CANCELLED Do NOT DESTROY

Chapter 6

PUMP, DE-ICING, S.P.E., TYPE DI., Mk. 2

LIST OF CHAPTERS

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LIST OF ILLUSTRATIONS

Introduction

1. The D.I. Mk. 2 pump is an electrically driven centrifugal pump, designed for horizontal line installation, and is primarily intended for pump de-icing fluid on to aircraft windscreens. It can also be used to supply a regular flow of fuel to the combustion heaters for aircraft cabins, or for thermal de-icing.

2. The pump mounting bracket casting situated between the pump and motor units, contains four alternative drain positions, the one selected for use being open and the remaining three plugged.

3. The pump may be mounted on a vertical or horizontal surface, but with the vent connection always at the top.

4. The unit is fitted with a de-aerating propeller and vapour guide cone and weighs 2 lb. 4 oz.

Special tools

5. In addition to the normal workshop tools and test equipment the special tools in the following table are required for re-conditioning the pump.

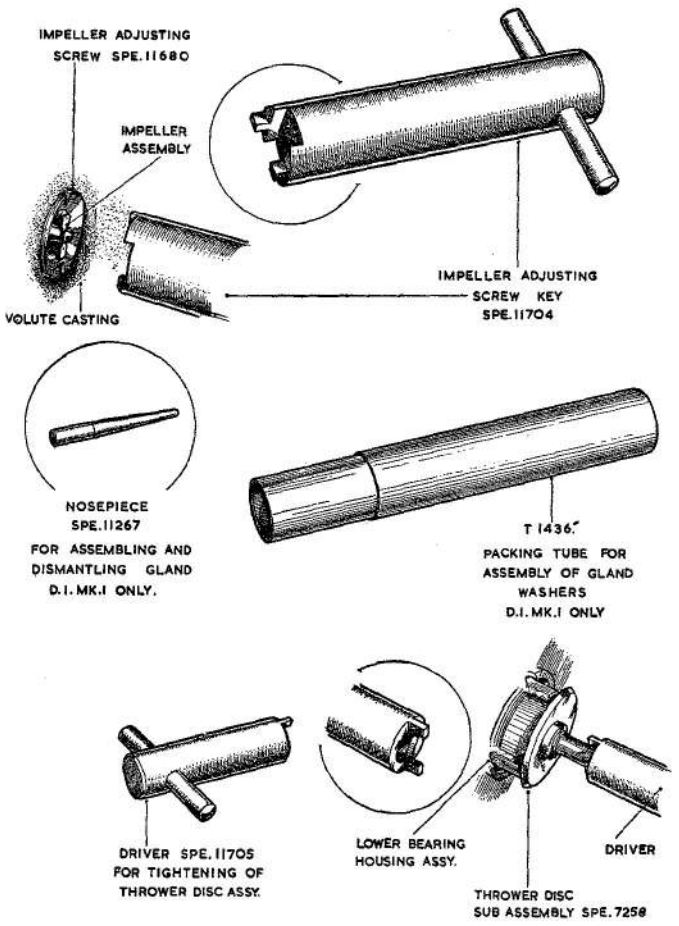

Fig. 1. Special hand tools

TABLE 1
SPECIAL TOOLS

Item No.	Nomenclature	Makers Part No.	Fig. No.	Ref. No.
1	Packing tube	T.1436	1	
2	Nosepiece	SPE.11267	1	
3	Adjusting screw key	SPE.11704	1	
4	Driver	SPE.11705	1	
5	Aligning pad	SPE.11260	3-4 and 5	
6	Bearing ring extension	SPE.7307	4	
7	Bearing pilot spindle	SPE.9070	4	
8	Adapter assembly	SPE.9067	4	
9	Adapter plate	SPE.7306	4	
10	Adapter plate	SPE.11257	3-4 and 5	
11	Bearing press extension	SPE.11259	3 and 5	
12	Plug	SPE.11708	3	
13	Locating ring	SPE.11707	3	
14	Locating ring	SPE.11706	5	
15	Hand press	SPE.8180	3-4 and 5	

DISMANTLING

Pump and motor

6. To dismantle the pump, break the lead seal and locking wire between the two screws securing the motor cover. Remove the screws and spring washers and withdraw the motor cover, exposing the upper bearing nut on the armature spindle and the brush-gear assembly within the motor casing.

7. Break the lead seal and locking wire between the gland drain plug and tag. Unscrew the six inlet casting securing nuts and locking wire tag and ease off the inlet casting over the studs in the volute casting. Any damage caused to the gasket when removing it can be ignored as all gaskets should be renewed when re-assembling the pump.

8. Unscrew and remove the four volute casting securing nuts and ease the volute casting off the motor casing studs. Remove the gasket between the casting and the pump mounting bracket.

