Chapter I

H.P. FUEL PUMP TYPE A.260 Y. Mk. 5

LIST OF CONTENTS

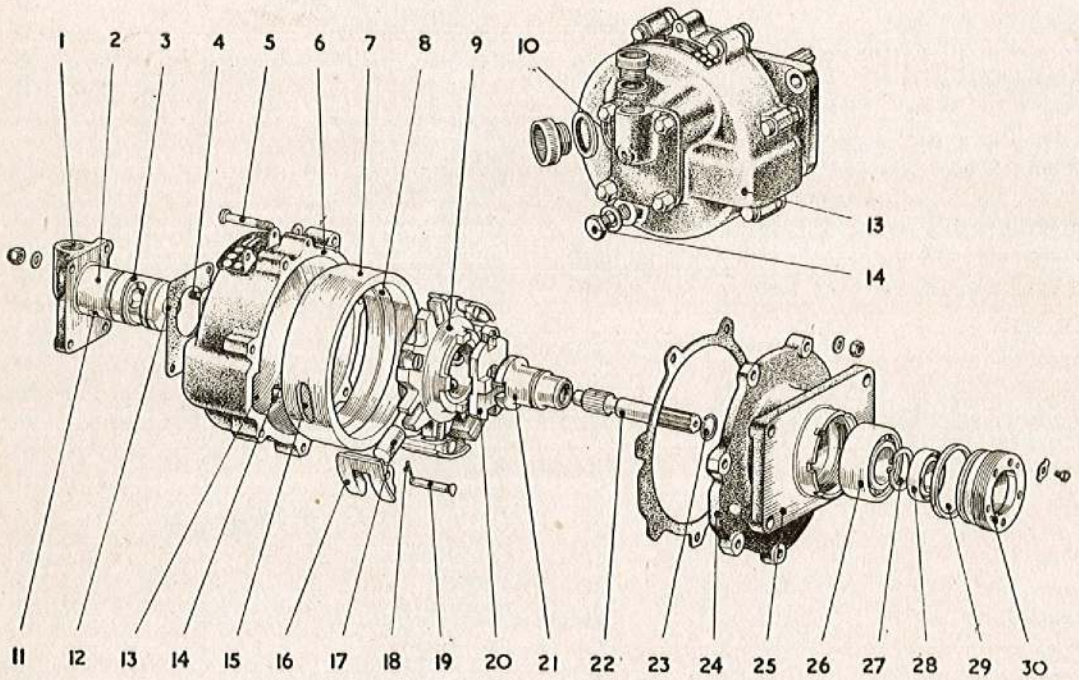
LIST OF ILLUSTRATIONS

GENERAL

1. The pump described in this chapter is the type A.260.Y, Mark 5. An exploded view of the pump is shown in fig. 1.

2. The log book which accompanies each pump provides a complete record of the history of the unit and contains the test figures, running times and complete details of servicing, repair and overhaul work effected, together with all replacements made since initial assembly. It is very important to ensure that all further details of this nature are recorded accurately in this log book, after each subsequent period of service, and after repair and overhaul.

3. During all work on the pump, extreme cleanliness must be observed, and every precaution must be taken to ensure that all parts are thoroughly clean. To prevent damage to nuts, bolts, etc. by rounding off



1 DELIVERY CONNECTION
2 DISTRIBUTING VALVE
3 PRESSURE BALANCING GROOVES AND DRILLINGS
4 SECURING BOLTS
5 FIXING BOLTS AND NUTS
6 PUMP CASE
7 BEARING RING
8 COLLECTOR GROOVE
9 ROTOR
10 INLET CONNECTION
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12 VALVE PLUGS
13 CHANNEL
14 LOCATING PEG
15 RADIAL SLOT
16 SLIPPER
17 PLUNGER
18 SPLIT PIN
19 GUDGEON-PIN
20 COUPLING
21 DRIVE SHAFT
22 QUILL SHAFT
23 SPRING CLIP
24 PUMP COVER
25 COVER FLANGE
26 BALL BEARING
27 SPRING CLIP
28 SEAL
29 RUBBER SEALING RING
30 GLAND HOUSING

Fig. 1. Exploded view of H.P. fuel pump, type A.260Y, Mk. 5

Preparation of details

45. Draw from stores all consumable parts, i.e. seals, split pins, and any new parts required.

Ensure that all details are scrupulously clean and have been approved for reassembly in accordance with para. 24 to 48 inclusive. All new and consumable parts drawn from stores must be inspected for damage, deterioration etc. and all traces of temporary rust preventive washed off.

Gland housing sub-assembly

46. The gland housing should be assembled as follows:—

OP. 1. Locate the spring-loaded seal on the pilot of tool 783.Y.41 with the largest lip of its metal casing against the shoulder of the tool.

2. Place the gland housing on the bed of a bench hand press, screw thread end downwards, directly under the arbor of the press.

3. Treat the spring-loaded seal-housing bore with barium chromate to Specification D.T.D.369A (latest issue).

4. Insert the spring-loaded seal in position in the mouth of the gland housing.

5. With an even and steady pull on the press torque bar, press the seal squarely to the bottom of its housing bore.

6. Clean off any excessive barium chromate.

7. Assemble square section sealing ring in gland housing groove, ensuring that the ring is not twisted when finally seated.

Drive shaft sub-assembly

47. Assemble the drive shaft assembly as follows:—

OP. 1. Place bolster 783.Y.44 on bed of bench hand press, flanged end uppermost, directly under press arbor.

2. Insert ball race squarely into recess of bolster, identification lettering downwards.

3. Insert chamfered end of drive shaft into ball race.

OP. 4. Holding the drive shaft squarely in position, apply pressure to its flange until the shoulder of drive shaft locates against the face of the inner race.

5. Remove from bolster.

6. Insert points of circlip pliers into holes in circlip and squeeze tool to spring open the clip.

7. Slide the circlip over the drive shaft shank to a position in line with the recess.

8. Release pressure on pliers thus allowing the clip to locate in the recess adjacent to the face of the inner race of the ball bearing.

Cover sub-assembly

48. To assemble the cover sub-assembly proceed as follows:—

OP. 1. Immerse cover for a few minutes in a tank of oil to Spec. D.T.D.585 the temperature of which should be approximately 45 degrees C.

2. Remove cover from oil.

3. Insert drive shaft sub-assembly into the cover bore, assuring that the ball race face locates against the counterbore shoulder.

Plunger sub-assembly

49. Assemble the plunger sub-assemblies as follows:—

OP. 1. If the slippers are to issue 4 or previous, chamfer the mouth of the gudgeon pin hole 0·025 in. to 0·030 in. at 45 deg. (using tool No. ENG. TR. 1190) on the face opposite to that on which the direction of rotation arrow is engraved.

2. Place the plunger in position in the cut-away portion of the slipper and align the slipper and plunger holes.

3. Insert the gudgeon pin through the slipper and plunger from the opposite side to that on which the direction of rotation arrow is engraved. If an old pin is being used, care must be taken to ensure that it is re-assembled in its original position (para. 20, Op. 4.) If a new gudgeon pin is used, the flat on the head of the pin must first be ground down by linishing until it is approximately 0·003 in. clear of the lip of the slipper bearing face.

OP. 4. Insert a split pin and bend over in the approved manner (*fig.* 7).

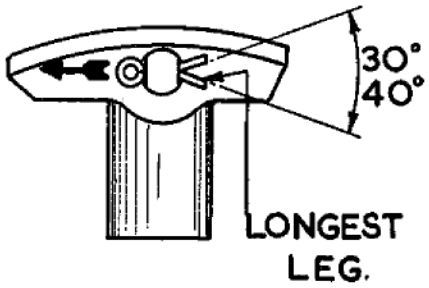

Fig. 7. Method of securing gudgeon pin

Bearing ring locating screw

50. Assemble seal in position on bearing ring locating screw. Insert the screw into its appropriate tapped hole and tighten up using a standard box spanner.

