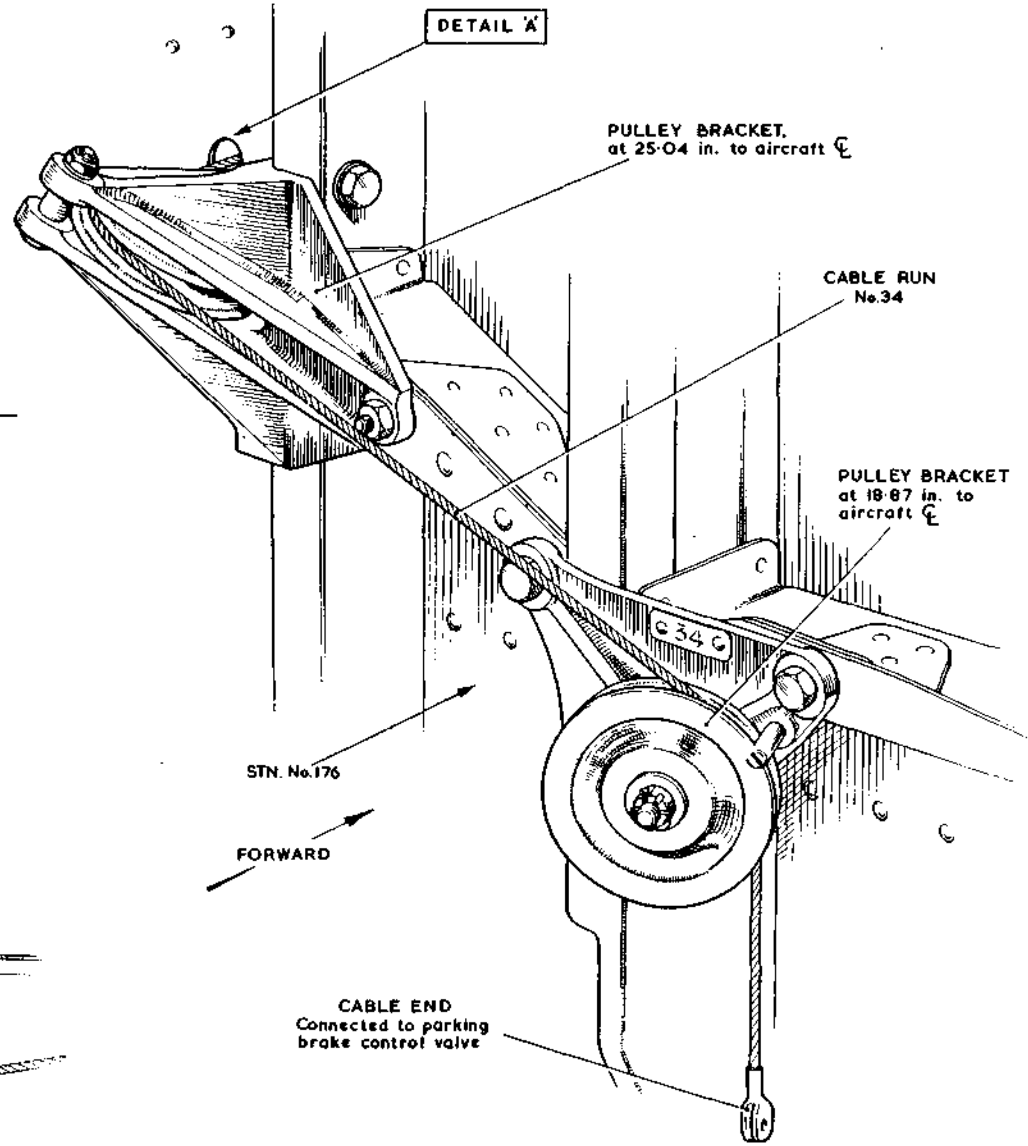
Fig. 35 Auxiliary controls in fuselage (6)
(post Mod. 216)



FORWARD END OF CABLE



DETAIL 'A'
CABLE SEAL IN BULKHEAD



AFT END OF CABLE

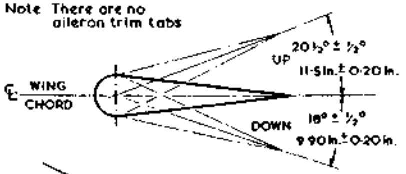
VIX-0304-64/R1

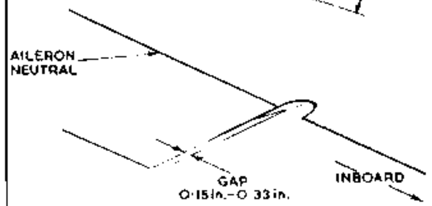
Fig. 36 Parking brake control circuit

AILERON MOVEMENTS

ANGLES MEASURED IN LINE OF FLIGHT

Note There are no aileron trim tabs





VIEW LOOKING UP AT AILERON

AILERON TRIM

STARBOARD AILERON HAS ADDITIONAL 4⅛°±½°(2·10in–2·70in) TRIM EACH WAY SUPERIMPOSED ON BASIC MOVEMENT CHECK THIS WITH AILERON NEUTRAL

AUTO-PILOT PORT AND STBD.

FULL TRAVEL {5°0' UP / 5°30' DOWN} ± ½°

WARNING. MICRO SWITCHES IN SAFETY CIRCUIT MUST OPERATE AT NO MORE THAN 3° 15' UP 3° 30' DOWN

Note. Difference between Port and Stbd must not exceed 0° 30'

TAIL PLANE MOVEMENTS

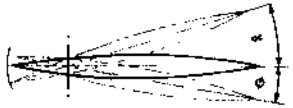
Note On initial rigging, checks to be made by T/P. rigging gauge (Item F2. Sect 2 Chap.4) placed on T/P. ribs No I (port and stbd.) and Clino mounted on gauge pads. Subsequent readings may be taken from calibrated scales on fins and T/P. fairings

TOLERANCES

*Stick angle ± 1°. T/P. angle ± 30' except in neutral position, when one end of T/P. should be 0° 00' and the other end 0° 00' ± 05' (ie Max. twist 0° 05') Max twist with T/P up (12° 30') is 0° 20'

RIGGING CHECK

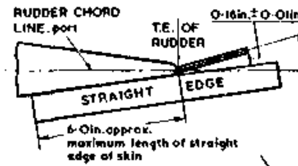
With stick and trim set at neutral, tail plane should also be at neutral in normal gear

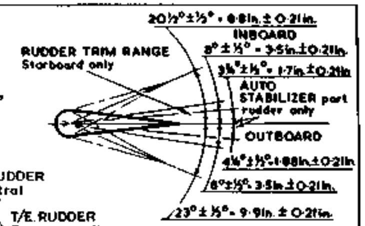


Note
Checks heavily outlined to be made only if remaining checks are unsatisfactory

Trim setting	NORMAL GEAR			RESTRICTED COARSE 0·26in. ACTUATOR EXTENSION			COARSE GEAR		
	STICK ANGLE	T.P. ANGLE		STICK ANGLE	T.P. ANGLE		STICK ANGLE	T.P. ANGLE	
Neutral trim	Neutral	0°0	*	Neutral	0° 15'	α	Neutral	0° 15'	ϕ
	5°45' Fwd.	3° 20'	ϕ	5° 45' Fwd	3° 20'	ϕ	4° 10' Fwd.	3° 30'	ϕ
	12°30' Aft	10° 30'	α	12° 30' Aft	11° 50'	α	10° Aft	12° 30'	α
Negative trim	Neutral	3° 40'	α	Neutral	4° 30'	α	Neutral	7° 20'	α
	5° 45' Fwd.	1° 30'	ϕ	5° 45' Fwd	1° 20'	ϕ	5° 45' Fwd.	1° 30'	ϕ
	9° Aft	12° 30'	α	8° 10' Aft	12° 30'	α	4° Aft	12° 30'	α
Positive trim	Neutral	0° 45'	ϕ	Neutral	0° 45'	ϕ	Neutral	1° 55'	ϕ
	5° 45' Fwd	3° 10'	ϕ	5° 45' Fwd.	3° 20'	ϕ	3° Fwd.	3° 30'	ϕ
	12° 30' Aft	7° 30'	α	12° 30' Aft	8° 20'	α	12° 30' Aft	11° 55'	α

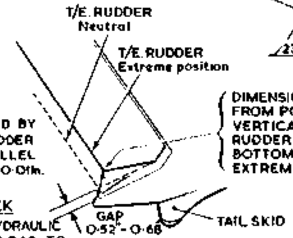
RUDDER MOVEMENTS





RUDDER FIXED TAB SETTING

RUDDER FIXED TAB TO BE SET 17° ± ½° INBOARD ON BOTH RUDDERS, FROM RUDDER CHORD LINE. 17° ANGLE MAY BE CHECKED BY PLACING STRAIGHT EDGE ON RUDDER PROFILE AT RIB STATIONS PARALLEL TO RIBS AND CHECKING 0·16in. ± 0·01in. DIMENSION



DIMENSIONAL CHECKS TAKEN FROM POINT ON FAIRING VERTICALLY BELOW T/E. OF RUDDER IN NEUTRAL TO BOTTOM T/E. OF RUDDER IN EXTREME POSITIONS

RUDDER DEFLECTION CHECK

WITH RUDDER NEUTRAL AND HYDRAULIC POWER ON, APPLY A 25lb SIDE LOAD TO THE TRAILING EDGE OF RUDDERS. MAXIMUM DEFLECTION ALLOWED IS 0·20 IN.

Note: When rudder movements are being checked care should be taken that the rudder trim is in neutral

TAIL PLANE TAB MOVEMENTS

(ELEVATOR)

Note. There are no elevator trim tabs

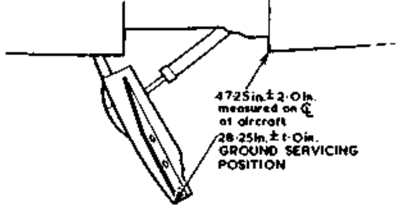
FLAP	TAIL PLANE ANGLE	ELEVATOR ANGLE RELATIVE TO TAIL PLANE
DOWN	Neutral	6° 0' ± ½°
	3° 30' Down	1° 0' ± 1°
	11° 50' Up	26° 30' ± 1°

Note. Tail plane control in restricted coarse gear

UNDER NORMAL FLIGHT CONDITIONS WITH FLAPS CLOSED. ELEVATOR AND TAIL PLANE REMAIN IN LINE AND MOVE TOGETHER

AIR BRAKE MOVEMENTS

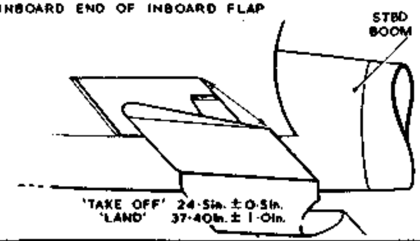
AIR BRAKE MOVES DOWNWARDS THROUGH 50° ± 2°



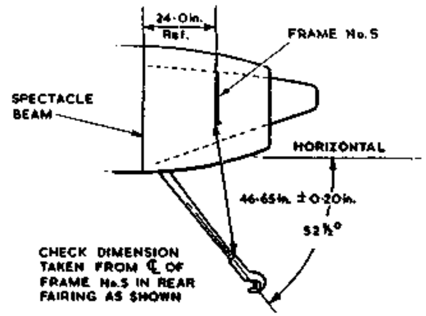
NOMINAL FLAP MOVEMENTS

BOTTOM SURFACE OF FLAP MOVES FROM CLOSED POSITION THROUGH 20° ± 2° TO 'TAKE OFF' POSITION AND 37° ± 2° TO THE DOWN POSITION MEASURED ALONG LOWER INBOARD EDGE OF INBOARD FLAP IN UP AND DOWN POSITION

DIMENSIONAL CHECK TO BE TAKEN AS SHOWN AT INBOARD END OF INBOARD FLAP



ARRESTER HOOK



EXTERNAL CONTROL LOCKING

NO EXTERNAL LOCKING DEVICES ARE PROVIDED FOR THE AILERON, RUDDER AND ELEVATOR SURFACES AS THESE ARE ALL GOVERNED BY POWER OPERATED CONTROL SYSTEMS. FOR LONG TERM PARKING, FLAPS MUST BE UP AND ELEVATOR THEN REMAINS AUTOMATICALLY LOCKED IN LINE

BREAK-OUT LOADS

RUDDER: PORT 12 lb. ± 1 lb. STBD. 12 lb. ± 1 lb.
Measured at aft end of rudder pedals

TAIL PLANE: FWD. 5 lb. ± ½ lb. AFT 5 lb. ± ½ lb.

FULL AILERON: PORT 10 - 18 lb. STBD. 17 - 24 lb.

AILERON: PORT 2 lb. ± ½ lb. STBD. 2 lb. ± ½ lb.

BOTH TAIL PLANE AND AILERON BREAK-OUT LOADS TO BE MEASURED AT A POINT 6 IN. ABOVE FULCRUM OF CONTROL COLUMN HEAD

AIRCRAFT LEVELLING

FOR RIGGING AND OTHER PURPOSES

JACK OR TRESTLE AIRCRAFT SO THAT LEVELLING BAR (Item F3, Sect.2, Chap.4) IS LEVEL (USED WITH THE HANDLE ASSEMBLIES INSERTED IN THE BUSHES ON FRAME 49 AND STARBOARD SIDE OF FUSELAGE) THE BOOM TRESTLES ARE ONLY A SAFETY SUPPORT AND MUST NOT BEAR ANY AIRCRAFT WEIGHT.

Fig.37 Flying controls rigging diagram

◀ Air brake movement amended - mod. 1030 ▶

SERVICING

WARNING...

(1) Prior to the operation of any of the flying controls care should be taken to ensure the safety of all personnel working on the aircraft. These precautions can take the form of guard rails and/or notices to the effect that HYDRAULIC FUNCTIONS ARE TAKING PLACE thus warning those concerned in servicing the aircraft to keep clear of the moving surfaces. Tools, rigging pins and all other foreign bodies must be kept clear of the surfaces and operating mechanisms, and great care exercised in ensuring that all rigging gauges are removed before hydraulic power is applied to the controls. These warnings apply particularly in the region of the fins and the gearing units in the cockpit. Failure to take adequate safety precautions in areas where clearances between the structure and the power operated controls is small can result in very severe injury.

(2) No attempt should be made to move the control column or rudder pedals or apply trim to any of the flying control surfaces, unless hydraulic power is applied to the relevant servo control units. Failure to observe this precaution may result in damage to the trims or strain on the various control linkages.

(3) The over-ride plunger must never be used when spreading the wings without first ensuring that all flaps (inner, centre and outer) are mechanically locked in the UP position, and the locking slider (Fig.34, Sect.3, Chap.2) on rib 4A has sprung fully out. Failure to observe this precaution when using the over-ride plunger may result in structural damage to the flap high-speed shaft-assembly.

General

189. Before commencing the rigging of the flying control systems, excepting that of the flaps, the aircraft must be securely jacked and trestled in accordance with the instructions laid down in Sect. 2, Chap. 4. Power operation of the flying controls requires that an officially approved hydraulic test rig be connected to the aircraft hydraulic system (item H 22, Sect. 2, Chap. 4); the hydraulic test rig must be attached to the Yellow and Blue systems as indicated in Sect. 3, Chap. 6, fig. 12. A suitable electric supply of 28 volts d. c., must also be attached to the aircraft electrical system as indicated in Book 2, Cover 1, Sect. 5, Chap. 1, Group A. 1.

190. The ballooned numbers on figs. 38 to 44, 46 and 47 refer to the paragraph numbers in the sequence of operations, with the Fig. No. added if the operation is on a different figure. The numbers quoted against the rigging pins, are the part numbers of the pins with the 10-20Y prefix omitted.

191. Cable tension measurements should be taken using a tensiometer, with the instrument's appropriate risers, (item H25, Sect. 2, Chap. 4). Instructions for the use of these tensiometers are included in the individual carrying cases supplied with the instrument. As slight variations occur in each instrument, care should be taken that each is returned to its own particular case.

Rigging the aileron control circuit (fig. 38 to 41).

192. Paragraphs 6 - 48 of this section and chapter describe the general layout of the component parts comprising the aileron control circuit together with the routing of the cables around the various pulley assemblies. With all the mechanical parts correctly mounted and the cable circuit loosely routed around the pulleys, the procedure to be followed is shown on fig. 38, 39, 40 and 41.

193. Successful rigging of the aileron circuit is dependent upon careful attention to detail and observance of the sequence of operations as detailed on the various stages. Removal of friction from the circuit by vibrating the cables, when tensioning is also of primary importance if equality of tension is to be achieved.

194. Should it be found necessary to change the autopilot actuator in either wing, the actuator should be functioned hydraulically and electrically and the neutral length of the ram set to give a dimension of 11.430 in. to 11.444 in. (This dimension to be measured from centre to centre of the attachment bearings).

Rigging the tail plane control circuit (fig. 42 - 45).

195. Paragraphs 49 to 102 give a general description of the tail plane control circuit and describe where the various components are located. For

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RIGGING AILERON CONTROL CIRCUIT

continued overleaf

◀RIGGING AILERON CONTROL CIRCUIT, STAGE 1 (Fig. 38)

◀ **SEQUENCE OF OPERATIONS**
(to be strictly adhered to)

(1) Place aileron manual gear change, at top of control column, in normal gear by rotating the hand-wheel fully anti-clockwise (fig. 40).

(2) Insert rigging pins (Item F5, Sect. 2, Chap. 4) as follows:—

(a) No. 5255 in port Teleflex cable tension regulator.

(b) No. 5257 in starboard Teleflex cable tension regulator.

(c) No. 5253 in aileron variable gearing unit.

(d) No. 5261 in control column stick head.

(3) If rigging pin No. 5261 cannot be inserted with rigging pin No. 5253 in position, adjust the connecting rod between the variable gearing unit and the stick head.

(4) Check that the threads and brake of the cable tension regulators are free from substances which could cause sticking of the threads or slipping of the brake e.g. PX-3 or grease. Check that the regulators can be partly compressed by hand without using excessive force.

(5) Fully collapse both regulators using locally manufactured collapsing jigs (Item K142, Sect. 2, Chap. 4).

(6) Tension all turnbuckles until screw threads are in safety. It should be possible to slightly slacken turnbuckles without removing threads from safety.

(7) Using tensiometer (Item H25, Sect. 2, Chap. 4), adjust turnbuckles B and C, in port and starboard wings, to tension all cables to 40–42 lb. Constantly vibrate cables to remove circuit friction.

Note . . .

(1) *Do not twist cables, and ensure that turnbuckle lock-nuts are tight before operating cables.*

(2) *Reserve adjustment of turnbuckles A and C in air brake bay for subsequent tension adjustments.*

(8) Remove rigging pins, checking that they withdraw freely without any tendency for the regulators to spring to a new position. If this occurs, the tensions must be equalized by repeating operation (7).

(9) Oscillate the stick head to remove circuit friction.

(10) Refit the rigging pins as in operation (2) except No. 5253.

(11) Repeat operations (7), (8), (9) and (10) until all cables are tensioned between 40–42 lb., and there is no movement of the regulators when withdrawing and inserting the rigging pin.

(12) Remove regulator collapsing jigs.

(13) Slightly reduce cable tensions, at wing turnbuckles B and C, by equal amounts until the tension is 38 ± 1 lb. and all cables are within 1 lb. of each other. Check that the regulator springs are just free of the fully collapsed position; if they are not, repeat operation (7) with a slightly higher initial tension.

(14) Oscillate the stick head to remove circuit friction.

(15) Check all cable tensions and adjust until all are 38 ± 1 lb. and are within 1 lb. of each other.

(16) Repeat operations (14) and (15) until, with the regulator springs just free of the collapsed position, the cable tensions are 38 ± 1 lb. and within 1 lb. of each other.

(17) Refit rigging pins as in operation (10), and check that there is no movement of the regulators when inserting and withdrawing the pins.

(18) Check that cable tensions are 38 ± 1 lb. and are within 1 lb. of each other.

(19) Check turnbuckles for safety, check tighten all locknuts, and wirelock.

(20) Remove rigging pins if stage 2 of rigging is not to be undertaken immediately. ▶

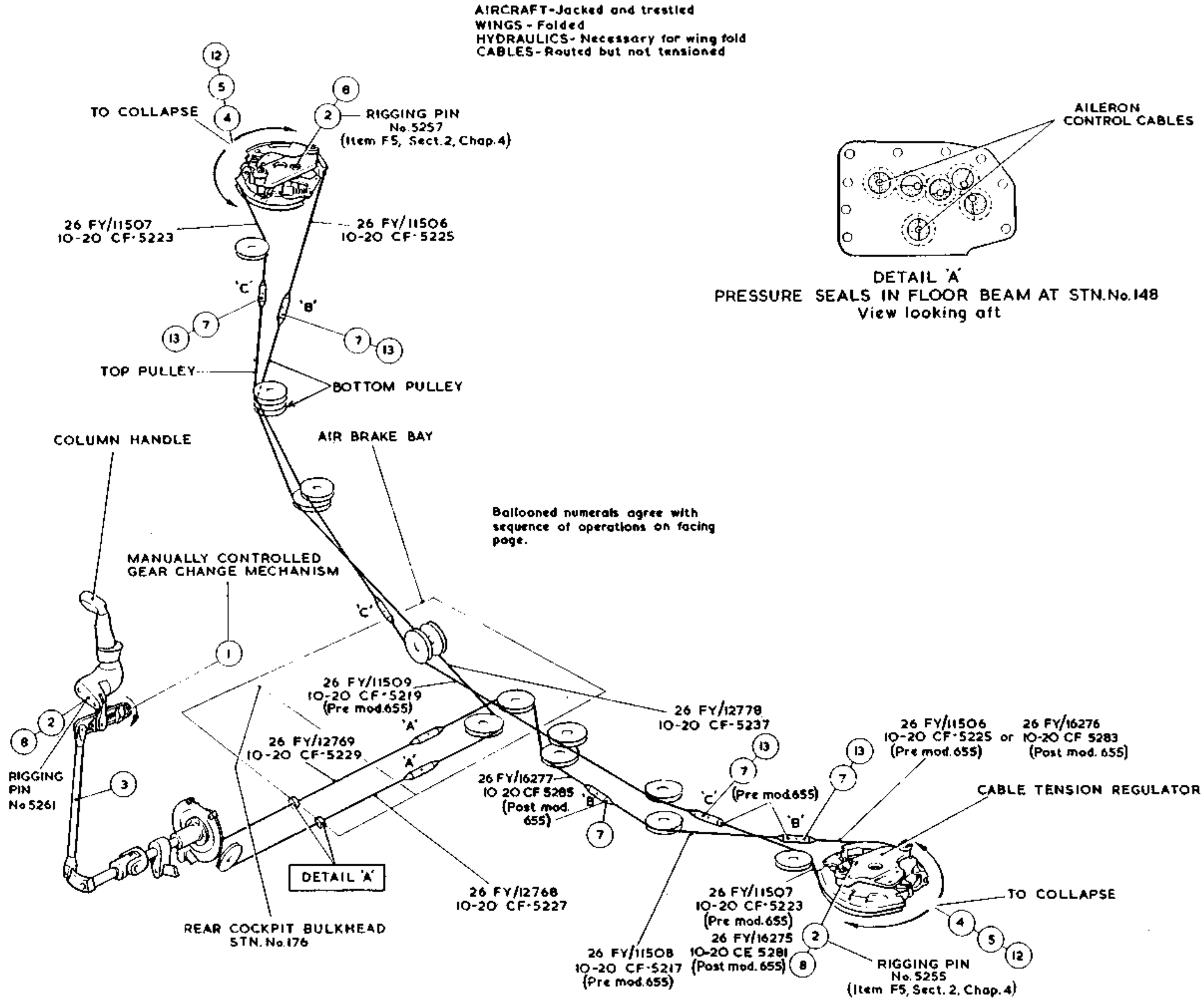


Fig. 38. Rigging aileron control circuit, stage 1
(BALLOONED NUMBERS AMENDED)

