

Chapter Forty-three

THE LUCAS FUEL-FLOW DISTRIBUTOR

Types 18/21J and 20/27L

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The information in this chapter has been supplied by Messrs. Joseph Lucas (Gas Turbine Equipment), Ltd., and was checked by them 28-9-1953, their ref. LFWM/MAS.

*This chapter revised by Amendment No. 112
February, 1954*

The flow distributor is designed to meter the fuel evenly to the individual burners on the engine. It functions essentially as a flow equaliser on the 'Duplex 2' burners employed in the Ghost 48 Mk. 1 engine and, in conjunction with the air-fuel ratio control, produces a flow, to each burner, which is very nearly proportional to pressure.

The complete type number consists of the basic type designation (e.g. FD.18), followed by a stroke number (/21) which indicates the installation, and a final letter (J) to indicate the schedule to which the unit has been calibrated.

The distributor, see Fig. 3, consists essentially of a spring-loaded steel plunger (4) operating in a closely-fitting cylindrical metering sleeve (10) in the body casting (6). A carbon sleeve (9) is cemented to the plunger to reduce 'stiction' and minimise hysteresis; the carbon portion extends almost to the upstream end of the plunger, the extremity of which forms the metering edge (12), controlling the flow to the burners.

Ten tapered metering slots (11) in the wall of the metering sleeve are uncovered progressively by the plunger metering edge as the plunger moves under the influence of fuel pressure. The metering slots terminate in drillings through the wall of the sleeve and communicate with radial drillings (5) which transfer the fuel to the delivery ports connected to the burners. Each slot, therefore, supplies an individual burner with a metered flow of fuel; differentiation in flow is applied to suit the special requirements of certain burner positions by calibrating the appropriate metering slots during manufacture.

The tail of the metering plunger beyond the carbon sleeve is reduced in diameter to form a pilot and operates in a carbon sealing bush (7)

which guides the plunger tail and also seals leakage from the pressure-balancing chamber below the carbon portion of the plunger. A small cross-drilling through the plunger pilot communicates with an axial drilling (3) running from the pressure end of the plunger; this drilling pressure-balances the plunger and prevents 'hydrauliking' by any fuel leaking between the plunger and metering sleeve wall.

Any leakage past the carbon seal is conducted through the plunger travel stop (8) and returned through the drain outlet to pump suction for recirculation. The proportion of fuel flow relative to fuel pressure is determined by the calibration of the control spring (13) whilst the opening point at which fuel commences to flow to the burners is related to fuel input pressure by the adjustment screw (1) on the end of the spring housing (2). This adjustment screw enables the operating range of the unit to be varied; rotating the screw moves the spring anchorage (14) in or out and thereby alters the spring loading.

OPERATION

With the engine stationary the metering plunger is at the bottom of its stroke and the metering slots are completely blanked off (refer to Fig. 3). When the engine is started, fuel is fed into the flow distributor body casting and when the pressure is built up to a sufficient pressure (of the order of 100 lb. per sq. in.) the metering plunger moves to uncover the metering slots, thereby allowing fuel to be passed to each individual burner via the radial drillings.

At low throttle valve delivery pressures the plunger uncovers only a small portion of the metering slots and at these low flows the pressure drop across the slots is sufficient to overcome all other effects and equalize the flow to all burners. Increased inlet pressures will cause the plunger to move further into the metering cylinder until the slots become fully uncovered; under these conditions the pressure drop across the slots is less and equalization of flow will depend upon the accuracy with which the burner set is matched.

INSTALLATION

The unit is bolted through its mounting flange to the port side of the engine, forming a junction between the main fuel delivery pipe from the control valve assembly and the individual pipes leading to the burners. For complete installation details refer to chapter 14.