Assembling the case

51. Position the seven cover securing bolts in their holes around the flange of the case. Temporarily place the nuts on the seven bolts, to engage with a few threads only. This operation will facilitate mounting the cover in the fixture by preventing the bolts from dropping out.

52. Mount the case in the special stripping fixture C.783.Y.46 as follows:—

OP. 1. Tighten knurled pivot locking screw to locate the fixture ring in the horizontal position.
2. Turn back the knurled screw attached to the movable fibre block.
3. With the flange of the case uppermost, lower the case squarely into position in the mounting ring.
4. Ascertain that the heads of the seven fixing bolts are correctly seated and that the case is located as far down in the fixing ring as possible.
5. Tighten knurled screw attached to the movable fibre clamping block, to secure the case firmly in the fixture.
6. Remove nuts from case-to-cover securing bolts.
7. Place the four bolts, complete with their dowels, in their respective drillings in the case.
8. Rotate the bolt heads slowly to allow the dowels under the bolt heads to locate in their mating drillings.

OP. 9. Ensure that each bolt head is correctly seated and does not stand proud of the bottom face of the case interior.

Assembling the bearing ring

53. By holding the bearing ring with the fingers of each hand in its collector groove, lower the ring squarely into the case, at the same time rotating the ring sufficiently for the peg end of the locating screw in the case to engage in the slot machined in the bearing ring. Ensure that the ring is flush against the bottom face of the case interior.

Assembling the rotor

54. Rotors are supplied as replacements with the bores of the bushes machined to the following sizes:—

1·3739 in. to 1·3740 in. dia. and 1·3740 in. to 1·3741 in. dia. The particular rotor required must be selected thus:—

OP. 1. Ensure that the distributing valve shank dimensions conform with those laid down in Part 2 of this Volume.
2. Measure the maximum diameter of the bearing portion of the valve shank (dia. A).
3. Select the rotor required from the following table:—

Dia. A.	Rotor bush dia.
1·3735 in. to 1·3737 in.	1·3739 in. to 1·3740 in.
1·3737 in. to 1·3739 in.	1·3740 in. to 1·3741 in.

OP. 4. Locate slipper sub-assemblies in their respective bores in the rotor.
5. Push all slipper sub-assemblies as far towards the centre of the rotor as possible.
6. Holding the rotor horizontally, dogs uppermost, lower the assembly carefully into the case concentric with the bearing ring. Care must be taken to ensure that the plated surfaces are not damaged during this operation.

Assembling the distributing valve

55. Assemble the distributing valve to the casing as follows:—

OP. 1. Place valve-to-case gasket in position under the valve head.

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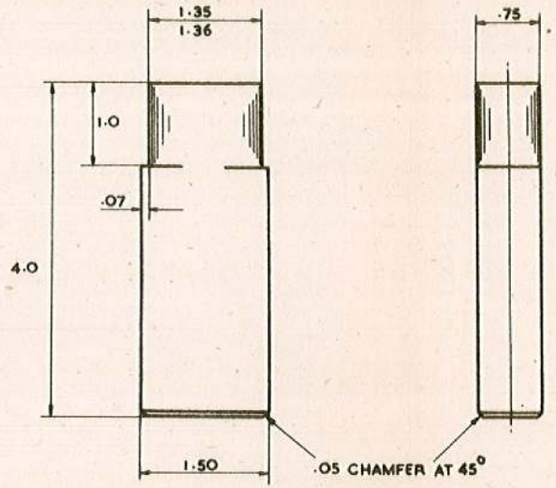
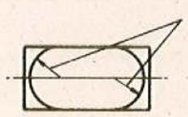
MATERIAL - BRIGHT MILD STEEL (EN6)

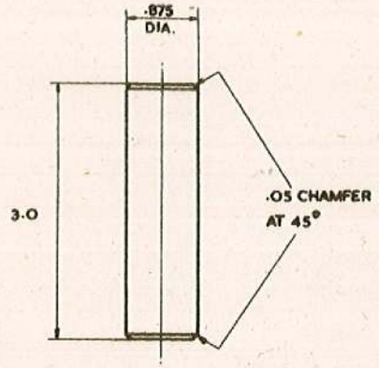
ARBOR FOR PRESSING IN SEAL





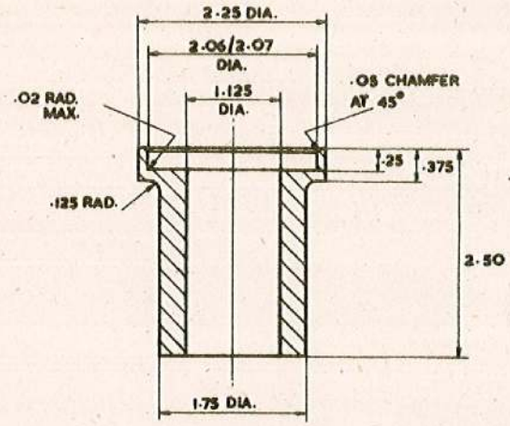
MATERIAL - BRIGHT MILD STEEL (EN6)

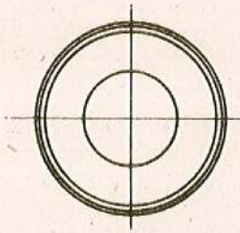
ARBOR FOR REMOVING SEAL.



MATERIAL - BRIGHT MILD STEEL (EN6)

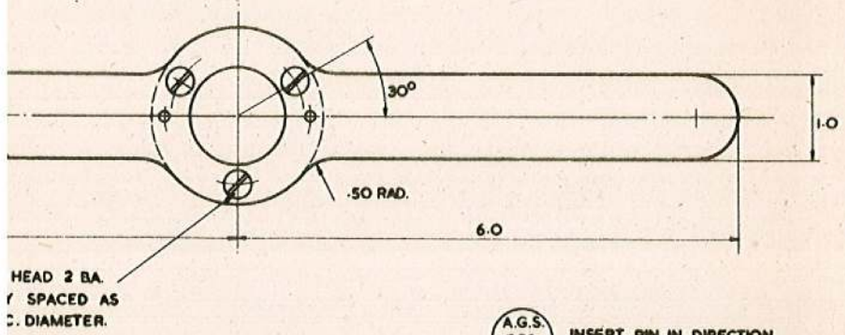
ARBOR FOR PRESSING OUT DRIVE SHAFT



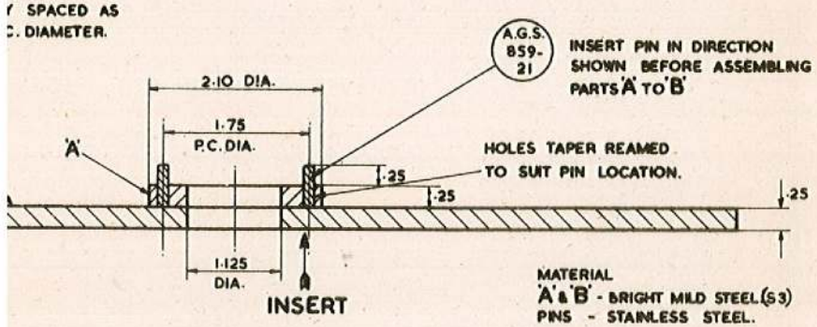


MATERIAL - BRIGHT MILD STEEL (EN6)

BOLSTER FOR PRESSING IN DRIVE SHAFT.



SPANNER FOR GLAND HOUSING.



