Chapter 1
POWER UNIT

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DESCRIPTION

Introduction

1. This chapter describes the power unit installation, gives details of certain servicing operations and recommends the methods of removal from, and assembly to, the aircraft. The fuel, oil and tank pressurisation systems are described in Chapters 2, 3 and 6 respectively of this section. Descriptive and servicing information on the Olympus engines are given in A.P.4501B, Vol.1, (Olympus 101), A.P.4501C, Vol.1, (Olympus 102) and A.P.4501E, Vol.1, (Olympus 104).

General

2. The Olympus 101, 102 or 104 jet turbine engines are housed in pairs inside the mainplane centre section between the

front and rear spars, leading edge air-intakes supply air to the engines; the intakes are secured to the engines by manacle rings to facilitate speedy removal.

3. Engine starting controls are grouped on the cockpit port console and the throttles are mounted in a quadrant between the two pilots. The disposition of the controls may be seen on the illustration in Sect.1, Chap.1 of this book.

4. Low pressure fuel is fed to the engine from the aircraft tanks, at a pressure of approximately 15 p.s.i., by submerged pumps. Warning indicators on the pilots' centre instrument panel illuminate when the fuel pressure falls below 5 p.s.i. The submerged pumps, together with recuperators in the fuel supply lines, maintain a positive pressure to the engine-driven pumps, thus preventing de-aeration and vapour locking. Fuel flow from the tanks is controlled by the L.P. cocks and these must remain on during engine running. A Vokes filter element on each engine is interposed between the fuel tank pipe lines and the engine driven pumps.

5. The high pressure fuel system is contained within the engine and is described in A.P.4501B, C or E, Vol.1.

6. Accessories driven by the engine consist of a generator, L.P. compressor tachometer generator, and a hydraulic pump.

7. These engines embody a complete oil system including an oil tank integral with the engine intake fairing and a fuel-cooled oil cooler. Details are given in A.P.4501B, C or E, Vol.1.

8. To localise an engine fire, each engine bay is divided into zones by bulkheads, integral with the engine, which seal on to the aircraft structure. The forward zone is designated zone 1. The rear zone, containing the engine fuel system, is sub-divided by an intermediate bulkhead immediately forward of the combustion chambers, the two divisions being known as 2A and 2B respectively. Any inflammable vapours which might accumulate in these zones are dispersed to atmosphere via an induced breather outlet and by ejector action from the exhaust duct tunnel.

9. Drainage from the engine fuel system, dump valve, combustion chambers, turbine annulus and exhaust outer cone is piped to collector tanks self-emptying in flight through an outlet in the centre engine doors.

10. Air is tapped from the engines, through compressor bleeds for the cabin air-conditioning system, airframe de-icing and pressurisation of the fuel tanks, fuel recuperators and hydraulic reservoir.

JET PIPE MOUNTINGS

11. The jet pipe is attached to the engine exhaust outer cone by a retaining channel, a flexible seal and a double manacle clamp, the engine exhaust cone being bolted to the turbine exhaust annulus flange. To allow for linear expansion, the jet pipe is provided with support rollers which run in guide rails in the aircraft tunnel. Both the jet pipe and outer cone are encased in shrouds which are hinged for servicing purposes.

ENGINE MOUNTINGS

12. Each engine is mounted in the main plane by the three point method. The attachment points, integral with the engine, consist of two trunnions, one on each side of the engine, fitted into bearing blocks on the engine compartment ribs, and steadied at the forward end by a single adjustable suspension link bolted to a forked bracket at the top of the L.P. compressor casing. The mountings are illustrated on fig.1.

13. To allow for lateral expansion, the mounting trunnions are subject to restraint on one side only whilst the forward suspension link is free to swing to allow for linear expansion of the engine forward of the trunnion.

ENGINE CONTROLS

14. Four throttle levers in a gated quadrant, between the first and second pilots' positions, control the engine high pressure fuel system and consequently the engine r.p.m. When the levers are moved initially, through 10 degrees, the high pressure cocks are opened and are again closed when the levers are moved rearward on to the closed stops.

15. All the control runs are similar in construction and operation; they consist of tubular push-pull rods, supported in triple roller bearings, and bellcrank levers where changes of direction in the runs are required. The throttle levers are attached by short connecting rods passing forward inside the quadrant to a bellcrank lever assembly, from which further connecting rods extend to bellcrank levers below the cockpit floor. Movement of the bellcrank levers is transmitted by link rods passing outboard, port and starboard, to the main control rods on each side of the fuselage. The control rods pass aft, supported in roller bearings, through Gaco seals in the rear pressure bulkhead, to a bellcrank assembly midway along the nose wheel bay. From this point the control runs follow the sides of the bomb bay, utilising bellcrank assemblies and transverse rods. The latter are connected to the main control rods which continue aft along the outside of the bomb compartment. At the engine bulkheads the rods branch to the engine bay ribs and finally pass aft to their respective engines.