AIRCRAFT - Jacked and trestled
WINGS - Spread
HYDRAULICS - Approved test rig connected
ELECTRICS - Approved 28 volt supply connected

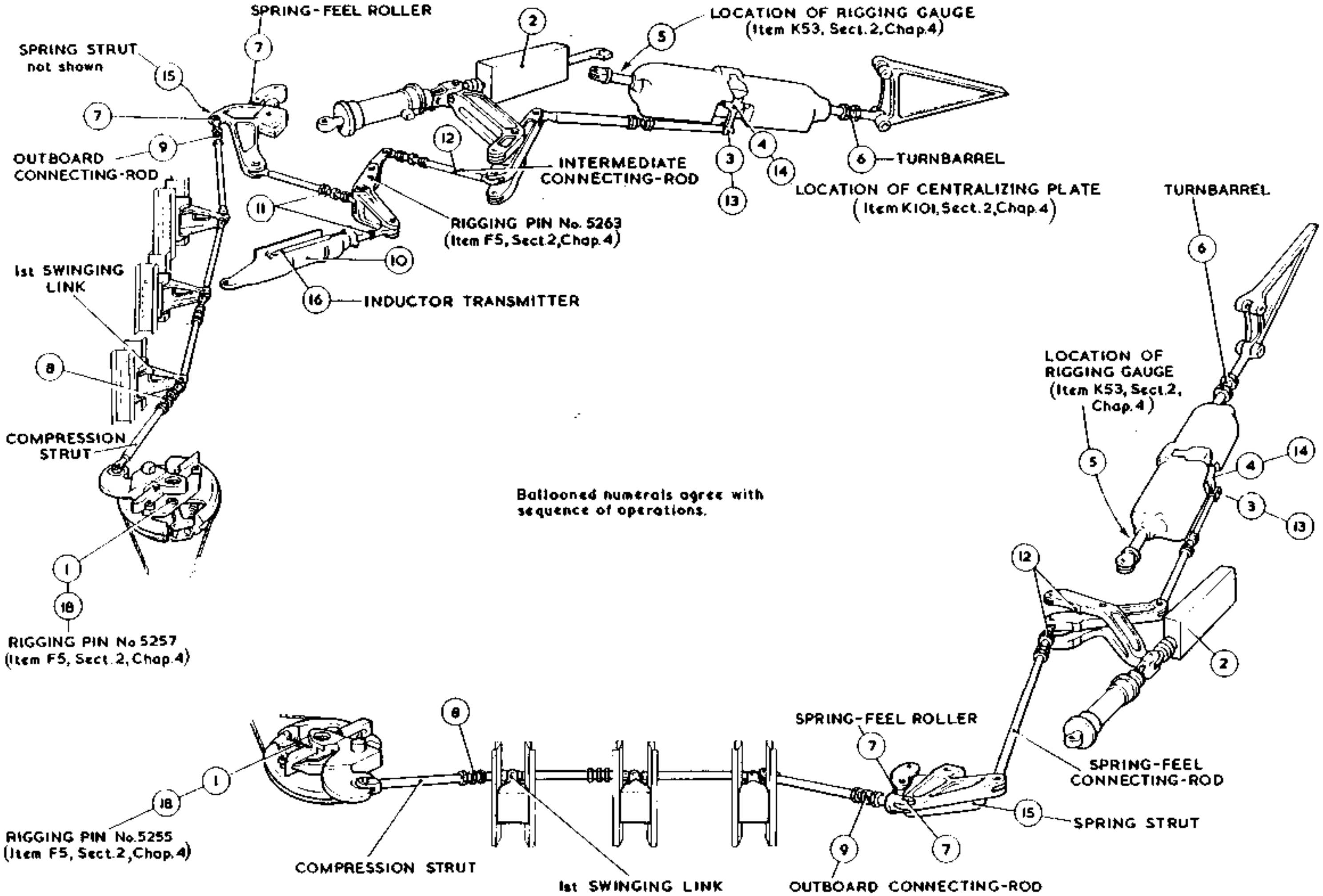
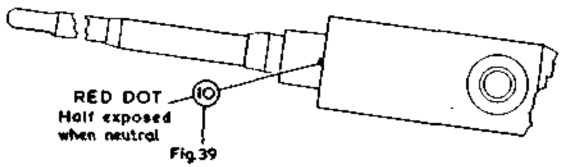
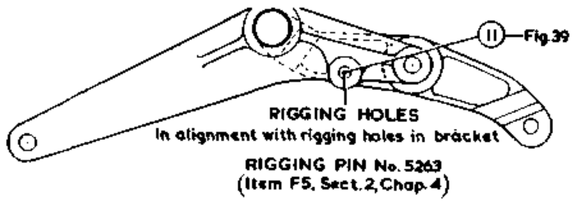


Fig. 39. Rigging aileron control circuit, stage 2

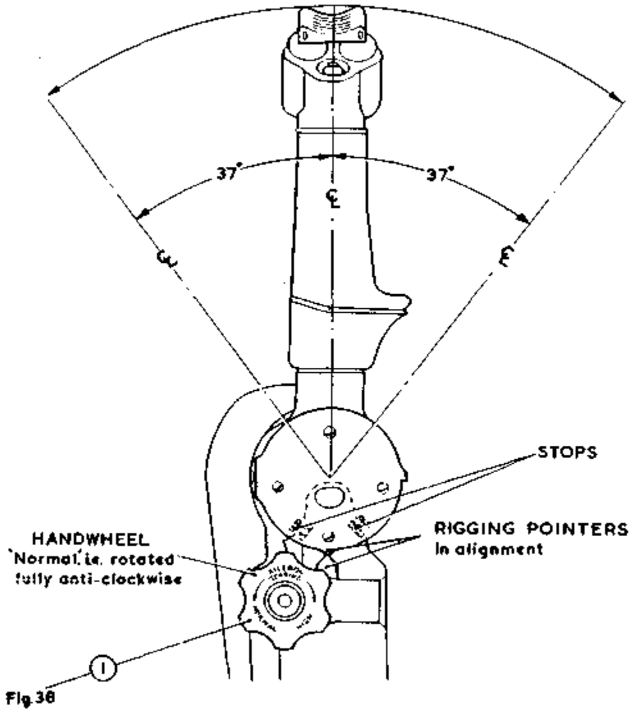
◄BALLOONED NUMBERS AMENDED►



ELECTRICAL TRIM ACTUATOR Starboard only



DUAL LEVER ASSEMBLY Starboard only



CONTROL COLUMN HANDLE

(1) Ensure that no obstructions exist at the trailing edge of the extension wings which can in any way prevent the full movement of the ailerons.

(2) Using the hand pump on the hydraulic test rig.
CAREFULLY move the aileron control handle and check the complete aileron circuit for freedom of movement.
WARNING The aileron control handle should not be operated with the hydraulic power OFF and the wings SPREAD.

(3) Using the hand pump on the hydraulic test rig.
Set the aileron control handle fully to PORT.
Retaining the handle in this position, take a linear measurement from the trailing edge of the STARBOARD wing to the trailing edge of the aileron. With the aileron fully DOWN the dimension obtained should read 9.90 in. ± 0.20 in. Any discrepancy in this dimension can be rectified by adjusting the AFT stop located on the STARBOARD bell-crank compensator casting at rib No. 4a.
Note... It will be found necessary to fold the extension wings to obtain access to the stops at the drive transfer mechanism.

(4) Using the hand pump on the hydraulic test rig.
Set the aileron control handle full travel to STARBOARD.
Retaining the handle in this position, check the linear measurement of the DOWN movement of the PORT aileron. (similar to 3). Any discrepancy in this dimension can be rectified by adjusting the AFT stop located on the PORT bell-crank compensator casting at rib No. 4a.

(5) Using the hand pump on the hydraulic test rig.
Retaining the aileron control handle full travel to STARBOARD. Take a linear measurement from the trailing edge of the STARBOARD wing to the trailing edge of the aileron. With the aileron fully UP the dimension obtained should read 11.50 in. ± 0.20 in. The FORWARD stop on the STARBOARD bell-crank compensator casting should now be adjusted in order that a clearance of 0.031 in. exists between the stop and the stop face of the bell-crank lever (fig. 41).

(6) Using the hand pump on the hydraulic test rig.
Set the aileron control handle full travel to PORT.
Retaining the handle in this position a dimensional check (similar to 5) can be taken of the fully UP position of the PORT aileron. The FORWARD stop on the PORT bell-crank compensator casting should now be adjusted to give a similar clearance of 0.031 in. between the stop and the stop face of the bell-crank lever.

◀ Note...
The aileron stops on the control column must be two turns clear at full travel. ▶

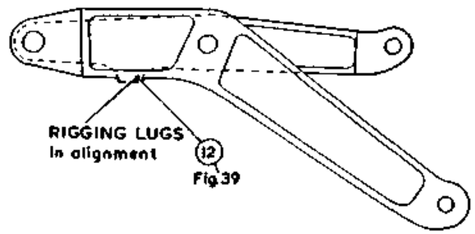
(7) Using normal power from the hydraulic test rig, check the aileron break-out loads measured 6 in. above the fulcrum of the control column handle. The correct load from neutral is 2 lb. ± ½ lb., increasing to 10-18 lb. at full port travel, and to 17-24 lb. at full starboard travel. Adjust the spring struts to achieve these loads. (Mod. 1121 introduces modified spring struts to give increased adjustment).

(8) Operate the aileron control handle and recheck all surface movements and neutrals.

(9) Lock up all components that have been disturbed to carry out the above functions. Wire-lock stops at wing fold.

AILERON TRIM

(10) Using normal power from hydraulic test rig and normal 28 volts electric supply. Set aileron control handle to neutral. Operate the aileron trim switch on the left hand console (on later aircraft this switch is located on the top of the control column hand grip) and check that the STARBOARD aileron moves in the correct sense. With the aileron trim actuator fully extended or retracted the linear measurement of the aileron movement should be 2.10 in. to 2.70 in. (UP and DOWN). Check setting of Inductor transmitter (on aileron trim actuator) in conjunction with visual indicator on the L.H. console.

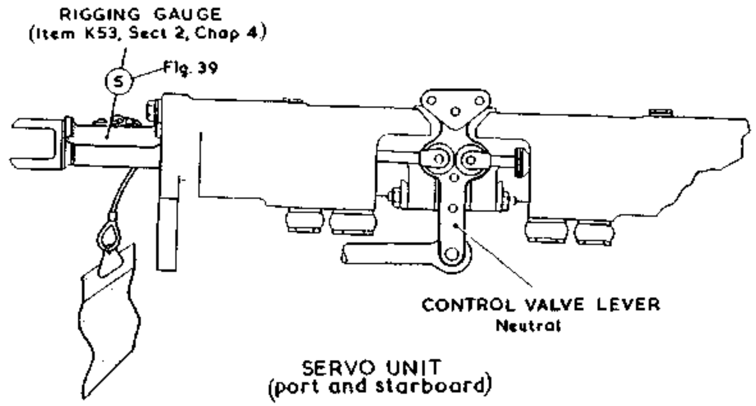


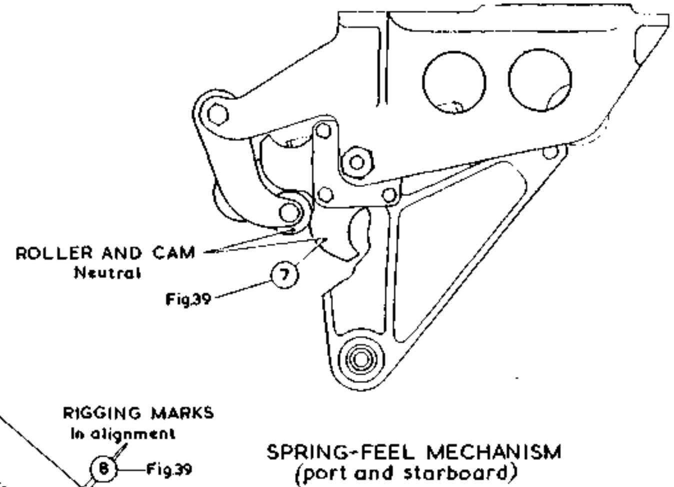
AUTOPILOT DUAL LEVER ASSEMBLY
Port and starboard

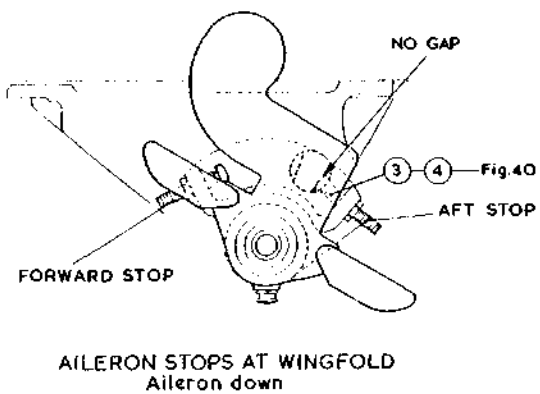
WARNING. **Before a flying control system is hydraulically operated, the system must be bled as laid down in Sect.3, Chap.6**

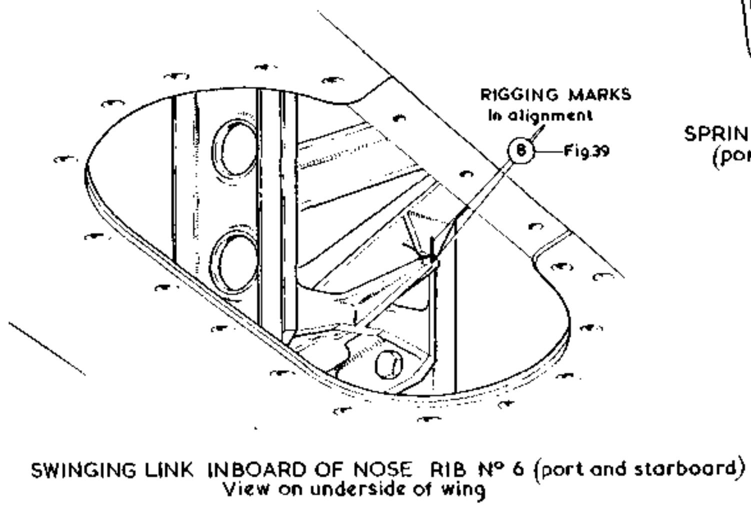
Fig. 40. Rigging aileron control circuit, stage 3 (1)

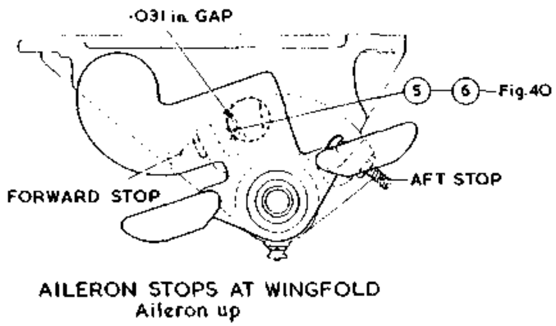
◀BALLOONED NUMBERS AMENDED▶











(ii) AILERON AUTOPILOT

Using normal power from hydraulic test rig and normal 28 volt electric supply.
Switch ON the Flight Instrument switch on panel 0.
Switch ON Rudder and Elevon switches on Autopilot panel
Turn selector switch to height, speed or Mach number.
Press engagement button on Autopilot panel.
Operate the Autopilot trim switch, on the R.H. console.
Retaining the switch either fully to PORT or STARBOARD, take a linear measurement between the trailing edge of the aileron and the trailing edge of the wing.
With the aileron in the full travel UP position the dimension should read 2.80 in. ± 0.30 in. In the full travel DOWN position the dimension should read 3.10 in. ± 0.30 in.
Further information relating to the Autopilot can be found in A.P.1409P.

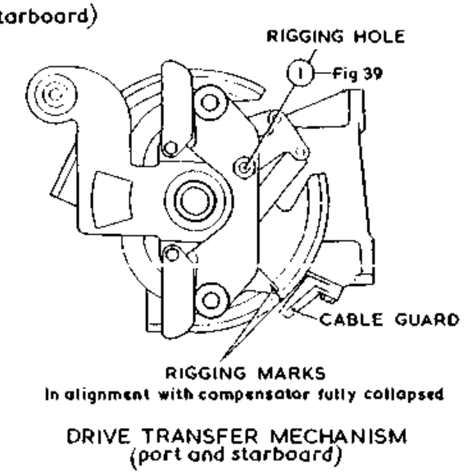


Fig. 41. Rigging aileron control circuit, stage 3 (2)

◀BALLOONED NUMBERS AMENDED▶

the purpose of rigging, the circuit may be divided into two sections, firstly, the part located in the fins and secondly, the part in the cockpit, with the main cables joining the two. Basically, the rigging involves placing each unit into the position it should occupy when the tail plane is neutral, then making the various connections and finally adjusting to suit.

WARNING...
The precautions detailed in the WARNING preceding para.189 must be taken during tail plane rigging and testing. Under no circumstances must the variable gearing mechanism forward of the control column be dismantled or adjusted. Before commencing work on the circuit, care should be taken that the Blue and Yellow hydraulic systems have been exhausted.

196. With the installation and pre-rigging of the trim unit, Mach gear change unit, variable gearing mechanism and cable compensators undisturbed, the cables correctly routed but loosely connected and only the turnbarrel ends of the adjustable connecting rods disconnected, the procedure for rigging the circuit is as given in fig. 42, 43 and 44. The first two illustrations give the rigging of the components in the fins and of the inter-connecting cables across the tail plane and the last one gives the rigging of the cockpit components and the main cable runs. Fig. 45 shows the location of all the cable and pulley assemblies in the complete circuit.

197. With the exception of the cables across the tail plane all the cables in the circuit are 15 cwt. The cables across the tail plane are each composed of three parts, the centre section being 15 cwt. but the ends, which pass over the small pulleys at the tail plane pivot, are 10 cwt. As shown in fig. 45, these cables cross over between the port tail plane pivot and the pulleys at tail plane port rib No. 4, with the cable from the forward face of the Mach gear change cable drum passing over the cable from the rear face. To obtain access to the variable gearing mechanism, viscous damper and g-weight it will be necessary to remove the pilot's seat and false floors.

Rigging the rudder control circuit (fig. 46 - 48)

198. Paragraphs 103 to 136 give a general description of the rudder control system and the location of the various components. For the purpose of rigging, the circuit may be divided into three sections as illustrated in fig. 46, 47 and 48. Fig. 46 deals with the section of the circuit which has all its component parts located in the cockpit, fig. 47 deals with the rigging of the mechanical details located in the fins and fig. 48 shows the location of the cable and pulley assemblies connecting the mechanisms located in the cockpit and the fins.

WARNING...
The precautions detailed in the WARNING preceding para. 189 must be taken during rudder rigging and testing. Prior to commencing work on the circuit, it should be ensured that the pressure in the Blue and Yellow hydraulic systems has been exhausted. With these systems exhausted, neither the rudder trim actuator (in the starboard fin) nor the autostabilizer actuator (in the port fin) should be electrically functioned, unless the eye end of the ram of the relevant actuator is disconnected. Failure to observe this precaution may result in the burn-out of the actuator or damage to the control valve lever of the servo control unit to which the ram is connected.

199. With the installation and pre-rigging of the major components undisturbed and the cable runs correctly routed but loosely connected, the procedure for rigging the circuit is as given in fig. 46 and 47. To obtain access to the rudder cable drum and Q-pot it will be necessary to remove the pilot's seat and false floors.

RIGGING THE FLAP CONTROL CIRCUIT (fig. 49 - 51)

WARNING...
(1) When the drive from the cable drum on rib 0 is dismantled or adjusted, do not disturb the tail plane tab control rigging.

(2) If the tail plane tab controls are disconnected to facilitate the flap rigging, it is essential to keep the cables taut during any movement of the flaps, to prevent the chain riding off the tab operating sprocket.

(3) When the fireguards are refitted after adjustments to the flap selector

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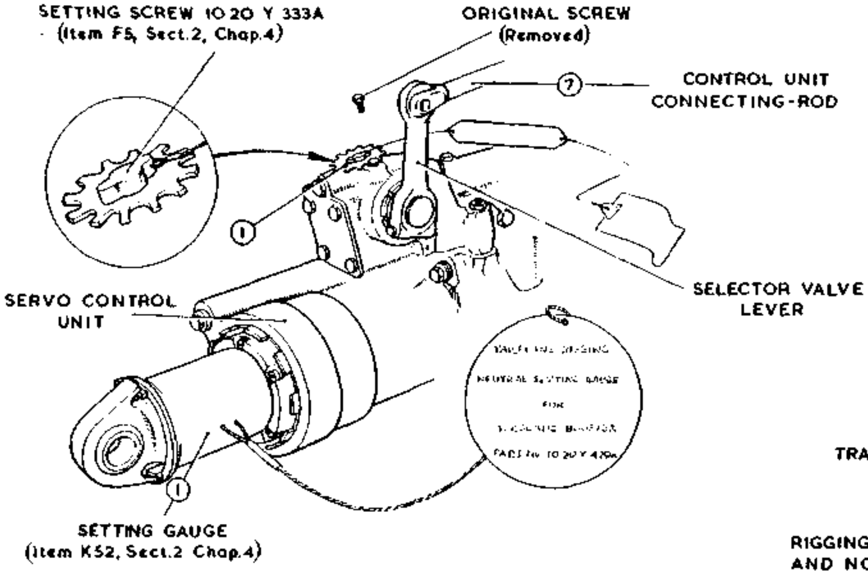
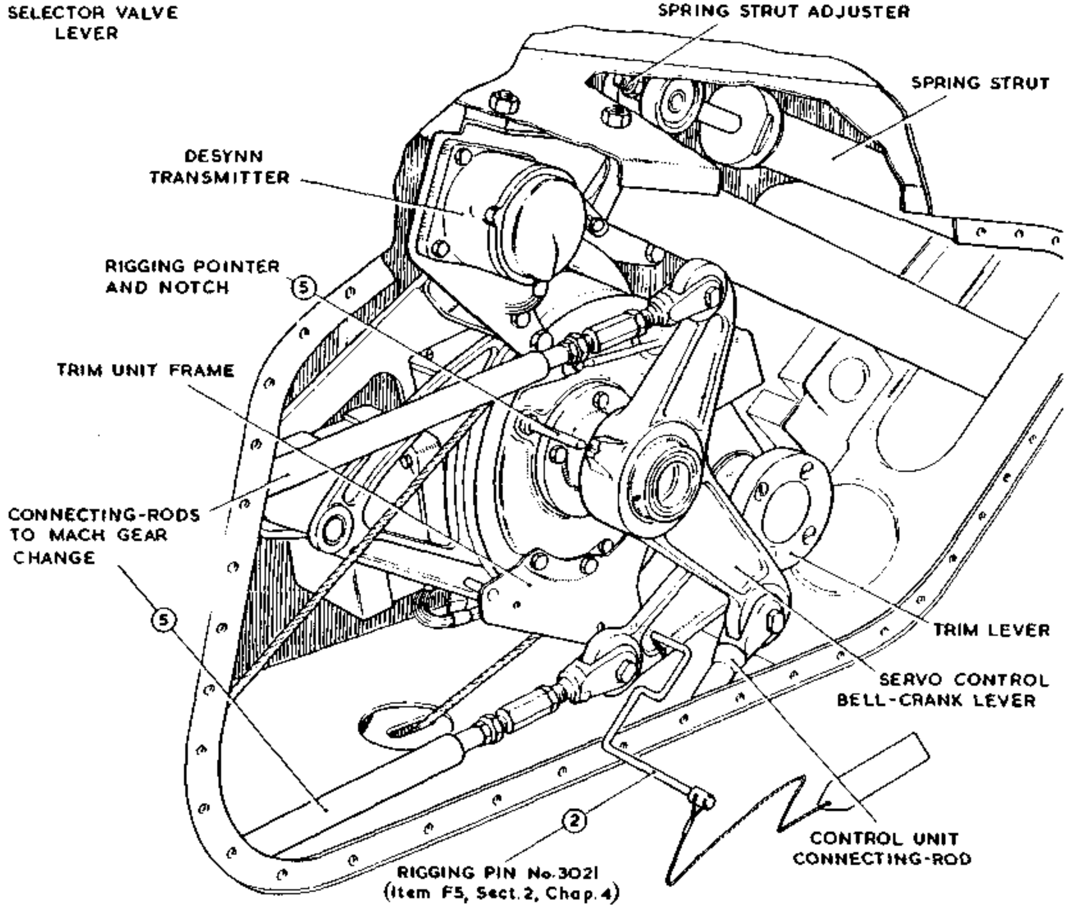


SERVO UNIT

AIRCRAFT - Jacked and trestled.
HYDRAULICS - Approved test rig capable of delivering 3000 p.s.i. connected. The rig should preferably have a hand pump, but an "inching" device is permissible.
ELECTRICS - Approved 28 volt supply connected.
CABLES - Routed but not tensioned.