SERVICING

Once the unit is installed on the engine, no servicing is necessary normally except for regular inspection of the pipes and connections for any signs of leakage. No leakage is permissible. In the event of leakage, disconnection of pipes will be

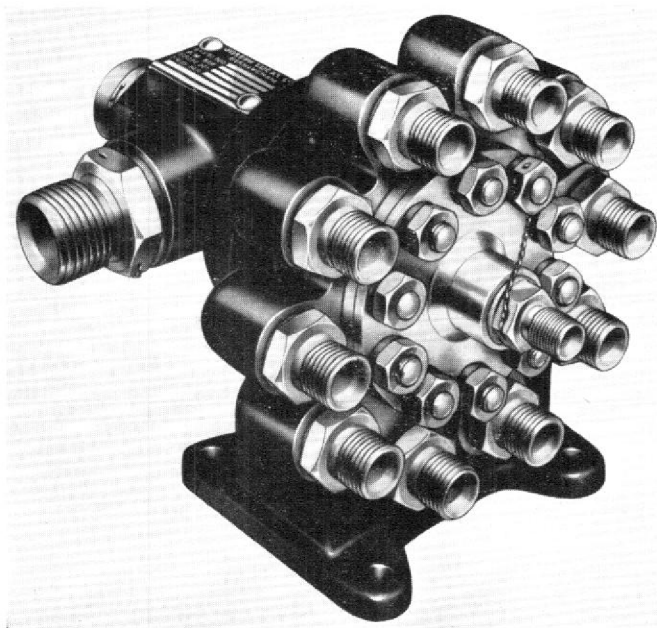


Fig. 1. Fuel flow distributor.

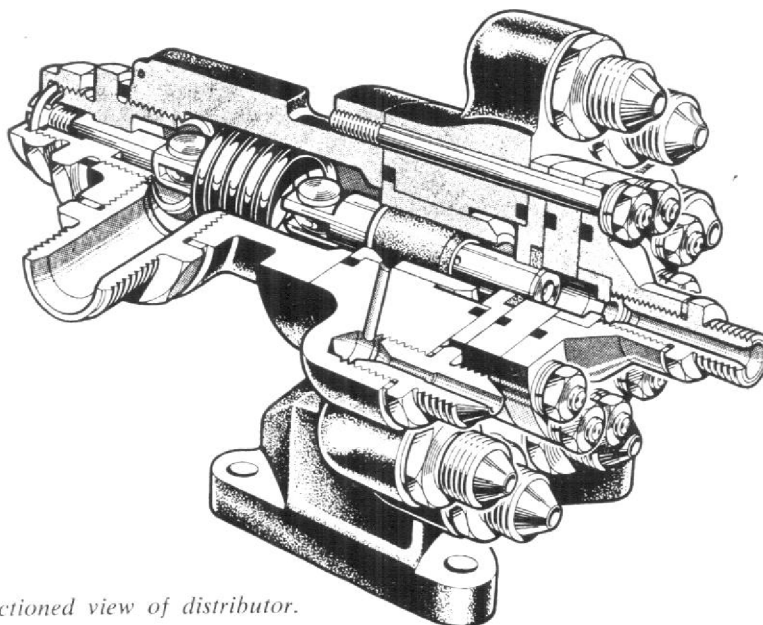


Fig. 2. Sectioned view of distributor.

necessary for tracing and rectifying, and at all times when the pipes are again connected the fuel system must be bled to expel all air. The procedure for bleeding the fuel system is described in chapter 8.

OVERHAUL

It is important that the unit is handled with care at all times and not subjected to severe shock, otherwise the calibration of the unit may be affected, or slight distortion may ensue resulting in sticking of the metering plunger. The importance attached to cleanliness while handling any components cannot be over-emphasised and extreme precautions must be observed at every stage of assembling and testing to ensure that all details are thoroughly clean. To avoid damage to the hexagon corners of nuts, bolts and unions, box or ring spanners should be used where possible. On time expired units, all joint and other sealing washers must be renewed, also any split-pins, tab-washers or locking wire whenever they are disturbed. In instances where a unit is to be assem-

bled temporarily, it is recommended that slave unions, nuts and washers should be used; such components, however, should be distinguishable to avoid their retention on final assembly.

SPECIAL TOOLS AND TEST RIGS are necessary for the repair and overhaul of the flow distributor; such tools and test rigs are listed below.