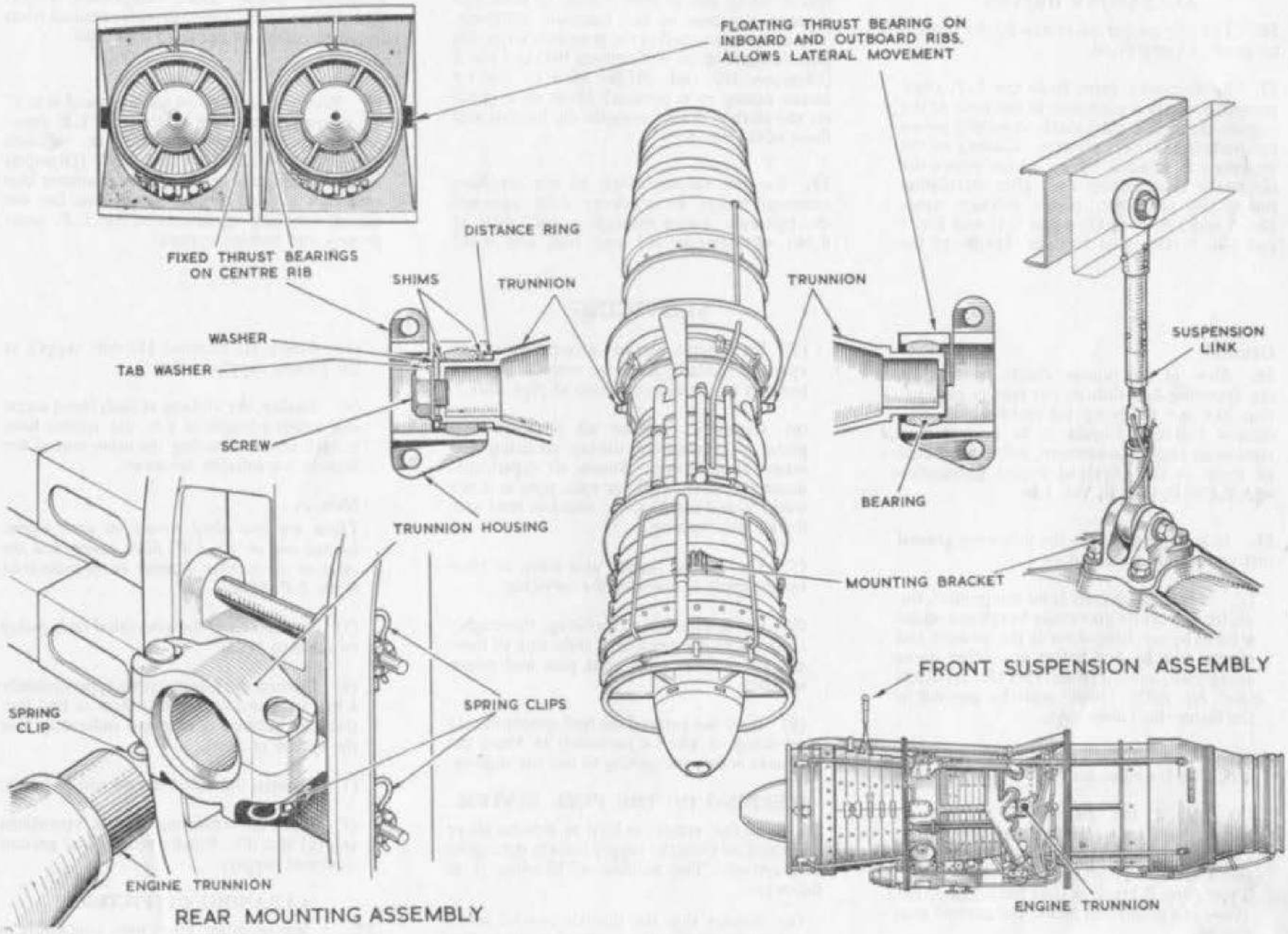


Fig. 1. Engine mountings

ACCESSORY DRIVES

16. The accessories are driven by the engine, no gearbox being fitted.

17. An accessory drive from the L.P. compressor operates a generator in the nose of the engine, through a quill shaft, to supply power for aircraft electrical services. Cooling of the generator is effected by air which enters the air intake nose fairing and, after circulating round the generator, passes through vanes No. 5 and No. 6 ◀(Olympus 101) and No. 1 and No. 5 (Olympus 102 and 104)▶ of the intake casing and is then ducted to discharge through the rear of the fireproof bulkhead. The cables connected to the generator terminals pass through ◀No. 3 (Olympus 101) and No. 2 (Olympus 102 and 104)▶ vane of the air intake casing to a terminal block on a panel on the starboard side towards the bottom and front of the engine.

18. On the forward face of the auxiliary scavenge pump, an accessory drive operates the hydraulic pump through a quill shaft at 0·366 ◀(Olympus 101 and 102) and 0·412 (Olympus 104)▶ H.P. compressor speed. Lubrication for the pump drive is obtained from an oil manifold on the front bulkhead.

19. Provision is made on the starboard side of the intermediate casing to drive the L.P. compressor tachometer generator at ◀0·640 (Olympus 101 and 104) and 0·667 (Olympus 102)▶ compressor speed. This generator also embodies a hand-turning connection for use during servicing operations of the L.P. compressor and turbine system.

SERVICING

General

20. Most of the routine checks specified in the Servicing Schedule do not require explanation but the following instructions are considered helpful. Should it be necessary to remove an engine component, reference should be made to the Olympus engine publication ◀A.P.4501B, C or E, Vol. 1.▶

21. It is important that the following general instructions are observed:—

(1) When the aircraft is on the ground, the engine bay centre doors may be opened ◀and secured by servicing stays at the forward end of the door,▶ but before any other doors are opened, locking struts, Part No. 1/U.1098 (*Ref. No.* 26DC/95006) must be inserted in the main-wheel door bays.

(2) All engine doors *must be closed* when the aircraft is towed or taxied.

(3) Should the aircraft be jacked, all engine doors *must* remain closed until beam, Part No. I/U.1017 (*Ref. No.* 26DC/95005) and Universal Jacking Trestle No. 18, with Type A or B brackets (less beam) (*Ref. No.* 4G/-) are positioned below the aircraft nose section.

(4) Protective covers, Part No. 1/Z.7104 (*Ref. No.* 26DC/95050) are to be fitted to the air intakes before any servicing of the engines.

(5) Fit suitable blanks immediately to any aperture resulting from the removal of components or the disconnection of pipe lines.

(6) Carefully examine all jointings and gland rings removed during servicing and renew as necessary. Renew all expendable locking devices, such as split pins and tab washers, and use 22 s.w.g. stainless steel wire for all wire locking.

(7) Use ground supply unit when an electrical supply is required for servicing.

(8) On completion of servicing, thoroughly clean the engines and bays, removing all loose articles such as nuts, split pins and pieces of wire.

(9) If air has entered the fuel system during servicing, it will be necessary to bleed the system before attempting to run the engines.

BLEEDING OF THE FUEL SYSTEM

22. The fuel system is bled to remove air or inhibiting oil from the supply lines to the engine fuel system. The method of bleeding is as follows:—

(1) Ensure that the throttle control levers are in the "H.P. COCK CLOSED" position, that is fully rearward.

(2) Ensure that the engine starting switch is OFF.

(3) Attach an external 112-volt supply at the ground supply socket.

(4) Slacken the locknut at each bleed screw and attach a length of ⅛ in. dia. rubber hose to each screw, directing the other end of the hose into a suitable container.

Note . . .

There are two bleed screws on each engine located one on the L.P. filter casing and the other on the transfer chamber at the main inlet to the L.P. filter.

(5) Switch one of the associated tank pump switches to OPEN.

(6) Slacken the bleed screws approximately a half turn and wait until a flow of fuel free from air bubbles is obtained indicating that the system is clear.

(7) Tighten the bleed screws and locknuts.

(8) Bleed the remaining engines, operations (4), (5) and (6). Finally remove the ground electrical supply.

CLEANING OF FILTERS

23. A low-pressure filter unit containing a Vokes filter element is interposed in the fuel supply lines to the engine-driven pump. Before removing an L.P. filter, first clean the external housing and place a suitable drain

container below the filter. With the L.P. cocks closed, remove the set-screws securing the filter cover and withdraw the cover and element. The element can then be removed as necessary.

24. When re-assembling the unit ensure that the joint washer, recessed into the cover, is in a good condition. Bleed the system before running the engine (para.22).

25. Cleaning of the oil filters is given in A.P.4501B, C or E, Vol.1.

DRAINING COLLECTOR TANKS

26. Although the rear collector tank which receives drainage from the combined dump valve and delivery casing is self-emptying in flight, it is necessary to remove any residual fuel before a centre engine door is opened or after a wet start. The forward tank, catering for any drainage from the fuel pump glands and oil cooler, must be released manually since this tank is not self-emptying. An accumulation of fuel in this tank is an indication that the fuel pump glands are defective and the cause should be traced and rectified. The method of draining both tanks is similar. Insert a screwdriver into the slot of the bayonet type valve to each tank, situated in the centre engine door, push upwards and turn until the valve engages in the open position. Residual fuel will now empty through the common drain.