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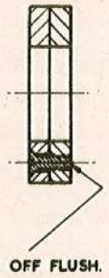
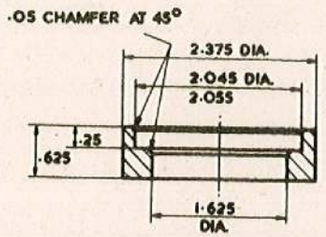
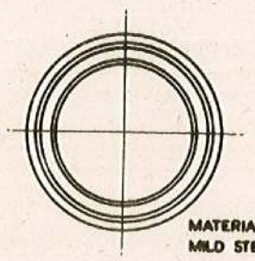
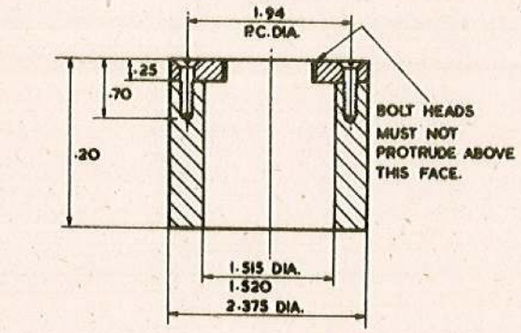


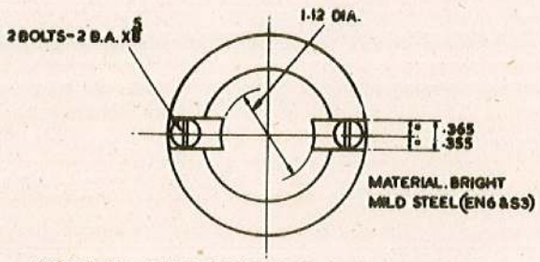




MATERIAL. BRIGHT MILD STEEL (EN6)

BOLSTER FOR PRESSING IN SEAL.





BOLSTER FOR PRESSING OUT DRIVE SHAFT

FIG.2

TOOLS TO BE MANUFACTURED FROM LOCAL RESOURCES.

ALL DIMENSIONS ARE IN INCHES

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the flats and corners, box or ring spanners must be used whenever possible.

4. All paper joints, gaskets, sealing washers and the drive shaft seal must be replaced by new ones whenever a joint or seal is disturbed, and new split pins and locking wire must always be used.

5. The special tools required for dismantling and assembling the fuel pump are illustrated in the appropriate section of the text and full details of the tools to be manufactured from local resources are given in fig. 2.

SPECIAL TOOLS

6. The repair of the fuel pump necessitates the use of special tools and rigs and these are of two categories: (a) those which are provisioned and (b) those which are to be manufactured from local resources.

7. All the special tools required are detailed in the List of Tools and fully dimensioned drawings are given in fig. 2 for those tools to be manufactured locally.

LIST OF SPECIAL TOOLS REQUIRED DURING OVERHAUL

To be provisioned

Part No.	Nomenclature
783.Y.46	Fixture for stripping and assembling pump
783.Y.59	Air line adapter
783.Y.48	Peg spanner
ENG. TR.1190	Tool for chamfering gudgeon pin hole in slipper

To be made locally

783.Y.40	Bolster for pressing out seal
783.Y.41	Arbor for pressing in seal
783.Y.42	Bolster for pressing out drive shaft
783.Y.43	Arbor for pressing out drive shaft
783.Y.44	Bolster for pressing in drive shaft
1336.Y.46	Tool for pressing out seal

CHECKS AND PRECAUTIONS BEFORE DISMANTLING

8. The following checks should be made before dismantling:—

(1) Study any complaints reported with the fuel pump, and carefully examine the exterior of the pump for visible signs of damage. Check that both ports have been securely covered to prevent the entry of any foreign matter into the interior of the pump.

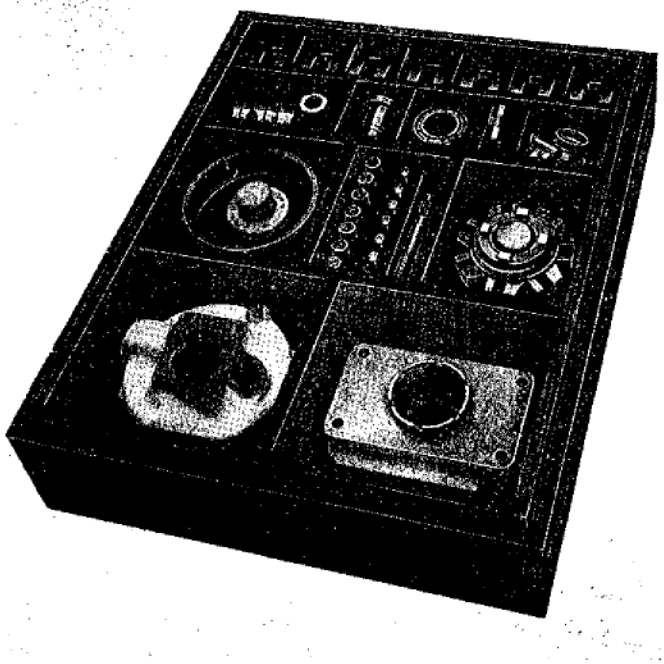

Fig. 3. Storage box

(2) The pump will contain inhibiting oil, which should be drained off before running the pump on the test rig.

(3) If the pump is in good running condition remove adapter flange and bolt the pump on to the calibration test rig, and connect up as for final calibration test (*fig.* 10).

(4) Proceed to calibrate the pump as described in para. 75. During initial calibration, the pump should run smoothly and quietly, and should any noises be heard which point to a damaged condition, the motor on the rig must be stopped and the pump completely dismantled as described in para. 9 to 23 inclusive. If the pump is functioning correctly the calibration test should be completed. The performance of the pump during this test is a good guide to the condition of the unit and will indicate parts requiring attention.

(5) Disconnect pipe lines, remove pump from adapter flange on rig.

(6) Drain pump and insert dust plugs into inlet and outlet connections.

DISMANTLING

General

9. The following instructions for dismantling the fuel pump are listed in the recommended sequence. Where the stripping of an assembly is not considered advisable, the complete assembly, if any part is defective, must be renewed. Defective pumps must be dealt with according to their reported complaint, complete stripping not being essential in every instance, i.e. where units have completed short running times, the stripping of sub-assemblies may be discretionary. Clean wooden trays must be available in which all details of the pump may be stored with safety. A suggested layout for such a tray is shown in fig. 3.

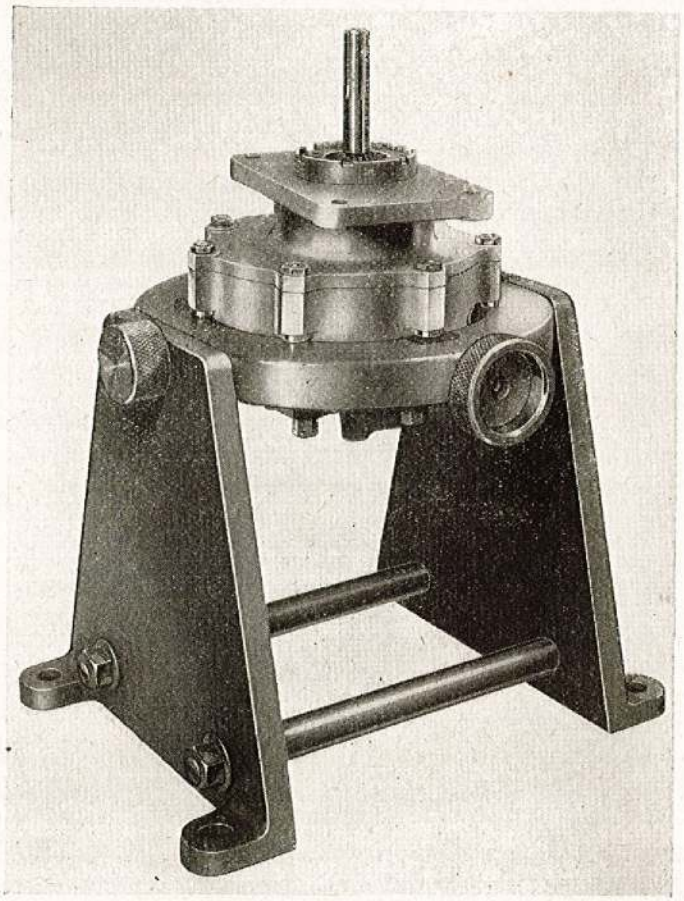

Fig. 4. Stripping fixture

OP. 3. Lift out valve fixing bolts from bottom of case. The dowels under these bolt heads are not normally removed from the bolt.