9. The vapour guide cone can be withdrawn by removing the two guide cone fixing screws and spring washers, access to which is made through the inlet end of the volute casting. Remove the impeller clearance adjusting screw, using key SPE.11704 (*fig.* 1).

10. Holding the commutator end spindle nut with a spanner, unscrew and remove the propeller fixing screw and its washer, together with the propeller. Strike the impeller a sharp blow in an anti-clockwise direction with a pencil or similar piece of wood and unscrew the impeller from the spindle. Screw on the nosepiece SPE.11267 (*fig.* 1), in place of the impeller.

11. Withdraw the pump mounting bracket over the studs of the motor casing and remove the mounting bracket bearing housing gasket, and, if considered necessary, the three drain plugs and washers from the pump mounting bracket.

12. The Flexibox carbon seat fuel sealing, gland requires no special dismantling procedure and will separate readily into its component parts.

13. Holding the fuel thrower disc with the special driver SPE.11705 (*fig.* 1) unscrew the spindle end nut and lift off the upper bearing dust shield.

14. Loosen the four grub screws in the brush box assembly which secure the brush lead tags and remove the four carbon brushes. Ensure that each brush is marked, relative to its box, so that the bedding on the commutator is undisturbed. If any brush is worn below its permissible worn dimension (6·5 mm.) it must be renewed.

15. Remove the two bearing housing screws and ease the bearing housing (with the armature assembly attached) off the motor casing studs. Great care must be exercised in passing the armature through the pole bore of the field assembly. Remove the bearing housing motor casing gasket.

16. Holding the armature, unscrew the fuel thrower disc, using the special driver SPE.17705 (*fig.* 1) and remove the lower bearing dust shield. With a hide or plastic faced hammer, tap the nosepiece SPE.11267 until the armature is free to be lifted from the lower bearing and its housing. Remove the bearing circlip from the bearing housing together with the bearing dust shield. The lower bearing can now be pressed out of its housing using the tools illustrated in fig. 3.

17. Unscrew the four screws securing the Breeze plug to the motor casing assembly and detach the two motor leads from it.

18. Loosen the two grub screws in the brush box assembly which hold the field coil leads and gentle bend the leads clear of the brush boxes. Carefully mark the position of the brush box assembly relative to the motor casing and stator assembly. Remove the two brush box carrier screws with the spring washers and lift out the brush box assembly and bearing dust shield through the aperture in the motor casing.

19. To remove the upper bearing it must be pushed outwards as the bearing bush is secured by two bars which locate in slots in the motor casing; these prevent the bearing from being removed in an inward direction.

20. The seal ring, fitted in a groove in the motor casing can be removed if damaged, or permanently flattened.

Note . . .

Do not remove the field coils from the motor casing.