TRIM AND SPRING FEEL UNIT

SEQUENCE OF OPERATIONS

1. With both servo control units fully retracted and their selector valve levers held in the UP position, select hydraulic power ON and operate the hand pump until the setting gauges (item K.52, Sect.2, Chap.4) can just be fitted over the rams. Select hydraulic power OFF and slowly return both selector levers simultaneously to NEUTRAL, then lock them in this position by fitting the neutral setting screws (10.20Y-333A) contained in the rigging pin box (item F5, Sect.2, Chap.4).

   WARNING
   With hydraulic power ON, the selector valve lever on one control unit must never be moved from NEUTRAL independently of the lever on the other control unit.

2. Operate the tail-plane trim switch on the control column until the hole in the trim lever is in line with the hole in the frame of the trim unit and rigging pin No.3021 (item F5, Sect.2, Chap.4) can be inserted. Check that the trim unit is held in the NEUTRAL position by the roller of the spring-feel unit resting in the dwell of the cam, if necessary adjusting the spring strut until this position is quite positive.

WARNING. **Before a flying control system is hydraulically operated, the system must be bled as laid down in Sect.3, Chap.6**

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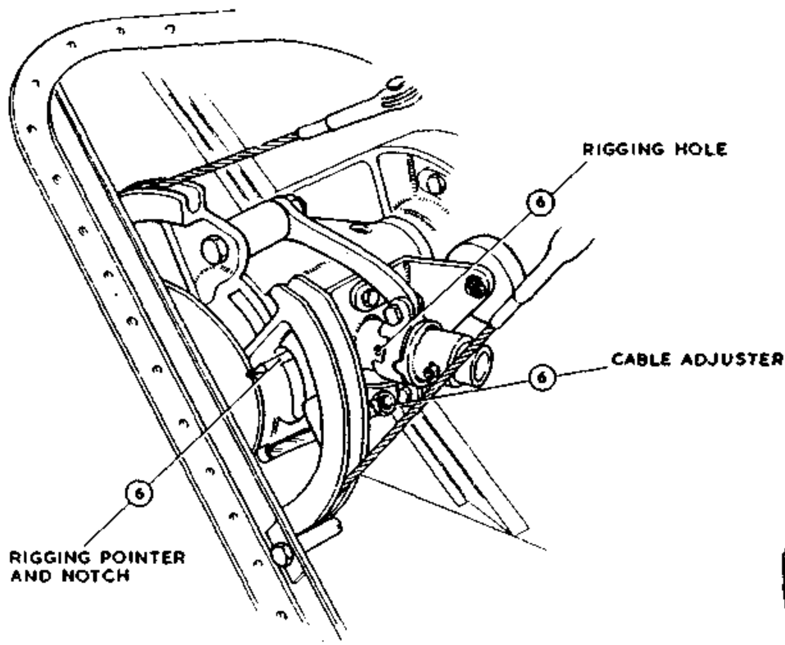
Fig.42 Rigging tail-plane control circuit stage 1 (1)



CABLE COMPENSATOR IN STARBOARD FIN

3. With electrics ON, check the position of the Mach gear change actuator by means of the lights to port of the main instrument panel (Sect. 1, Chap. 1). *If the actuator is not in NORMAL gear (i.e., either the GREEN or AMBER light is ON)* select the Mach gear change switch on panel 'H' to AUTO and depress the micro switch striker in the throttle box until both lights are OUT. After a short pause select the gear change switch on panel 'H' to OFF and release the micro switch striker. The actuator will now be in NORMAL gear (i.e., the ram fully retracted).

4. Position the Mach gear change unit *in NEUTRAL by inserting rigging pin No.* 3031 (item F5, Sect. 2, Chap. 4). Unscrew the gear change stop bolts a few turns.

WARNING
The Mach gear change switch on panel 'H' must not be moved from the OFF position while any of the rigging pins are fitted.

5. Maintaining the spring-feel roller in the dwell of the cam, adjust the length of the lower connecting-rod between the Mach gear change and the trim unit until its attachment bolt can be fitted. Attach the upper connecting rod and adjust its length so that the rigging notch on the servo control bell-crank lever is in line with the rigging pointer on the trim unit.

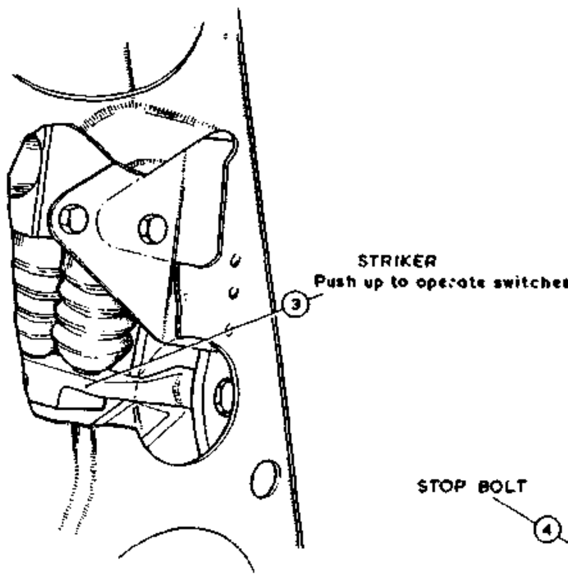
6. By means of *the adjusters on the cable compensators in the starboard fin*, adjust the inter-connecting cables across the tail plane to bring the rigging pointer on the compensator in line with the rigging notch on its mounting casting; then tension the cables equally until the rigging hole in the compensator shaft is just completely exposed. Taking care not to introduce any cable twist, tighten and wire-lock the adjuster lock nuts.

7. *With both control unit connecting-rods set at their nominal lengths* (16.8 in. between centres), drop the eye-end of each rod over its attachment point on the respective selector valve lever and adjust the turnbarrel until the attachment bolt can just be fitted by hand.

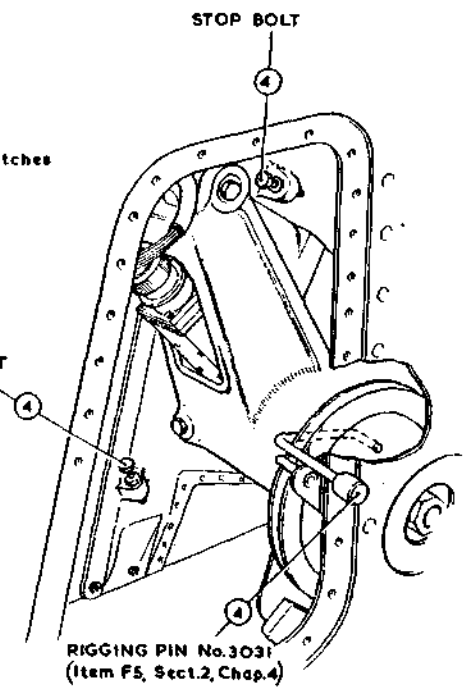
8. Remove the setting screws from the control units and refit the original screws. Remove the setting gauges from the control unit rams and apply full hydraulic rig pressure. By means of the calibrated scale stencilled on the fins and the tail plane, check that one end of the tail plane is NEUTRAL and that the other end is not more than 0 deg. 5 min. out of NEUTRAL (5 min. is equivalent to 0.1 in. at the trailing edge). Adjust the control unit connecting-rods to achieve this condition.

9. Adjust the Desynn transmitter above the trim unit so that the indicator at the bottom of the pilot's main instrument panel reads zero. The transmitter is adjusted by loosening its attachment bolts, which pass through slotted holes, and rotating the unit until the zero reading is obtained.

10. Lock all nuts, bolts, screws and turnbarrels.

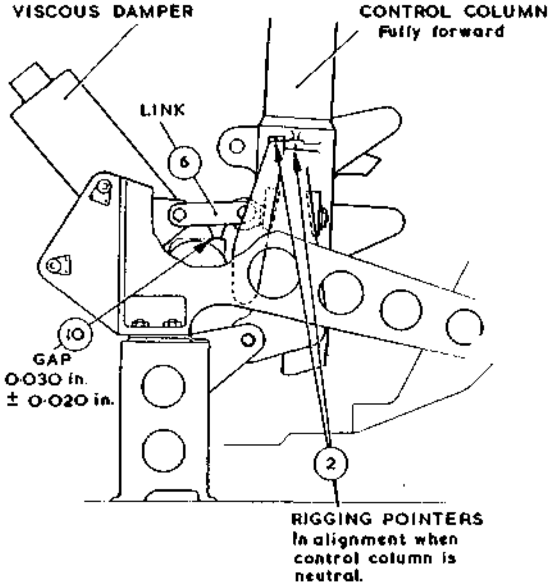


MICRO SWITCHES
IN THROTTLE BOX

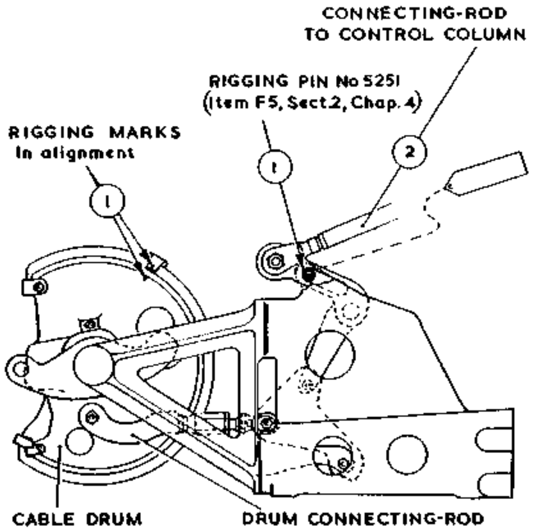


MACH GEAR CHANGE UNIT

Fig.43 Rigging tail plane control circuit stage 1 (2)



CONTROL COLUMN AND VISCOUS DAMPER



VARIABLE GEARING UNIT

SEQUENCE OF OPERATIONS

◄ 1. Insert rigging pin No.5251 (item F5, Sect.2, Chap.4) in position in the tail plane variable gearing unit and check that the cable drum is in NEUTRAL, i.e., that the rigging mark on the drum is in alignment with the mark on the cable guard. ►

2. Adjust the control column connecting-rod to bring the rigging pointer on the starboard side of the column in line with the rigging pointer mounted on the viscous damper support beam.

3. Attach the connecting-rod from the control column to the g-weight lever and adjust its turnbarrel so that the rigging mark on the lever is in alignment with the rigging lug.

◄ 4. Ensure that the cable runs between the cockpit and the trim unit are correctly routed (fig.45), especially below the aileron gearing unit if Mod. 974 is not embodied. Using the turnbarrels forward of the port boom compensator, tension the cables simultaneously and equally to 35 ± 3.5 lbs, compressing the compensator after each adjustment. ►

5. Remove the rigging pins from the variable gearing, Mach gear change and trim units. Select the Mach gear change switch on panel 'H' to AUTO, then hold the Mach gear change test switch on the observer's starboard console (Sect.1, Chap.2) in the COARSE position until the AMBER light to port of the main instrument panel comes ON; after a short pause, return the switch on panel 'H' to OFF.

WARNING
The tail plane trim actuator must NOT be operated with hydraulic power OFF, once the circuit has been completely rigged.

6. Disconnect the viscous damper link from the control column and swing the link back clear of the column. Using the hand pump on the hydraulic test rig, move the column full travel both forward and aft and check that the tail plane movements given in fig.37 for COARSE gear and NEUTRAL trim can be obtained; adjust the Mach gear change stop bolts, as necessary, and *tighten and wire-lock their lock-nuts. Check that the trim indicator records the correct tail plane angle at both full travel positions.*

7. Refit the pilot's false floors, except for the panel immediately aft of the control column, and set the Mach gear change actuator in NORMAL gear by repeating the procedure given in fig.43, sub.para.3. Check that the tail plane movements given in fig.37 for NORMAL gear and NEUTRAL trim can be obtained, adjusting the control column stops as necessary; do not lock the stop bolt lock-nuts.

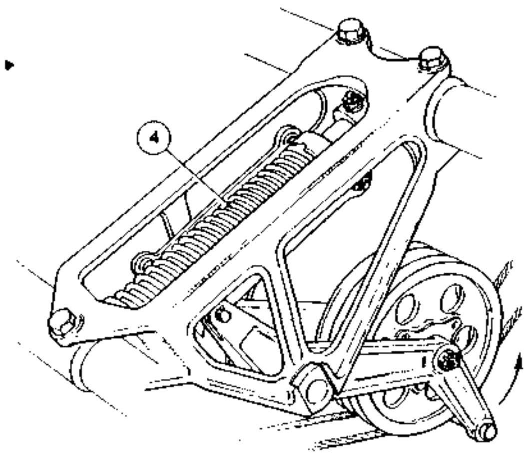
8. Check the tail plane angles in NORMAL gear with full POSITIVE and full NEGATIVE trim applied and the angles in RESTRICTED COARSE and COARSE gear with NEUTRAL trim.

9. Adjust the spring-feel spring strut to obtain the break-out loads shown in fig.37 and check that the control column is returned to NEUTRAL when it is released from any other position.

10. Reconnect the viscous damper link to the control column and, in NORMAL gear and NEUTRAL trim, move the column forward against its stop. Check that the gap between the damper link and the safety stop is as shown; if necessary, adjust the forward stop to bring the gap within the limits and then check that the tail-plane angle is still within the tolerances allowed. Tighten and wire-lock the lock-nuts on both stop bolts and refit the remaining floor panel.

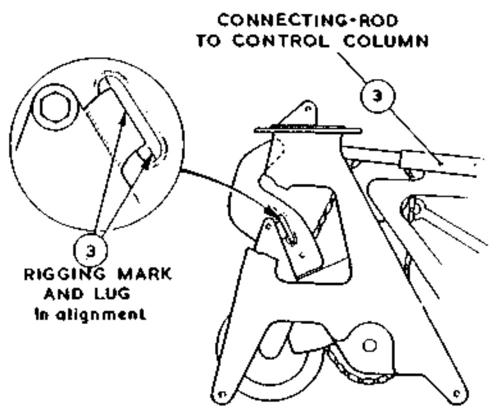
11. Lock all nuts, bolts, screws and turnbarrels and check the entire circuit for safety and the possibility of fouls.

Note...
After the pilot's ejection seat has been refitted the control column may foul the seat before being arrested by the rear stop bolt. If this foul does occur, the stop bolt should be re-adjusted and a check made to ensure that the tail plane movements are still within the tolerances allowed.



CABLE COMPENSATOR IN PORT BOOM

WARNING. **Before a flying control system is hydraulically operated, the system must be bled as laid down in Sect.3, Chap.6**



G-WEIGHT LEVER

Fig.44 Rigging tail plane control circuit stage 2

◄ Rigging pin in compensator deleted ►

LOCATION OF PULLEY ASSEMBLIES

1. BELOW CONTROL COLUMN
2. REAR FACE OF MAIN SPAR AT STN. No. 227.04 (Refer to 'S' Fig. 33)
3. REAR FACE OF MAIN SPAR INBOARD OF RIB No. 2 (In port wheel well)
4. REAR FACE OF MAIN SPAR INBOARD OF RIB No. 3 (In port wheel well)
5. REAR FACE OF PORT STUB BOOM DIAPHRAGM
6. ABOVE PORT FIN RIB No. 10 (Fig. 19)
7. IN PORT FIN HEAD OUTBOARD OF TAIL PLANE PIVOT
8. ON OUTBOARD FACE OF TAIL PLANE RIB No. 4 (Port)
9. ON OUTBOARD FACE OF TAIL PLANE RIB No. 4 (Starboard)
10. IN STARBOARD FIN HEAD OUTBOARD OF TAIL PLANE PIVOT

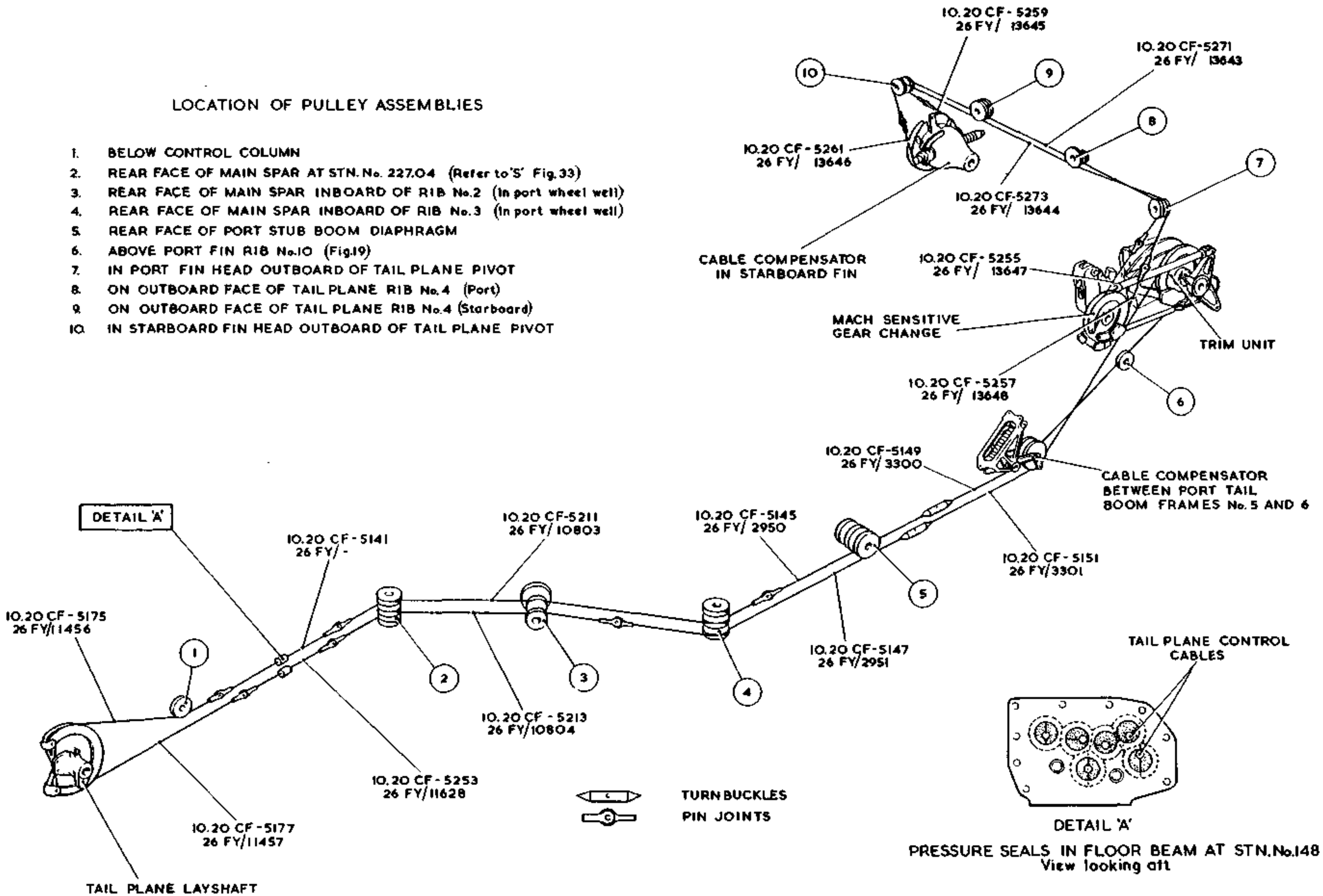
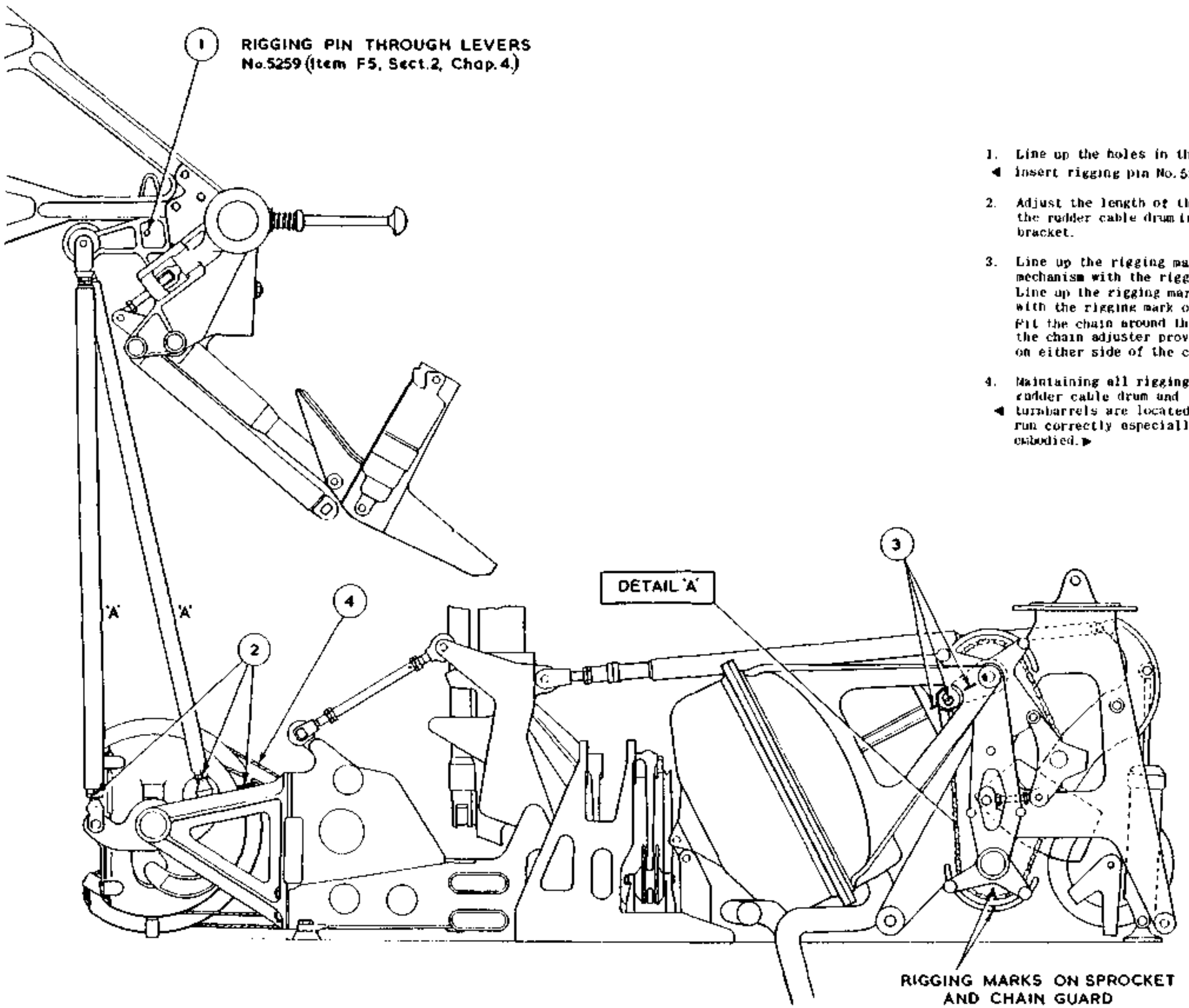


Fig. 45 Rigging tail plane cable circuit
◄ Stores reference numbers added ►

WARNING. Before a flying control system is hydraulically operated, the system must be bled as laid down in Sect.3, Chap.6

AIRCRAFT - Jacked and trestled
HYDRAULICS - Systems primed
ELECTRICS - 28 volt d.c. supply-off
CABLES - Loosely coupled

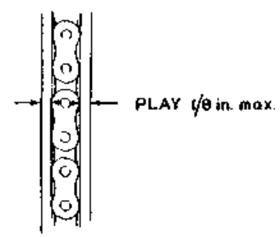


1. Line up the holes in the operating arms of the rudder pedal mechanism and ◄ insert rigging pin No.5259. (item F5, Sect.2, Chap.4). ►

2. Adjust the length of the connecting-rods 'A' to bring the rigging mark on the rudder cable drum in line with the rigging mark on the layshaft mounting bracket.