4. Slacken knurled pivot locking screw on fixture, swing fixture ring through 180 degrees and re-lock.

5. Unscrew bearing ring locating screw and remove from case together with its adjacent sealing washer, the washer being discarded.

6. Swing fixture ring back through 180 degrees and lock in position.

7. Slacken knurled locking screw attached to movable fibre clamping block.

8. Lift case from stripping fixture, at the same time withdrawing the seven case-to-cover fixing bolts.

Note . . .

The nameplate must not be removed, except when replacing case.

Withdrawal of bearing ring

22. If difficulty is experienced in executing Op. 2 of the previous paragraph, dismantling of case should be executed as follows:—

OP. 1. Execute Op. 3 to 8 of previous paragraph.

2. Immerse case in oil to Specification D.T.D.585 at an approximate temperature of 45 degrees C. for a few minutes. This treatment will cause the case to expand sufficiently to allow easy withdrawal of the bearing ring as described in Op. 1 and 2 of para. 21.

Removal of a tight distributing valve

23. This method is to be employed only if valve is difficult to withdraw as described in para. 13.

OP. 1. Swing fixture ring through 180 degrees and re-lock.

2. Execute para. 14 to 18 as applicable.

3. Lift the coupling from the rotor dogs.

4. With a suitable mallet, lightly tap the boss on the end of the valve formed by the end plug, at the same time ensuring that the valve does not drop suddenly on to the bench. If after the boss becomes flush with the rotor face, the valve is still tight, place a hard wood drift, of smaller diameter than that of the rotor bore against the valve end and continue to tap until the valve is freed. If it is necesssary to use a wooden drift, both hands will be in use, an assistant will therefore be necessary to control the exit of the valve, thus obviating any possibility of damage.

OP. 5. Remove valve-to-case gasket and discard.

6. Remove rotor assembly as described in Op. 2, 3, and 4 of para. 19.

7. Remove bearing ring, valve bolts, bearing ring locating screw, as described in relevant paragraphs.

INSPECTION

General

24. All inspection checks are described in this section with the exception of those for ball and roller races which are described in A.P.1464B. When carrying out the dimensional checks, reference should be made to the Schedule of Fits and Clearances in Part 2 of this Volume. The inspection checks are listed to correspond with the normal dismantling sequence of operations.

25. It is important that the bench upon which the work is to be done must be scrupulously cleaned and kept free from all dirt and swarf. It is recommended that the bench should be covered with zinc sheeting or linoleum. All parts must be thoroughly cleaned and washed before inspection, using a parawash machine having a kerosine bath and spray gun, and subsequently dried by compressed air. All traces of jointing material must be carefully cleaned off. Hard brushes or abrasives of any kind must not be used for cleaning, or rag for drying.

Permissible wear

26. All parts subject to wear must be checked with the Schedule of Fits and Clearances laid down in Part 2 of this Volume.

Redundant and consumable parts

27. During inspection, all parts rendered redundant by the embodiment of essential modifications must be rejected. The

Inspector therefore, must have complete information concerning all modifications. Tab-washers, seals, split pins, gasket and other consumable parts will be rejected during dismantling.

Scores and surface damage

28. The standard of acceptance when dealing with scores and other forms of surface damage may vary according to the number of hours the pump is to run, and the issue of up-to-date instructions. The acceptance of such parts is at the discretion of the Inspector-in-Charge.

Distributing valve

29. To inspect the distributing valve proceed as follows:—

OP. 1. Check the shank diameter with a comparator gauge to ensure that it conforms with the specified dimensions.

2. Examine lands between the inlet and outlet ports for scoring. Scores may be polished out provided that minimum dimensions laid down in Part 2 of this Volume are not exceeded. If, after polishing, score marks are still excessive, the valve must be scrapped.

3. Examine drillings for presence of foreign matter particularly in the feed drillings to the pressure grooves.

4. Ensure that the threads of the pressure connection and its sealing face are not damaged.

Quill shaft

30. The quill shaft should be inspected in the following manner:—

OP. 1. Check splines for burrs with a master form gauge, and ensure that the shaft conforms with the minimum dimensions laid down in Part 2 of this Volume.

2. Examine individual splines for fretting. Any such fretting may be polished out, providing that the permissible minimum worn dimensions are not exceeded.

3. Examine the quill shaft for straightness.

OP. 4. Check serrations for wear. If discoloration due to overheating is present, the quill shaft must be renewed.

5. Ensure that the spring clip is not broken or deformed.

Gland housing

31. The gland housing should be inspected as follows:—

OP. 1. Inspect the 2 B.A. and 2 $\frac{3}{16}$ in. diameter threads for damage.

2. Check seal housing bore for disruption due to ejection of seal. All burrs must be carefully removed.

3. Ensure that $\frac{1}{8}$ in. diameter peg spanner holes are not elongated.

4. Ensure that the groove for square section ring has not been damaged by the removal of the sealing ring.

5. Examine threads and hexagon head of the locking screw for damage and ensure that the protective treatment is still effective.

Pump cover

32. Inspect the pump cover as follows:—

OP. 1. Examine the seven cover-to-case bolt holes for damage.

2. Ensure that sealing face is free from burrs.

3. Inspect mounting flange to ensure that it is undamaged and that the machined face is flat, smooth and free from burrs at its periphery.

4. Examine ball race in accordance with A.P.1464B.

5. Ascertain that the circlip is free from distortion or cracks.

6. If race housing bore has been damaged during ejection of ball bearing, the cover must be renewed.

7. Examine gland housing thread and locking slots for damage.

8. Inspect spigot bearing face for slipper contact marks or burrs. Polish if necessary.

Drive shaft

33. To inspect the drive shaft proceed as follows:—

OP. 1. Inspect coupling slots for fretting.

2. Polish seal journal to remove sealing rubber marks.

3. Ensure that shank has not been damaged due to the removal of ball race.

4. If discoloration due to overheating is apparent, the drive shaft must be replaced.

5. Examine dimensionally in accordance with the Schedule of Fits and Clearances.

Coupling

34. Inspect the coupling as follows:—

Op. 1. Check slots and dogs to ensure that dimensions conform with figures quoted in Part 2 of this Volume.

2. Inspect dogs and slots for fretting. Polish if necessary.

Rotor

35. Inspect the rotor as follows:—

OP. 1. Check plunger bores with a Solex comparator to ensure that they conform with the dimensions laid down in Part 2 of this Volume. Excessive scoring in these bores is not permissible.

2. Ensure that the driving dogs are within permissible worn dimensions.

3. The erosion in the bore of the lead-indium plated bush between the plunger ports radially must not exceed 75 per cent of the land between consecutive ports (*fig.* 6). Neither flaking of the bore, deep enough to expose the bronze metal, nor scratch marks between a number of consecutive ports are permissible. Scratch marks in any other part of the bore are permissible provided they are not severe. The presence of numerous pieces of foreign matter embedded in the bore of the bush is not permissible.

4. If the rotor conforms with the checks laid down in Op. 1, 2 and 3, the rotor may be considered satisfactory for reassembly provided that the delivery figures obtained in the calibration test before initial stripping, do not indicate that there is an excessive leak at the bore.