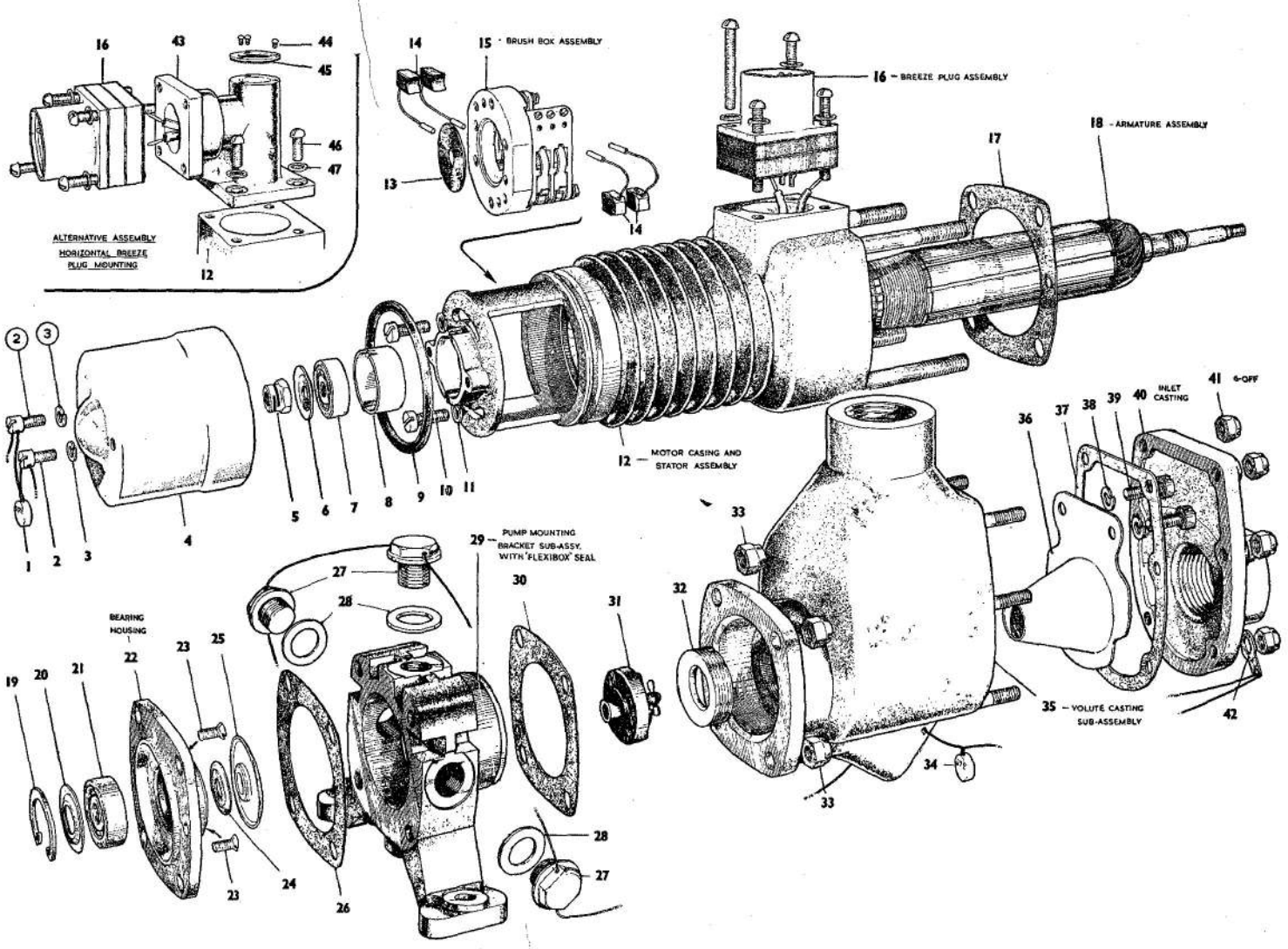

Fig. 2. Exploded view of D.I., Mk. 2 pump

KEY TO FIGURE 2

1 SEAL, LEAD
2 SCREW, MOTOR COVER FIXING
3 WASHER, SPRING
4 COVER, MOTOR
5 NUT, UPPER BEARING
6 COVER, DUST, UPPER BEARING
7 BEARING, UPPER
8 BUSH, MOTOR CASING BEARING
9 RING, SEAL
10 SCREW, BRUSH BOX CARRIER
11 WASHER, SPRING
12 MOTOR CASING AND STATOR ASSEMBLY
13 SHIELD, DUST, BEARING
14 BRUSH, CARBON (WITH LEAD AND TAG)
15 BRUSH BOX ASSEMBLY
16 BREEZE PLUG ASSEMBLY
17 GASKET, MOTOR CASING-BEARING HOUSING
18 ARMATURE ASSEMBLY
19 CIRCLIP, BEARING
20 SHIELD, DUST, BEARING
21 BEARING, LOWER
22 HOUSING, BEARING
23 SCREW, BEARING HOUSING
24 COVER, DUST, LOWER BEARING
25 THROWER DISC ASSEMBLY
26 GASKET, MOUNTING BRACKET-BEARING HOUSING
27 PLUG, GLAND DRAIN
28 WASHER, GLAND DRAIN
29 PUMP MOUNTING BRACKET SUB ASSEMBLY WITH FLEXIBLE SEAL
30 GASKET, MOUNTING BRACKET-VOLUTE CASTING
31 IMPELLER AND PROPELLER ASSEMBLY
32 SCREW ADJUSTING
33 NUT, SECURING, VOLUTE CASTING
34 SEAL, LEAD
35 VOLUTE CASTING SUB ASSEMBLY
36 GUIDE CONE
37 GASKET, INLET TO VOLUTE CASTING
38 WASHER, SPRING, GUIDE CONE FIXING
39 SCREW, GUIDE CONE FIXING
40 INLET CASTING
41 NUT, SECURING, INLET CASTING
42 TAG, LOCKING
43 BRACKET, MOUNTING, BREEZE PLUG
44 SCREW, DRIVE, PARKER-KALON
45 COVER, FIREPROOF
46 SCREW, FIXING, MOUNTING BRACKET
47 WASHER, SHAKEPROOF, MOUNTING BRACKET