3. Line up the rigging marks on the top sprocket and lever of the q - feel mechanism with the rigging mark on the q - pot casting.
Line up the rigging mark on the bottom sprocket of the q - feel mechanism with the rigging mark on the lower chain guard.
Fit the chain around the top, bottom and jockey sprockets and tension with the chain adjuster provided until a slack movement of 1/8 in. is maintained on either side of the chain centre-line at the middle of the vertical run.

4. Maintaining all rigging marks in alignment, tension the cables between the rudder cable drum and the q - feel layshaft pulley to 40 ± 4.0 lb. (The ◄ turnbarrels are located below the q-pot assembly). Ensure that the cables run correctly especially below the aileron gearing unit if Mod.974 is not embodied. ►



DETAIL 'A'

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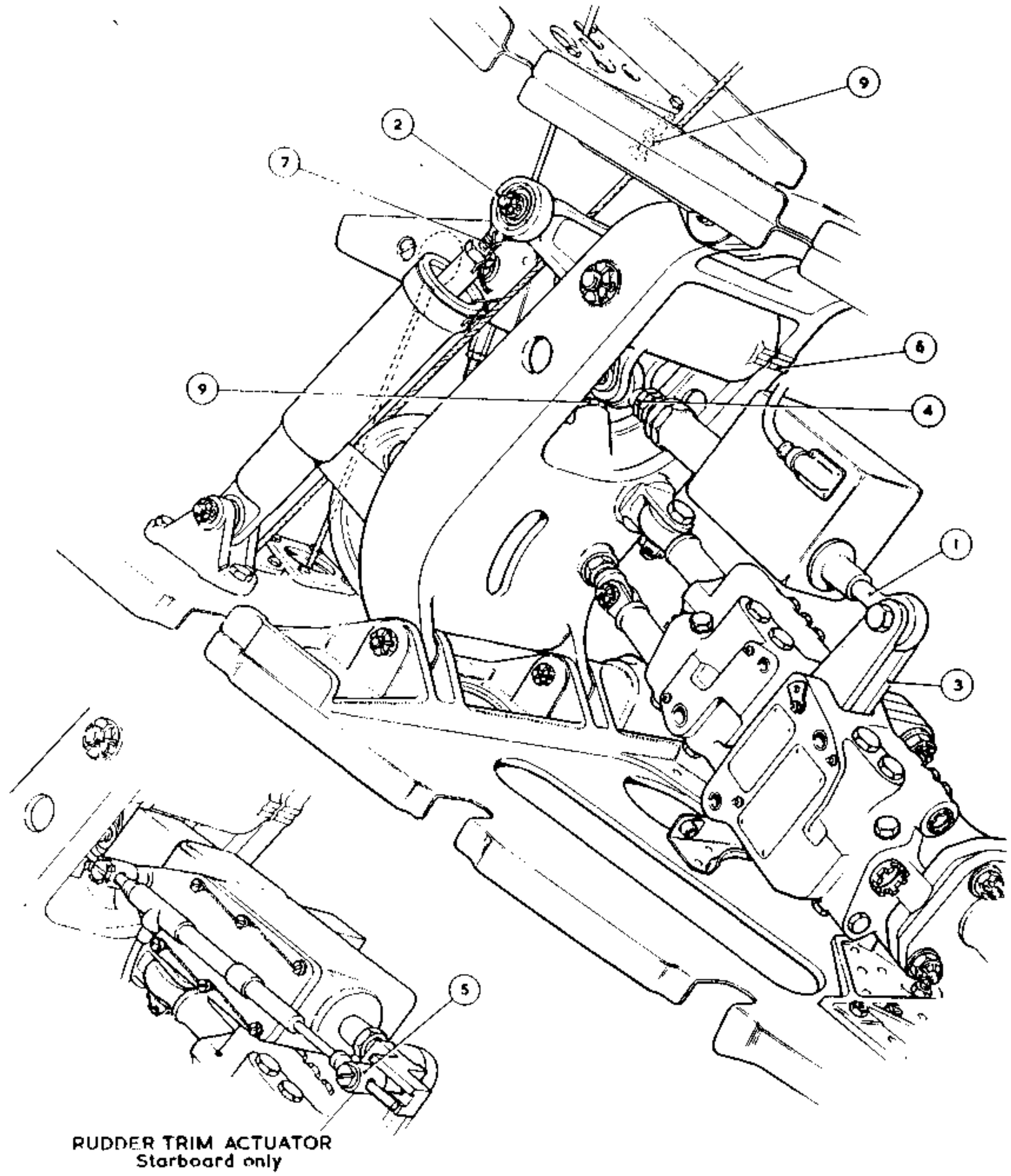
Fig. 46 Rigging rudder mechanism in cockpit

◄ Rigging pin number altered ►



1. Detach the eye ends of the trim actuator (starboard) and the autostabilizer actuator (port) from the servo control unit valve levers. Operate both actuators electrically to set the ram of each neutral. The trim actuator is neutral when the spot on the ram is HALF exposed, the autostabilizer actuator is neutral when the spot on the ram is just FULLY exposed.

2. Disconnect the eye end of the spring centring strut in each fin.

3. Using the hand pump on the hydraulic test rig (para.109) manually operate the control valve levers in each fin to bring the control units to neutral, i.e. with the valve levers central (OFF) the control units should be at mid travel and the rudders neutral.

4. Adjust the eye ends of the trim and autostabilizer actuators until each can be connected to its respective control valve lever without moving the lever from its neutral position.

   Note...
   Neither of the actuators, once connected to their respective valve levers, must be operated electrically with the hydraulic power OFF.

   WARNING Ground functioning
   The rudders must not be moved full travel, inboard or outboard, when full trim (inboard or outboard) has already been applied.

5. With electrical power applied, adjust the inductor transmitter attached to the trim actuator in the starboard fin so that, with the rudders neutral the indicator on the L.H. console reads ZERO.

6. Adjust the lengths of the cables (fig.48) from the cockpit mechanism to the fins and the balance cable over the tail plane so that the rigging marks on the bell-crank lever and the mounting beam in each fin are in alignment. Keeping the rigging marks in alignment, tension the 15 cwt.cables simultaneously and equally to 40 lb. ± 4.0 lb. and the 25 cwt. cable to 51 lb. ± 5 lb.

7. Adjust the length of the spring strut in each fin until its attachment bolt can be fitted by hand.

   WARNING
   The caulked side of the eye ends must always face outboard.

8. Lock all nuts, bolts and turnbarrels.

9. Remove the rigging pin from the operating arms of the rudder pedal mechanism (fig.46). Using normal hydraulic power, check the rudder range of movement and deflection as shown in fig.37. Adjust the stops in each fin at Rib 11 and on the mounting beam to correct the range of movement.

10. Using normal power from the hydraulic test rig, and with the rudders neutral operate the rudder trim switch and check that the range of trim movement is as shown in fig.37 (starboard only).

11. Adjust the fixed tabs at the rudder trailing edge to the dimension laid down in fig.37.

12. Using normal power from the hydraulic test rig, attach the special electrical test unit to the autostabilizer actuator. Function the actuator by means of the test set and check that the rudder movements agree with fig.37 (port only).

Note...
(1) When the rudder movements are being checked, a certain amount of judder is permissible, provided that it can be damped out by placing a hand on the trailing edge.

(2) When the rudder is on full travel and full trim, there must be 0.020"-0.050" clearance between the balance weight arm and the stops, introduced by mod.700, bolted to the fin skin. The stops may be relieved to obtain this clearance.

Fig. 47. Rigging rudder mechanism in fins

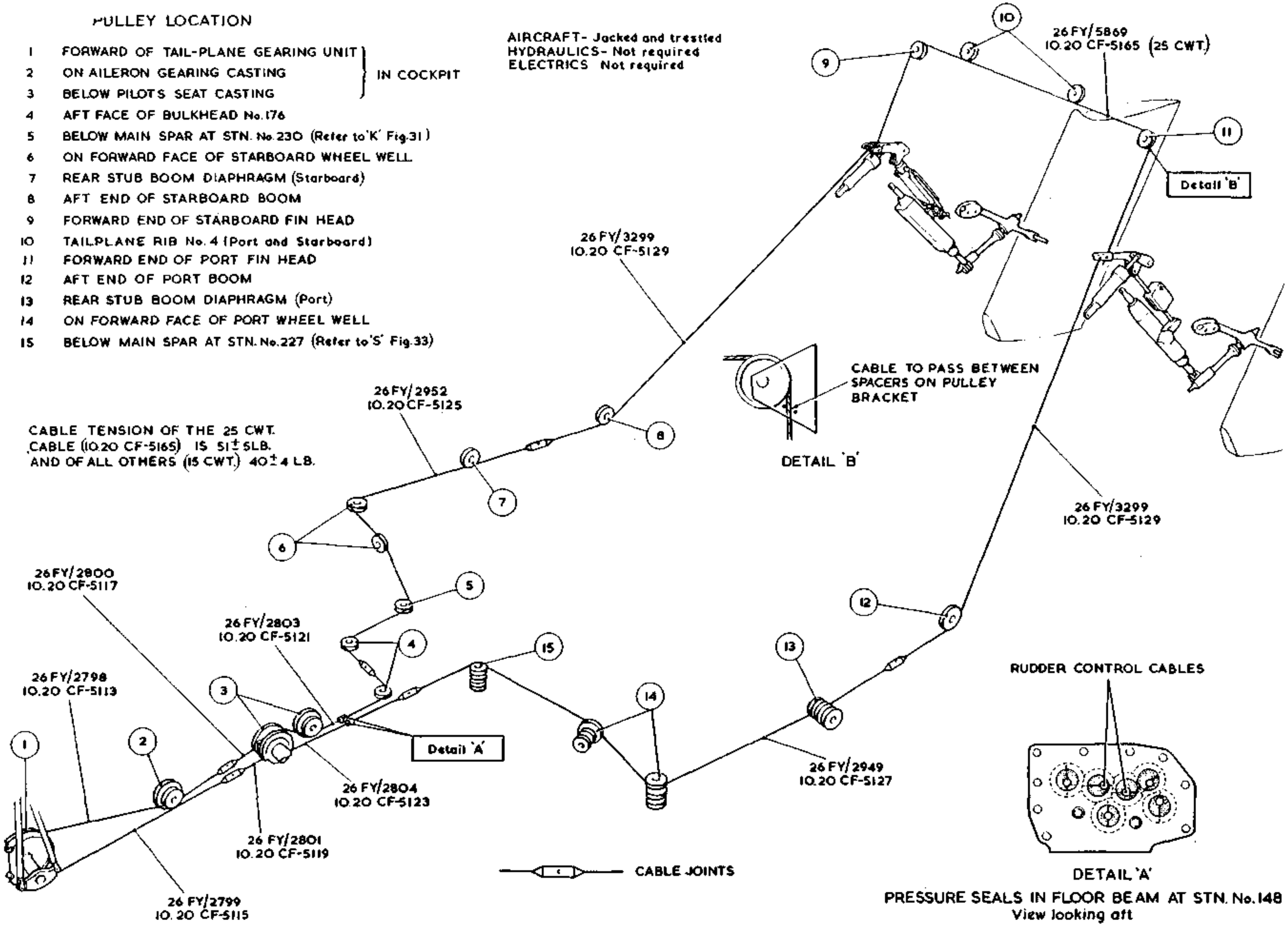


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Fig. 48. Rigging rudder cable circuit

(DETAIL 'B' ADDED)

circuit, check that the arrester hook cables are not trapped, by operating the arrester hook cockpit control and ensuring that it has full and free movement.

200. Paragraphs 137 to 158 give a general description of the flap control system and describes where the various components are located. The installation and adjustment of the flap sections are given in Sect. 3, Chap. 2 and the fitting of the U-plates in Vol. 6. The rigging of the circuit is in two stages; firstly, the rigging of the circuit from the cockpit selector lever to the servo control unit and, secondly, the setting of all the flap tracks and the rigging of the cables from the large double-grooved cable drum at rib No. 0.

Selector circuit

201. With the cables between the drum in the throttle box and the terminal pulley on rib No. 0 correctly routed but loosely connected, the procedure for rigging the circuit from the selector lever to the cable drum on the port side of rib No. 0 is as follows:—

(1) Ensure that the nuts securing the link to the selector lever and cable drum in the throttle box are tightened and split-pinned securely, then select the lever to the flaps UP position.

(2) Rotate the terminal pulley to its rigging position and lock it by inserting rigging pin No. 831 (Item F5, Sect. 2, Chap. 4).

(3) Ensuring that the cables (No. 19 and 20) remain correctly routed, as described in para. 188, tension them to 20 lb. Taking care not to introduce any cable twist, tighten the turnbuckle locknuts.

(4) Connect a hydraulic rig (Item H17, Sect. 2, Chap. 4) to the GREEN system. Disconnect the spring strut (fig. 51) then operate the hydraulic hand pump and move the Servodyne valve to bring the flaps to the UP position. Check that the rigging pin holes in the radius rod are in line, then bias the valve in the flaps UP direction to take up the free movement without opening the valve. Adjust the spring strut to fit exactly between the terminal pulley and the lever, and reconnect.

(5) Ensure that all rigging pins are removed, and with hydraulic power ON, select flaps DOWN, when fully down, select UP. Then check that:—

(a) The terminal pulley rigging holes are in line.

(b) The radius rod rigging holes are in line.

(c) With the selector lever in the bottom of the UP gate, the valve lever is biased UP.

(6) Re-adjust the cables and strut spring as necessary, to achieve these conditions, and complete all locking.

Note . . .

(1) *The rigging pin No. 1305, through the radius rod, must only be used to check adjustments and must not be left in position whilst hydraulic power is on.*

(2) *The link between the valve lever and the lever assembly is preset to a between centres length of 3·25 in.*

Operating circuit

202. The following instructions are given in the recommended order for rigging the complete flap circuit, but individual parts may be rigged by following the instructions under the relative sub-heading, provided that due regard is paid to the position of the remainder of the circuit when establishing the NEUTRAL position. At all stages of assembly, a minimum clearance of 0.025in. must be maintained between the flap attachment arms and the bogies and tracks, and 0·05 in. between the flaps and the associated structure during flap travel, and all moving parts should be liberally lubricated with grease, XG–295. The rigging pins referred to are all contained in the rigging pin box (Item F5, Sect. 2, Chap. 4). As both sides of the circuit outboard of the large cable drum at rib No. 0 are similar, only the port side is described here. With all the flap sec-

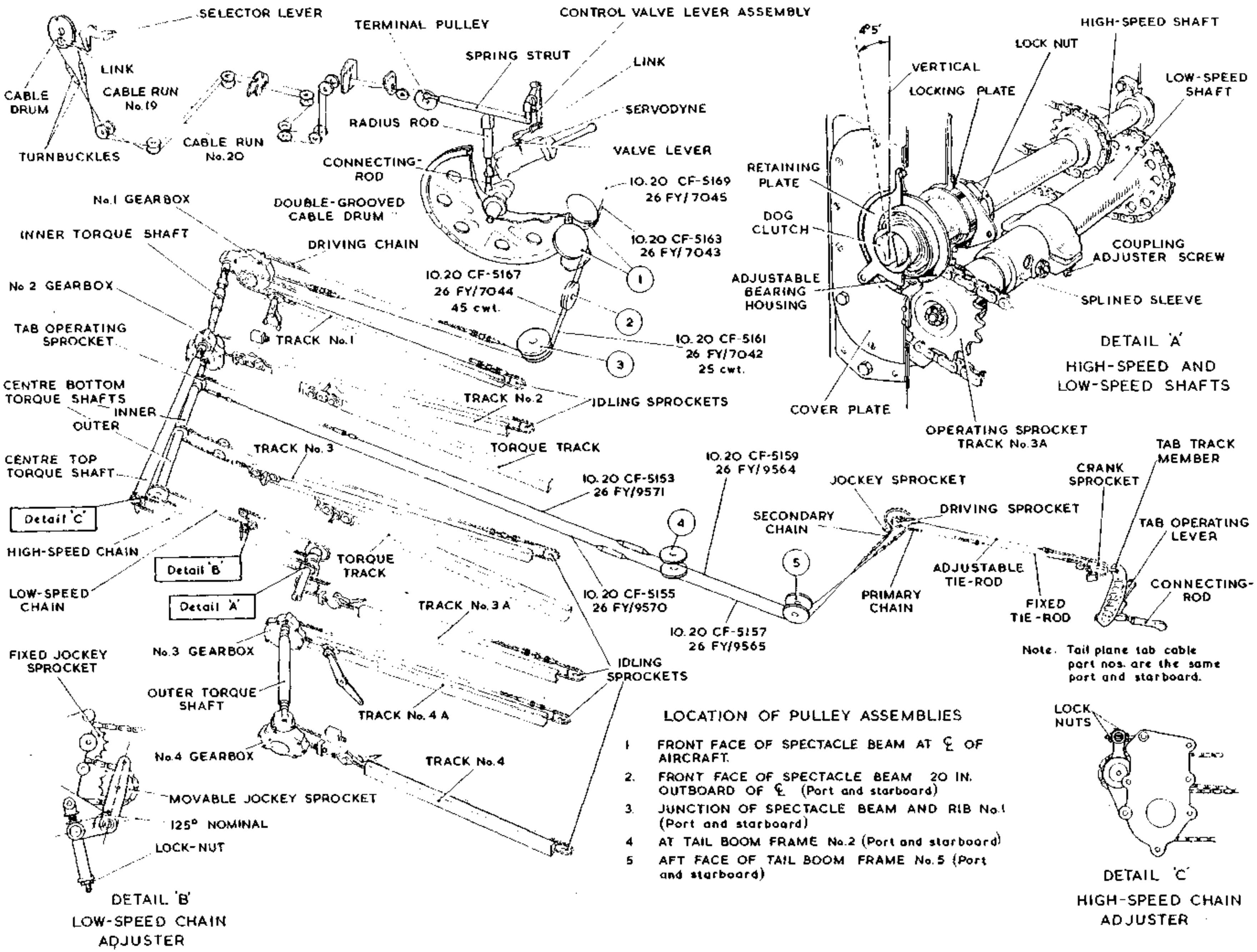

Fig. 49. Flap and tail plane tab rigging diagram

(DETAIL '8')

tions, chains and bogies, and the 45 cwt. and 25 cwt. cables removed, the procedure is as follows in paras. 203 - 213.

Flap track No. 1 (fig. 50)

203. (1) Remove the retaining bolt holding the driving and operating sprockets and their serrated caps on to gearbox No. 1. Remove the idling sprocket, run the bogie into the rear of its track and wrap the forward chain around the operating sprocket, engaging the solid link with the tooth space on the sprocket. Feed the front chain into the guard tube and re-assemble the operating sprocket to the gearbox with the serrated caps, retaining bolt and driving sprocket, but without the driving chain; temporarily tighten the bolt.

(2) Wrap the rear chain around the idling sprocket and assemble the sprocket, chain guards, nuts, bolts and washers to the trailing edge structure and tighten and wire-lock securely.

(3) Connect the two ends of the chain together and move the bogie to approximately its mid-travel position, when the tensioner is accessible through the hole in the track shear web. Tension the chain to eliminate slack but do not wire-lock.

(4) Check the bogie for free running over its full length of travel and then return it to the forward position and insert rigging pin No. 795 (No. 797 for the starboard side) in position in the operating sprocket.

Flap track No. 2 (fig. 50)

204. (1) Disconnect the inner torque shaft from gearbox No. 2 by over-engaging the torque shaft splines with the splined stub shaft on gearbox No. 1. Remove the operating sprocket from gearbox No. 2 and run the chain and bogie assembly into the front of the track. Check for free running and refit the sprocket.

(2) Wrap the front chain around the operating sprocket, engaging the solid link with the tooth space. Wrap the rear chain around the idling sprocket and join the two ends. Tension the chain to eliminate slack but do not wire-lock.

(3) Remove the stop block at the front of the torque track and run the torque bogie into the track, assembling the side-load rollers at the same time. Refit the stop block.

(4) Assemble the flap arm to the two bogies as described in Sect. 3, Chap. 2. Run the bogies forward and insert rigging pin No. 799 (No. 801, starboard) in the operating sprocket. Check that the rigging pin is still in position at flap track No. 1 (para. 203 (4)) and re-connect the torque shaft to gearbox No. 2.

Flap track No. 3 (fig. 50)

205. (1) Remove the link at the rear of the operating track and run the chain and bogie assembly into the track. Check for free running and refit the link.

(2) With the rigging pin still in position at flap track No. 2 (para. 204 (4)) thus locking the centre bottom inner torque shaft, set adjuster to 2.7 in. as shown in fig. 50 and wrap the front chain around the operating sprocket on the torque shaft so that the bogie is aft of or as near as possible to the rigging marks on its track.

(3) Wrap the rear chain around the idling sprocket and join the chain ends. Tension the chain to remove slack but do not wire-lock.

(4) Remove the block from the front of the torque track and insert the torque bogie, assembling the side-load rollers at the same time. Check the bogie for free running and refit the block. Assemble the flap arm to the operating and torque bogies as described in Sect. 3, Chap. 2.