ENGINE CONTROL LEVERS, BASIC SETTING

27. The setting for one throttle control system is given in the following paragraphs as the four systems are similar. Exceptions are in the port and starboard centre engine rib section which differ and are described separately, and in the length of the rods connecting the forward arms of the throttle console forward bellcrank levers to the forward arms of the bellcrank levers below the pilots floor. The rod lengths are as follows:-

Port outboard	18·575 in.	± 0·01 in.
Port inboard	19·61 in.	± 0·01 in.
Starboard inboard	19·61 in.	± 0·01 in.
Starboard outboard	18·575 in.	± 0·01 in.

Port outboard throttle control system

(1) Attach the fixed length control rod 18·74 in. ± 0·01 in. between the pilots' throttle lever and the bottom arm of the bellcrank lever at the forward end of the throttle console.

(2) Set the centre of the throttle lever in alignment with the neutral mark on the throttle console and lock with the friction adjuster.

(3) Set the vertical control rod, which attaches the forward arm of the console forward bellcrank lever to the forward arm of the bellcrank lever below the pilots' floor, to the 18·575 in. ± 0·01 in. measurement and attach it to the bellcrank levers. Check that an angle of 90 degrees exists between the centre line of the lower arm of the bellcrank beneath the pilots' floor and the pilots' floor.

(4) Secure the control rod between the lower arm of the pilots' floor bellcrank lever and the upper arm of the inner torque shaft on the torque shaft assembly, also situated below the pilots' floor, adjacent to the fuselage wall. Adjust, as necessary, on the forward end of the control rod to position the centre line of the upper torque shaft arm at an angle of 90 degrees to the centre line of the control rod.

(5) Secure the control rod between the lower arm of the inner torque shaft of the torque shaft assembly and the take-off link on the complementary control rod. Adjust, as necessary, on the forward end of the control rod to position the take-off fork pin centre six inches from the datum face of former 316 in.F.

(6) Complete the assembly of the four control rods commencing at the torque shaft assembly and connect them to the upper arm of the upper inboard bellcrank lever at former 115·5 in.F. Adjust, as necessary, on the last but one rod until the centre line of the upper arm of the upper inboard bellcrank lever is at an angle of 90 degrees to the centre line of the last control rod.

(7) Secure the control rod between the rear arm of the upper inboard bellcrank lever and the forward arm of the lower inboard bellcrank lever, situated at former 115·5 in.F. Adjust, as necessary, at the lower end of the rod until the centre line of the forward arm of the inboard lower bellcrank lever is at an angle of 90 degrees to the centre line of the control rod.

(8) Connect the rear arm of the lower inboard bellcrank lever, situated at former 115·5 in.F, and the rear arm of the lower bellcrank, situated at the junction of the bomb bay rib and bulkhead 63·19, with a set of five control rods. Adjust, as necessary, on the adjusters, until the centre line of the rear arm of the lower bellcrank lever is at an angle of 90 degrees to the rib web.

(9) Connect the control rod that joins the forward arm of the bomb bay rib lower bellcrank lever to the forward arm of the bellcrank lever at the forward end of the centre engine rib. Adjust, as necessary, on the inboard end of the rod until the centre line of the rear arm of the centre engine rib bellcrank lever is at an angle of 90 degrees to the centre engine rib web.

(10) On the port side, attach the set of three control rods to the rear arm of the forward centre engine rib bellcrank lever, and the forward arm of the rear upper, centre engine rib, bellcrank lever. Adjust, as necessary, on the adjuster,

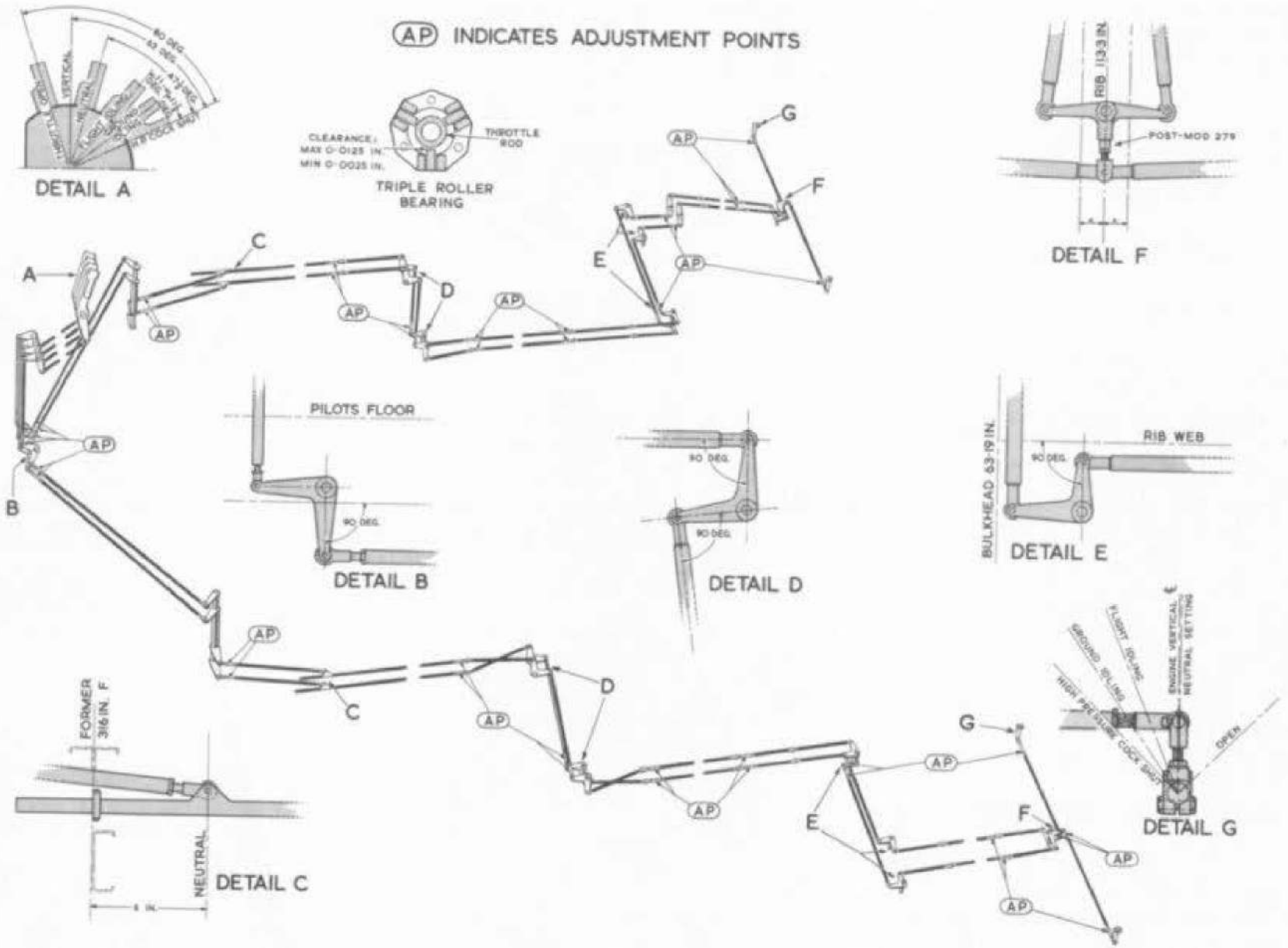


Fig. 2. Engine control setting.