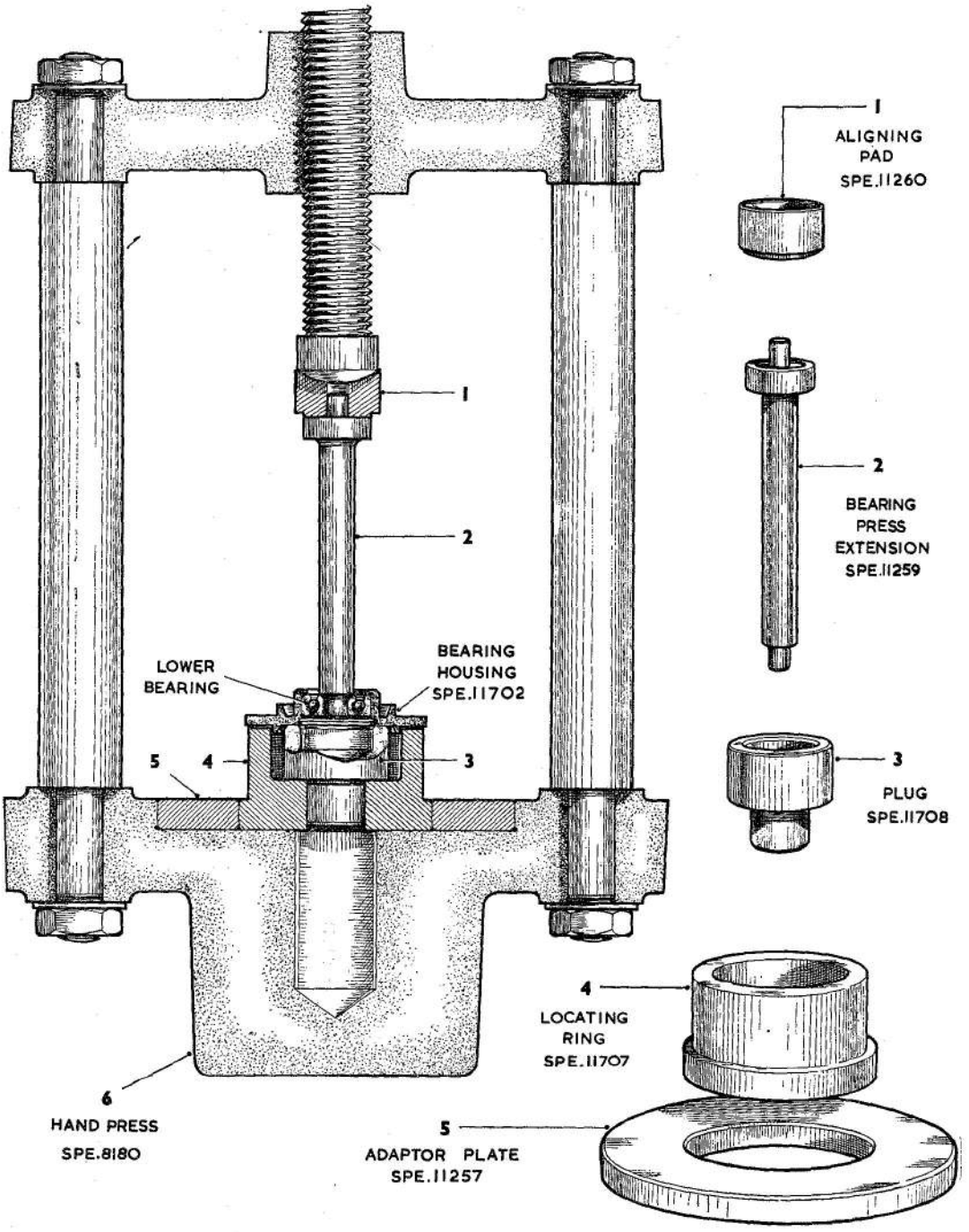

Fig. 3. Tools for removal of lower bearing

INSPECTION AND REPAIR

21. All parts must be inspected and cleaned, any defects must be remedied or renewed where necessary. All rubber, paper, or fibre washers must be replaced by new, before re-assembly.

MOTOR

Motor casing and field coil assembly

22. Inspect the motor casing and field coil assembly, if unserviceable the complete assembly must be replaced with new Where the field coils show low insulation due to moisture, bake the complete assembly up to 120 deg. C.

Armature

23. Lightly skim and polish the commutator, making sure, after this operation, the diameter is not less than 0·594 in. After skimming, the insulation slots must be undercut, butts removed and cleaned using dry compressed air. The commutator must run true with the spindle within 0·001 in. clock reading.

24. Examine armature spindle for scoring, should there be radial grooves below 0·155 in. dia. the armature must be rejected. Slight signs of scoring must be rectified by polishing the spindle with crocus paper to a mirror finish.

