Chapter Forty-nine

THE TECALEMIT METERING PUMP

Micro pump type PE 7710

Contents

Illustrations

The information contained in this chapter has been supplied by Messrs. Tecalemit Ltd., and was revised by them in January, 1957; letter reference DRP/GEV dated 14-1-57 refers. All enquiries regarding their products should be made to them.

The Tecalemit micro pump has been designed for the precise lubrication of high speed rotating parts, such as supercharger rotors and gas turbine mainshaft bearings where conditions do not permit the circulation of oil over the bearings or surfaces. Maximum operating efficiency and service life are obtained by the complete absence of valves and by zero clearance volume in the displacement cavity. A characteristic of its design enables the pump to accurately meter the lubricant delivered, even when this is supplied at a pressure higher than that at which it is delivered. Over a given speed range the pump is designed to give substantially proportionate delivery, that is to say, the volumetric efficiency remains constant with varying speeds.

Each metering pump (Fig. 1 and 2) consists of a light alloy forging (8-Fig. 2) into which is fitted a meehanite cylinder (15-Fig. 2) with a plain bore. The cylinder carries two pistons (10 and 13-Fig. 2) in opposition to each other. The pumping piston (10) contains a tappet head which bears on a cam extension of the oil pump driving shaft. A coil spring (9-Fig. 2), which is fitted under the tappet head and surrounds an extension of the cylinder, ensures that the tappet maintains contact with the cam. The position of the metering piston (13) in relation to the pumping piston is adjusted by a knurled nut (2-Fig. 2) screwed into the pump body forging. Eleven equally spaced notches (3-Fig. 2), which are numbered from 0 to 10, are cut in the outer periphery of the knurled nut. A flat spring-steel tongue (12-Fig. 2) engages in a notch and locks the nut in a specific position which gives an indication of the quantity of oil that is delivered by the pump. Later issues are fitted with a gauze filter in the adjusting head cap to prevent the ingress of foreign matter. (Mod. 1290).

Oil is supplied to the pump from a space arranged under the pump spigot from which a drilling in the pump body communicates with a port in the pump cylinder. A Neoprene sealing ring is fitted round the pump spigot under the flange, to prevent leakage from the supply channel. When replacing the pump, care must be taken that the ring does not block the supply passage. Another port in the cylinder communicates with the outlet port from which the metered oil supply is taken, at right angles to the bore of the cylinder.

With the cam in its lowest position, the pumping piston uncovers the supply port in the cylinder and the space between the two pistons fills with oil. As the cam rotates, the pumping piston moves outwards covering the supply port. The two pistons then move together with a metered quantity of oil between them. Towards the outer extremity of the pump stroke, the metering piston uncovers the outlet port and the continued movement of the pumping piston evacuates the pump space against the spring load on the metering piston caused by the collapsing of the springs in the adjustable knurled nut. The quantity of oil delivered depends on the position of the metering piston with reference to the pumping piston, as determined by the knurled nut, and only slightly on the oil inlet pressure. The capacity of each pump is 0.60 pints per hour at 1000 r.p.m., but before installation they are adjusted on a test rig, by means of the knurled nut at the outer end, to give the delivery specified for the installation.

SERVICING BETWEEN OVERHAULS. Provided there is no reason to suspect faulty operation of

the metering pump there are no specific adjustments required between overhauls. The only attention needed during routine inspections is as follows:—

(a) Make a thorough visual inspection of the exterior of the metering pump for signs of damage.

(b) Ensure that the output adjustment locking spring (12) is sprung firmly home into the relative notch on collar (3), has not been strained, that the peening into the screw driver slot of screw 14 is secure, and that non-corrodible locking wire (D.T.D.189) is fitted through the loop in the locking spring (12) and is bound tightly in position around the adjusting head of the pump (Fig. 3 and 4).

(c) Carefully examine the pipe and union or banjo plug connected to the pump outlet port for signs of oil leakage. Tighten union or banjo plug. Replace the washers if they appear unserviceable.

(d) Examine base of metering pump flange after test run of engine following tightening of 2 B.A. nuts. This flange should be thoroughly cleaned off *before* test run commences. Any signs of lubricant leakage from the flange indicates that neoprene joint washer needs renewing. Jointing compound **must not** be used on this joint face.

(e) Examine the vent orifice (Fig. 5) in adjusting head cap (1) for signs of excessive oil leakage therefrom. Any leakage indicates that the pump should be changed and the original sent for rig testing.

(f) Ensure that the two 2 B.A. plain nuts securing the metering pump flange to the main oil pump are tight and that the spring washers beneath are in sound condition.

(g) Should it be considered necessary to test the metering pump delivery on the engine or in situations where test rig facilities are not readily available, proceed as instructed by the engine manufacturer under Servicing and Maintenance.

(h) Adjust the metering pump, should the above tests show this to be necessary, by turning the knurled adjuster plug (2) whilst holding the leaf spring (12) clear of notch engagement until the latter spring engages the lowest numbered notch which will provide the delivery specified.