Tool No.	Description
T.160988	Adjusting tool—range adjusting screw
T.167552	Adapter—micrometer head—port calibration
T.177125	Spanner—bottom cover retaining nuts
T.190008	Adapter—inlet connection—test rig
T.190009	Guide rod—spring anchorage assembly
T.208260	Adapter—hydraulic clamping fixture
T.208260/H	Adapter and fixture—dismantling and assembly
T.210859	Adapter—plunger loading—port calibration
—	Test rig—port calibration
—	Test rig—performance calibration

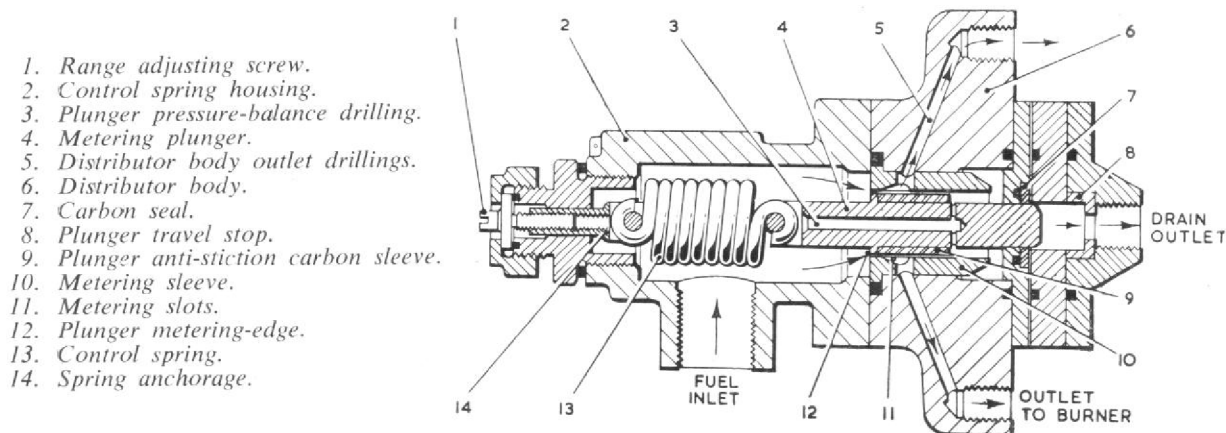


Fig. 3. Schematic diagram of flow distributor.

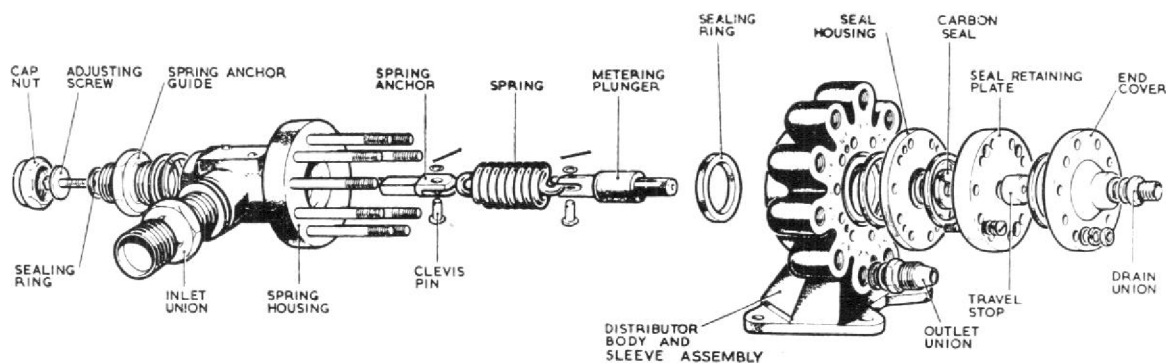


Fig. 4. Dismantled view of flow distributor.

CHECKS AND PRECAUTIONS BEFORE DISMANTLING

Study any complaints reported with the unit then examine the exterior for any visible sign of damage or interference, with particular attention to the locking wire on the adjusting screw lock-nut. Ensure that all unions have been blanked off completely to prevent the entry of foreign matter to the interior of the unit.

If its general condition is suitable, the unit should be mounted on the performance test rig and a calibration check carried out in accordance with the instructions given on page 8. If the unit has been reported as leaking, however, it should be leak-tested first under the conditions specified on page 9 in order to locate the source and nature of the leak and facilitate investigation.

DISMANTLING THE FLOW DISTRIBUTOR

One or more clean, dry metal boxes should be placed close to the work to receive the components so that they may be stored safely pending inspection.

It is recommended that not more than one dismantled unit be present on the bench at any one time; this will avoid an accidental transfer of parts from one assembly to another so reducing the possibility of a shortage of items on rebuild. Scrap all tab-washers, split pins and lock wires on removal. Mount the unit on the dismantling fixture T.208260 as shown in Fig. 5.