Brushgear

25. Examine brushes for wear, if worn below 6·5 mm. long, replace with new. If the brushes are still usable, ensure that they are returned to their original boxes. The brushes should have been suitably marked, relative to their boxes, before removal, and should be an easy fit in them. Examine the condition of the brush springs and brushgear. If there are any signs of corrosion the brushgear assembly must be replaced by new.

26. Thoroughly clean out the motor casing with dry compressed air. If new brushes are fitted they must be bedded to the contour of the commutator. Information on method of brush bedding is contained in A.P.4343, Vol. 6, Sect. 18, Chap. 1.

Bearings

27. Examine condition of bearings. Holding the outer race between the fingers, slowly rotate the inner race, feeling for roughness of the tracks, also check for side, or, end play. Should any of these faults be evident, replace with new bearings.

28. It is important that, should it be necessary to re-sleeve the upper bearing, the tools shown in fig. 4 are used, mounted in the hand press. When replacing the lower bearing use the tools illustrated in fig. 5.

Electrical connection

29. Examine bakelite plates and Breeze plug threads. If damaged, renew.

PUMP

Flexibox seal

30. Examine seal face for scoring, if slight, relap to a mirror finish. If excessive, renew. If the spring is weak, or broken, renew. If the seal ring is slack (this would permit leakage), renew.

Impeller assembly

31. Examine carbon seal face for scoring or wear. If slight, relap to a mirror finish. If excessive, renew.

Note . . .

Ensure, finally, before reassembly that all mating surfaces are clean and free from torn gaskets and dried jointing compound.

ASSEMBLY

Pump and motor

32. To assemble the complete pump and motor after fitting new components as required, and renewing all gaskets and joint rings proceed as follows:—

33. Press the lower (impeller end) bearing into the bearing housing using the tools shown in fig. 5. Insert the bearing dust shield with the outer flange flush against the bearing, securing it in position with the bearing circlip.

34. To replace the upper (commutator end) bearing, first press it into the bearing bush using the tool shown in fig. 4. Insert the bearing and bush assembly into the motor casing from the front so that the two ears on the bush locate in the slots in the casting and lock the assembly.