A metering pump should not be rejected merely because it is necessary to employ a slightly higher setting in order to obtain the required delivery. The range of adjustment consists of eleven notches numbered 0 to 10 and on no account may the adjustment be turned beyond the notch marked 10 to obtain the required delivery. If it is necessary to

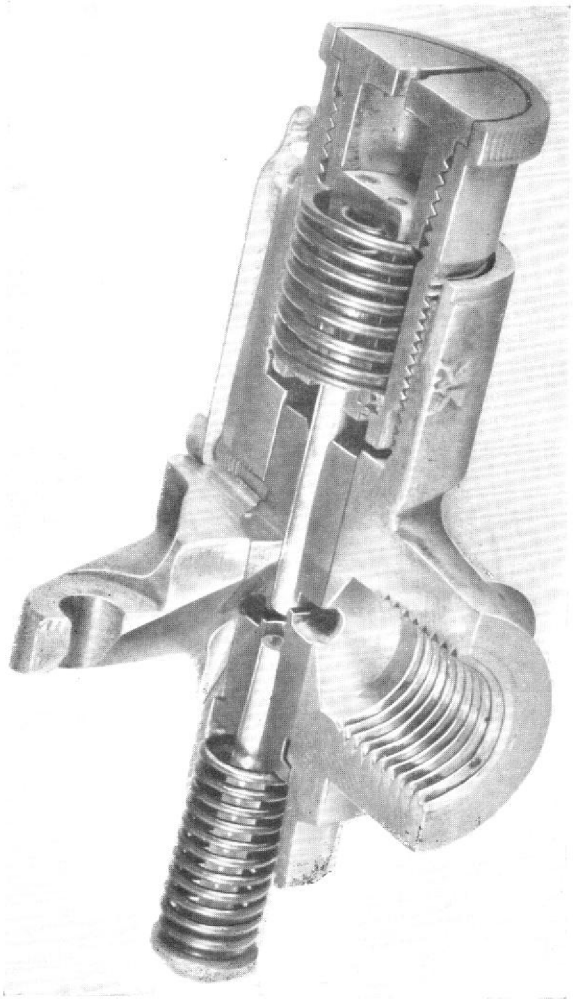

Fig. 1. Sectioned micro pump. (Pre Mod. 1290)

continue running the engine for more than five minutes with the metered oil supply disconnected, it is essential to supply the main bearings with clean filtered oil of the correct grade by means of a syringe through the normal supply pipe. If the flow is insufficient at No. 10 setting, the metering pump is faulty—before rejecting the metering pump, ensure that the oil supply duct is not blocked, possibly by displacement of the sealing ring—and must be changed for a serviceable metering pump. On satisfactory completion of this check, or adjustment, the locking spring should be tightly wired into position. Re-connect the delivery pipe to the metering pump, using new washers if the original ones are in any way unserviceable.

DISMANTLING. The metering pump comprises two sub assemblies and two other separate parts which because of the inherent characteristics of the design are really inseparable, namely:—

(a) The adjusting head assembly complete with the metering piston is a peened up assembly (items 1, 2, 3, 4, 5, 6, 7, 13).

(b) The pump body and cylinder which are integral (items 8, 12, 14, 15).