RESTRICTED

until the centre line of the rear arm of the rear bellcrank lever is parallel to the engine rib centre line.

(11) On the starboard side, connect the single control rod to the rear arm of the forward, centre engine rib, bellcrank lever and the lower arm of the reversing lever, situated on the centre engine rib. Adjust, as necessary, on the rear end of the rod until the centre line of the lower arm of the reversing lever is at an angle of 90 degrees to the centre line of the control rod. Connect the set of control rods between the upper arm of the reversing lever and the forward arm of the rear, centre engine rib, bellcrank lever. Adjust, as necessary, on the adjuster, until the centre line of the rear arm of the bellcrank lever is parallel to the centre line of the engine rib.

(12) Release the throttle friction adjuster and check the controls for freedom of movement.

(13) Reset the pilots' throttle lever in the neutral position as before and lock.

(14) Connect the control rod between the rear arm of the centre engine rib, rear, upper bellcrank lever and the engine throttle lever. Adjust as necessary, on the outboard end of the rod, until the centre line of the throttle lever is at an angle of 5¼ degrees from the engine vertical (fig.2, detail G) when viewed from the rear of the engine. On aircraft with Olympus 102 and 104 power units, the rear arms of the bellcrank levers at the aft end of the centre engine rib have been made adjustable. These are used in conjunction with the control rod adjuster to set the throttle levers as specified. The setting angles for the other throttle levers are:-

Port inboard	1½ deg.
Starboard inboard	5¼ deg.
Starboard outboard	1½ deg.

(15) Release the pilots' throttle lever and check co-ordination between the positions of the pilots' throttle levers and the engine throttle levers.

(16) Check the complete engine control system for freedom of movement and that all the adjustable rod ends are in safety and are wirelocked.

ENGINE MOUNTINGS

28. Periodical lubrication is the only servicing normally required on the engine mountings.

JET PIPE MOUNTINGS

29. The jet pipe mountings will require periodic lubrication and general examination for signs of burning and damage. No other servicing is normally required

LUBRICATION

30. All connection points on the engine control system should be lubricated with grease XG-295. The triple roller bearings are to be lubricated at their points of contact with the control rods; the metal axles passing through each roller are to be lubricated with oil, OX-14.

INHIBITING AN ENGINE

31. The engines of a parked aircraft should be turned regularly at periods stipulated in current authorised orders, normally every seven days. When an aircraft is to be unattended for longer periods the engines must be inhibited in accordance with instructions contained in A.P.4471A, Vol.1. Similarily any engine removed for storage purposes should also be inhibited.

GENERATOR

32. Generator removal is contained in A.P.4501B, C or E.

HYDRAULIC PUMP

33. Hydraulic pump removal is contained in A.P.4501B, C or E.

JET PIPE INSTALLATION

34. The method of installing a jet pipe into the aircraft is as follows:-

REMOVAL AND ASSEMBLY

(1) Remove the blanking cover from the end of the engine exhaust cone.

(2) Disconnect the exhaust cone shroud securing wires and remove the upper half of the exhaust cone shroud.

(3) Push the bellows joint as far as possible towards the engine.

(4) Fit the jet pipe into the jet pipe tunnel utilising either, jet pipe trolley 26DC/95120 or 26DC/95268. Ensure that the jet pipe rollers engage correctly with the jet pipe tunnel rails, and push the jet pipe forward until it is fully engaged with the engine exhaust cone flange.

(5) Fit the two retaining channel halves and hold them in position by hand until the jet pipe has been moved rearwards a distance of 0·4 in., which is the movement required to engage the retaining channels correctly.

(6) After ensuring that the 0·4 in.