35. Enter the armature spindle through the bore of the lower bearing assembled

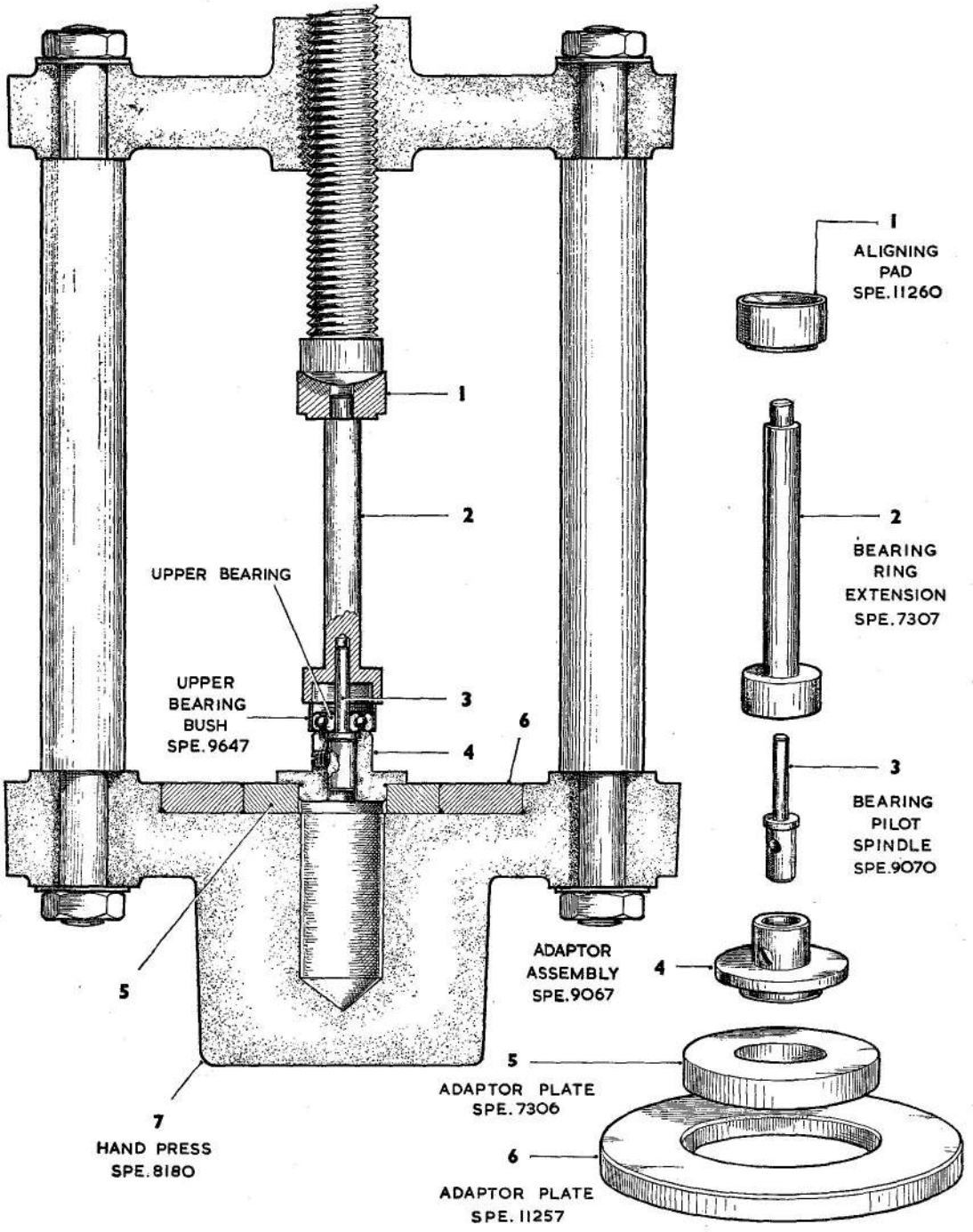

Fig. 4. Tools for sleeving upper bearing

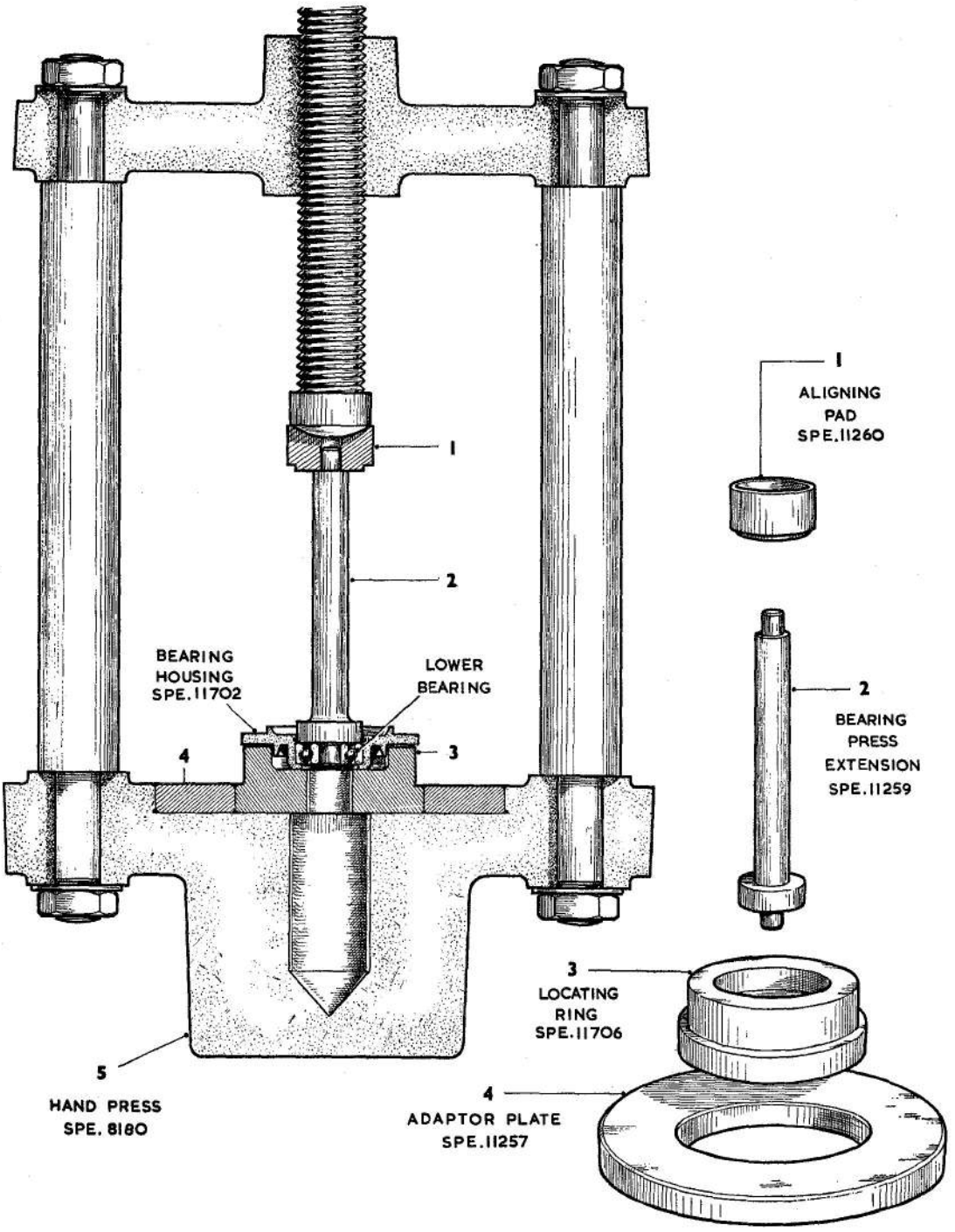

Fig. 5. Tools for replacing of lower bearing

in its housing. Place the lower bearing dust shield on the armature spindle with the raised flange away from the bearing and screw on the thrower disc assembly, using the special driver SPE.11705 (*fig.* 1).

36. If separated on dismantling, replace the bearing dust shield in the shallow recess of the brush box assembly and cement in position, using " Boscoprene " Cement. Fit the brush box assembly in position in the motor casing assembly, rotating it until the marks (made on the two assemblies when dismantling) are in line. Secure in position with the two brush box carrier screws and spring washers. Connect the two field coil leads to their terminals in the brush boxes and secure by tightening the grub screw.

37. Prepare the end faces of the motor casing assembly and the bearing housing with " Hermeticoll " jointing compound. Place a new paper gasket in position on the face of the motor casing assembly and enter the armature carefully through the pole bore of the field coils and guide the spindle evenly into the upper bearing. Smear a little jointing compound on the threads of the two csk.hd. screws which hold the bearing housing in position, insert, and tighten up securely.

38. Place the upper bearing dust shield in position on the armature spindle with the raised flange away from the upper bearing. Replace the nut and tighten with a box spanner, holding the fuel thrower disc assembly on the armature with the special driver SPE.11705 (*fig.* 1).

39. To replace the " Breeze " electrical connection, connect the two field coil leads up to the pins in the plug and secure the plug in position with four round head screws and shakeproof washers.

40. Raise the finger springs on the brush box assembly, insert the four brushes into their original boxes. If new brushes have been fitted ensure they are properly bedded to the contour of the commutator. Secure the brush tags to their terminals in the brush carrier.

41. The pressure applied to each brush by the spring is 5 lb. per sq. in., which is equivalent to a force of 0·154 lb. (70 grammes) on the brush contact surface.