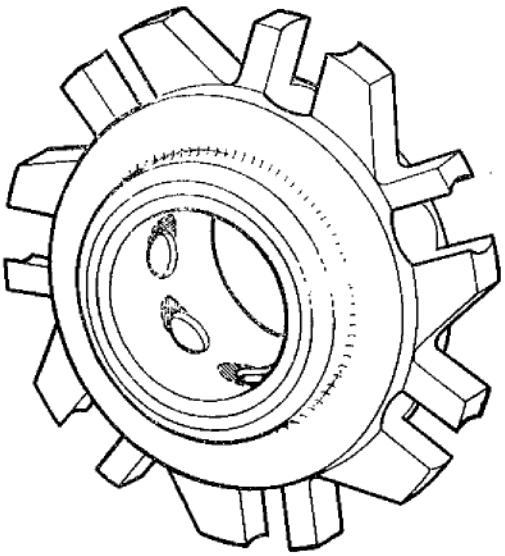

Fig. 6. Area of permissible wear on rotor bush bore

Note . . .

If the driving dogs in use are worn below the specified minimum dimensions the rotor should be turned through 90 *degrees when reassembling, in order to engage in the coupling with the alternative pair of dogs.*

Gudgeon-pins

36. Inspect the diameters for wear and scrap if not in conformity with the dimensions quoted in the Schedule of Fits and Clearances.

Slipper

37. Check the slipper as follows:—

OP. 1. Check bore in accordance with the dimensions laid down.

2. Inspect leading edge for minute particles of foreign matter picked up during rotation. If possible remove this matter without damaging lead-indium plated surface.

3. Flaking of the lead-indium plating on the bearing surface is not permissible.

OP. 4. Examine for wear and scratch marks on the bearing surface. If these are deep enough to expose the bronze metal, the slipper must be replaced.

Plunger

38. Check the plunger as follows:—

OP. 1. Inspect plunger diameter and gudgeon-pin hole for wear. These figures must not exceed the permissible worn dimensions.

2. Ensure that plunger sliding surface is free from fused-on particles of foreign matter.

3. If scratch marks are present, the plunger may be cleaned up by lapping to within dimensions laid down in Part 2 of this Volume.

Bearing ring

39. Inspect for undue wear or scratch marks on slipper bearing surface especially on the arc of highest loading. Examine the ring locating screw for damage to threads and spigot; ensure that the sealing face of the screw is freed from burrs.

Case

40. To inspect the case proceed as follows:—

OP. 1. Examine threads of inlet connection for damage.

2. Inspect all bolt holes for burrs or damage.

3. Ensure that the valve and cover sealing faces are free from burrs or damage.

4. Examine threads of bearing-ring locating screw hole for damage.

5. Ascertain that the sealing face around bearing ring locating screw hole is free from damage.

6. Ensure that the identification nameplate is firmly attached.

7. Examine bottom face of case for undue wear marks caused by slippers.

8. Ensure that the threads of the cover securing bolts are not damaged and the bolt is not distorted.

OP. 9. Check the threads of the cover bolt nuts for damage and distortion, also that the hexagon corners are not rounded and the locking wire holes are not damaged or distorted.

Valve securing bolts and nuts

41. Inspect threads for damage and ensure that dowels in bolt heads are secure and undamaged. Do not attempt to re-dowel these bolts. If either dowel or bolt is unserviceable, replace with complete new bolt-dowel sub-assembly.

42. Inspect the threads of the dome nuts for damage and examine for rounding or damage to hexagon corners. Inspect locking wire holes for damage or distortion.

Magnetic crack detection

43. The following parts must be subjected to a magnetic crack detection test. Areas to which special attention should be directed are quoted in parenthesis.

(1) Quill shaft (shear neck).

(2) Drive shaft (junction of slots in flange, and shank radius).

(3) Coupling (roots of dogs and slots).

(4) Rotor (roots of dogs and base of horns).

If any doubt exists as to the soundness of any of the following parts, they should be subjected to a magnetic crack detection test:

(1) Valve.

(2) Bearing ring.

(3) Plunger.

(4) Gudgeon-pin.

Details of the procedure and equipment for electro-magnetic crack detection are given in A.P.880C. It is essential that all details subjected to magnetic crack detection tests are demagnetized and, to remove all traces of detector "ink", thoroughly washed with kerosine after testing.

REBUILDING THE PUMP

Rebuilding sub-assemblies

44. Before the actual rebuilding of the pump is commenced, various sub-assemblies must be completed. These are dealt with first so that the assembling of the pump may be treated in a straightforward unbroken sequence of operations.

10. Remove all external locking wire by severing with standard wire-cutters.

11. Remove dust plugs and ensure that all test rig fluid has been drained off.

Mounting pump in stripping fixture

12. Mount the pump (*fig.* 4) in the special stripping fixture C.783.Y.46 as follows:—

OP. 1. Tighten knurled pivot-locking screw to locate fixture ring in the horizontal position.
2. Turn back knurled screw attached to movable fibre clamping block.
3. Locate pump case squarely in fixture ring with the quill shaft uppermost, the transfer port being located in the slot provided.
4. Tighten knurled screw attached to movable fibre clamping block to secure pump firmly in fixture.
5. Slacken knurled pivot locking screw in fixture and swing ring through 180 degrees and re-tighten screw to lock-ring in position.

Removal of distributing valve

13. To remove the distributing valve from the main casing proceed as follows:—

OP. 1. Unscrew the four dome nuts on the valve fixing bolts, using a standard box or ring spanner.
2. Remove steel washers from valve bolts and discard.
3. Carefully withdraw the distributing valve from the case by lifting vertically from the fixing bolts. If difficulty is experienced with this operation, refer to para. 23.
4. Remove the valve-to-case gasket and discard.

Removal of quill shaft

14. To remove the quill shaft the following operations should be carried out :—

OP. 1. Slacken knurled pivot locking screw on fixture and swing ring through 180 degrees and re-tighten screw to lock ring in position.
2. Remove spring clip, which locks quill shaft into drive shaft, by inserting small screwdriver or penknife blade into one of the recesses provided in the drive shaft and prising inwards and upwards.
OP. 3. Withdraw quill shaft vertically from drive shaft.

Dismantling gland housing

15. When dismantling the gland housing proceed as follows:—

OP. 1. Disengage locking tab from bolt in gland housing by bending downwards the lug adjacent to the hexagon face.
2. Unscrew bolt.
3. Remove locking tab and discard.
4. Insert pins of tool No. 783.Y.48 into $\frac{1}{8}$ in. dia. holes in gland nut.
5. Turn tool anti-clockwise to unscrew gland housing from cover.
6. Remove and dispose of square-section rubber sealing ring from gland housing periphery by prising out of recess with penknife blade.
7. Locate gland housing in bolster 783.Y.40 with its screwed thread uppermost.
8. Insert oval portion of drift 1336.Y.46 into mating recess machined in top face of gland housing to locate on face of drive shaft seal.
9. Keeping drift at right angles to the gland housing face and using a mallet, tap out drive shaft seal and discard seal.

Removal of pump cover

16. To remove the pump cover proceed as follows:—

OP. 1. Unscrew nuts from case-to-cover fixing bolts.
2. Remove adjacent washers and discard.
3. Lift off cover from case.
Note . . .
If difficulty is experienced in executing Op. 3 lightly tap the cover mounting flange upwards with a mallet to unseal the cover from its gasket.
4. Remove case-to-cover gasket and and discard.

Removal of bearing sub-assembly from cover

17. As the bearing is a shrunken fit in the cover, the cover must first be heated in oil

to Spec. D.T.D.585 at an approximate temperature of 45 degrees C. for a few minutes. This process will cause the cover to expand slightly thus enabling the bearing sub-assembly to be readily extracted from the cover by hand.

Dismantling of bearing sub-assembly

18. The dismantling of the bearing sub-assembly should be carried out in the following manner:—

OP. 1. Insert the points of standard circlip pliers into the holes in the circlip located against the face of the ball bearing.