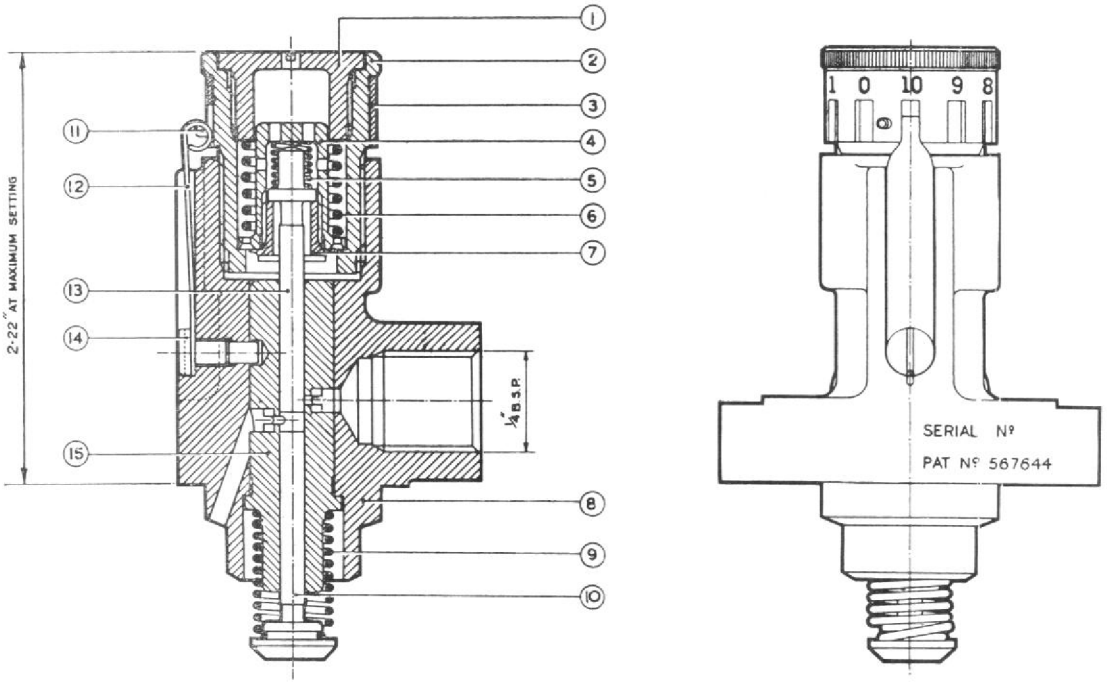

Fig. 2. Micro pump assembly. (Pre Mod. 1290)

1. *Adjusting head cap.*
2. *Knurled adjuster plug.*
3. *Serrated (notched) collar.*
4. *Inner cap.*
5. *Resistance spring.*
6. *Main spring.*
7. *Screwed sleeve.*
8. *Pump body.*
9. *Piston spring.*
10. *Pumping piston.*
11. *Parker Kalon screw.*
12. *Locking spring.*
13. *Metering piston.*
14. *Dowel screw.*
15. *Cylinder.*

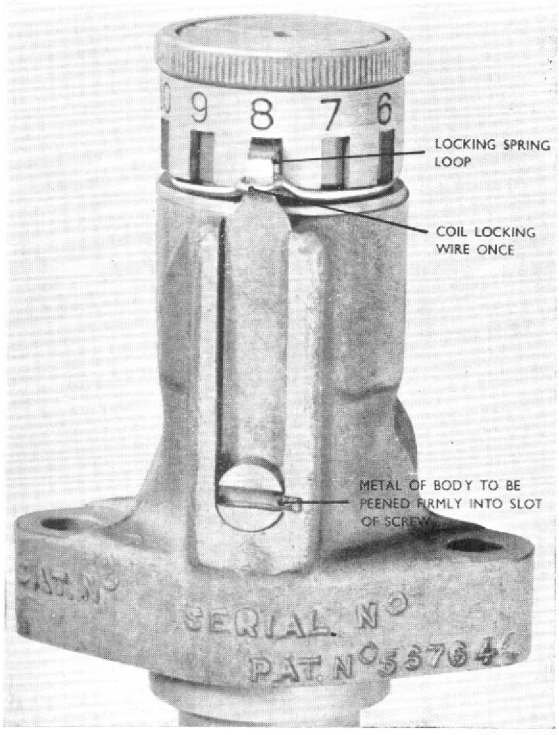

Fig. 3. Locking of locking spring and screw.

(c) The pumping piston (item 10).

(d) The pumping piston spring (item 9).

While item No. 7 is peened into the two ends of the slot milled on the face of the outer flange of item No. 4 mainly to prevent loosening of these two parts and consequent alteration of output adjustment of the regulating piston it would not in any event be possible to replace the piston as a separate spare part because this item is lapped to and paired with the cylinder (15).

The cylinder (15) is a shrunk fit in body (8) and the fitting of metering piston (13) and pumping piston (10) are carried out by selective assembly.

Any disturbance of this cylinder in the body (8) is liable to affect its internal diameter which will of course affect both the pistons (10 and 13).

It will therefore be clear that if any defects occur to the springs (5 and 6), the pistons (10 and/or 13) or the cylinder (15) the only possible course is to change the complete pump. The only part that can, in fact, be renewed separately is the pumping piston spring (9).

No special tools are necessary for dismantling the metering pump which is effected as overleaf:—

(a) Remove the banjo bolt which connects the delivery pipe to the metering pump, remove the two washers, and gently ease the pipe clear of the metering pump.

(b) Unscrew the two 2 B.A. plain nuts which secure the metering pump to the bottom casing of the main oil pump, remove the spring washers, and carefully ease the metering pump off the studs. Should the synthetic rubber sealing ring, which forms the joint between the metering pump and the oil pump casing, remain in the latter, it should be extracted and placed on the spigot of the metering pump.

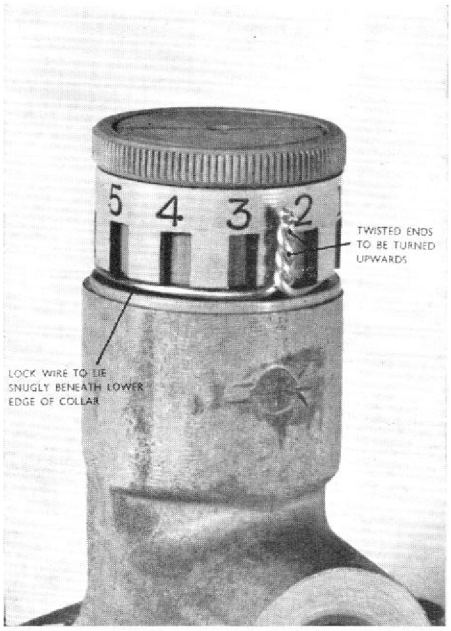

Fig. 4. Wire locking.