High-speed chain (fig. 49)

206. (1) Wrap the high-speed chain around the sprockets on the centre top torque shaft and on the high-speed shaft and join the ends, taking

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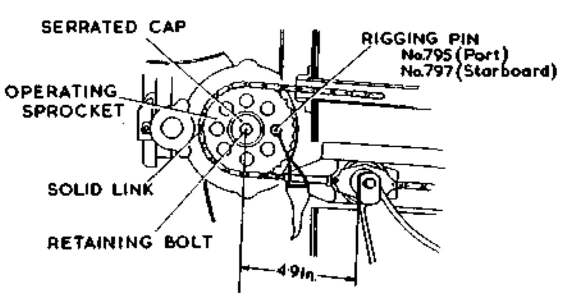
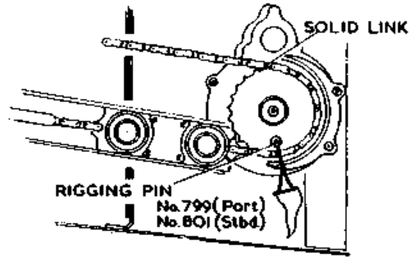
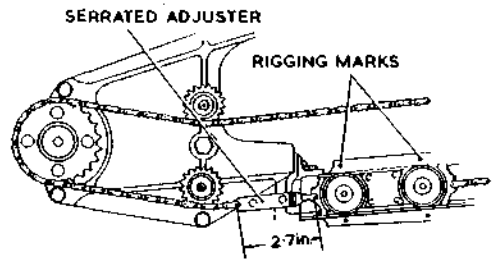


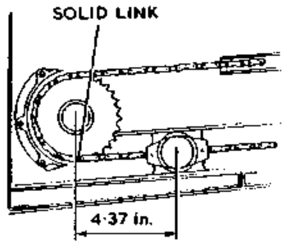
TRACK No.1 DRIVE MECHANISM
(Port and starboard)



TRACK No.2 DRIVE MECHANISM
(Port and starboard)



TRACK No.3 DRIVE MECHANISM
(Port and starboard)



TRACK No.3a DRIVE MECHANISM
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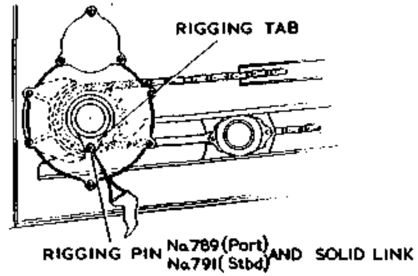
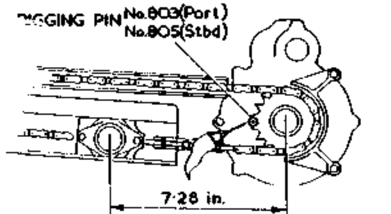
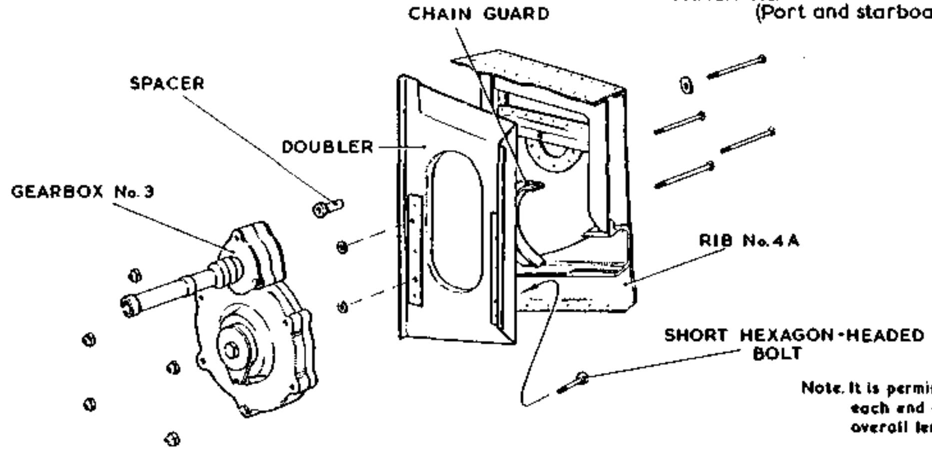


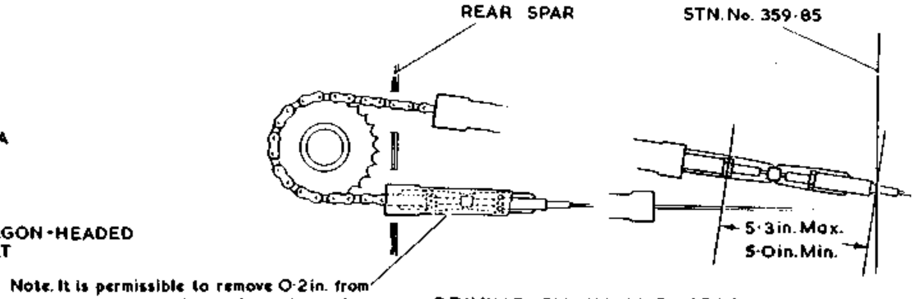
TRACK No.4a DRIVE MECHANISM
(Port and starboard)



TRACK No.4 DRIVE MECHANISM
(Port and starboard)



ASSEMBLY OF GEARBOX AND DOUBLER
TO RIB No.4A



DRIVING CHAIN AND SPROCKET
Gearbox No.1

Fig. 50 Flap rigging details

◄ Note added to driving chain detail ►

care that the joining bolt is fitted so that it will not foul the chain guard, or low speed chain joint bolt.

(2) With the rigging pin still in position at flap track No. 2 (para. 204 (4)) connect a hydraulic test rig (item H22, Sect. 2, Chap. 4) to the Green system operate the rig to fold the wings and then with flaps fully up, slide the sprocket on the high-speed shaft inboard clear of its splines. Rotate the shaft so that the dog clutch is in the position shown in fig. 49, detail A. Re-engage the sprocket on the splines, tighten the lock-nut and split-pin it.

(3) Set the adjustable bearing centrally in the bearing housing so that the gap in its flange is centrally over the cover plate bracket. Lightly tighten the lock-nut to hold the bearing housing in this position.

(4) Using the hydraulic test rig, spread the wings to engage the dog clutch and then tighten and wire-lock the bearing housing lock-nut. Remove the rigging pins from gearboxes No. 1 and 2 and run the bogies over their full length of travel to check for free running of the high-speed chain, leaving the bogies in the fully aft position. Tension the chain, using the adjuster at the outboard end of the centre top torque shaft to take up slack and then wire-lock the adjuster lock-nuts.

Low-speed chain and flap track No. 3A (fig. 49 and 50)

207. (1) With the bogies in tracks No. 1, 2 and 3 still fully aft, wrap the low-speed chain around the sprockets on the centre bottom outer torque shaft and on the low-speed shaft and around the two jockey sprockets. Join the two ends fitting the bolt head inboard, so that the joint is between the top of the rear sprocket and the diaphragm forward of this sprocket, then tension the chain by moving the bottom jockey sprocket to take up slack and wire-lock the adjuster. Run the bogies in tracks No. 1, 2 and 3 up and down to check for free running of the low-speed chain, leaving them in the fully forward position and re-insert the rigging pins in gearboxes No. 1 and 2.

(2) Slacken the two coupling adjuster screws on the low speed shaft and slacken the clamp bolt on the splined sleeve. Slide the sleeve outboard to bring the two adjuster screws clear of their opposing shaft faces.

(3) Run the chain and bogie assembly into the forward end of flap track No. 3A and wrap the rear chain around the idling sprocket. Wrap the front chain around the operating sprocket, engaging the solid link with the tooth space. Join the two chain ends and tension the chain to eliminate slack but do not wire-lock.

(4) Position the bogie, as shown in fig. 50, and then re-engage the splined sleeve on the low-speed shaft and adjust the adjuster screws to take up slack, ensuring that the bogie is still at the rigging position. Tighten and wire-lock the adjuster screw lock-nuts.

Flap track No. 4A (fig. 50)

208. (1) With the wings folded, disconnect the chains from the bogie and disconnect the torque shaft from gearbox No. 3. Remove the gearbox and doubler from rib No. 4A. Assemble the side-load rollers to the bogie and run the bogie into the forward end of the track. Check the bogie for free running over its full length of travel and then feed the chain through the guard tube and wrap it around the idling sprocket.

(2) Assemble the doubler to the gearbox by means of the short hexagon-headed bolt and stiffnut. Insert a screwdriver into the slot in the locking slider on the inboard side of the gearbox, then press it and turn until the gap in the sprocket is rotated to the top of the sprocket. Position the gearbox and doubler close to the rib and tilt the assembly so that the chain can be placed on the sprocket, with the solid link engaging with the tooth space. Assemble the gearbox and doubler to the rib, complete with the chain guard, spacer, distance tube and washers as shown in fig. 50. Reconnect the torque shaft to

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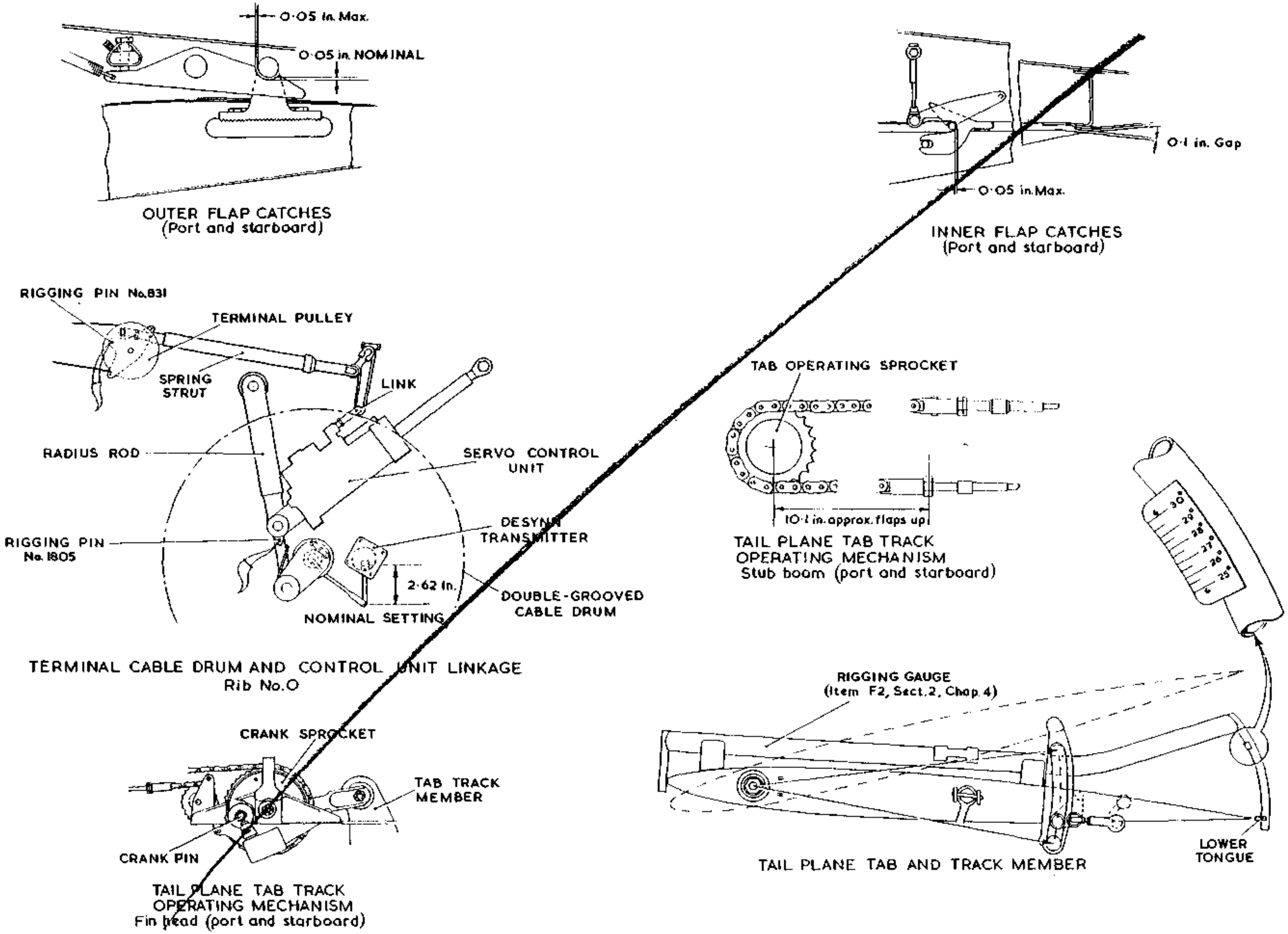

F 51 Flap and tail plane tab rigging details

◄ Rigging gauge detail added ►

care that the joining bolt is fitted so that it will not foul the chain guard, or low speed chain joint bolt.

(2) With the rigging pin in position at flap track No.2 (para. 204(4)) connect a hydraulic test rig (item H22, Sect.2, Chap.4) to the Green system; fold the wings and with flaps fully up, slide the sprocket on the high-speed shaft inboard clear of its splines. Rotate the shaft ◀ until the dog clutch is in the position ▶ shown on fig.49, detail A. Re-engage the sprocket on the splines, tighten the locknut and split-pin it.

◀ (3) Set the adjustable bearing centrally in the bearing housing with the gap in the flange positioned centrally over the bracket projecting from the cover plate. Lightly tighten the locknut to hold the bearing housing in position. Note that when mod.943 is embodied the bearing housing is located by a locking plate bolted to the bearing casting. ▶

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(4) Using the hydraulic test rig, spread the wings to engage the dog clutch and then tighten and wire-lock the bearing housing locknut. Remove the rigging pins from gearboxes No.1 and 2 and run the bogies over their full length of travel to check for free running of the high-◀ speed chain, leaving the bogies fully aft. Tension the chain, using ▶ the adjuster at the out-board end of the centre top torque shaft to take up slack and then wire-lock the adjuster locknuts.

Low-speed chain and flap track No.3A (fig.49 and 50)

207. (1) With the bogies in tracks No.1, 2 and 3 still fully aft, wrap the low-speed chain around the sprockets on the centre bottom outer torque shaft and on the low-speed shaft and around the two jockey sprockets. Join the two ends fitting the bolt head inboard, so that the joint is between the top of the rear sprocket and the diaphragm forward of this sprocket, then tension the chain by moving the bottom jockey sprocket to take up slack and wire-lock the adjuster. Run the bogies in tracks No. 1, 2 and 3 up and down to check for free running of the low-◀ speed chain, leaving them fully forward, and re-insert the rigging ▶ pins in gearboxes No. 1 and 2.

(2) Slacken the two coupling adjuster screws on the low speed shaft and the clamp bolt on the splined sleeve. Slide the sleeve outboard to bring the two adjuster screws clear of their opposing shaft faces.

(3) Run the chain and bogie assembly into the forward end of flap track No.3A and wrap the rear chain around the idling sprocket. Wrap the front chain around the operating sprocket, engaging the solid link with the tooth space. Join the two chain ends and tension the chain to eliminate slack but do not wire-lock.

(4) Position the bogie, as shown on fig.50, re-engage the splined sleeve on the low-speed shaft and adjust the adjuster screws to take up slack, ensuring that the bogie is still at the rigging position. Tighten and wire-lock the adjuster screw locknuts.

Flap track No.4A (fig.50)

208. (1) With the wings folded, disconnect the chains from the bogie and disconnect the torque shaft from gearbox No.3. Remove the gearbox and doubler from rib No.4A. Assemble the side-load rollers to the bogie and run the bogie into the forward end of the track. Check the bogie for free running over its full length of travel and then feed the chain through the guard tube and wrap it around the idling sprocket.

(2) Assemble the doubler to the gearbox by means of the short hexagon-headed bolt and stiffnut. Insert a screwdriver into the slot in the locking slider on the inboard side of the gearbox, then press it and turn until the gap in the sprocket is rotated to the top of the sprocket. Position the gearbox and doubler close to the rib and tilt the assembly so that the chain can be placed on the sprocket, with the solid link engaging with the tooth space. Assemble the gearbox and doubler to the rib, complete with the chain guard, spacer, distance tube and washers as shown on fig.50. Reconnect the torque shaft to

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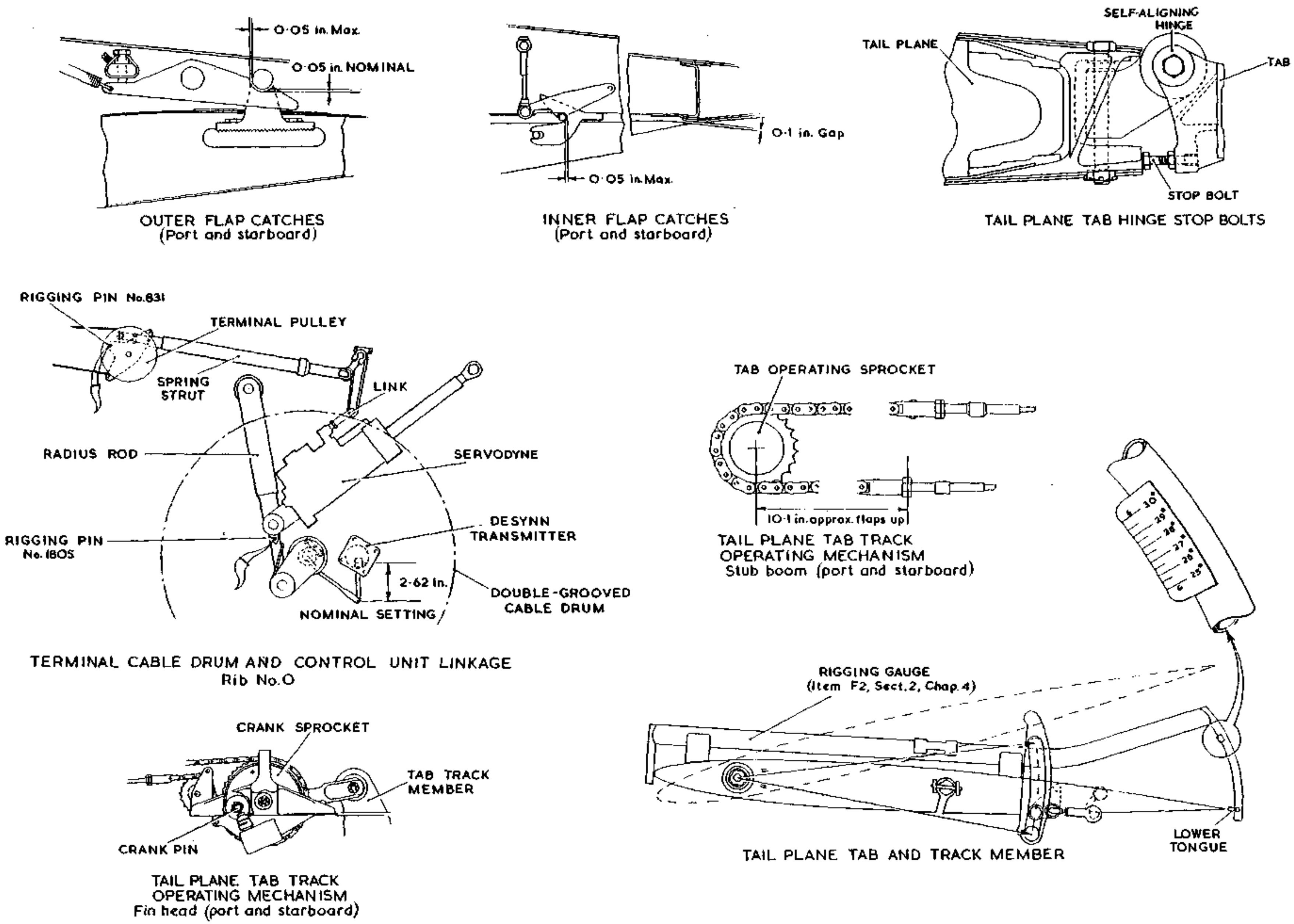

Fig.51 Flap and tail plane tab rigging details

◄ Tab hinge detail added ►

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the gearbox. By means of a screwdriver turn the locking slider so that the sprocket pulls the chain forward (the sprocket rotates in the opposite direction to the locking slider). Continue to turn in this direction until rigging pin No. 789 (No. 791, starboard) can be inserted through the slot in the rigging tab and into the gearbox.

(3) Join the chain ends to the bogie and remove the rigging pin. Slide the bogie aft until the chain tensioner is accessible through the access door adjacent to the doubler. Tension the chain to eliminate slack but do not wire-lock. Return the bogie to the rigging position, ensuring that the solid link is engaged with the tooth space, and refit the rigging pin. Spread the wings and check that the dog clutch engages correctly.

Flap track No. 4 (fig. 50)

209. (1) Disconnect the torque shaft between gearboxes No. 3 and 4, by over-engaging the splines with gearbox No. 3. Run the bogie into the track with the adjuster pointing forward. Wrap the chain around the operating and idling sprockets with the tie-rod to the adjuster end. Run the bogie to the rear of its track and back to check for free running and tension the chain to eliminate slack but do not wire-lock.

(2) Position the bogie as shown in fig. 50 and insert rigging pin No. 803 (No. 805, starboard) into gearbox No. 4 to lock the operating sprocket in this position. Reconnect the torque shaft between gearboxes No. 3 and 4.

Chain tensioning

210. (1) Remove the rigging pins from all the gearboxes and move the operating bogies fully aft. Tension each of the operating chains so that a load of 5 lb. $\pm \frac{1}{2}$ lb. positioned midway between the sprockets deflects the chain so that it just contacts its flap track. Tighten the adjuster lock-nuts and wire-lock them, taking care to keep the locking wire lying close to the adjusters so that it will not foul the guard tubes. Return the bogies to the rigging position and check that each of the rigging pins can be easily inserted.

Assembling the flap sections

211. (1) Temporarily set the adjusters for the flap catch rollers on the underside of the inner flap shroud so that the rollers are free to move up and down and so engage the catch hooks on the inner flap without strain, when the flaps are initially fitted and manually operated.

(2) Fit the centre, inboard and outboard flaps (Sect. 3, Chap. 2), and the flap U-plate as described in Vol. 6. Having adjusted them to fit the wing profile and checked them for free running, adjust the flap catches and rollers to obtain the clearances shown in fig. 51.

Driving chain and cables (fig.49 and 50)

212. (1) Temporarily remove the retaining bolt securing the driving and operating sprockets to gearbox No. 1 and fit a longer bolt so that the driving sprocket and its serrated cap can be pushed inboard clear of the splines on the gearbox shaft, without disturbing the operating sprocket.

(2) Attach the relevant 45 cwt. and 25 cwt. cables to the large double-grooved cable drum at rib No. 0 and tighten and split-pin their attachment bolts. Ensure that the cable drum is still set to the flaps UP position and that the rigging pin (No. 1805) is inserted in the radius rod and connecting-rod (fig. 51).

(3) Route both cables (the 45 cwt. one on top) via their respective pulleys to the entrance to the guard tubes inboard of rib No. 1. Feed the driving chain through the lower guard tube and connect it to the 25 cwt. cable. Pull the chain through the guard tube from the front, pullling the cable with it. Wrap the chain around the driving sprocket and feed it aft through the upper guard tube. Unclamp the guard tube and slide it forward so that the chain

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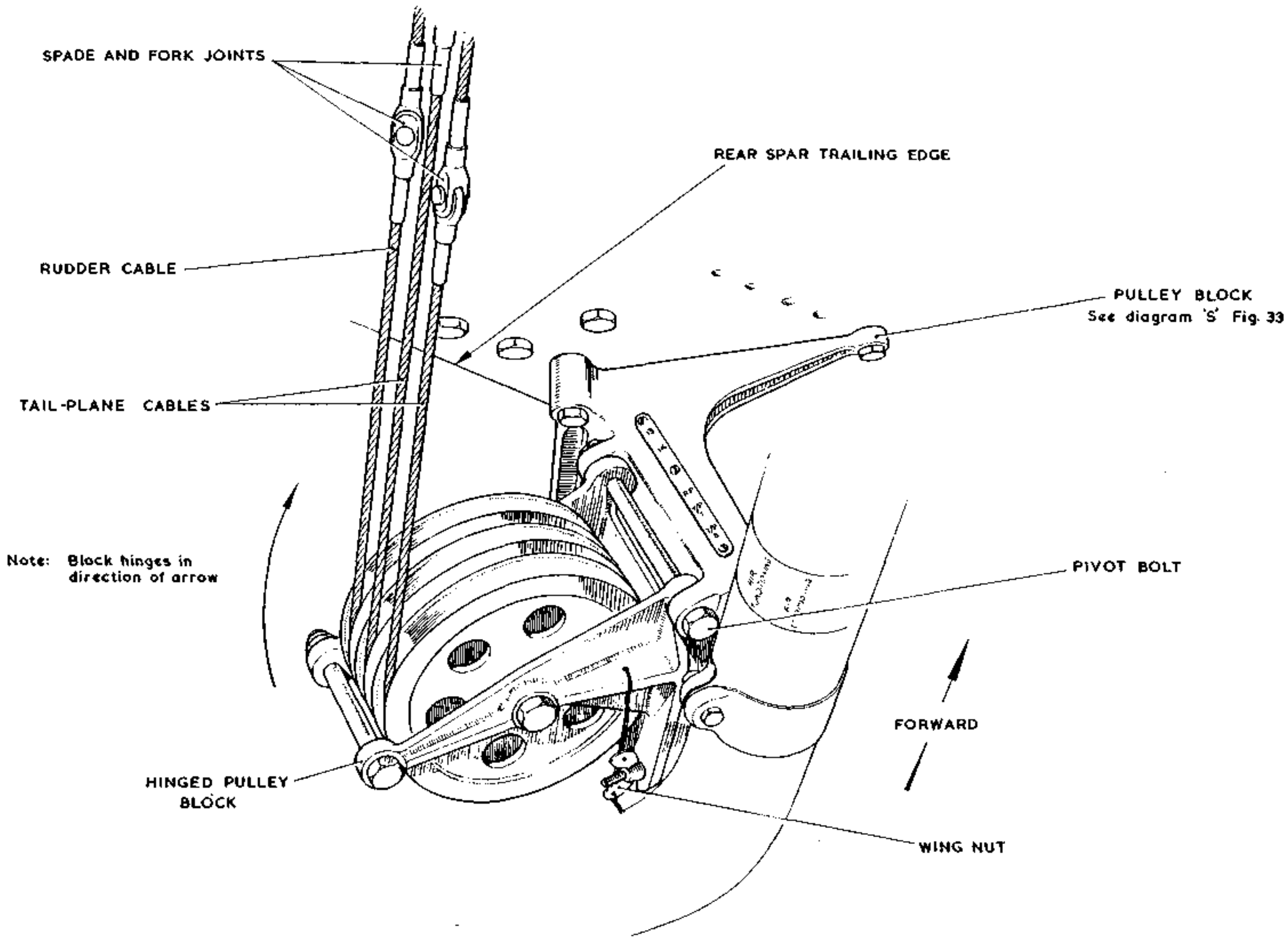

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Fi[illegible]2 Hinged pulley block in zone 'A'

◄ Wire-locking added ►

can be joined to the 45 cwt. cable. Adjust the 45 cwt. cable tensioner so that when the lower run of the chain is pulled to remove slack from the upper run, the dimension shown in fig. 50 is obtained; do not lock the tensioner.