2. Squeeze pliers to expand circlip, thus releasing it from its groove in the drive shaft.

3. Place special bolster 783.Y.42 on bed of standard bench hand press lugs uppermost.

4. Locate bearing sub-assembly in position for pressing out drive shaft by inserting flange of drive shaft into bore of bolster so as the bolster lugs contact the faces of the ball races (*fig.* 5).

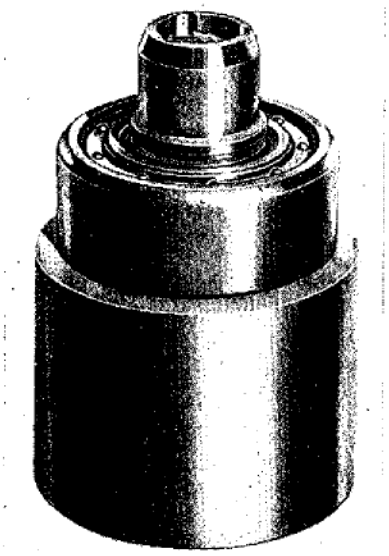

Fig. 5. Pressing out drive shaft

OP. 5. Place arbor 783.Y.43 squarely against the chamfered face of the drive shaft.

6. Apply pressure to arbor to expel drive shaft, ensuring that arbor does not foul on the inner ball race.

Removal of rotor sub-assembly

19. Remove the rotor sub-assembly as follows:—

OP. 1. Lift off coupling piece from rotor dogs.

2. Push all slipper sub-assemblies as far towards the centre of the rotor as possible.

3. Ensure that rotor sub-assembly is concentric in case.

4. Lift rotor sub-assembly squarely from case, care being taken that the plated bearing surfaces of the slippers are not damaged during these operations.

Dismantling of rotor sub-assembly

20. During these operations care must be taken not to damage the plated bearing surfaces; proceed with the dismantling in the following manner:—

OP. 1. Withdraw plunger and slipper assemblies from bores in rotor arms.

2. Straighten bent ends of split pins which retain the gudgeon-pins.

3. Withdraw split pins from gudgeon-pins and discard.

4. Withdraw gudgeon-pins and separate plungers from slippers. The gudgeon pins must be identified in some way to ensure that if they are approved for re-assembly, they are re-inserted into the slippers from which they were removed.

Note . . .

No attempt must be made to remove bearing bush from rotor.

Dismantling of remaining details from case

21. The remaining details of the case should be removed as follows:—

OP. 1. Place fingers inside case to grip bearing ring firmly in its collector groove.

2. Lift bearing ring from case by an even upwards pull (if difficulty is experienced with this operation, refer to para. 22).

Note . . .

While carrying out Op. 2 to 6 inclusive of this paragraph, the fixture ring may be pivoted to an angle most convenient for the operator, but returned and locked in the horizontal position on completion.

OP. 2. Align the bore of the rotor bush with the valve bore in the case wall.

3. Insert the valve shank through the case and whilst steadying the rotor sub-assembly in position with one hand, gently ease the valve shank into the rotor bore. Until the valve shank has squarely entered the rotor bore, it will be found necessary to apply to the valve, a rotary movement reciprocating through a few degrees.

4. After the valve shank has sufficiently entered the rotor bore, align the bolt holes in the valve flange with the fixing bolts and complete the insertion.

Note . . .

Great care must be exercised in executing Op. 3 and 4 to ensure that the plated surface of the rotor bore is not damaged.

OP. 5. Place washers and dome nuts on to valve fixing bolts.

6. Ensure that the heads of the valve bolts are still correctly seated.

7. Progressively tighten dome nuts to secure valve in position.

Coupling

56. With the dogs uppermost, place the coupling in position on the face of the rotor so that the slots in the coupling engage with two of the rotor dogs. Selection of rotor dogs may be in accordance with note appended to para. 35. Apply lubricating oil to Spec. D.E.D.2472 or similar, to coupling and rotor assembly.

Assembling the cover

57. Assemble the cover to the casing in the following manner:—

OP. 1. Place case-to-cover gasket in position on the sealing face of the cover and apply to it a coating of oil to Specification D.E.D.2472.

OP. 2. Carefully lower the cover into position on the case, allowing the case-to-cover securing bolts to pass through their respective holes in the cover; at the same time slowly rotate the drive shaft by hand to match up the slots in the drive shaft, with the dogs on the coupling.

3. Place the washers and nuts on the seven securing bolts.

4. Tighten nuts.

5. Pack grease to Spec. D.T.D.577 around the spring-loaded seal.

6. Using the peg spanner 783.Y.48 screw gland housing into cover until it butts against the face of the ball race. Care must be taken during this operation to ensure that the static and dynamic sealing rings in the gland housing are not damaged or distorted.

7. Select the 2 B.A. tapped hole which aligns most suitably with a slot in the spigot of the mounting flange.

8. Insert 2 B.A. screw together with its locking washer into the tapping selected.

9. With one tab of the locking washer located in the slot in the spigot of the mounting flange, tighten screw with a standard box spanner.

10. Bend up the other tab of locking washer until it is adjacent to one of the hexagon faces of the screw.

11. Insert serrated end of quill shaft into the mating recess in the drive shaft.

12. Slide spring clip over quill shaft and spring it into its recess in the drive shaft with the aid of a screwdriver or penknife blade.

13. Rotate quill shaft by hand to ensure that the bearing is free running.

TESTING

Rotation check

58. Turn quill shaft by hand a few times to ensure that all dynamic parts move freely.

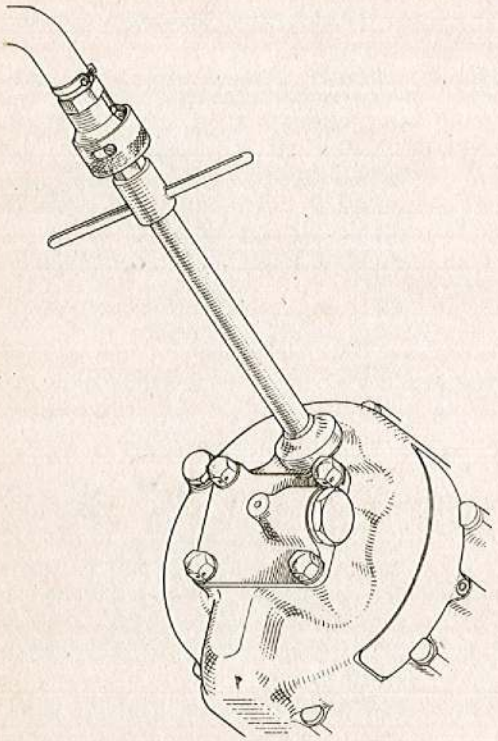

Fig. 8. Air line adapter

Static low-pressure test

59. Carry out the static low-pressure test as follows:—

OP. 1. Seal off the outlet connection of the pump with a suitable $\frac{3}{8}$ in. B.S.P. plug and sealing washer.

2. Connect the air line adapter to the inlet connection of the pump (*fig.* 8).

3. Insert the tapered connection of the adapter to an air line coupling.

4. Immerse the complete pump unit into a tank of kerosine.

5. Apply a pressure of 50 lb. per sq. in.

6. Carefully inspect for any leakage of air from the pump as indicated by the formation of air bubbles. (If leakage is evident, the cause must be traced and remedied).

7. Release air pressure.

8. Lift pump from tank and drain off surplus kerosine.

OP. 9. Remove air line connection and outlet blanking plug, and insert dust caps into the inlet and outlet connections.

10. Wipe exterior of pump free of kerosene with clean rag.

11. Pack recess in gland housing around the drive shaft, with grease to Spec. D.T.D.577.

Running-in on oil

60. The oil used in this test is to be to Specification D.T.D.585, D.T.D.44.D or D.T.D.620. Pump inlet pressure to be 0 to 20 lb. per sq. in.; the desired pressure is about 15 lb. per sq. in.