(c) Remove the locking wire. Before withdrawing the wire from the loop in the locking leaf spring (12) use this to hold away the spring (12) from the notches in the adjuster plug (2), whilst unscrewing completely the latter from the pump assembly (Fig. 7).

(d) Pull the pumping piston (10) and spring (9) away from the bottom of the cylinder (15).

CHECKS WHEN DISMANTLED. The following checks should be made whenever a dismantled metering pump is under examination:—

(a) Take the adjusting head assembly in one hand and with the other hand very gently attempt to pull the metering piston (13) away from its mounting in the screwed sleeve (7) then attempt to move the piston back and forth to locate any free movement.

The metering piston (13) should always be pressed firmly against the inner end of the screwed sleeve (7) by the small spring (5) and any free play is indicative of weakness, breakage or collapse of the resistance spring (5) in which event the pump assembly should be replaced.

(b) Having ascertained that there is *no* free movement of the metering piston (13) the movement *under control of the resistance spring* (5) should now be checked by a micrometer height gauge alongside the protruding metering piston (13) and depressing the latter until the definite stop due to the piston (13) contacting the cap (4) is felt. This movement should be 0.025 in. $\pm$ 0.003 in. (Fig. 8).

The exposed slotted end of the cap (7) should be carefully observed during this test to ensure that the piston (13) is not depressed beyond the point in the preceding paragraph.

Should the movement of the metering piston vary from that laid down above the pump assembly should be replaced.

(c) The total movement of the metering piston (13) when fully compressing the resistance spring (5) and the main spring (6) when measured in similar manner to (b) above should exceed 0.156 in. If this movement is less than 0.140 in. the pump assembly should be replaced.

(d) Ensure that the Parker Kalon screw (11) is firmly home in the adjusting head of the pump by measuring the projection which should be $\frac{1}{32}$ in. beneath the head of the screw (11). Should the projection exceed

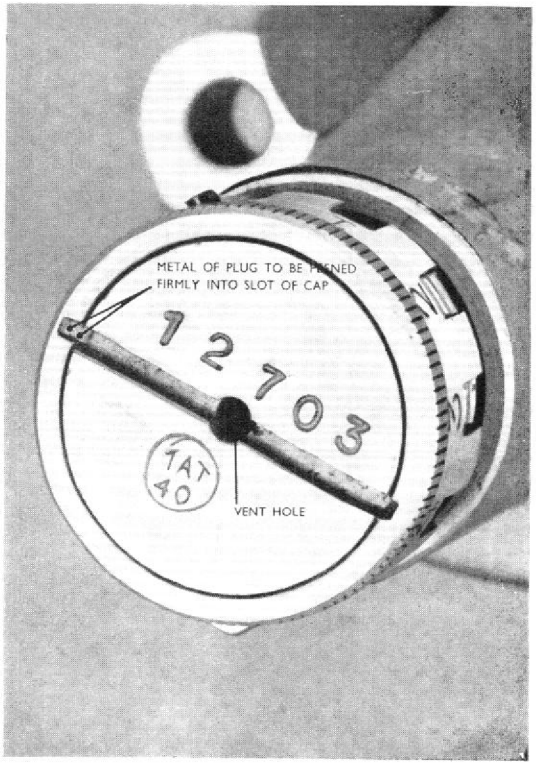

Fig. 5. Vent orifice and locking of cap in adjuster plug.

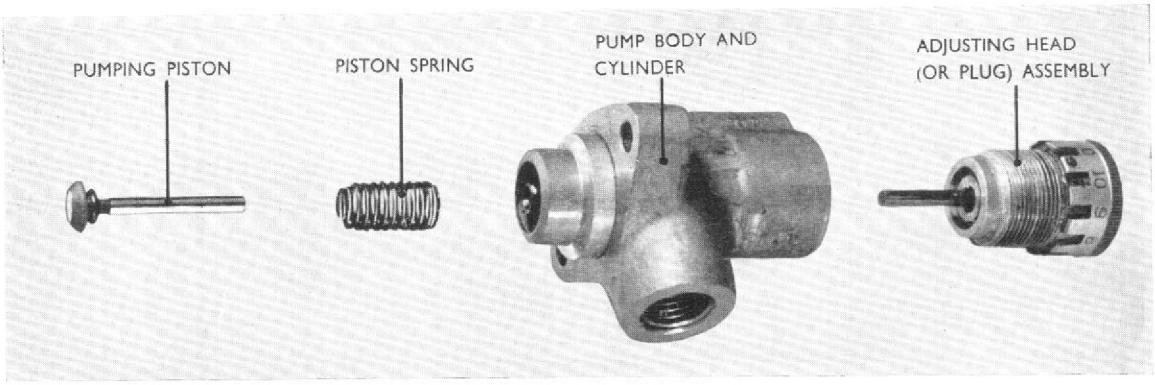

Fig. 6. Main sub-assemblies.

this figure it is advisable to suspect loosening of the screw (11) and replace the pump assembly.