REMOVING THE INSTALLATION FITTINGS

Installation connections assembled to this unit comprise unions or adapters, with suitable sealing washers, which are fitted to the inlet and to the outlet ports and to the drain outlet. Certain outlet adapters form 'bias-flow' unions and are numbered accordingly. When a unit is received it should be complete with dust caps on each union or adapter.

Unscrew the fittings and remove them together with their joint washers which consist of a rubber ring surrounded by a steel ring.

REMOVING THE SPRING HOUSING

With the spring housing uppermost unlock and remove the adjusting screw cap-nut from the end of the spring housing, remove the adjusting screw and screw in the guide rod T.190009 (see Fig. 9).

Invert the unit, remove the retaining nuts, spring washers and plain washers from the distributor body end cover and remove the cover, sealing ring and plunger travel stop. Invert the unit again to bring the spring housing uppermost and ease it away from the distributor body, holding the guide rod down meanwhile so that the metering plunger assembly will not be withdrawn from the distributor body.

When the housing is free from the distributor body face, unscrew the guide rod, taking care to avoid lifting it until it is clear of the spring anchor threads, remove the rod and lift off the spring housing, leaving the plunger and spring assembly in the distributor body. Lift the spring and plunger out of the distributor and place the assembly in a safe position where no damage can occur to the carbon surface on the plunger.

DISMANTLING THE SPRING HOUSING

To remove the spring anchor guide from the end of the housing the latter should be replaced on the distributor body, the spring and plunger having already been removed, so that the housing can be held securely whilst the guide is being slackened. Unlock the guide, release it with a standard ring spanner and remove complete with sealing rings. Remove the steel outer ring and sealing ring from the large end and remove the small sealing ring from the annular groove in the small end face of the guide. Before discarding the sealing rings inspect them for any defects which may have been a source of leakage.

DISMANTLING THE SPRING AND PLUNGER ASSEMBLY

To separate the plunger and spring anchorage from each end of the spring, remove the two split pins and washers and extract the clevis pins securing the assembly. Place the plunger in a safe position pending cleaning and inspection.

DISMANTLING THE DISTRIBUTOR BODY

Remove the four setscrews from the face of the carbon seal retaining plate, the end cover having been removed during removal of the spring housing. Lift off the seal retaining plate and seal housing together with their sealing rings. Invert the housing over the palm of the hand and shake

out the carbon seal and small sealing ring. Remove the sealing ring from the face of the retaining plate and from the face of the distributor body. Before discarding the rings inspect them for possible sources of leakage. Remove the distributor body from the dismantling fixture.

The extremely close clearances necessary between the plunger and the metering sleeve bore are obtained by machining the plunger to match the sleeve bore after the sleeve has been shrunk into the distributor body; *under no circumstances therefore must any attempt be made to remove a sleeve as it will be found impossible to refit it satisfactorily.* It cannot be emphasized too strongly that this matching of the plunger, sleeve and body during manufacture is essential to the correct performance of the distributor and for the same reason, should more than one unit be undergoing overhaul at the same time, great care must be taken to ensure that there is no possibility of components becoming interchanged.

CLEANING

Prior to cleaning, remove all remaining joint washers and sealing rings. If any defect in the unit is suspected to be due to the presence of foreign matter, the parts suspected should be inspected before cleaning, otherwise the cause of the defect may be washed away.

The components must be cleaned individually in kerosene. It is recommended that parts should be pressure-washed using an appropriate bath and jet-nozzle supplied by a pump having adequate filtering facilities. Cloth, hard brushes and abrasives must not be used under any circumstances.

After cleaning, all components should be dried thoroughly under a compressed air blast, which must be free from water, and placed in clean dry containers.

INSPECTION

Visual inspection of the components is described in this section. Where dimensional checks are necessary, the appropriate details are given in the Schedule of Fits, Clearances and Repair Tolerances on page 14.

Every component should be inspected closely for signs of damage or wear and if necessary the part should be discarded and a replacement demanded.

Scrupulous cleanliness is essential at all times. It is advisable that the surface of the bench be covered with zinc sheeting, bakelized fabric or linoleum; this will assist in maintaining the high standard of cleanliness required.

DISTORTION CHECKS

Distortion checks should not be necessary but if distortion is suspected, a joint face may be checked by means of a surface plate and marking blue whilst the alignment of bores relative to each other or to joint face squareness should be checked in accordance with general inspection practice.