42. The motor should now be run in the vertical position on no load for 3 hours, or until the brushes bed over the full arc and at least 80 per cent of their width. The insulation resistance at the end of this run with the motor still warm, should not be less than 10 megohms.

43. To prevent unnecessary ingress of dirt, etc., into the motor during this test, the seal ring should be replaced in the groove of the motor casing, and the motor cover temporarily secured in position. Remove the cover after the test as it will be necessary to hold the nut when assembling other components.

44. Prepare the end face of the bearing housing and the face of the pump mounting bracket assembly with jointing compound. Fit a new paper gasket on the face of the bearing housing and ease the pump mounting bracket into position. As this sub-assembly cannot be permanently secured until the volute casting is in position, it is necessary to temporarily tighten down the pump mounting bracket, in order to effect the seal between it and the bearing housing while the jointing compound is still tacky, by tightening down on two diagonally opposite motor casing studs using standard 2 B.A. nuts, packing up with washers if necessary.

45. With the D.I., Mk. 2 pump it is not necessary to screw the special nosepiece on to the armature spindle. The flexibox seal is assembled by inserting the coil spring into the housing and pushing the bush with internally set rubber ring on to the central spigot of the housing. Assembly is completed when the impeller and propeller assembly which contains the carbon gland seat is screwed into position.

46. The impeller and propeller assembly is screwed on to the armature spindle by hand, holding the end nut with a suitable spanner.

47. Remove the temporarily secured motor cover. Prepare the end face of the pump mounting bracket and the flanged end face of the volute casting by applying jointing compound. Fit a new paper gasket on the pump bracket face, fit the volute casting over the motor casing studs and tighten down with the four securing nuts. Ensure that the volute casting is assembled so that when the pump is mounted in position the vent is vertical.