(e) Ensure that the peening into the screw driver slot of screw (14) and of adjuster body plug (1) is in good order. If there is any sign of displacement the pump assembly should be replaced.

(f) Pull out pumping piston (10) and carefully examine the fixing of the spring (9) under the foot of piston (10). The bottom coil of spring (9) is decreased in size during manufacture to enable a snug fit to be achieved at this point. The upper coil grips an enlarged shoulder formed on the lower end of the cylinder (15), and when reinserting the piston (10) the spring (9) should be firmly twisted *against* the winding of the coils to ensure that the upper coil does encompass this shoulder ; a pull outwards on the piston (10) will disclose whether the spring (9) is held firmly in position (Fig. 9). Should it prove impossible to achieve a secure hold in the above manner the spring (9) should be replaced.

The piston (10) should be examined for signs of scoring and tested for free movement in the cylinder (15). Should the piston (10) tend to stick in the cylinder (15) this indicates that the piston has become bent through incorrect assembly and the pump assembly should be replaced.

FITS AND TOLERANCES. The metering pump is made to exceedingly fine limits and the pistons (10) and (13) and cylinder (15) are lapped together, thus becoming non interchangeable.

Since the total output of the pump is perforce so small at maximum efficiency, slight discrepancies through wear and tear are liable to create serious loss of output.

It is therefore not possible to provide a table of fits and tolerances. Nearly all the possible defects necessitate complete replacement of the pump assembly.

REASSEMBLING. When reassembling the metering pump after overhaul or inspection the first essential requirement is scrupulous attention to cleanliness of all parts. The smallest particle of grit may cause scoring or jamming of the metering and/or pumping pistons in the cylinder and possibility of complete failure of the lubrication system fed by the pump.

The following precautions should be carefully observed : —

(a) Ensure that the pumping piston spring (9) is fitted the right way up, i.e. the diminished end coil to fit snugly within the groove formed for this purpose adjacent to the cam foot at one end of the piston. This is achieved by screwing the spring on to the groove *against* the winding of the coils.

(b) Ensure that the opposite end of the pumping piston spring (9) is firmly engaged upon its register which is an enlarged portion of the outer wall of the cylinder (15) formed for the purpose during the machining of the latter. This engagement is made by a screwing action against the winding of the coils in the same manner as above. Test after (a) and (b) by grasping the pump in one hand and the cam foot of piston (10) in the other and attempting gently to separate the two by pulling apart.

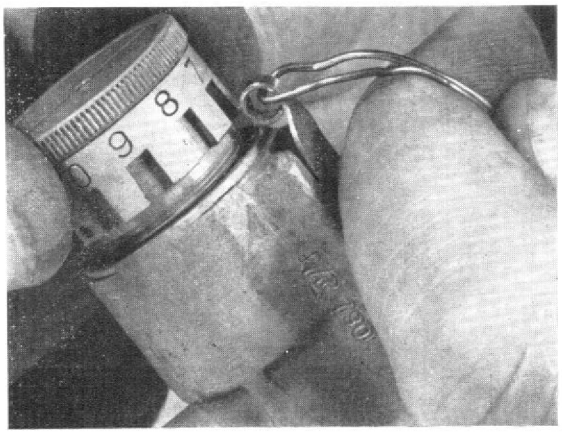

Fig. 7. Using locking wire to hold locking spring clear of notches in adjuster plug.

(c) Next the adjusting head or plug assembly (1 to 7) should be screwed into the pump body (8) taking care to ensure that the piston (13) enters squarely into the cylinder (15).

The setting of the adjustment collar (3) in relation to the leaf spring (12) should be dealt with as follows:—

i. For pumps being reassembled merely after inspection the adjustment should be restored to the position occupied before dismantling.

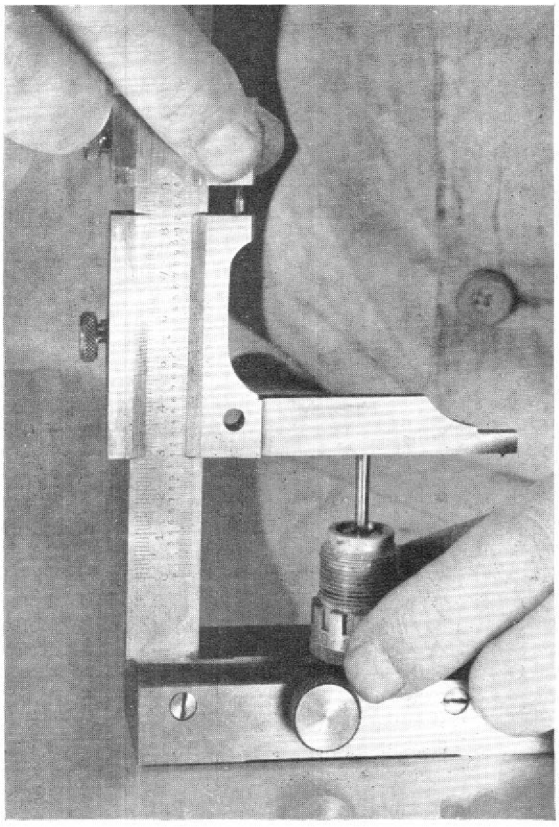

Fig. 8. Checking movement under control of resistance spring; using a vernier height gauge.