DISMANTLING AND
ASSEMBLING ADAPTER
T-208260

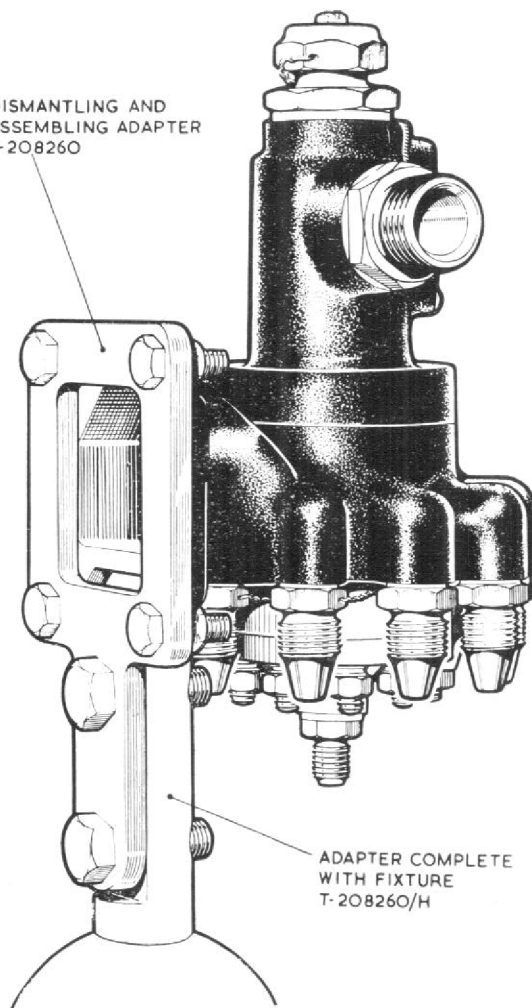


Fig. 5. Dismantling assembly fixture.

PERMISSIBLE WEAR

Details which are subject to wear must be checked dimensionally in accordance with the Schedule of Fits and Clearances.

REDUNDANT PARTS

It is usual during an overhaul to discard parts rendered redundant by essential modifications; sufficient details of such modifications must be available to the inspector therefore to enable redundant parts to be discarded and new parts to be embodied on re-assembly.

SCORES AND SURFACE DAMAGE

In general, scores or surface damage on moving parts and joint faces will impair the operational efficiency of a unit and any part so affected should be rejected. Certain defects, however, may be acceptable provided that the inspector in charge is satisfied that they are insufficient to impair the efficiency and safety of the unit.

INSTALLATION CONNECTIONS

Inspect all adapters and unions for cleanliness and general condition of their hexagons, threads

and sealing faces. The union nipples on the distributor outlet adapters and the seatings in the inlet and drain unions must be free from damage and scores which may be a source of leakage.

METERING PLUNGER

Examine the plunger for pitting, severe scoring, cracking and severe inclusion of foreign matter in the carbon surface. Should any such defects appear excessive no attempt should be made to rectify the matter; the plunger and the distributor body and sleeve assembly must be rejected and returned to the manufacturer for repair.

The metering edge at the clevis end of the plunger is of extreme importance to the efficient functioning of the distributor and inspection of this edge should be carried out with the aid of a magnifying glass. Ensure that the edge is clean and free from burrs, nicks and other damage.

Inspect the plunger generally for any other visible defect and subject the components to a magnetic crack-detection test, particular attention being paid to signs of radial cracking around the clevis pin holes in the fork. Following inspection for cracks ensure that the plunger, particularly the carbon surface, is washed thoroughly in a kerosene spray to remove all traces of the crack-detecting ink.

DISTRIBUTOR BODY AND METERING SLEEVE

Using a small magnifying mirror examine the metering sleeve bore for scoring and other damage. Minute longitudinal scratches are permissible provided that they do not run into the edges of the metering slots. No scoring whatever may be permitted between the run out of the metering slots and the edge of the bore and circumferentially between any portion of two adjacent ports.

See that the metering edge of the bore is free from damage, burrs and scores. Any razor-sharpness however should be polished out with fine emery paper, taking great care to avoid producing a visible chamfer or radius. *Scrapers and other such tools must not be used to clean up this edge.*

Examine the cast surfaces of the body for damage, cracks and corrosion, particularly for radial cracks around the inlet and outlet ports and around the retaining-bolt holes in the mounting flange. See that the sealing ring grooves are clean and that the sealing surface surrounding each port is free from damage. Check that the radial drillings are clean and free from obstruction and that all threads are serviceable.