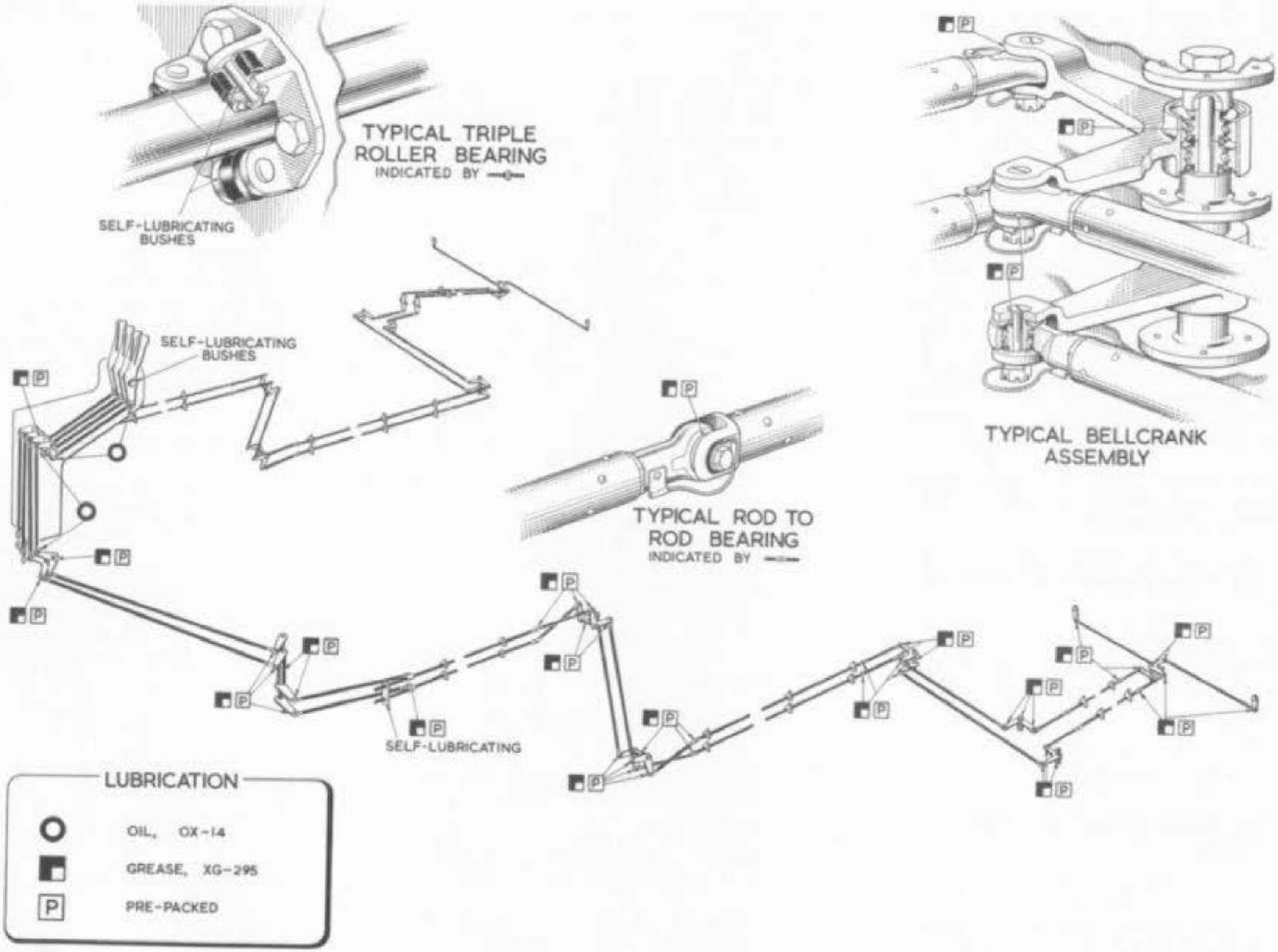


Fig. 3. Engine controls - lubrication.

movement is positive, push the bellows joint back over the retaining channels to mate up with the jet pipe flange, ensuring that the 3/16 in. dia. dowel in the bellows joint flange engages correctly with the hole in the jet pipe flange.

◀ (7) Fit the double manacle clamp over the jet pipe and bellows flanges. Tighten the clamp bolts to 80 lb. in.

(8) Fit the single manacle clamp to to secure the front flange of the bellows to the engine exhaust outer cone. Tighten the clamp bolt to 80 lb. in.

(9) Positively wire lock the securing bolts of the single and double manacle clamps. ▶

(10) Check that the jet pipe is still free to move and that the rollers are on the rails.

(11) Refit the exhaust cone shroud, ensuring that the securing wires are in the correct position, the longest being fitted in the front channel.

(12) Connect the flexible fuel drain to the adapter on the bellows joint and wire-lock.

(13) Connect the thermo-couples and the flame switch.

◀ (14) Fit the jet pipe end cap. ▶

JET PIPE REMOVAL

35. The jet pipe removal procedure is the reverse of that for installation. Wooden wedges must be fitted to prevent uncontrolled movement of the jet pipe, before the retaining channel is removed. Refer to Sect.2, Chap.4 for ground equipment.

ENGINE CHANGE UNIT

WARNING . . .

The exhaust cone bellows guard must remain on the engine while the latter is un-installed, and may only be removed after the engine is installed.

The cone guard must also be fitted to the engine before the latter is removed from the aircraft.

Preliminary checking

36. Before an engine is removed or installed, the rigging angle of the aircraft must be checked in accordance with the following procedure:-

(1) Gain access to the main wheel bay where two 3/8 in. dia. holes will be found in the inboard rib.

(2) Insert a 3/8 in. dia. steel rod in each hole and place a straight edge across the rods.

(3) Using a clinometer, check the aircraft rigging angle. This angle, although normally + 5 deg., will vary according to surface level, tyre pressures, etc.

(4) Record the rigging angle, since when the engine is installed, the sum of the aircraft angle plus 2 deg. 45 min., (this is the correct engine angle) becomes the true aircraft/engine linearity angle, i.e., if the aircraft rigging angle is found to be 4 deg. 17 min. then the true engine angle would be 7 deg. 2 min.

(5) When it is necessary to change an engine already installed, a simplified procedure would be to check the existing engine prior to removal; this would enable the replacement engine to be installed in the original position.

Preparation of engine bay

37. Before an engine is installed in an aircraft the following preparation is required in the engine bay.

(1) The jet pipe, if fitted, must be withdrawn into the tunnel so that there is no possibility of it fouling the engine rear cone assembly. Wooden wedges should be fitted to prevent the jet pipe sliding rearwards.

(2) The flame switch fitted to the front face of the jet pipe tunnel must be disconnected and placed inside the jet pipe tunnel.

(3) The top half of the engine trunnion bearing housing must be removed whilst it is readily accessible.

(4) Securing the bottom half of the bearing housing is a ½ in. dia. bolt which is to be removed and the bearing housing pushed back into the engine bearer ribs.

(5) Check the front suspension link mounting bolt on the aircraft for security and correct fitment in the engine mounting bracket bushes.

Preparation of engine for installation

38. The engine should be mounted on a mobile stand (Ref.No.40B/1141) securely fastened during transport, and lined up underneath the engine bay into which it is to be installed. The engine should now be removed from the stand in accordance with the following instructions:-

(1) Engage the hook at the top of each engine hoist (Ref.No.26DC/95068) with the attachment points provided in the engine bay. The front hoists should be engaged with their hooks facing rearwards and the rear hoist hooks facing forward, whilst the winding end of the hoists should face away from the engine. At this stage the front hoists will