ii. For pumps undergoing engine or rig tests the adjustment should be set to the notch on collar (3) as found necessary according to output required. *See Testing paragraph. (Page 8).*

iii. Ensure that the locking wire is placed in position through the loop of leaf spring (12) and bound firmly around the collar (3). (Fig. 3 and 4).

(d) Ensure that the sealing ring fits snugly under the mounting flange of body (8). It is highly important that the inlet hole adjacent to the flange face should not be obstructed, and great care should be taken in this operation.

(e) Immediately prior to mounting the metering pump the engine should be rotated until the driving cam on the main oil pump spindle is seen to be at bottom dead centre (position of 'no lift') relative to the particular metering pump being fitted.

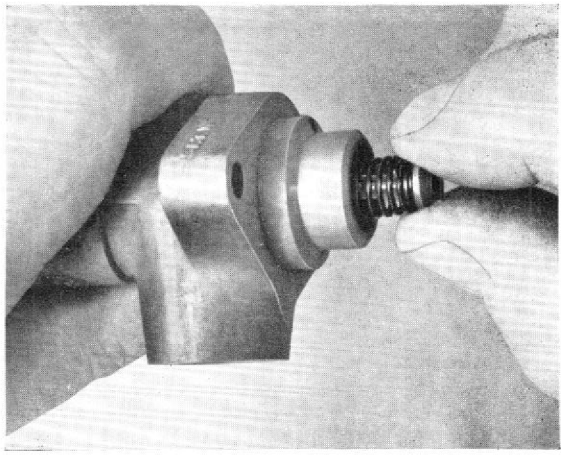

Fig. 9. Checking grip of piston spring.

Insert the metering pump spigot into the bore in the main oil pump casing making sure that the pumping piston (10) enters smoothly on to the cam. Hold the metering pump in position against the load of spring (9) with one hand so that the flange of the metering pump is firmly bedded against the main oil pump casing.

With the other hand fit the two spring washers and 2 B.A. plain nuts; the metering pump must be held in position in this manner until both nuts are at least

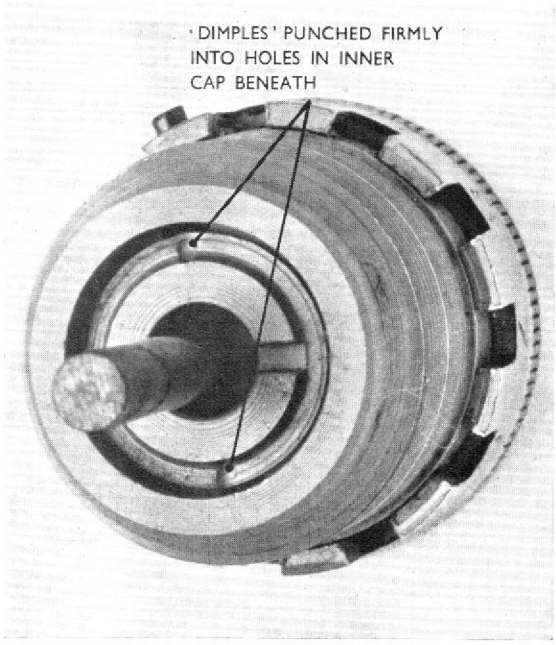

Fig. 10. Locking of adjusting head internal details. (The word 'HOLES' should read 'SLOTS')