OP. 1. Connect up pump on running-in rig as shown on fig. 9.

2. Run the pump at 2,800 r.p.m. for 5 minutes at each of the following pressures: Zero, 100, 300 and 600 lb. per sq. in.

3. Run the pump at 3,500 r.p.m. for 10 minutes at each of the following pressures: 250, 500, 750 and 1,000 lb. per sq. in.

4. Remove pump from rig and drain.

TO FIG. 10

1 FUEL RESERVOIR AND COOLER
2 VACUUM CONTROL VALVE
3 STOP VALVES
4 AIR PRESSURE CONTROL VALVE
5 THERMOMETER
6 VAPOUR TRAP
7 VACUUM GAUGE
8 FLUID TRAP
9 FILTER
10 SUCTION LINE
11 TACHOMETER
12 VACUUM GAUGE LINE
13 PUMP MOUNTING FLANGE
14 PRESSURE GAUGE LINE
15 PRESSURE GAUGE
16 PRESSURE GAUGE
17 PRESSURE GAUGE LINE
18 DELIVERY LINE
19 PRESSURE CONTROL VALVE
20 PUMP DRIVING HEAD
21 RETURN LINE
22 THREE-WAY COCK
23 RETURN LINE
24 FLOWMETER
25 BY-PASS LINE
26 RETURN LINE

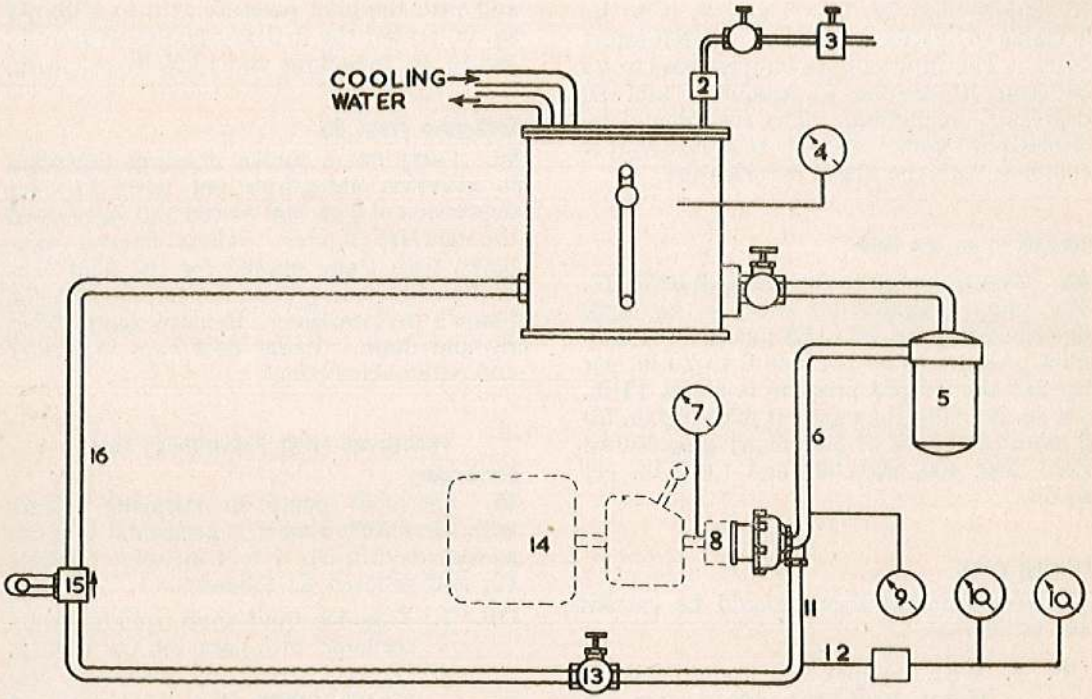

Fig. 9. Schematic layout of running-in test rig

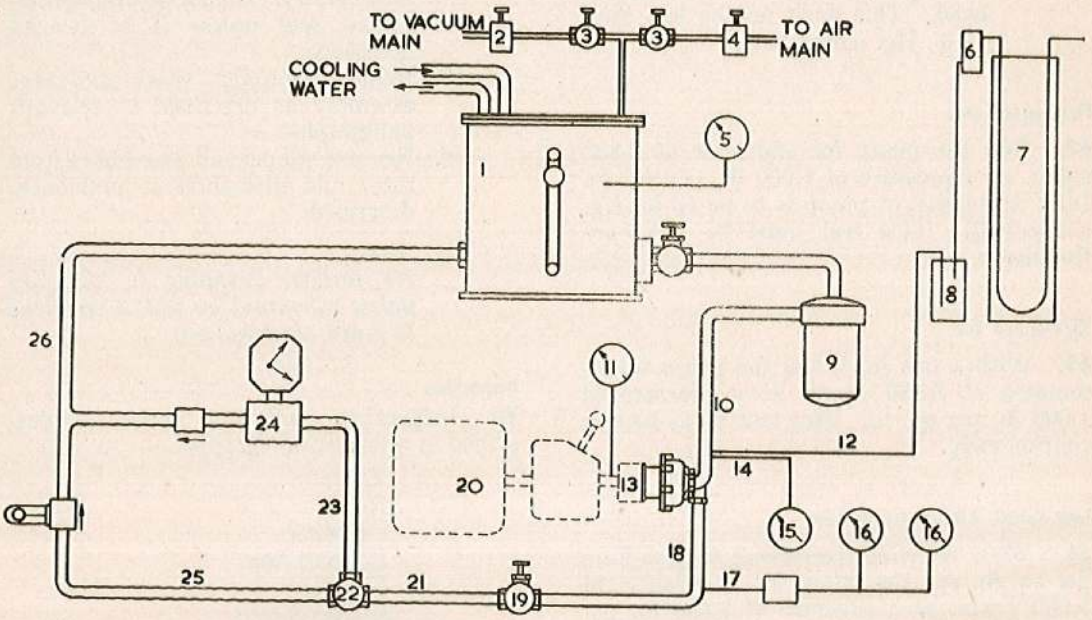

Fig. 10. Schematic layout of calibration test rig

Test fluid

61. The fuel used in tests 62 to 68 inclusive, 73 and 74 and 77, Op. 3 and 5, is to be kerosine to Specification RD.E/F/KER latest issue. The limits of its temperature to be between 10 degrees C. minimum and 30 degrees C. maximum. The fuel should be checked at regular intervals to ensure that it complies with the above specification.

Running in on test fluid

62. Connect pump to rig as shown in fig. 10. The pump remains on this rig for tests described in para. 62 to 68 inclusive. Pump inlet pressure to be between 0 to 20 lb. per sq. in.; the desired pressure is about 15 lb. per sq. in. Run the pump at 3,500 r.p.m. for 5 minutes at each of the following pressures: Zero, 200, 400, 600, 800 and 1,000 lb. per sq. in.

Priming check

63. The priming check should be carried out as follows:—

OP. 1. With the inlet to the pump and the outlet from the pump open to atmosphere, run the pump at 300 r.p.m. for 3 minutes.

2. With the inlet to the pump blanked off and the outlet to the pump open to atmosphere, run the pump at 300 r.p.m. and record the suction head. This must not be less than 12 in. Hg. (corrected).

First proof test

64. Run the pump for one hour at 3,500 r.p.m. at a pressure of 1,000 lb. per sq. in. Inlet depression at pump is to be 12 in. Hg. (corrected). This test must be run continuously.

High-speed test

65. With a free inlet, run the pump for 10 minutes at 3,850 r.p.m. at a pressure of 1,000 lb. per sq. in. This test must be run continuously.

Low speed, high-pressure test

66. With the inlet pressurised at 0 to 5 lb. per sq. in. run the pump for 15 minutes at 1,000 r p.m. at a pressure of 1,000 lb. per sq. in.