(4) With the flaps UP and the rigging pin in gearbox No. 1, re-engage the driving sprocket and its serrated cap with the splines on the gearbox shaft, and refit and lock the retaining bolt. Remove the rigging pins from gearbox No. 1 and from the radius rod and connecting-rod on rib No. 0 and tension the 45 cwt. cable to 875 lb. Check that the flaps are fully UP, and, if necessary, ease the flap mechanism by scraping the tracks and trailing edge engagement, and by greasing the U-plate.

(5) Select the flap selector lever to DOWN and operate the test rig until the lower guard tube can be unclamped and moved far enough aft to expose the 25 cwt. cable tensioner. Adjust the tensioner so that when the flaps are moved back to the UP position, the tension in the 25 cwt. cable is 150 to 250 lb. Check that the tension in the 45 cwt. cable is 875 lb. (on no account must this tension rise above 1400 lb.) and that the flaps are housed correctly, then wire-lock the tensioners on both cables, keeping the locking wire lying close to the tensioners so that it will not foul the guard tubes. Return the guard tubes to their correct positions and secure their clamps. (The flaps will have to be partially lowered to wire-lock the 25 cwt. cable tensioner and secure the guard tube).

Note...
It is permissible for the 45 Cwt. cable tension to drop to a minimum of 750 lbs. in service, but the cable must always be tensioned to 850 lbs. when being adjusted.

Final tests and adjustments

213. (1) Having rigged the entire flap operating circuit in accordance with the foregoing instructions, select TAKE-OFF (20 deg.) on the selector lever and operate the test rig hand pump until the flaps cease to move. Check that the distance the inboard end of each inboard flap has moved agrees with the dimension given in fig. 37. Check that the indicator on the main instrument panel reads 20 deg. ± 2 deg. and adjust the length of the indicator transmitter arm on rib No. 0 if necessary, to achieve this.

WARNING...
When the transmitter arm is being adjusted or removed the transmitter spindle must be held to prevent it unwinding violently.

(2) Select flaps DOWN on the selector lever and again operate the test rig hand pump until the flaps cease to move. Check that the dimension agrees with fig. 37 and that the indicator shows flaps DOWN.

(3) Select flaps UP and operate the hand pump until the flaps cease to move. In conjunction with an electrician, set the inboard and outboard flap operated micro switches so that 0.04 in. rearward movement of the flaps operates the switches.

RIGGING THE TAIL PLANE TAB CONTROL CIRCUIT (fig. 49 and 51)

214. Paragraphs 159 to 170 give a general description of the tail plane tab control circuit. The rigging of the circuit involves setting the drive from the port and starboard flap operating mechanisms to the respective fin-head mechanisms and then rigging the tab itself. Since the part of the circuit in the starboard boom and fin is identical to the part in the port side, the following instructions contained in sub-para. (1) to (3) apply equally to both sides of the circuit.

(1) With the flaps correctly rigged and locked in the fully UP position, fit the appropriate chain to the tab operating sprocket on the centre bottom inner flap torque shaft so that the dimension on the lower run of the chain is as shown in fig. 51. With the jockey and driving sprockets and the secondary chain in the top of the fin leading edge undisturbed and their relative positions therefore still correct, route and join the interconnecting cables between the chain on the flap torque

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shaft and the secondary chain in the fin head as shown in fig. 49.

(2) With the jockey sprocket, crank sprocket and chain on the rear of the aft upper fin-head rib undisturbed and their relative positions therefore still correct, adjust the micro switch setting as described in Book 2, Sect. 5, Chap. 1, Group C15. Rotate the crank sprocket anti-clockwise (looking from the port side) until the crank pin extension is hard against its stop and then assemble the tie-rods (adjustable one on top) between the front and rear chains and tension to remove slack; wire-lock the adjustable tie-rod lock-nuts.

(3) Tension the interconnecting cables between the chain on the flap torque shaft and the secondary chain to 65 lb. ± 6.5 lb. by means of the turnbuckles in the boom, then tighten and wire-lock the turnbuckle lock-nuts.

(4) Repeat the above instructions for the corresponding section of the system in the other boom and fin.

(5) With the tail plane control system correctly rigged and an approved hydraulic test rig connected to the Blue or Yellow systems, ensure that the tail plane is in neutral and then position the special rigging gauge (item F2, Sect. 2, Chap. 4) squarely on the top of the tail plane, as shown in fig. 51. With the tail plane in this position adjust the connecting-rods between the port and starboard tab operating levers and the respective tab outboard hinge brackets until the trailing edge of the tab is in line with the lower tongue on the rigging gauge. Move the rigging gauge over the full span of the tail plane adjusting the connecting-rods so that the trailing edge of the tab is in line with the rigging gauge tongue over its full length.

Note...

Any malalignment of the tab must be below the rigging gauge tongue and must not exceed 0.1 in. One half turn of adjustment of either connecting rod eye end moves the tab trailing edge by approximately 0.1 in.

(6) Set all the hinge stop bolts to give 0.05 in. clearance from their respective stop faces. Then move the control column and operate the test rig hand pump to move the tail plane UP and DOWN in 2 deg. increments and check that there is no movement of the tab relative to the tail plane. If movement does occur, adjust the connecting-rods from the crank sprockets to the track members so that there is no movement at the extreme tail plane positions.

(7) Return the tail plane to NEUTRAL and screw out the stop bolts on the two centre hinges until the centre of the trailing edge of the tab is raised 0.4 in. above the NEUTRAL position. Note how much the outboard ends of the trailing edge have moved from the NEUTRAL position.

(8) Connect an approved hydraulic test rig to the Green system and lower the flaps sufficiently to take the strain out of the connecting-rods between the tab operating levers and the outboard hinge brackets; then adjust these rods to bring the outboard ends of the trailing edge down 0.20 in. ± 0.05 in. below the original neutral position.

(9) With the flaps fully up, recheck the 0.4 in. dimension and adjust the stops on the centre hinges to suit. Then check the 0.2 in. ± 0.05 in. dimension and adjust the connecting-rods if necessary. On the two remaining hinges screw out the stop bolts so that they are finger tight against their respective stop faces.

(10). Again move the tail plane UP and DOWN in 2 deg. increments and check that any movement of the tab relative to the tail plane is within the limits 0.00 in. above the new NEUTRAL and 0.01 in. below. When all checks are satisfactory, tighten and wire-lock the stop bolt lock-nuts and check the entire circuit for safety and locking.

RIGGING THE AIR-BRAKE CONTROL CIRCUIT

215. Paragraphs 171 to 187 give a general description of the air-brake control circuit. With the emergency control cable (No. 21) securely attached to the selector lever in the left-hand console and correctly routed as far as the selector valve unit, as described in para. 188, the procedure for rigging the circuit is as follows:

(1) With the aircraft jacked and trestled to allow full lowering of the air brake, connect a hydraulic test rig (Item H17, Sect. 2, Chap. 4) to the Green system and retract the alighting gear.

(2) On pre mod. 1030 aircraft, select the GROUND/NEUTRAL/FLIGHT switch to FLIGHT and the 50 deg./60 deg. switch to 60 deg., then hold the toggle switch on the starboard throttle handle fully aft and operate the test rig hand pump until the air brake is fully extended. Check that the position indicator in the cockpit reads 59 deg. ± 2 deg. adjusting the transmitter operating arm (fig. 23) as necessary to achieve this.

WARNING...
When the transmitter arm is being removed or adjusted, the transmitter spindle must be held, to prevent it unwinding violently.

(3) On pre mod. 1030 aircraft, hold the toggle switch fully forward and operate the test rig hand pump until the air brake is in its mid-travel position, then select the 50 deg./60 deg. switch to 50 deg.

(4) Hold the toggle switch fully aft and operate the test rig hand pump until the air brake ceases to move, then check that the indicator reading is 50 deg. ± 1 deg., adjusting the outboard micro switch setting screw as necessary to achieve this.

(5) Hold the toggle switch fully forward and close the air brake, then check that the indicator reads zero. Select alighting gear DOWN and operate the test rig until each undercarriage leg is locked down.

(6) Select the GROUND/NEUTRAL/FLIGHT switch to GROUND, hold the toggle switch fully aft and operate the test rig hand pump until the air brake ceases to move, then check that the indicator reads 29 deg. ± 1 deg., adjusting the inboard micro switch setting screw as necessary to achieve this.

(7) Temporarily screw the bell-crank lever stop bolt on the selector valve in a turn or so, then, holding the lever against the bolt, operate the test rig hand pump and carefully screw out the bolt until the air brake starts to move up.

(8) Tighten the stop bolt lock-nut and select the emergency air brake control lever in the cockpit to SHUT. Connect the cable to the bell-crank lever securely and tension it to 25 lb.

HINGED PULLEY BLOCK (fig. 52)

216. The illustration shows the hinged pulley block which is located in Zone A. After the removal of two wing nuts, the block can be swivelled forward thus taking the tension out of the rudder and tail plane control cables, which pass around it, without disturbing the turnbuckles. This action enables access to be gained to otherwise inaccessible equipment or it allows the cables to be broken for removal of other equipment. After the necessary action has been taken, the cables joined and the pulley block reset, the cable tensions will be correct provided that the following instructions are strictly adhered to :-

(1) Before attempting to swivel the block forward, insert rigging pin No. 5259, (item F5, Sect. 2, Chap. 4) in the rudder pedal operating arms as shown in fig. 46. (If the rudder pedals are not in NEUTRAL, hydraulic power will have to be connected to either the Blue or Yellow system and the pedals moved until the rigging pin can be inserted).

(2) Remove the two wing nuts from the pulley block and swivel it forward. If it is required to disconnect the cables, they must first be marked so that they can be refitted in their correct positions on the pulley assembly. Then remove the cable guard and the shackle pins from the spade and fork joints forward of the pulley block and join the

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broken ends with lengths of cord, sufficiently long to enable the required action to be taken.

(3) Before resetting the block, join the cables and make a very careful check of the cable runs. Reset the block, wire-lock the wingnuts and remove the rigging pin from the rudder pedals.

VISCOUS DAMPER RESPONSE CHECK (fig. 53)

217. A viscous damper response check rig (item G12, Sect. 2, Chap. 4) is used to check the operation of the viscous damper. The rig measures the control column load when differing air pressures are applied to the Q-pot. Calibration cards plotting load/air pressure, for various temperatures, are supplied with the rig.

Preparation for check

218. Prepare for the check as follows :-

(1) Open the sliding hood fully, and place the rig in the canopy rails and press firmly against the windscreen arch. Fit the locking strut under the sliding hood arch and screw the locking tube hard down.

Note...
If Mod. 1018, which limits the hood opening, is embodied, locking strut Pt. No. 10.20Y 5453A must be used. This strut is introduced by Mod. 8067.

(2) Check the air temperature in the vicinity of the aircraft. If the temperature is outside the range (15 deg. C to 23 deg. C) covered by the calibration cards, either raise or lower the temperature in the cockpit with a heater/cooling rig, or perform the check at a time when the conditions are suitable.

Note...
Calibration cards outside the normal operating temperatures in the cockpit are not supplied because the loading figures obtained would be such that no reliance could be placed on the check.

(3) Connect a controllable air supply, with a gauge to read accurately over the range 0-12 p.s.i. to the Q-pot pressure head. Leave the suction side open to atmosphere.

(4) Connect a 28 V.d.c. supply to the rig motor.

(5) Set the rigging spool on the rig to neutral, by inserting the pin, supplied with the rig, through the holes in the spool and the side plate.

(6) Connect a hydraulic servicing trolley (item H22, Sect. 2, Chap. 4) to the Blue or Yellow system. Run the trolley to pressurise the system, thus ensuring that the controls will be neutral.

(7) With the control column neutral, insert rigging pin No. 5261 (item F5, Sect. 2, Chap. 4) in the hole in the control column handle. Adjust the handle grip connecting-rod until the cage fits round the handle. Lock the cage.

(8) Remove the rigging pin from the spool.

WARNING...
The rig will be damaged if operated with the pin still fitted in the spool.

Response Check (fig. 53)

219. With the preparation completed (para. 218), check the viscous damper response as follows :-

(1) Set the indicator plate to FWD.

(2) To prevent vibration, preload the mechanism, using the spring loading knob, to 30 lb. on Scale 'A'.

(3) Switch motor ON, and adjust the speed control knob until the motor is running at 90 r.p.m.

WARNING...
To avoid overheating the motor, occasionally check the motor temperature by hand. If necessary, switch off and allow the motor to cool down.

(4) With zero pressure in the Q-pot, adjust the spring loading knob until a wisp of yellow shows at the edge of the slot in the indicator plate.

(5) Record the loading figure indicated on Scale 'A'.

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TABLE 2

FLYING CONTROL CABLES—WEIGHTS, DIAMETERS AND TENSIONS

Cable	Weight	Diameter	Tension	Remarks
All aileron cables	15 cwt.	0·15 in.	◀38±1 lb	All cable tensions to be equal to ± 1 lb.
Tail plane main cables	15 cwt.	0·15 in.	35±3·5 lb▶	
Tail plane interconnecting cables across tail plane	10 cwt. and 15 cwt.	0·12 in. and 0·15 in.	—	Each comprising three parts: centre section 15 cwt., outer sections passing over tail plane pivot 10 cwt. Tensioned by compensator in starboard fin.
Rudder main cables	15 cwt.	0·15 in.	40±4 lb	No compensators in circuit
Rudder balance cable	25 cwt.	0·18 in.	51±5 lb.	
Flap drive cables (top)	45 cwt.	0·24 in.	875 lb	Tension must never exceed 1400 lb. Minimum tension after bedding down 750 lb.
Flap drive cables (bottom)	25 cwt.	0·18 in.	150–250 lb.	
Tail plane tab cables	20 cwt.	0·16 in.	65±6·5 lb	

(6) Repeat the test with the indicator plate in the AFT position.

(7) Repeat the test in the FWD and AFT positions with 2, 4, 5, 6, 7, 8, 10 and 12 p.s.i. air pressure applied to the Q-pot.

(8) The readings in the FWD and AFT positions, for pressures of 0–5 p.s.i., should not differ by more than 25% of the larger figure, and for 6–12 p.s.i. should not differ by more than 20% of the larger figure, and the mean must be be within the limits of the curves for the prevailing temperature.

Note . . .

The scale setting can be checked before use, or when the readings are suspect, by applying a spring balance load of 10 lbs. to the hook on lever 'K'. Scale 'A' should read the figure shown on the correction plate. If incorrect, slacken the scale retaining bolts, slide the scale to correct the reading and tighten the bolts. Check setting by repeating the test.

(9) On the completion of tests remove equipment fitted when preparing the aircraft for the check.

Q-FEEL SYSTEM LEAK CHECK

WARNING . . .

Do not pressurise the suction side of the viscous damper.

220. To check the Q-feel system, excluding the viscous damper, for leakage:—

(1) Blank off the pipes from the Q-pot to the viscous damper at the damper end (fig. 7).

(2) Pressurise the suction and pressure pipe runs simultaneously to 10 p.s.i.

(3) Check the leak rate of the combined pipe runs.

(4) Pressurise the pressure pipe run alone to 10 p.s.i. and check the leak rate. The maximum permissible leakage is 0·5 lb. per minute.

(5) Subtract the leak rate (4) from (3) to give the leak rate for the suction pipe run. The maximum permissible leak rate is 0·25 lb. per minute

REMOVAL AND INSTALLATION

WARNING . . .

The precautions detailed in the WARNING preceding para. 189 must be taken before any of the flying control surfaces are hydraulically operated.

General

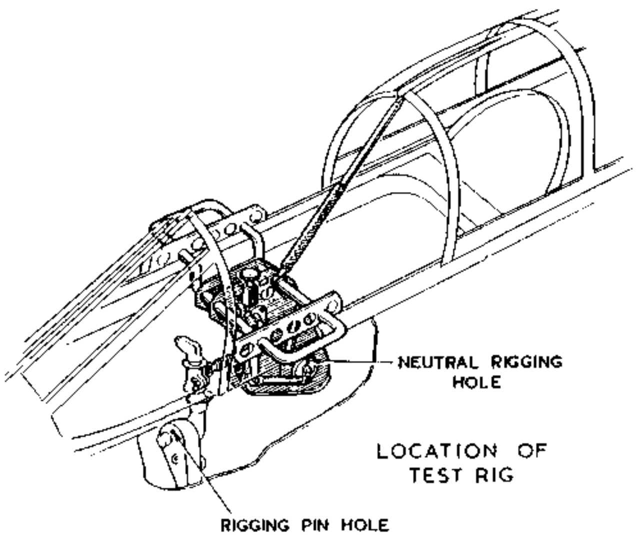
221. The procedure for removal and installation of the ailerons and of the flaps is given in Sect. 3, Chap. 2; of the tail, tail-plane tab and rudder in Sect. 3, Chap. 3; of the air brake in Sect. 3, Chap. 1, and of the aileron, tail-plane and rudder control units in Sect. 3, Chap. 6. The removal and installation of many of the other components described in this chapter is straightforward and will be readily apparent, although their extraction through the access holes may require some negotiation. Instructions are, therefore, only given for the removal of those components where a definite procedure is required or where unforeseeable difficulties may arise. The following points require attention during the removal and installation of all components, whether the procedure is described in this chapter or not:—

(1) Unless otherwise stated, installation of a component is the reverse of its removal and therefore, the means of locking the component and the method of removal should be carefully noted.

(2) To assist in assembly, and to prevent losses when units are dismantled, note the position of nuts, washers and bolts in the assembly, and fit the nuts, washers and bolts in their respective holes.

(3) Unless otherwise stated, all moving parts should be assembled with anti-freeze grease, XG–295.

(4) Removal, installation and testing of all electrical wiring and other components must be done in con-



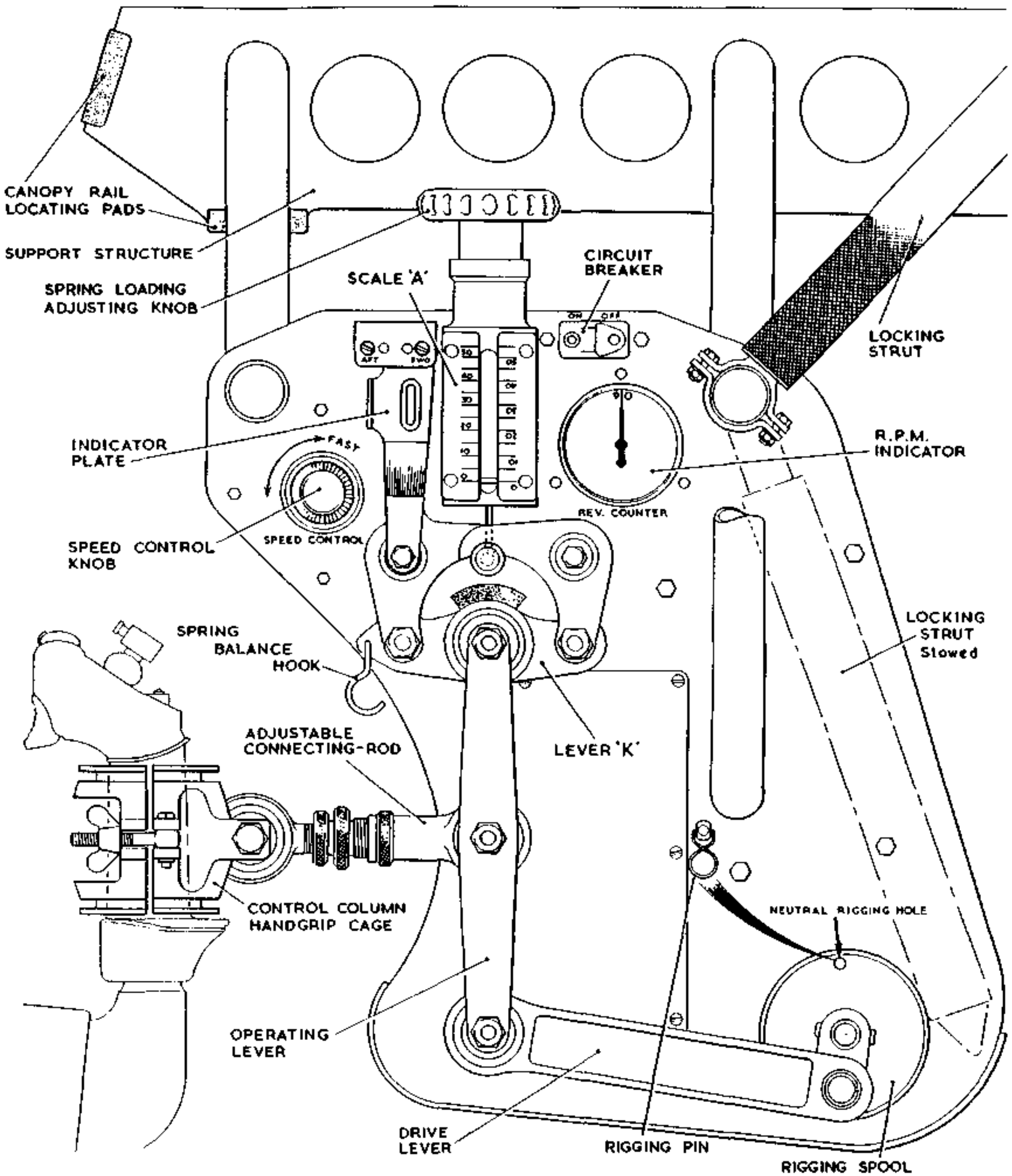


Fig. 53 Viscous damper response check rig

◄ Instructions deleted, rigging holes added ►

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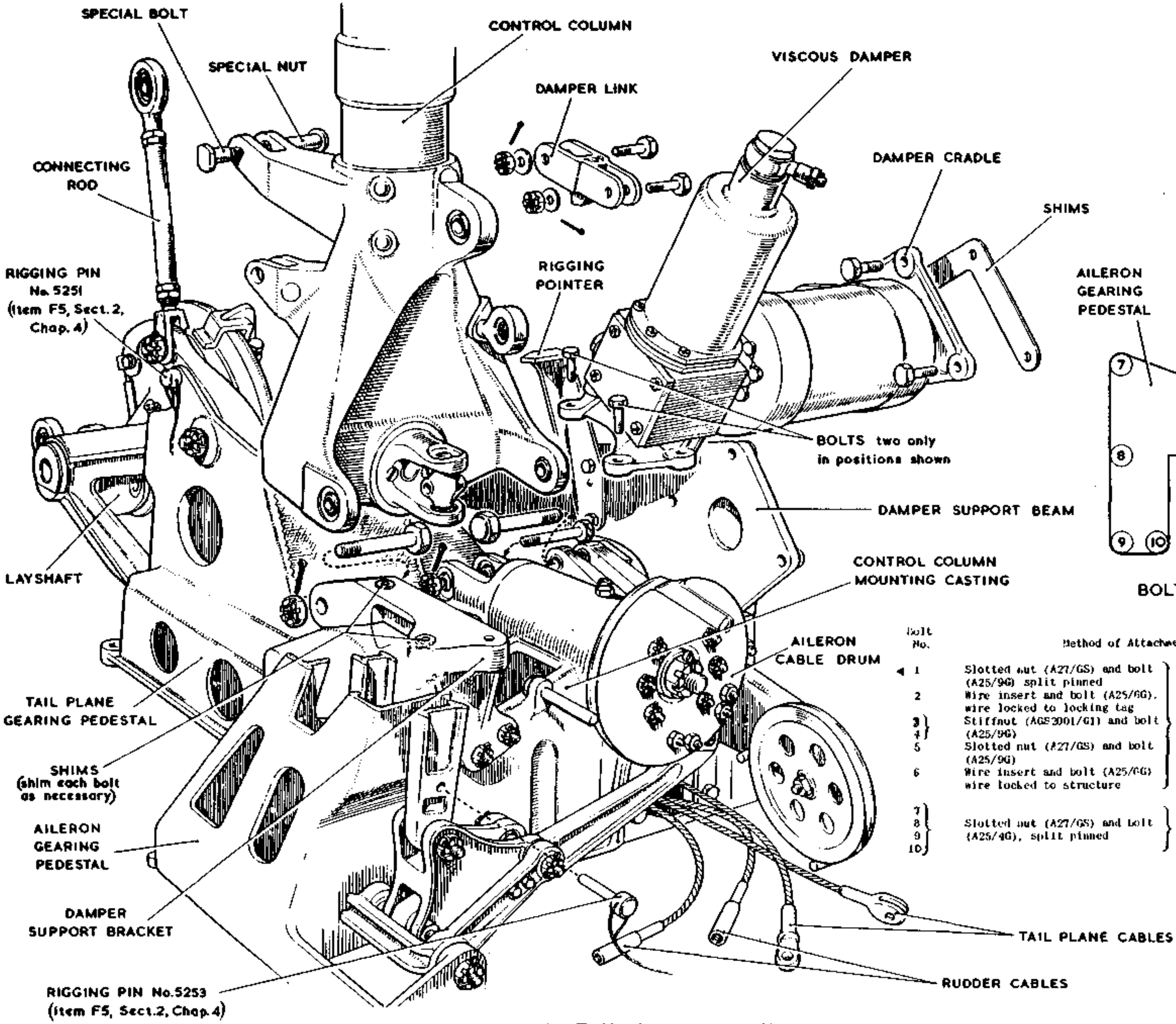