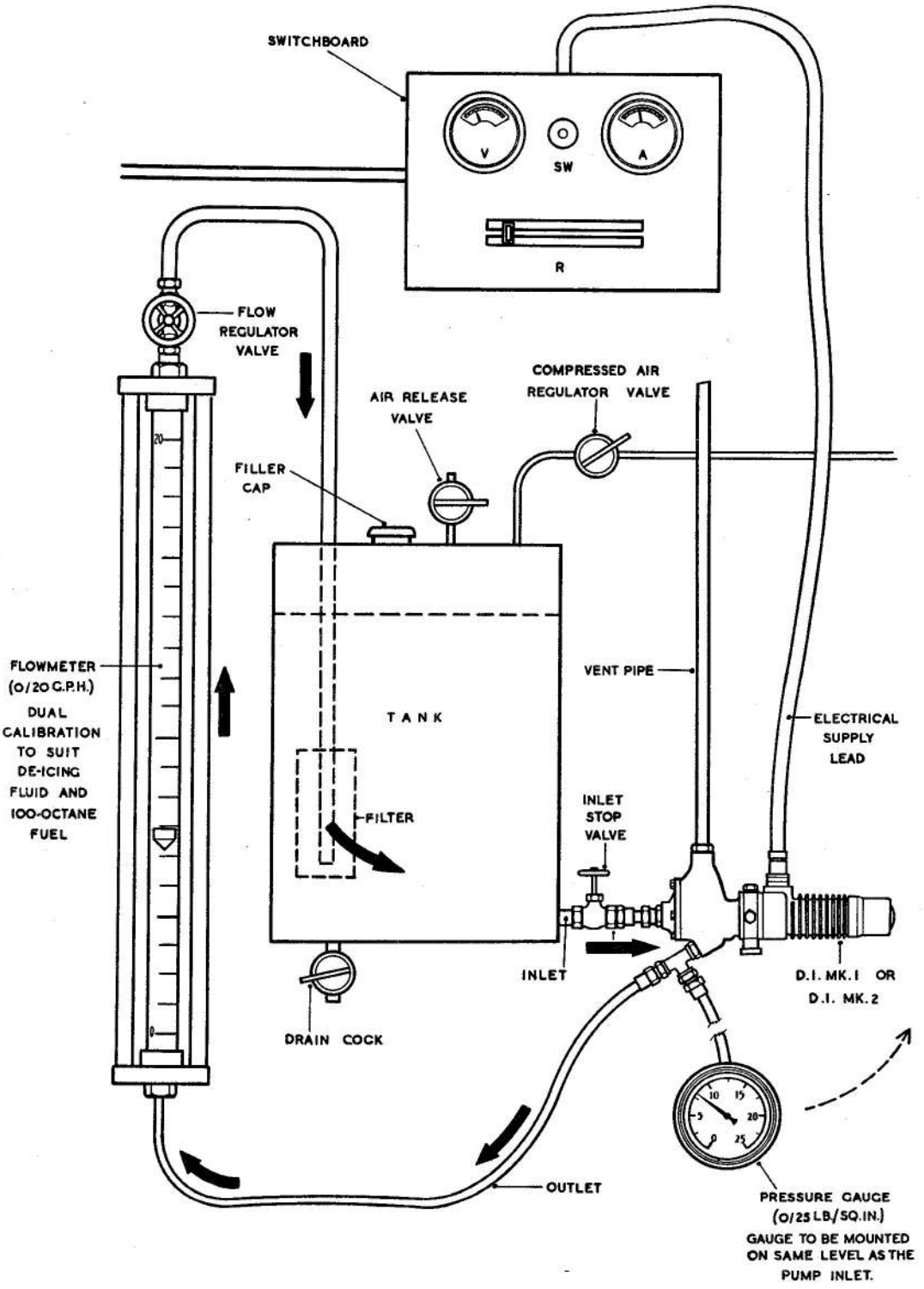

Fig. 6. Diagrammatic arrangement of test rig

Calibration (100-Octane only)

67. Run the pump under a 6 in. head of fluid above the pump inlet, with the vent pipe attached and the flow adjusted to 20, 10, 7, 5, 2, 1 and zero gallons per hour. Measure the delivery pressure and motor current at each flow stage for input voltages of 22, 24 and 28·8-volt d.c.

Volt d.c.	Delivery rate in gallons per hour	Delivery pressure in lb. per sq. in.	Max. current in amperes
22·0	7·0	10·0	2·3
24·0	7·0	13·0	2·4
28·8	7·0	18·0	2·7

Causes of failure on test

68. Probable causes of defects which may develop in this pump and their remedies are as follows:—

Trouble	Probable cause	Remedy
Gland leakage (Flexible seal)	(a) Bad finish between gland seal faces	Dismantle gland and relap faces.
	(b) Low pressure between gland faces	If suspected, dismantle gland and use selective assembly when replacing
Excessive current	(a) Excessive loading on Flexibox gland	If suspected, dismantle gland and use selective assembly when replacing
Low delivery pressure	Fault motor	Check speed and brush setting. Adjust if necessary.
Pressure surge	(a) Tight or pre-loaded bearings	Check fits and ease if necessary
	(b) Tight gland	See notes on excessive current
Low insulation resistance	Dampness in motor windings	Prolonged drying of armature and field at 120 deg. C.

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