Calibration check (A)

67. With the pump running at 3,500 r.p.m. and with the inlet pressure at 0 to 2 lb. per sq. in. record the delivery figures at zero lb. per sq. in. (free flow) and 1,000 lb. per sq. in.

Calibration check (B)

68. Carry out a similar check as described in previous paragraph but with an inlet depression of 6 in. Hg. (corrected) and record the delivery figures. These figures, compared with those quoted for the final calibration test, will give an indication as to the pump's performance. Remove pump from rig and drain. Insert dust caps into inlet and outlet connections.

PROCEDURE AFTER PRELIMINARY TESTS

Dismantling

69. Assemble pump in stripping fixture with the fixture ring in a horizontal position as described in Op. 1 to 4 inclusive of para. 12, and proceed as follows:—

OP. 1. Examine quill shaft splines in accordance with para. 30, Op. 1 and 2.
2. Remove cover and gasket as described in para. 16.
3. Examine face of cover spigot for excessive wear marks caused by slippers.
4. Examine ball race and drive shaft without removing them from the cover unless they are suspected of being faulty. Do not disturb spring-loaded seal unless it is deemed necessary.
5. Remove coupling, valve and rotor assembly as described in relevant paragraphs.
6. Remove slipper sub-assemblies from rotor and dismantle as previously described.

Note . . .

No further stripping is necessary unless warranted by test observations or detail examination.

Inspection

70. Inspect the following details as described in relevant paragraphs:—

Valve
Rotor
Coupling
Bearing ring
Plungers
Gudgeon-pins
Slippers

Carry out magnetic crack detection tests on the following as laid down in para. 43:—

Valve
Rotor
Coupling

Rebuilding after strip examination

71. Rebuild the pump in the special fixture as described in relevant paragraphs. If any details apart from gaskets, washers, split pins, etc. are removed, pump must again be subjected to tests as described in para. 58 to 60 and 62 to 68.

FINAL TESTS

Second static low-pressure test

72. Repeat static low-pressure test as detailed in para. 59.

73. Remount the pump on the test rig as shown in fig. 10. The pump remains on this rig for the following tests.

Proof and high-speed tests

74. Repeat test described in para. 64 and 65.

Calibration test

75. With the test fluid at a temperature of 15 ± 2 deg. C. and 6 in. Hg. (corrected) depression at pump inlet, calibrate in the following stages and record the flow at each stage in gallons per minute.

Stage	R.P.M.	Delivery pressure lb. per sq. in.
1	300	200
2	1,000	1,000
3	1,500	1,000
4	2,000	1,000
5	2,500	1,000
6	3,000	1,000
7	3,500	1,000
8	3,500	Zero
9	300	200
10	1,000	1,000

Minimum acceptance limits are as follows:—

Stage	Gallons per minute
1	·75
2	2·0
7	9·75
9	·75
10	2·0

On completion of test remove pump from rig, drain, and insert dust caps into inlet and outlet connections.

PREPARATION FOR DESPATCH

Wire locking

76. 22 S.W.G. non-corrodible steel wire should be used for locking purposes which should be carried out in the following manner:—

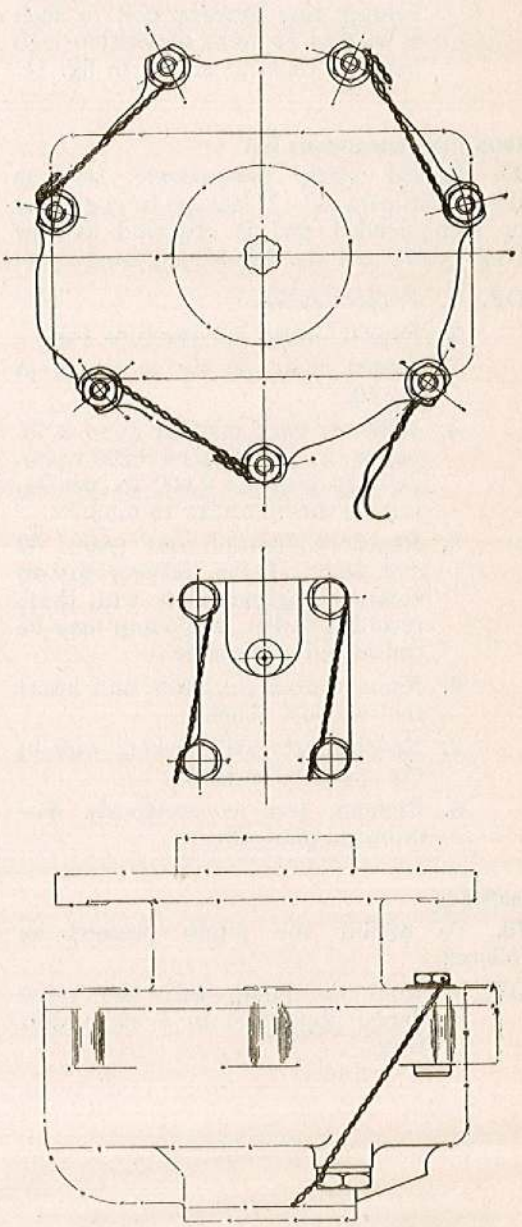

Fig. 11. Method of wire locking nuts and screws

OP. 1. Mount pump in the special fixture ring, quill shaft uppermost; lock six of the cover nuts in pairs, and anchor a length of locking wire to the seventh, as shown in fig. 11.

2. Swing mounting ring through 180 deg. and lock dome nuts on the valve flange in pairs as shown in fig. 11.

3. Remove pump from fixture.

4. Secure the free end of the wire attached to the cover nuts to the bearing ring locating bolt in such a way as to form a positive lock between them as shown in fig. 11.

Third static low-pressure test

77. Repeat static low-pressure test as detailed in para. 59. If leakage from gaskets or spring-loaded seal is observed at this stage, carry out the following procedure:—

OP. 1. Replace gasket.

2. Repeat static low-pressure test.

3. Mount pump on rig as shown in fig. 10.

4. With an inlet pressure 0 to 2 lb. per sq. in. pump speed 3,500 r.p.m. delivery pressure 1,000 lb. per sq. in. run the pump for 15 minutes.

5. Repeat calibration test (*para.* 67 *and* 68). If the delivery figures compare approximately with those recorded earlier, the pump may be considered serviceable.

6. Remove from rig, drain and insert the two dust plugs.

7. Re-lock nuts with locking wire in the approved manner.

8. Pressure test as previously described in para. 59.

Inhibiting

78. To inhibit the pump proceed as follows:—

OP. 1. Hold the pump with the valve flange uppermost in a clean drip tray.

OP. 2. Remove dust plugs from inlet and outlet tappings.

3. Using a funnel incorporating a filter, run oil to Spec. D.E.D.2472 (latest issue) into the inlet connection.

4. Slowly turn the quill shaft in a clockwise direction until oil flows from the outlet connection.

5. Place the outlet connection dust plug together with its sealing washer into position and screw plug up tight.

6. Continue running oil into the inlet connection, at the same time tilting the pump slightly to ensure that it is completely filled.

7. Place inlet connection dust plug and sealing washer in position and screw plug up tight.

8. Remove pump from tray and wipe off surplus oil.

9. Attach a label to the pump to the effect that the pump has been inhibited.

10. Treat quill shaft with temporary rust preventive to Spec. D.T.D.663 (latest issue).

11. Pack recess in gland housing around drive shaft with grease to Spec. D.T.D.577 (latest issue).

Final inspection

79. Check that all locking wire is secure and complete, and that no oil is leaking from around the dust plugs. Repaint cover or case as necessary. All test readings, running times and inspection records must be entered on an approved record sheet, from which details are to be extracted and entered into the pump log book for future reference. Any defects found in the pump must also be included in the log book, together with a report on all parts renewed.

Packing

80. Securely pack the completed pump into the special packing box provided.