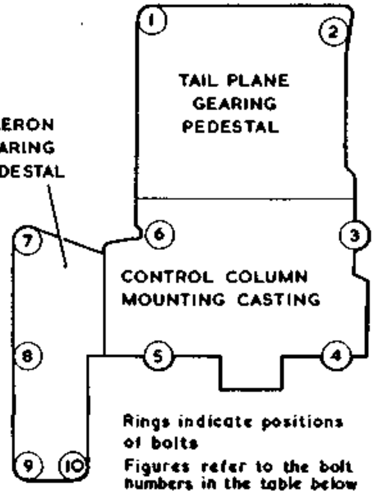

BOLTING DIAGRAM

Bolt No.	Method of Attachment and Locking	
◄ 1	Slotted nut (A27/GS) and bolt (A25/9G) split pinned	These six bolts are also fitted with : Bonded seal (AGS. 1186-6) Special washer (10. 20CF. 5077) Standard washer (SP. 13G) Distance piece (10. 20CF. 5079)
2	Wire insert and bolt (A25/6G). wire locked to locking tag	
3, 4	Stiffnut (AGS2001/G1) and bolt (A25/9G)	
5	Slotted nut (A27/GS) and bolt (A25/9G)	
6	Wire insert and bolt (A25/6G) wire locked to structure	
7, 8, 9, 10	Slotted nut (A27/GS) and bolt (A25/4G), split pinned	These four bolts (A254G) are also fitted with : Bonded seal (AGS. 1186-6) Standard washer (SP. 13G) ►

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Fig. 54 Tail plane and aileron controls

◄ Rigging pin numbers altered ►

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junction with an electrical tradesman.

(5) The access panels referred to are illustrated in Sect.2, Chap.4, fig.6 and 7; the keys to these illustrations indicate to which components each panel gives access, and reference should be made to these keys, when removing components for which the procedure is not described.

WARNING...
To avoid fouling the flying control mechanism, when the panels are refitted, the correct length bolt must be fitted in each hole. The plain length of each bolt is stencilled on the panel or on the adjacent structure.

(6) When the tail plane is raised or lowered on one control unit and the test rig hand pump, to give access to the other side, the tail plane should be moved to the extreme position and the control valve lever wire-locked to give further selection in the same direction; this overcomes any tendency of the control unit to creep. The same procedure should also be followed when the tail plane is raised or lowered on both units and it is required to keep it in this position; in this instance, both selector levers should be locked.

AILERON AUTOPILOT ACTUATOR (fig. 3)

Removal

222. The procedure for removing either the port or starboard aileron autopilot actuator is as follows :-

(1) Remove access panels No.58, 104, 141A and 143 from the appropriate main plane. Ensure that the autopilot is switched OFF and that the Yellow hydraulic system is exhausted.

(2) Disconnect both ends of the aileron control unit connecting-rod and remove the rod.

(3) Disconnect and blank off the two hydraulic pipe lines on top of the actuator and disconnect the electrical wires at the plug and socket on the lower wing skin.

(4) Remove the 2B.A. nut and bolt from the attachment fork between the actuator and the centring strut. Remove the $\frac{1}{4}$ in. B.S.F. nut and shouldered bolt at the ram of the actuator and the 5/16 in. B.S.F. nut and 8 mm. bolt at the anchorage end. Remove the attachment fork.

(5) Swing the centring strut, inner and outer levers clear and withdraw the actuator through the access hole in the bottom skin.

Installation

223. Installation of an aileron autopilot actuator is the reverse of removal but the bonded seals in the inlet and exhaust connections should be inspected and, if necessary, renewed. Before the actuator is installed, it should be functioned electrically and hydraulically to set it to its neutral length of 11.430 in. to 11.444 in. between centres. During assembly it should be ensured that all the mechanical joints move freely and, after installation, the checks given in fig. 41 should be made, when the actuator has been bled and operated to eliminate air (Sect. 3 Chap. 6).

AILERON TRIM ACTUATOR (fig. 3)

Removal

224. In order to remove the aileron trim actuator, the starboard wing must be in the spread position. The procedure for removing the actuator is as follows :-

(1) Remove access panels No. 142 and 143 (the air mileage unit is mounted on panel No. 142; after detaching the panel disconnect the electrical connections and the pitot pressure and suction lines from the unit).

(2) Remove the hand-hole cover on rib No. 9 and remove the 5/16 in. B.S.F. bolt connecting the actuator eye-end and the aileron trim dual lever assembly.

(3) With the right hand through the hand hole on rib No. 9, disconnect the electrical wiring from the actuator.

FITTING INSTRUCTIONS

1. Before installing the transmitter, check that the tail-plane movements are as given in fig.37.
2. Offer up the bracket, locating plate and transmitter and cable assembly to the lower fin head rib, but do not finally tighten the nuts.
3. Set the tail plane in neutral and insert rigging pins No.3021 and 3031 (item F5, Sect.2, Chap.4) in the trim unit and Mach gear change unit respectively (fig.42 and 43). Rotate the transmitter, which is secured to the bracket by three bolts passing through slotted holes, to obtain a ZERO reading on the cockpit indicator.
4. Remove the rigging pins and set the Mach gear change in COARSE gear (fig.44). Operate the tail plane to the maximum negative position (12 deg. 30 min.) and adjust the fore-and-aft position of the transmitter bracket to produce the correct reading on the indicator.
5. With the gear change still in COARSE gear, operate the tail plane to the maximum positive position (3 deg. 30 min.) and check that the correct indication is given.
6. Move the tail plane through its complete range of movement in 2 deg. increments and adjust the transmitter so that the correct readings (±0 deg. 15 min.) are obtained.
7. Mark off the rivet positions on the locating plate from the holes in the bracket.
8. Remove the bracket and then remove the transmitter and cable assembly from the bracket.
9. Drill and countersink the locating plate and rivet it to the bracket.
10. Re-assemble the unit in the fin and recheck the readings.
11. Secure the bolts and then secure the transmitter lever with the washer and split pin.
12. Fit the serrated plate and cable guard and adjust to give a nominal clearance ◄ of 0.03 in. from the trim unit cable drum. ►

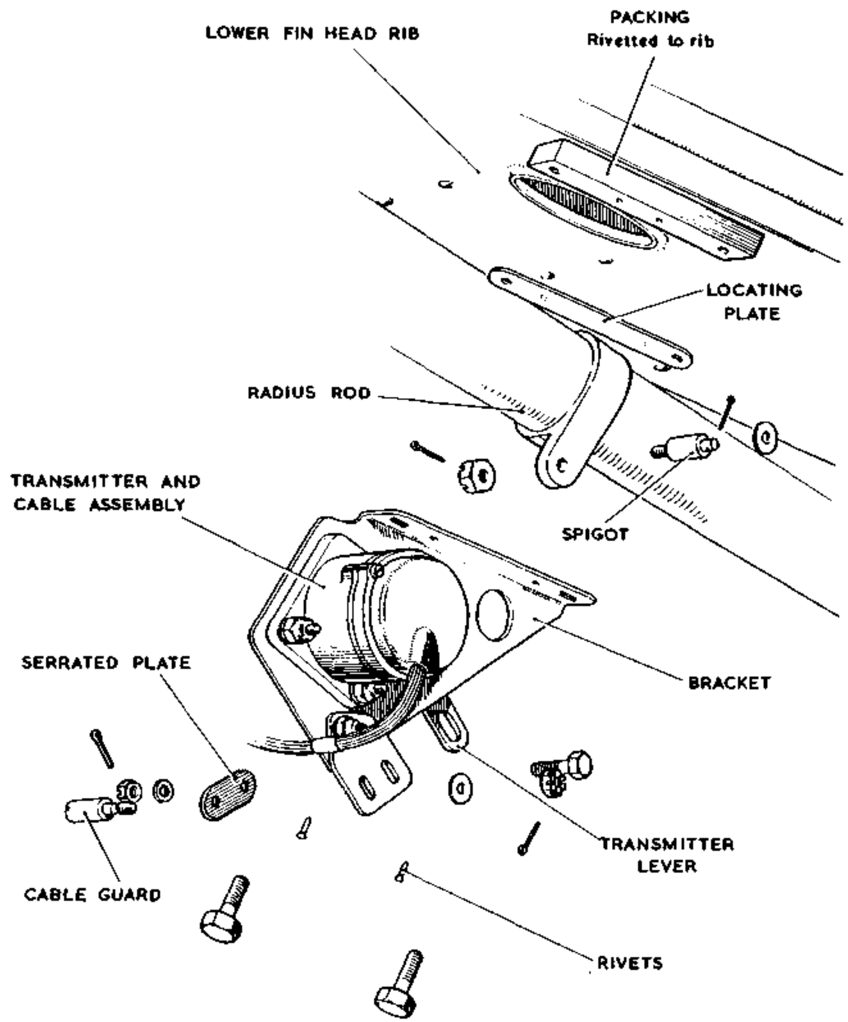

Fig.55 Installation of tail plane Desynn transmitter

◄ Bolt through serrated plate reversed ►

(4) Remove the forward attachment bolt. (On pre Mod. 499 aircraft, this bolt is rather difficult to reach; on post Mod. 499 aircraft, however, an access panel on the lower wing skin between rib No. 9 and 10, and a sight hole in rib No. 9 make removal of the bolt easier). Remove the actuator.

Installation

225. Before refitting the aileron trim actuator, it should be functioned so that the red dot on its ram is half exposed. The eye-end should be left unlocked for final adjustments when connecting-up. The procedure for installing the actuator is then as follows:—

(1) Position the actuator in the wing and refit the front attachment bolt and nut. Reconnect the electrical wiring to the actuator.

(2) With rigging pin No. 5263 (Item F5, Sect. 2, Chap. 4) in position in the aileron trim dual lever assembly (fig. 40) adjust the actuator eye-end so that the connecting bolt between the lever and the eye-end can be fitted and locked. Tighten and lock the eye-end locknut.

(3) With hydraulic rig (Item H22, Sect. 2, Chap. 4) connected to either the Blue or Yellow system, check that the aileron trim movements are as given in fig. 37.

(4) Refit all the access panels. (After connecting up the air milage unit, check the pressure and static lines for leaks).

TAIL PLANE MACH GEAR CHANGE ACTUATOR

Removal

226. Before removing the tail plane Mach sensitive gear change actuator, ◀access panels No. 49, 72, 77 and 144 should be removed from the port fin, and panels No. 52 and 58 from the ▶starboard fin. A hydraulic test rig (Item H17, Sect. 2, Chap. 4) should be connected to either the Blue or Yellow system. The procedure for removing the actuator is then as follows:—

(1) Select NEGATIVE trim and operate the control column and the test rig hand pump to bring the tail plane fully up (12 deg. 30 min).

(2) Disconnect the connecting-rods to both servo control unit control valve levers. Disconnect the connecting-rods between the Mach gear change unit and the trim unit at the trim unit end. Disconnect the electrical leads to the actuator.

(3) Swivel the Mach gear change unit anti-clockwise (looking from the port side) until access to the actuator rear attachment can be gained; it may be helpful to note the position of the lower stop bolt and then unlock the lock-nut and screw the bolt right in to allow maximum movement of the unit.

(4) Remove the special nut and special bolt. (The nut and bolt both have heads, on which are two parallel flats, approximately 0·45 in. apart).

(5) Remove the forward attachment nut and bolt and then remove the actuator through the outboard access hole.

Installation

227. Refitting of a gear change actuator is the reverse of the removal. After installation, the lower stop bolt must be reset to the position it originally occupied, and with full hydraulic rig pressure applied to either the Blue or Yellow system, the tail plane movements (fig. 37) should be checked. After the checks have been completed the access panels should be refitted.

TAIL PLANE TRIM ACTUATOR

Removal

228. The procedure for removing the tail plane trim actuator is as follws:—

◀(1) Remove access panels No. 43, 49, 71, 72 and 144 from the port fin, panel No. 85 from the port boom, and panel No. 52 from the ▶starboard fin. Open the fuel bay doors.

(2) Disconnect the connecting-rods to both servo control unit control valve levers and remove the tail plane Desynn transmitter and its mounting.

(3) With the roller of the spring-

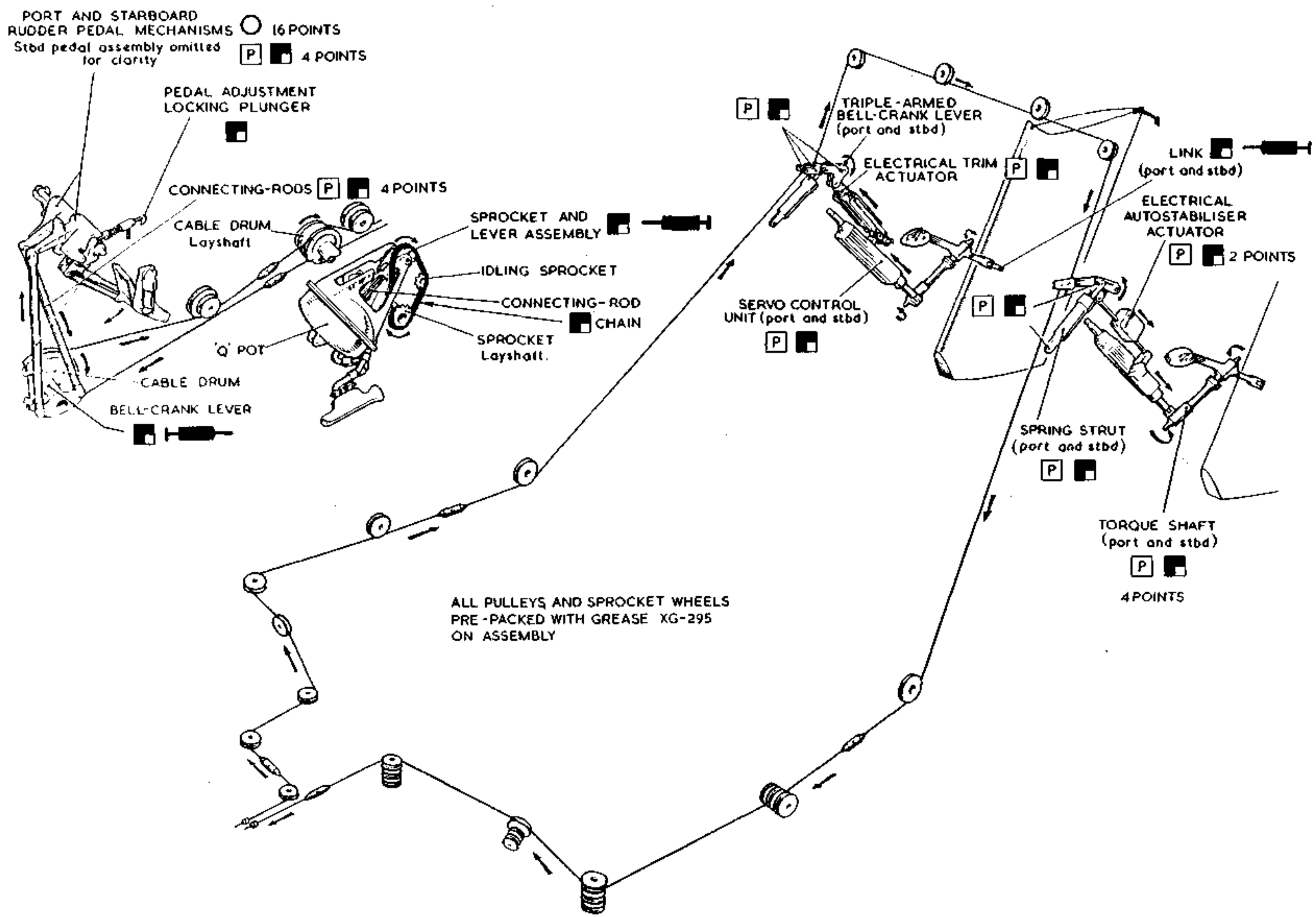

Fig. 56. Lubrication—rudder controls

(SPROCKET AND LEVER ASSEMBLY SYMBOL)

feel mechanism in the dwell of its cam, measure the extension of the spring strut from the strut body to the fork end. Connect a hydraulic test rig (Item 1117, Sect. 2, Chap. 4) to either the Blue or Yellow system, hold both control valve levers up and operate the test rig hand pump until the tail plane ceases to move. Cease hand pump operation (para. 221 (6)). Slacken off the spring strut.

(4) Swivel the hinged pulley block in Zone A forward, as described in para. 216, and break the two tail plane cables (the lower two on the pulley assembly), joining the broken ends with a length of cord, about 4 ft. long; this will give sufficient slack in the cables to enable the trim unit to be taken out of the fin.

(5) Disconnect the connecting-rods between the Mach gear change unit and the trim unit at the trim unit end, then rotate the gear change unit and disconnect the other ends of the connecting-rods; remove the rods from the fin.

(6) Remove the pin between the locking solenoid and the cam locking lever and disconnect the electrical wiring to the actuator. Remove the inboard and outboard trim unit bearing caps.

(7) Remove the trim unit from the fin. This may be accomplished by guiding the forward end of the unit into the forward corner of its compartment, at the same time lowering the unit, then lifting the forward end of the unit up and turning it outwards through the access hole. Alternatively, the web which supports the outboard bearing of the unit may be removed, so that the unit may be lifted straight out.

(8) Remove the actuator from the trim unit.

Installation

229. Before installing the tail plane trim actuator into the trim unit, it must first be set to its neutral length as follows:—

(1) Run the actuator out to its fully extended position and adjust the eye-end of the ram so that the between centres length of the actuator is 11·54 in. ±0·010 in.; leave the eye-end unlocked for final adjustment.

(2) Run the ram back until the between centres length of the actuator is 10·92 in. ±0·010 in. This is the neutral length.

230. With the actuator set to its neutral length, it should be installed in the trim unit and its eye-end adjusted until the rigging holes in the trim lever and the trim unit body are in alignment; the eye-end should then be locked. The trim unit is installed in the fin in the reverse order to its removal, but the following points require attention:—

(1) The spring-feel roller should set in the dwell of the cam, before the spring strut is adjusted to its original length (para. 228(3)).

(2) Before resetting the hinged pulley block in Zone A the routing of the control cables should be very carefully checked. The block should be reset as described in para. 216.

231. After installation of the trim unit, the following checks should be made:—

(1) With full hydraulic rig pressure connected to either the Blue or Yellow system, move the tail plane fully up and fully down and return it to the neutral position. Check that the trim unit, trim lever, spring-feel roller, Mach gear change unit and the cable compensators in the port boom and starboard fin are all in their respective neutral positions (fig. 42, 43 and 44).

(2) Move the tail plane up and down a few times and then select COARSE gear and NEUTRAL trim and check that the maximum movements are as given in fig. 37, adjusting the Desynn transmitter, if necessary, so that the correct indications are given in the cockpit.

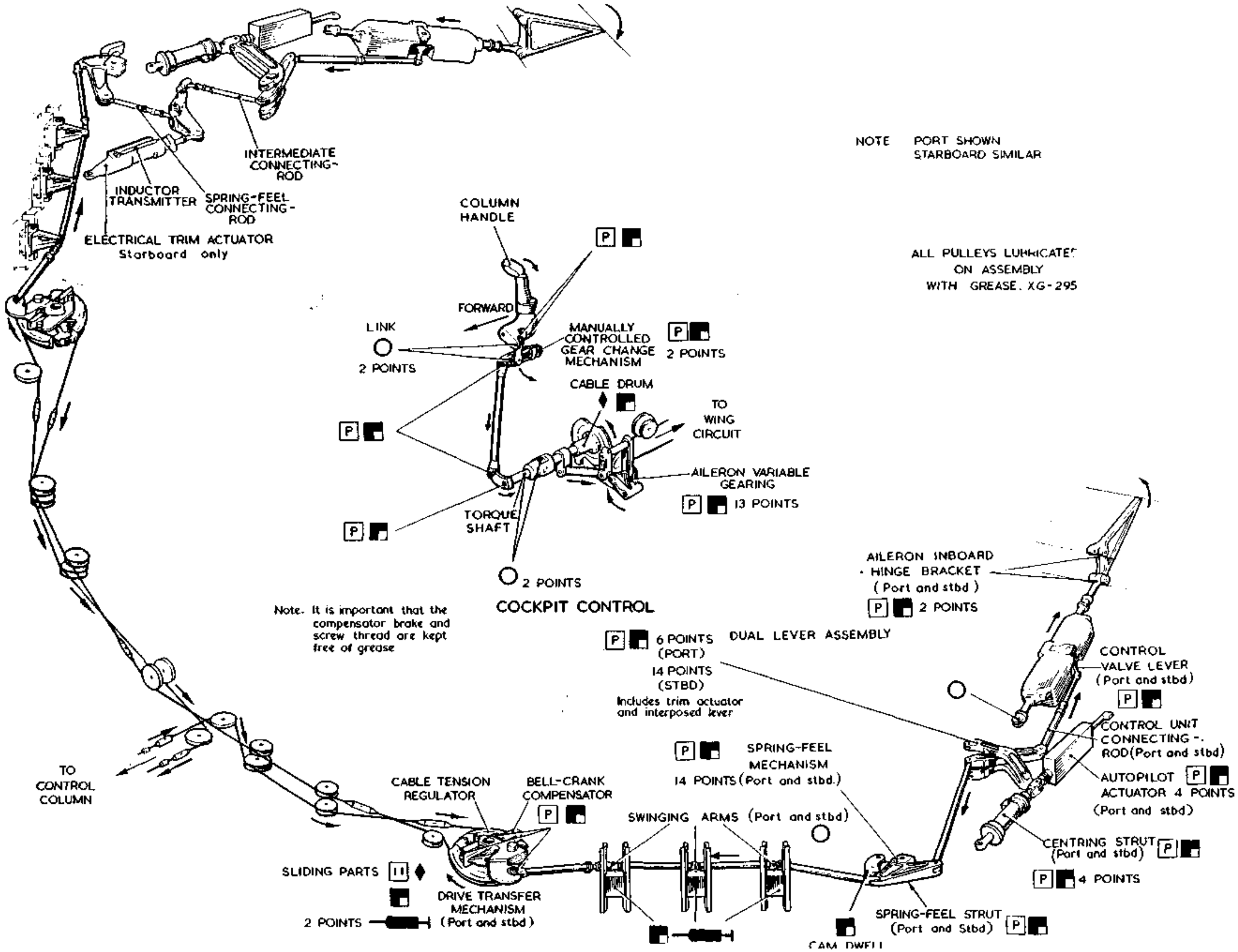

Fig. 57. Lubrication—aileron controls

◂SYMBOL ADDED▸

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(3) With the Mach gear change actuator still in COARSE gear check the maximum movements with full NEGATIVE and full POSITIVE trim applied.