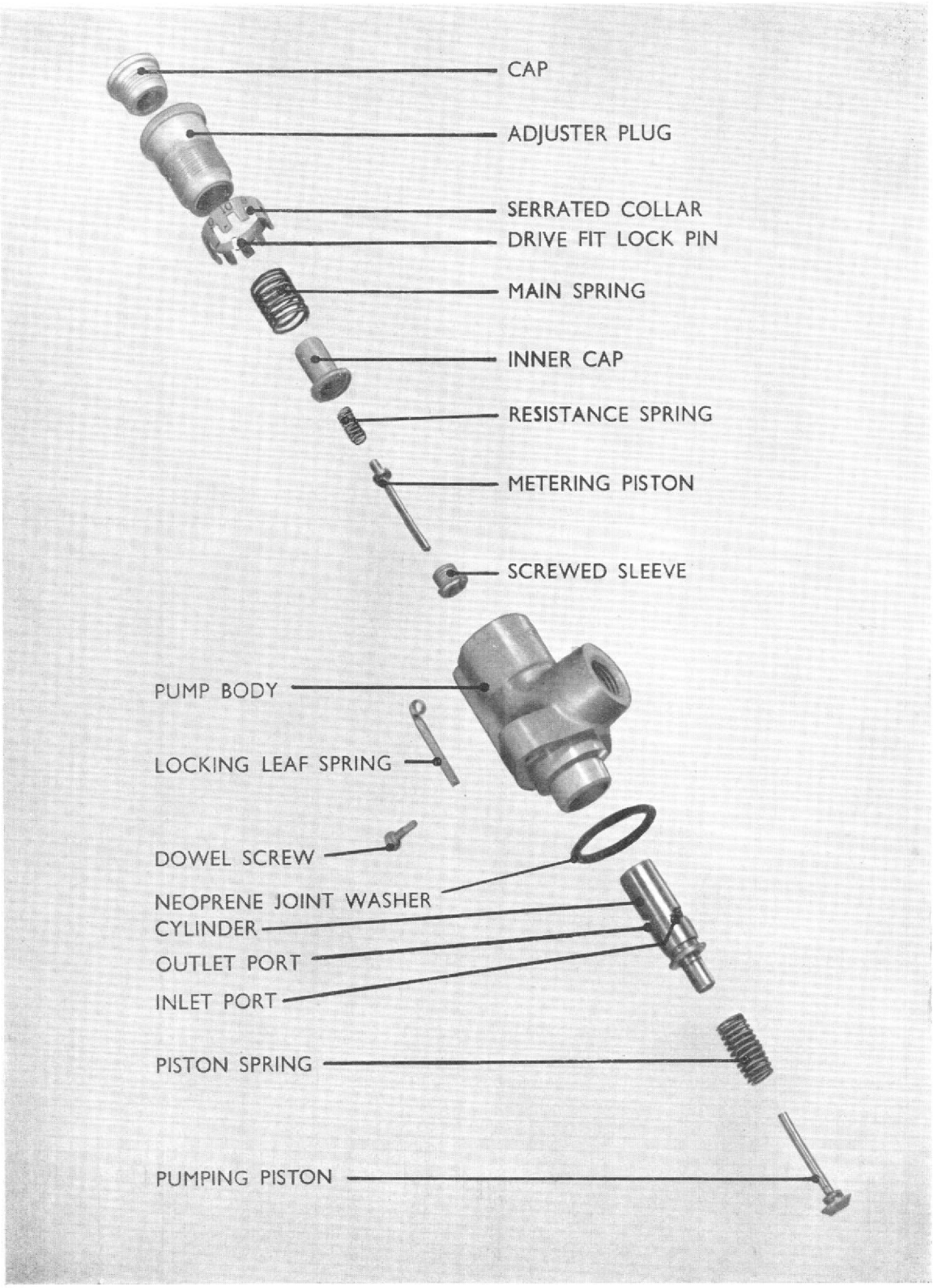

Fig. 11. Micro pump completely dismantled.