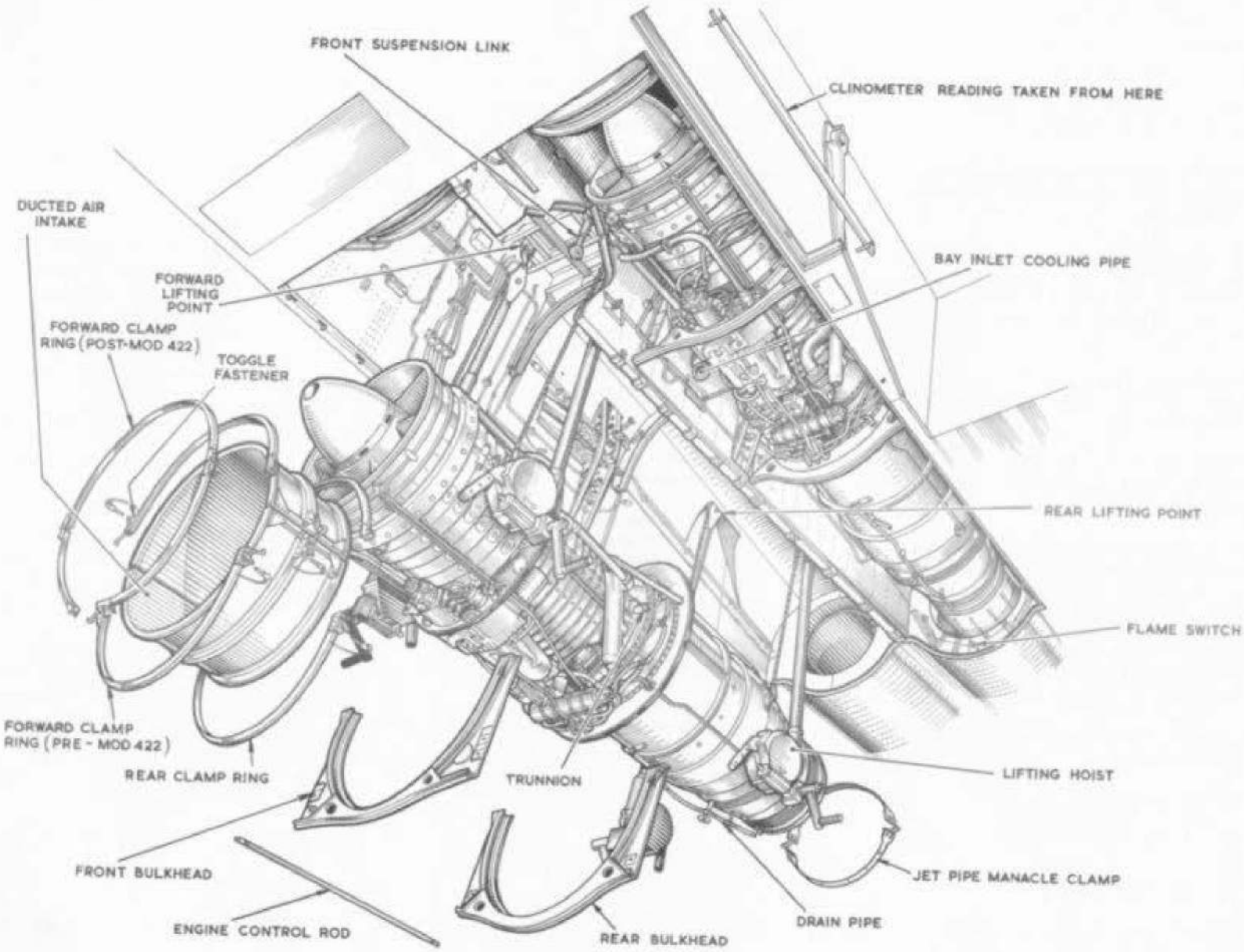


Fig. 4. Engine removal (1)

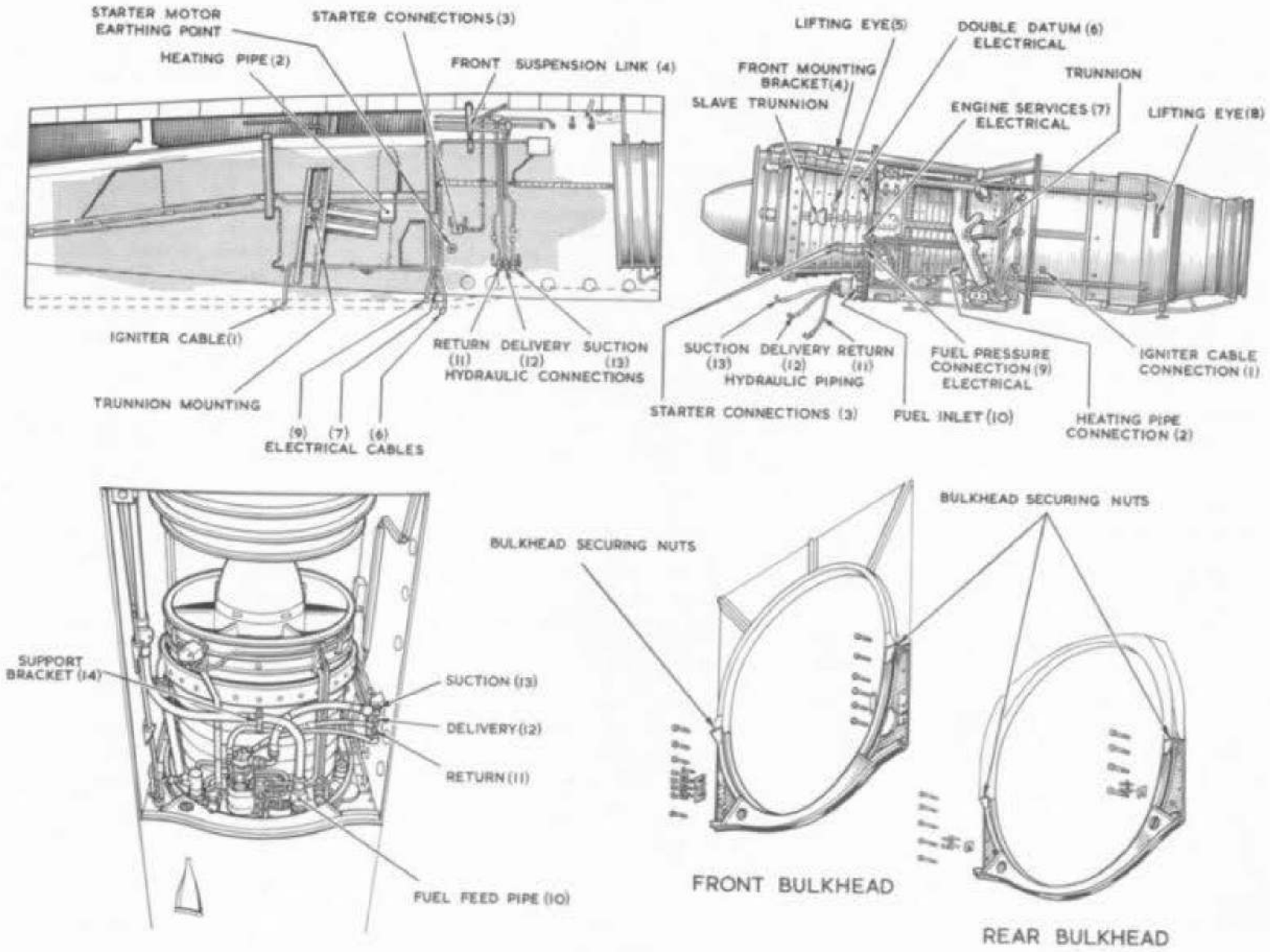


Fig. 5. Engine removal (2)

hang in their true position, i.e., at the rear of the engine front trunnion mountings.

(2) With a suitable number of personnel stationed at each hoist and another man acting in a supervisory capacity, the engine change unit should now be disconnected from the stand and lifted by giving each hoist a simultaneous number of turns, taking special care that the engine common breather pipe and other engine attachments do not foul the stand whilst lifting is in progress. When the e.c.u. is raised sufficiently remove the stand.

39. When the stand has been removed the fixed trunnion bearing can be assembled; the procedure is as follows:-

(1) Remove the slave trunnion fitted to the L.P. compressor casing.

(2) Fit a 0·3 in. distance piece on the trunnion, ensuring that the bore radius is nearest to the engine.

(3) Lubricate the trunnion with oil OX-14 and fit the phosphor-bronze bearing, which must be free to turn.

(4) Fit two 0·1 in. shim washers: Note that the thickness of these washers may have to be adjusted to maintain a 0·1 in. offset between the engine centre line, when cold, and the jet pipe.

(5) Assemble the end plate, tab washer and bolt to the threaded portion of the trunnion, ensuring that the tab of the locking washer has fully engaged with the hole provided in the trunnion.

(6) With a ¾ in. spanner tighten the complete assembly and turn back the locking tab in the usual manner.

(7) Fit the free floating bearing to the trunnion on the opposite side of the engine, no distance piece or spacing washers being required.