(4) To check that the rudder cable circuit is correct after resetting the hinged pulley block, oscillate the rudders a few times and then, with zero trim indicated on the cockpit indicator and with the anti-yaw actuator OFF, check that the rudders are in neutral.

TAIL PLANE INTERCONNECTING CABLES

Removal

232. If it is desired to renew the interconnecting cables across the tail plane, the old ones can be removed and the new ones installed in one series of operations, as follows :-

(1) Remove access panels No.17 and 18 from the starboard fin, No. 12, 40, 124 and 125 from the port fin and the two access panels from the bottom skin of the tail plane.

(2) With both an approved hydraulic rig and electrical power connected, set the tail plane controls in neutral, i.e. check that the roller of the spring-feel mechanism is in the dwell of the cam, insert rigging pin No. 3021 (item F5, Sect. 2, Chap. 4) in the trim bell-crank lever and, with the Mach gear change unit set in NORMAL gear, insert rigging pin No. 3031 (item F5, Sect. 2, Chap. 4) in the unit. Shut off the hydraulic rig.

(3) Remove the cable guards from the port and starboard tail plane pivot pulley blocks and from the two pulley blocks adjacent to the access holes in the tail plane bottom skin.

(4) Slacken off the cables by unscrewing the tensioners on the cable compensator in the starboard fin.

(5) Break the cables at the spade and fork joints in the starboard fin and securely attach a piece of stout cord, about 4 ft. long, to the end of each of the cables which pass across the tail plane; secure the other ends of the cords to some point on the fin.

(6) Pull both cables through from the port fin until the joint in the front cable can be broken through access hole No.124 and the joint in the rear cable through access hole No.40.

(7) Pull the cables back from the starboard fin until the spade and fork ends are at the port tail plane pivot pulleys. Take the cross out of the cables by passing the forward one over the rear one. The front cable should now have forks at both ends and the rear one spades at both ends.

Installation

233. (1) Attach the new cables securely to the port ends of the old ones, joining fork to fork and spade to spade. Carefully pull the old cables out of the tail plane from the starboard fin head, pulling the new ones with them.

(2) With the aid of a mirror and a strong light, check that the cables do not cross over in the tail plane and that they are correctly routed over the pulleys.

(3) Unfasten the old cables from the new ones and from the cords and attach the cords to the new cables. Pull the cables taut from each end and check that they are not crossed, then, at the port tail plane pivot, cross the rear cable over the front one.

(4) Pull the cables through from the port fin until they can be joined to the cables from the Mach gear change. Pull them back from the starboard side and join them to the cables from the compensator. Check that the cable from the front of the Mach gear change drum passes around the front pulley at the port tail plane pivot, over the other cable and over the rear pulley at tail plane port rib No.4, to terminate at the rear of the compensator. Check that the cable from the rear of the Mach gear change drum passes around the rear

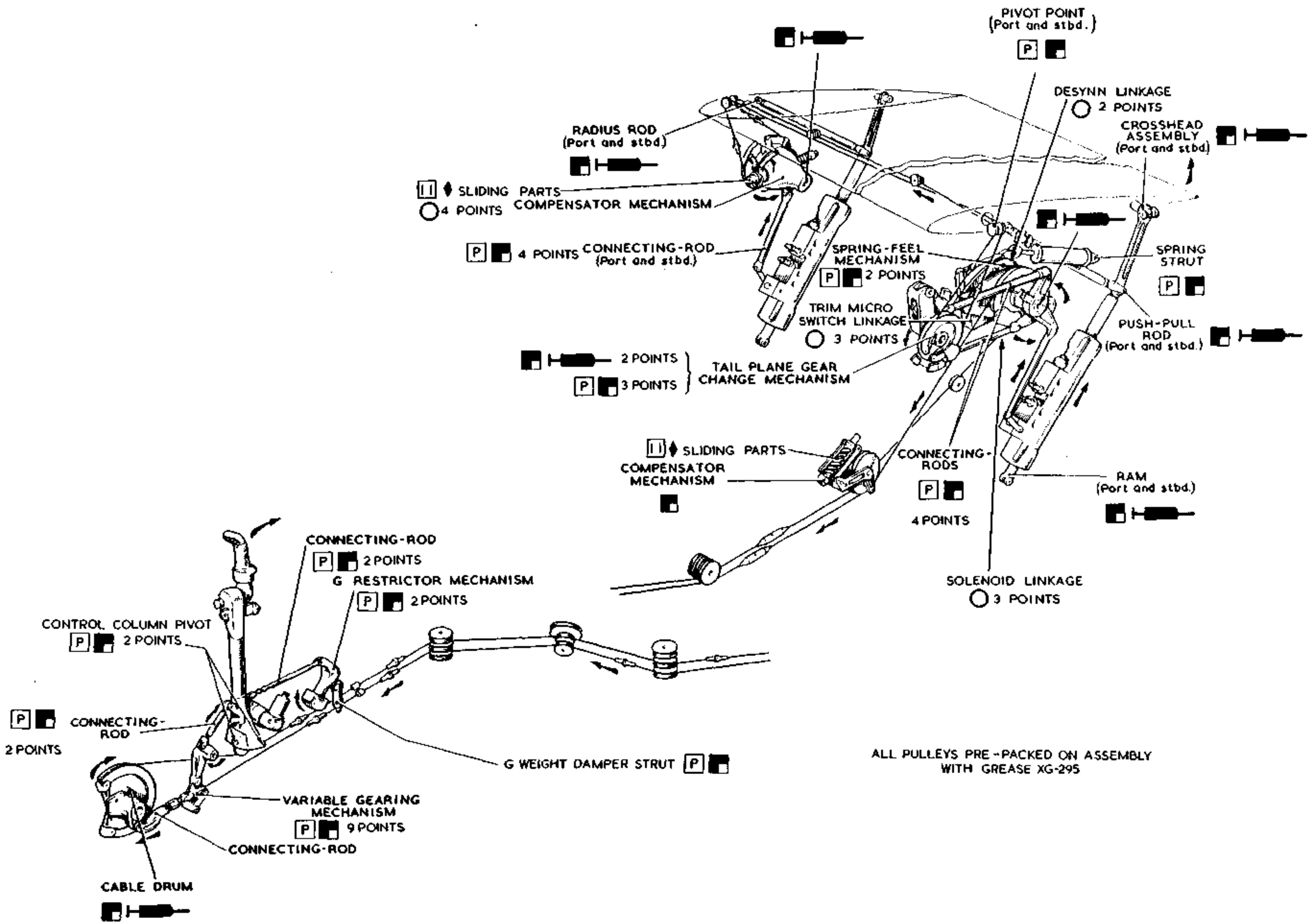

Fig. 58 Lubrication—tail plane controls

◄ Symbol added to compensators ►

pulley at the pivot, under the other cable and over the front pulley at rib No. 4, to terminate at the front of the compensator. Check, when Mod. 983 is embodied, that the cables run correctly over the slotted fairlead on rib No. 3. Refit the pulley guards to the pulley blocks in the tail plane.

(5) Adjust the cables, by means of the tensioners on the compensator, so that the rigging pointer on the compensator lines up with the notch on its mounting casting (fig. 43). Then tension both cables equally, until the rigging hole in the compensator shaft is just completely exposed.

(6) Remove all the rigging pins and apply full hydraulic rig pressure to either the Blue or Yellow system. With the tail plane in neutral, check that the maximum twist does not exceed 0 deg. 5 min.

(7) Refit the pulley guards at the tail plane pivots and lock all parts that have been disturbed. Recheck the cable runs and then refit the access panels.

RUDDER SYSTEM Q-POT

Removal

234. The procedure for removing the rudder system Q-pot is as follows :-

(1) Having removed the pilot's ejection seat and false floors, disconnect the Q-pot connecting-rod, by cutting the locking wire and removing the special bolt and special nut joining the rod to the top sprocket and lever assembly.

(2) Disconnect the hose connections in the pressure and suction lines. Disconnect the viscous damper pipes at the damper, blanking off the exposed ends on the pipes and the damper with suitable blanks; tie the pipe ends to the Q-pot.

(3) Slacken off the chain adjuster and then remove the Q-pot top attachment bolt and nut, taking care not to lose the shims. Remove the forward attachment bolt and then lift the Q-pot clear.

Installation

235. When the rudder Q-pot is being refitted, the top attachment bolt should be fitted with its head (which carries a grease nipple) pointing to starboard. The shims should be equally disposed either side of the sprocket and lever assembly. After installation, the chain should be tensioned as shown in fig. 46.

AILERON AND TAIL PLANE VARIABLE GEARING UNITS (fig. 54)

Removal

236. The aileron and tail plane variable gearing units, the tail plane and rudder cable drums, the control column and the viscous damper can be removed as one unit. Before the assembly can be removed, the pilot's ejection seat and false floors must be removed. To ease assembly, the aileron, tail plane and rudder controls should be set in neutral and then all pressure exhausted from the Blue and Yellow hydraulic systems. The procedure for removing the units is then as follows :-

(1) Insert rigging pin No. 5259 (item F5, Sect. 2, Chap. 4) in the rudder pedal operating arms, then remove the two wing nuts from the pulley block in Zone A and swivel the block forward (para. 216). Release the tension in the aileron control circuit by means of turnbuckles A (fig. 38).

(2) Remove the control column to g-weight connecting-rod. Remove the Q-pot (para. 234) and the pulley bracket immediately aft of the aileron cable drum.

(3) Disconnect the rudder cables at the turnbuckles aft of the gearing units and the tail plane cables at the spade and fork joints aft of the units. Disconnect the aileron cables from the cable drum.

(4) Disconnect the connecting-rods from the rudder pedal operating arms to the layshaft and set the pedals in their fully forward position.

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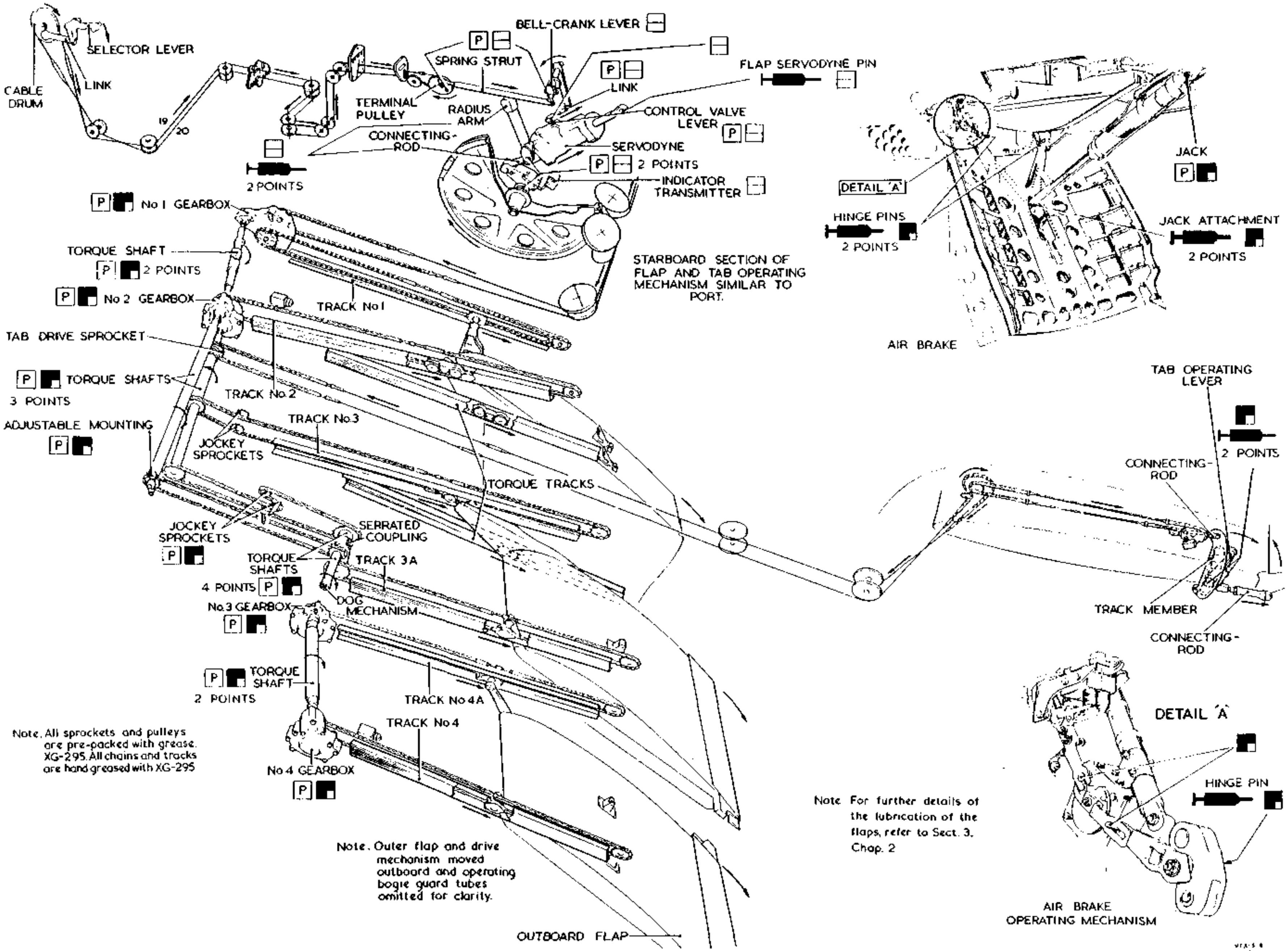

Fig. 59 Lubrication–flap operating mechanism and air brake

(5) Disconnect the electrical wiring from the control column. Remove the ten bolts securing the gearing units to the cockpit floor.

(6) Lift the complete assembly aft and then out of the cockpit.

Note...
The control column and the viscous damper and its cradle may be removed from the gearing units, either in the aircraft or after the assembly has been removed. When removing the damper, and cradle, the positions of the shims (Fig.54) should be noted. On no account may the damper be adjusted or separated from its cradle. Additionally, the tail plane and aileron gearing units must never be adjusted, dismantled or separated.

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Installation

237. The procedure for assembling the control column and the viscous damper to the gearing units, and installing the complete assembly in the aircraft is as follows :-

(1) With the gearing units on the bench, insert rigging pins No.5251 and 5253 (item F5, Sect.2, Chap.4) in position in the tail plane and aileron gearing units, respectively (fig.54). Check that the rigging marks on the tail plane cable drum and on the cable guard are in alignment; adjust the drum connecting-rod, if necessary, and wire-lock it (fig.44).

(2) Assemble the control column and the viscous damper and its cradle to the gearing units (fig.54), ensuring that the shims are in the same position as before removal. If in doubt, the horizontal bolts should be tightened, and the clearance between the damper and the support bracket measured with feelers. Shim the gap accordingly to prevent any movement of the damper when the vertical bolts are tightened. Assemble the connecting-rod from the tail plane gearing unit to the column and adjust its length until the column is approximately $2\frac{1}{2}$ deg. aft of vertical; do not wire-lock. Align the rigging pointer on the damper support beam with the rigging mark on the column. (The bolts securing the pointer pass through slotted holes to allow angular adjustment of the pointer to be made). Hand tighten the securing bolts but do not drill the hole for the locking rivet.

(3) Check that, with the aileron manual gear change handwheel wound fully anti-clockwise, (i.e. to the NORMAL position), the rigging pointers on the rear of the control column are in alignment (fig. 40); adjust the aileron connecting-rod on the forward face of the column, if necessary. Remove the rigging pin from the aileron gearing unit (sub-para.(1)).

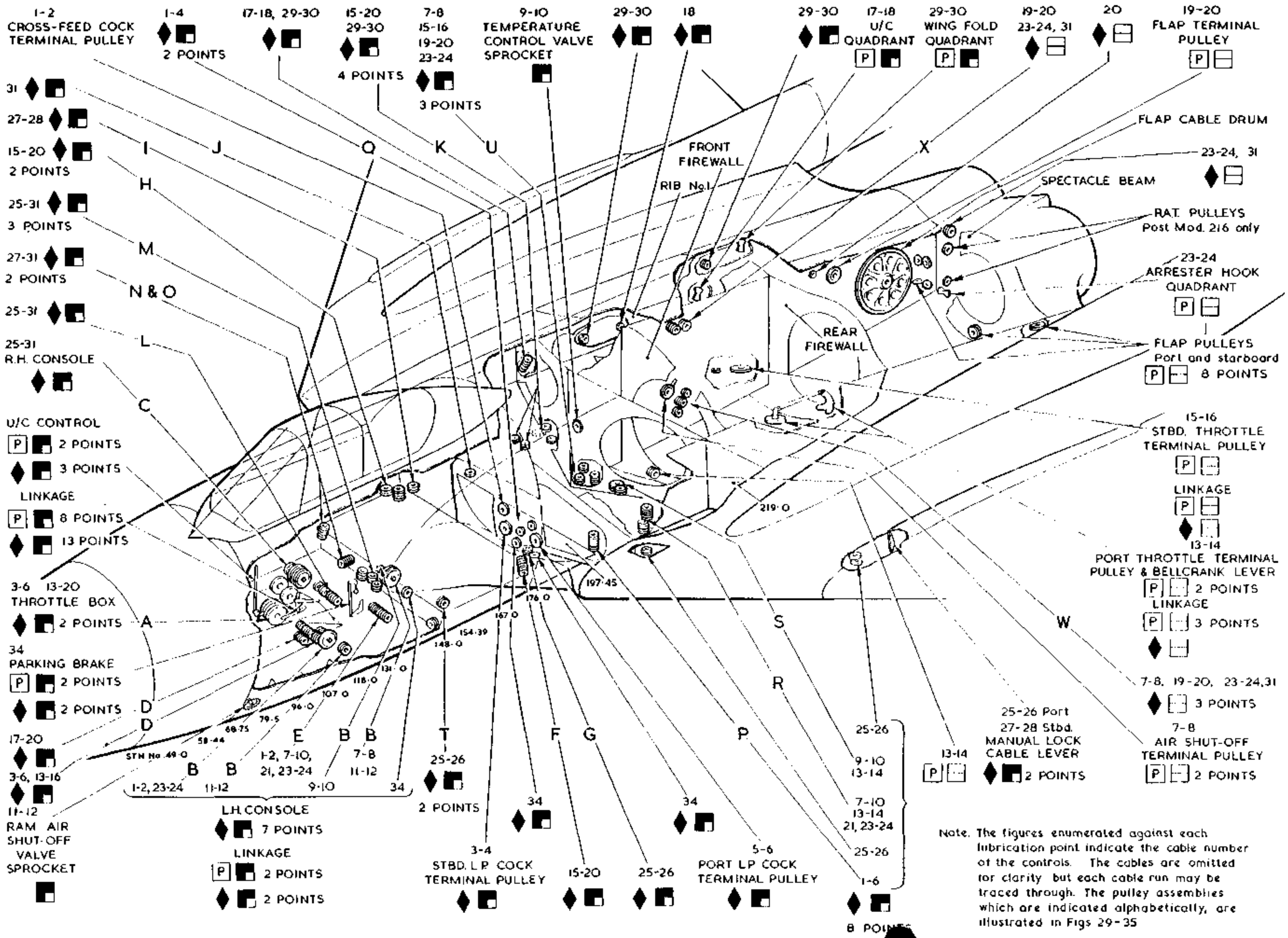
(4) Position the complete assembly on the cockpit floor and pull the tail plane and rudder cables taut from the rear so that their runs around the cable drums and through the gearing units can be checked. A special check should be made that the lower run of the rudder cable is in the groove of the cable drum. Refit the ten securing bolts (fig.54).

(5) Check that the rigging pin is still inserted in the rudder pedal operating arms (para.236 (1)) and connect the connecting-rods from the arms to the layshaft, adjusting their lengths to bring the rigging mark on the rudder cable drum in line with the mark on the starboard layshaft mounting bracket (fig.46).

(6) Refit the aileron pulley bracket aft of the aileron cable drum and connect up all the cables, checking that they are not twisted between the gearing units and the cable seals at Stn.No.148. Ensure that cable No.10.20CF.5229 goes to the starboard side of the aileron cable drum and cable No.10.20CF.5227 goes to the port side (fig.38).

(7) Refit the Q-pot and the g-weight connecting-rod. (It is not necessary to adjust the connecting-rod at this stage).

(8) Re-set the hinged pulley block in Zone A and check the rigging of the tail plane and rudder circuits (para. 195 to 199). The aileron cable circuit will have to be re-



Note. The figures enumerated against each lubrication point indicate the cable number of the controls. The cables are omitted for clarity but each cable run may be traced through. The pulley assemblies which are indicated alphabetically, are illustrated in Figs 29-35

Fig. 60 Lubrication-auxiliary controls

rigged as described in fig. 38.

(9) With the viscous damper link disconnected from the control column and the rigging pin removed from the tail plane gearing unit (sub-para. (1)), connect a hydraulic test rig (item H22, Sect. 2, Chap. 4) to either the Blue or Yellow system and check that the aileron, tail plane and rudder movements are as given in fig. 37, adjusting the various control stops as necessary. (To adjust the tail plane control column stops, the false floors will have to be temporarily refitted). Note the exact angle of the tail plane in NORMAL gear and NEUTRAL trim with the control column against its forward stop. (For example this angle may be 3 deg. 28 min.).

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(10) Remove the false floors and, with the control column in neutral, connect the viscous damper link to the column. In NORMAL gear and NEUTRAL trim, carefully move the control column forward, noting the gap between the damper link and its safety stop (fig. 44). Cease control column movement, when either the gap is 0.03 in. $\pm$ 0.020 in. or the tail plane reaches the exact angle noted in sub-para. (9). Adjust the connecting-rod from the tail plane gearing unit to the column until, with the tail plane at that angle, the gap is 0.03 in. $\pm$ 0.020 in. Lock the connecting-rod turnbarrel.

Note...
While the above adjustment is being made the link should at no time contact its safety stop.

(11) Allow the control column to return to its new neutral position and slacken the two bolts securing the rigging pointer to the damper support beam. Align the pointer with the rigging mark on the column and tighten the bolts. Drill through the existing hole in the beam and through the pointer and insert an 1/8 in. rivet to lock the pointer in this position. Wire-lock the bolt heads together.

(12) Adjust the g-weight connecting-rod to bring the g-weight neutral (fig. 44). Refit the false floor and move the control column forward until the tail plane is at the exact angle noted in sub-para. (9), adjusting the front stop bolt until it just contacts its stop face at this position; note the exact number of turns required. Adjust the rear stop an equal number of turns. The range of tail plane movements should now be the same as it was before the damper was connected.

(13) Make a final check of all locking and refit the ejection seat.

Note...
After the pilot's ejection seat has been refitted, the control column may foul the seat before being arrested by the rear stop bolt. If this foul does occur, the stop bolt should be re-adjusted and a check made that the tail plane movements are still within the tolerances allowed.

TAIL PLANE DESYNN TRANSMITTER (fig. 55)

238. The procedure for removal of the tail plane Desynn transmitter will be apparent from the illustration. Once a transmitter has been fitted and adjusted, the only subsequent adjustment that should be required is given in fig. 43. The procedure for the initial installation and adjustment of a new transmitter, bracket and locating plate is given in the illustration.

239. To eliminate the possibility of fouling between the upper rod of the Mach gear change unit and the cable guard, Mod. 1113 introduces a shorter thread on the cable guard and a thinner nut.

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