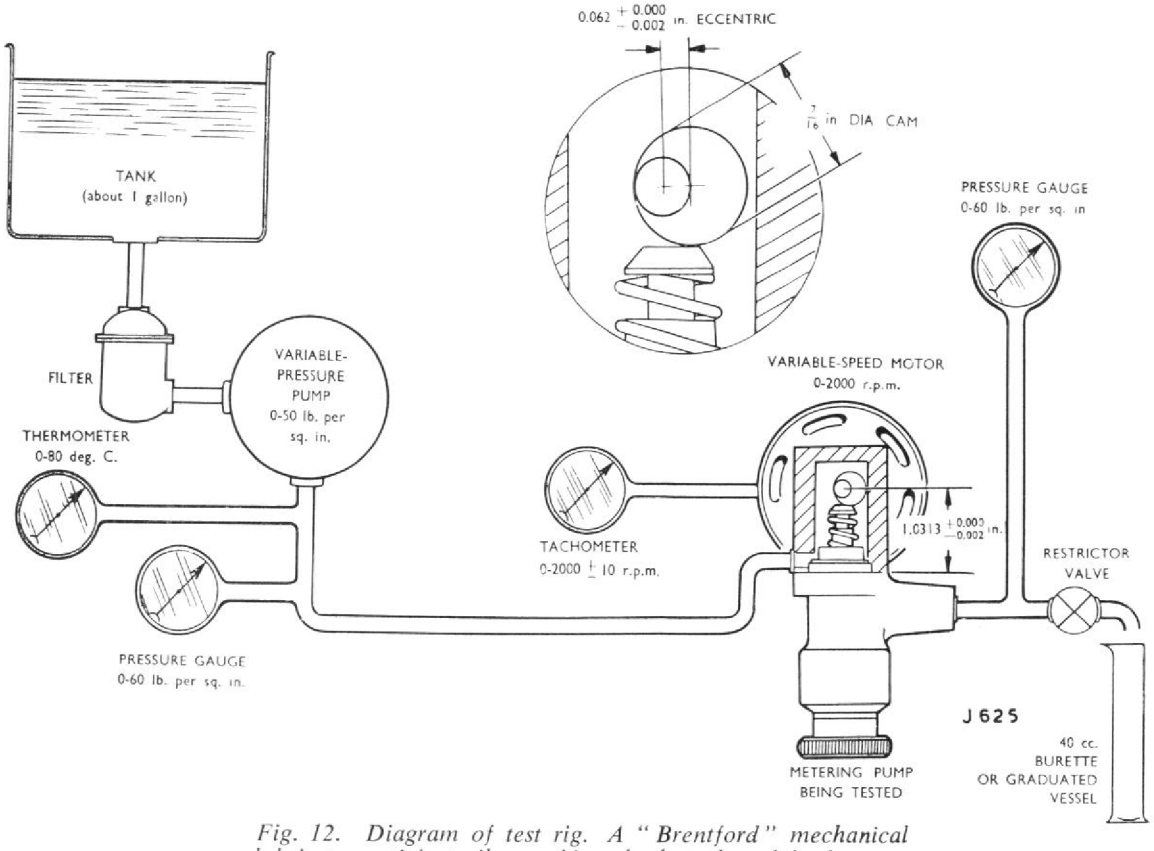

Fig. 12. Diagram of test rig. A "Brentford" mechanical lubricator satisfactorily combines both tank and feed pump.

finger tight. Then tighten the nuts securely with a spanner.

Reconnect the delivery pipe to the metering pump, using new washers (Engine Part No. N.1502) if the originals are in any way unserviceable.

TESTING. The oil used shall be to Specification approved for use with this engine as shown in the leading particulars at the beginning of this handbook and supplied through a suitable filter to the metering pump at a variable pressure.

The temperature of the oil entering the pump shall be between 20 deg. C. and 40 deg. C.

The feed and delivery pressures shall be measured immediately adjacent to the pump inlet and delivery connections respectively.

The pump must be mounted on a suitable fixture, care being taken to maintain the distance between mounting face and camshaft centre line within the tolerance quoted in Fig. 12. During the test, the pressure in the camshaft cell should not exceed zero, and to facilitate the leak test the pump should be mounted horizontally or vertically with the adjusting cap downwards.

With an oil feed pressure of 20–25 lb. per sq. in. a delivery pressure of 5 lb. per sq. in. and a speed of 473 r.p.m. the delivery shall be checked and must not be less than 90 millilitres (0.158 pints) per hour with the adjuster plug at No. 7 setting.

With an oil feed pressure of 40–45 lb. per sq. in. a delivery pressure of 5 lb. per sq. in. and a speed of 1340 r.p.m. the pump shall be set to deliver 400-500 millilitres (0.71-0.88 pints) per hour in the position of maximum capacity (i.e. Notch 10 on the adjuster plug).

Note.—When this setting has been made it must not be possible to screw down the adjuster plug more than three notches in addition to a complete turn.

With conditions as for the above test carry out the following delivery curve.

Adj. Plug Setting.	*Delivery.*	
	Mls./hr.	*Pts./hr.*
10	400–500	0.71–0.88
7	260–350	0.46–0.61
4	80–170	0.14–0.30
1	not more than 40	not more than 0.07

With an oil feed pressure of 40–45 lb. per sq. in. a delivery pressure of 20 lb. per sq. in. and a speed of 1340 r.p.m. the delivery shall be checked and must not be less than 260 milliletres (0.46 pints) per hour with the adjuster plug at No. 7 setting.

With an oil feed pressure of 40–45 lb. per sq. in. a delivery pressure of 5 lb. per sq. in. and the adjuster plug at No. 7 setting check that the delivery at 1750 r.p.m. is not less than 300 millilitres (0.53 pints) per hour.

During the test the oil leakage through the air vent of the adjusting cap shall not exceed 12 drops per hour.

Note.—The above calibration applies to pumps of new manufacture only. Pumps which have been in service and/or repaired may be accepted with the adjuster plug at higher settings (i.e. Notches 8, 9, and 10) provided the delivery requirements as specified for No. 7 setting are all met in the one position of higher adjustment.

On no account must the adjustment be turned beyond the zero point after No. 10 position in order to obtain increased delivery.

FINAL CLEARANCE. On satisfactory completion of these tests the pump shall be locked with the adjuster plug at No. 7 setting or at the notch found necessary as mentioned herein, on pumps which have been in service, by passing locking wire tightly through the lock spring (12). (Fig. 3 and 4).

STORAGE. All orifices must be sealed after test and the unit protected against damage and possible separation of the pumping piston and spring, by wrapping in alkathene, sealing same with adhesive tape and a further alkathene wrapping, after which the pump is to be packed in a suitable cardboard box for transit.

A test certificate, detailing performance, and a release note, should accompany new pumps, or pumps repaired by the manufacturer when the pumps are delivered to the engine manufacturers.