40. The fixed bearing, when attached to the engine bay centre rib, is positioned on the port side of No.2 and No.4 engines and on the starboard side of No.1 and No.3 engines.

Engine control rod Gaco seals

41. When the Gaco seals on the engine control rods at the rear pressure bulkhead are assembled, it is important that the seals are fitted correctly. Reference should be made to Sect.3, Chap.1, of this book for an illustration of the correct method of assembly.

Engine bearer trunnion cap securing bolts

42. Great care must be exercised when tightening the rear bolts securing the engine bearer trunnion caps, port and starboard in No.2 engine bay. Excessive loading will stretch and waist the bolts.

Engine hoisting

43. When an engine is removed or installed, the hoists must be operated so that the load is distributed evenly amongst them. Uneven lifting will cause excessive loads on some hoisting points, and on aircraft not fitted with Mod.607, causing structural distortion, particularly in the region between the attachment of the fore and aft lifting point lateral intercostals and the adjacent ribs.

44. After an engine is removed on aircraft not fitted with Mod.607, the lateral stringer intercostals fore and aft of all lifting points, must be inspected, particularly in the region between the attachment of the fore and aft intercostals and the adjacent rib. If any distortion or damage is evident a repair should be carried out in accordance with instructions in A.P. 4505, Vol.6, Part 1.

INSTALLATION OF ENGINE CHANGE UNIT

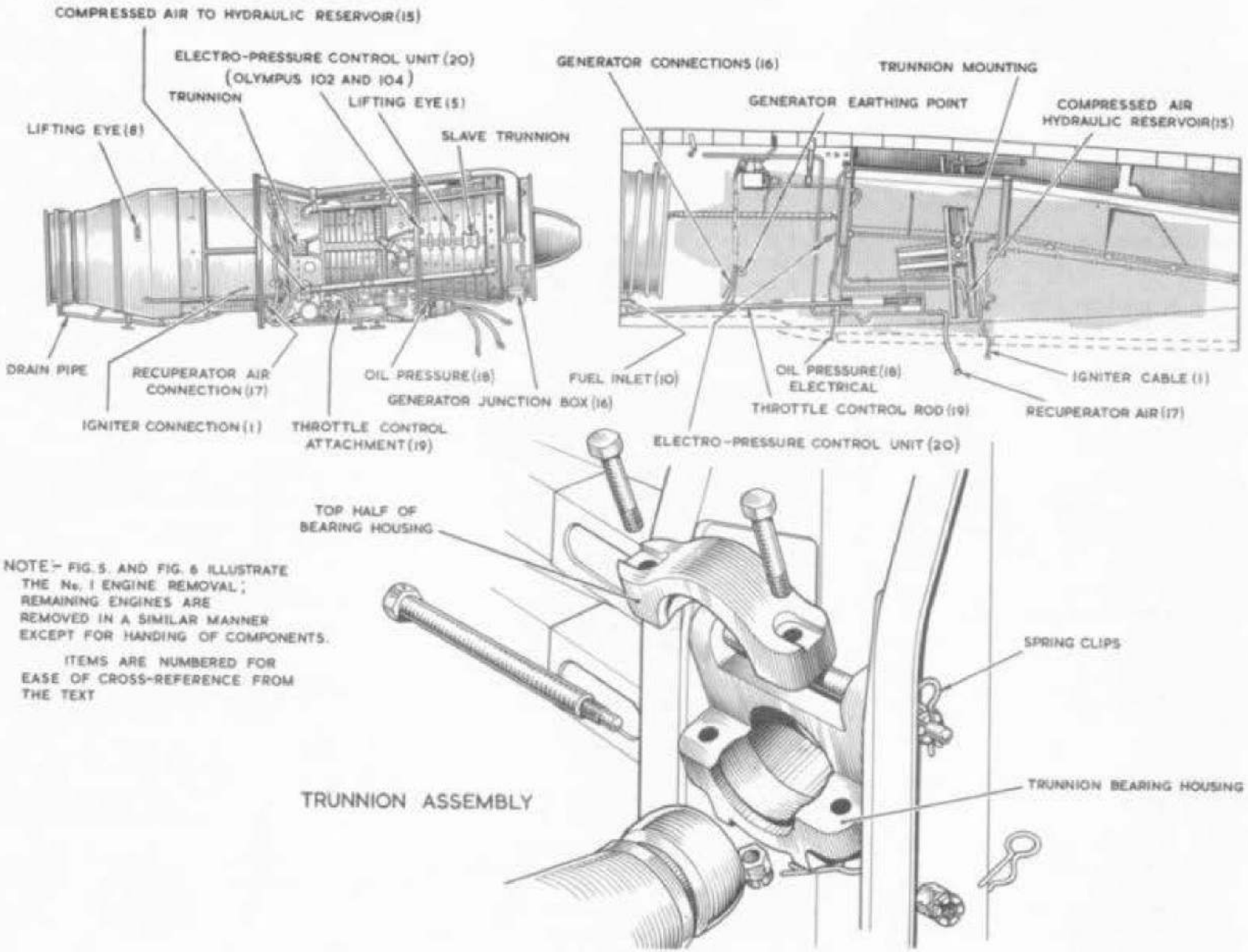
45. Prior to the installation of the engine, check that the preparation has been correctly carried out, then proceed in accordance with the following instructions. It will be necessary to station one man in the air intake tunnel.

46. At the call of the operator in charge of the e.c.u. installation, each hoist is given a simultaneous number of turns and, just before the e.c.u. enters the engine bay, the forward hoists should be brought up from behind the front mounting trunnions and positioned in front of the engine air intake casings. The e.c.u. is now brought into the engine bay in easy stages, half or quarter turns only being given on the hoists. Careful attention must be given to those items which are likely to foul the aircraft fittings.

47. With the e.c.u. approximately half way into the engine bay, the forward hoists are to be given eighteen full turns in order that the angle of the e.c.u. is approximately parallel with that of the aircraft. Note that the figure of eighteen turns is based on an aircraft angle of 5 deg., for a greater or lesser angle, the number of turns must be proportional. At this stage it is necessary for one man to be positioned above the engine to observe that the e.c.u. bulkheads are engaging correctly with those of the aircraft.

48. The e.c.u. is now raised slightly above its correct position and the fixed bearing trunnion housing swivelled into position to mate up with the engine phosphor-bronze bearing. The bottom housing bolt is now fitted and the engine carefully lowered until the engine bearing is seating in its housing; with the aid of a probe illuminator (Ref.No.5A/3859) ensure that the bearing is correctly seated.

49. The same procedure is now adopted for the floating bearing and, after ensuring



NOTE:- FIG. 5. AND FIG. 6 ILLUSTRATE THE No. 1 ENGINE REMOVAL; REMAINING ENGINES ARE REMOVED IN A SIMILAR MANNER EXCEPT FOR HANDING OF COMPONENTS.

ITEMS ARE NUMBERED FOR EASE OF CROSS-REFERENCE FROM THE TEXT

Fig. 6. Engine removal (3)

that both bearings are correctly seated, the top halves of the bearing housings should be bolted into position. Note that by fitting the fixed bearing in its housing first, the amount of engine manoeuvring is reduced to a minimum.

50. The front suspension link may now be fitted; ensure that an equal number of of threads are visible on each side of the turnbuckle.

51. The four hoisting winches are then removed.

52. Place a straight edge across the front face of the air-intake casing and, with a clinometer, check the engine rigging angle and make any necessary adjustments to the front link in order to obtain the required angle described in para.36 of this chapter.

53. When the correct angle of the engine has been obtained, ensure that the front link is in safety, that the locknuts are tight, and that the turnbuckle is wire-locked and sealed. The rear trunnion housings and mounting bracket bolts should then be tightened and split-pinned.

54. Engine components and other fitments are now to be installed. The method of installation is a reversal of the procedure given in the removal instructions.

55. Finally, attach the engine control rods as follows:-

(1) Set the throttle control in the cockpit to the mid-position.

(2) Refit the control rod to the bell-crank lever on the engine centre bay rib and lock; refit the cover.

(3) Refit the control rod to the throttle arm, ensuring that the 2 B.A. bolt is fitted to the forward side of the lever to prevent fouling of the full range flow controls.

(4) Set the throttle controls as described in para.27 of this chapter.

56. The method of jet pipe installation which is carried out at this stage is given in para.34 and bleeding of the fuel system para.22.

57. On completion of installation ensure that all tools, rags and other material used during engine servicing have been removed from the aircraft. Replenish with fuel and oil as instructed and ground test the engine in accordance with the Ground Handling Notes

REMOVAL OF ENGINE CHANGE UNIT

58. Assuming that the doors have been removed, the following paragraphs give the sequence for the removal of the engine change unit beginning at the front of the installation and working rearwards.

59. Release the three toggle fasteners (fig.4) of the ducted air-intake, one secured to the centre stiffening channel and two removed with the sealing rings; remove both halves of the intake.

NOTE . . .

On aircraft fitted with Mod.422, the front clamp ring on the removable air intake is removed or assembled by releasing the bottom toggle fastener as illustrated in fig.4.

60. After closing the low-pressure cocks, use a C spanner to release the nut of the main fuel feed pipe fitted to the "King" coupling on the e.c.u. (fig.5, item 10) and also release the nut of the pipe joint on the engine bay rib. Disconnect the pipe from the support bracket (fig.5, item 14) on the front of the L.P. compressor and remove the pipe.

61. Disconnect the starter leads from the engine bay rib, one lead being connected to an earthing stud and the other to a junction box, the cover of which is secured by two screws (fig.5, item 3).

62. Loosen the four nuts of the generator cable junction box on the e.c.u. and, after removing the cover, release the three cable connections in the box and also disconnect the breeze plug on the outside of the box (fig.6, item 16); refit the cover.

63. Disconnect the three Avery couplings of the hydraulic pump pipes from the bracket on the engine bay rib (fig.5, items 11, 12 and 13).

64. Release and remove the four (Olympus 101) or five (Olympus 102 and 104) breeze plugs on the front face of the e.c.u. bulkhead. These plugs carry the cables for the following items:-

(1) Fuel low pressure warning indication (fig.5, item 9).

(2) Oil pressure indicators (fig.6, item 18).

(3) Hot air valve actuator, engine anti-icing actuator and L.P. compressor R.P.M. indicator (fig.5, item 7).

(4) R.P.M. governor (fig.5, item 6).

(5) Electro-pressure control unit for jet pipe temperature limiter system on aircraft fitted with Olympus 102 and 104 power units (fig.6, item 20).

65. On the right-hand side of the aircraft bulkhead are the union nut connections of the recuperator system pipe. Release the connections on both sides of the bulkhead (fig.6, item 17).

66. The front bulkhead may now be taken off as follows (fig.5):-

(1) Remove the 2 B.A. bolts parallel

with and at right angles to the bay rib.

(2) Remove the 2 B.A. bolts holding the fairleads for the engine control rod and the igniter plug leads.

(3) Remove the 3/16 in. B.S.F. nuts securing the two halves of the bulkhead together.

67. Beginning in zone 2A, release the nut of the recuperator system pipe at the bracket on the engine bay rib and remove the pipe (fig.6, item 17). Remove the two clips securing the flexible pipe (bracket to e.c.u.) on the bay rib and disconnect the union nut. Leave the flexible pipe attached to the e.c.u. since this simplifies fitment when the e.c.u. is being installed.

◀ 68. Disconnect the hydraulic reservoir pressurisation and bomb bay door seal system air supply pipe line by undoing the union nut on the engine H.A.V. casing (fig.6, item 15). ▶

69. Remove the manacle clamp securing the aircraft de-icing, cabin heating and pressurisation system supply pipe to the e.c.u. and also the manacle clamp at the first joint of the pipe situated on the engine bay rib (fig.5, item 2). Remove this section of the pipe entirely.

70. On the opposite bay rib is the bay inlet cooling pipe which is held in position by two bolts and two dowels. Release the bolts and remove the pipe (fig.4).

71. Remove the control rod between the full range flow control throttle lever and the engine bay rib bellcrank lever by disconnecting the bolts at each end. The control rod from the opposite side of the bellcrank lever and running parallel to a bolted joint in bay 1 is also removed entirely after a small shield over one portion of the rod has been removed. The rod is removed to prevent fouling of the e.c.u. or removal hoist (fig.6, item 19).

72. On each side of the rear bulkhead are the igniter plug cable fairleads, held in position by four 2 B.A. bolts. Remove the bolts, disconnect the cables from the igniter plugs and pass them through the bulkhead (fig.5 and fig.6, item 1).

73. The rear bulkhead (fig.5) is now taken off by removing the 2 B.A. bolts parallel to and vertical with the bay and the 3/16 in. B.S.F. nuts securing the two halves of the bulkhead together.

74. Gain access to the aircraft pyrometry leads through an access panel at the top rear end of the jet pipe tunnel and disconnect the electrical cables. Following this, disconnect the jet pipe from the e.c.u. (para.35).

75. Attach the four hoists to the links provided in the engine bay roof and the hoist cables to the appropriate lifting eyes on the L.P compressor and turbine annulus (fig.5, items 5 and 8); take the weight of the e.c.u. (fig.4).

WARNING . . .

The clutch mechanism on the hoists is a safety device to prevent over-loading of the hoists, and it must not be used as a load distribution guide when distributing the weight of the engine evenly amongst the hoists prior to the removal of the e.c.u.

76. Ensure that the hoists are securely attached, then release the engine as follows:-

(1) Disconnect the front suspension link (fig.5, item 4).

(2) Remove the top halves of the engine trunnion bearing housings (fig.6).

(3) Take the weight of the engine on the hoists.

(4) Push back the bearing housings into the engine bearer ribs to give clearance when lowering the e.c.u.

77. The engine may now be lowered on to a suitable stand by a reversal of the procedure given in the installation paragraphs.