CARBON SEAL

Inspect the sealing bush for signs of cracking on the faces and chipping on the edges, particularly on the edge of the bore. See that there are no severe radial scores on the sealing face. The small sealing lip at one end of the bore must be free from chipping and severe scratching or scoring.

CONTROL SPRING

Examine the spring visually for surface defects and for cracks, particularly adjacent to the attach-

ment loops. See that no foreign matter is trapped between the coils and that no distortion is apparent.

SPRING ANCHORAGE

Inspect the spring anchorage generally for damage and for signs of radial cracks around the clevis pin holes in the fork. Examine the holes for wear and see that the threads in the stem are clean and free from damage.

SPRING ADJUSTING SCREW AND LOCK-NUT

Examine the adjusting screw for damage to the threads, flange, spannering square and screw-driver slot. Roughness and severe scoring is not acceptable on the underside of the flange; a damaged surface here may allow fuel to leak across the sealing ring in the end face of the spring anchorage guide. It is not advisable to attempt to polish severe score marks from the flange face as out-of-squareness with the thread may result and create a further source of leakage.

See that the locknut hexagon is not damaged and that the threads are satisfactory. Check that the locking wire holes are clean and that their edges are smooth; a sharp edge or burr may fracture the wire.

SPRING ANCHORAGE GUIDE

Inspect the guide for general condition and see that the hexagon is undamaged. The surface of the flange adjacent to the larger thread should be free from scores as these could be a source of leakage between the face and the joint ring. See that the threads are undamaged, that the sealing ring groove in the small end face is clean and that the square guide hole through the centre is free from obstruction.

CLEVIS PINS

Examine the clevis pins for excessive wear and cracks. See that the split pin holes are clear.

SPRING HOUSING

Inspect the spring housing generally for signs of damage and cracks; also for the presence of corrosion. See that the small end and fuel inlet boss facings are undamaged and that the threads are in good condition. Severe scoring or damage marks are not permissible on either of these faces or on the large end facing owing to the risk of leakage. See that the studs are tight and are not bent, and that the threads are in good condition. The locking wire lug on the small end of the housing must be free from cracks and damage and the hole must be clear.

CARBON SEAL HOUSING AND RETAINING PLATE

Examine the seal housing generally for cleanliness, checking that the sealing face at the bottom of the housing recess is thoroughly clean and free from radial scores. See that there are no scores on the faces of the housing.

See that the sealing ring groove in the face is clean, that the central hole is free from obstruction and that the face surrounding the hole on the

sealing ring side is undamaged; this face retains the carbon seal in position and any deviation from flatness will cause out-of-squareness of the carbon seal when the distributor is assembled. Check that the four counterbores for the retaining screws in the outer face are clean.

END COVER AND PLUNGER TRAVEL STOP

Inspect the threads and face of the tapped boss for cleanliness checking that the boss facing is flat and free from damage, as this is a sealing face. See that the sealing ring groove in the inner face is clean and check that the plunger travel stop is a good fit in the central counterbore.

REBUILDING THE FLOW DISTRIBUTOR

It is essential to ensure that all details, the assembly bench and all tools are clean before commencing to rebuild the unit.

Prior to assembly it is essential that all sealing rings are immersed completely in kerosene for a period of not less than 24 hours to permit maximum swelling to take place under absorption of fuel.

Initially the distributor is to be assembled with certain slave components to facilitate an intermediate rig-test for calibration of the metering ports, after which the complete unit is to be rebuilt and subjected to a final calibration and performance test.

ASSEMBLING THE DISTRIBUTOR BODY

Mount the body on the assembling fixture T.208260, see Fig. 5, locate a square-section rubber sealing ring in the circular groove surrounding the central bore in the distributor body outlet face and insert the metering plunger into the sleeve bore so that the plunger protrudes from the outlet face. Fit a sealing ring to the counterbore in the carbon seal housing, place the housing, counterbore outermost, over the plunger pilot and locate the housing spigot in the distributor body, registering the four small holes with the small tapped holes in the body facing. Place the carbon seal over the plunger pilot and slide the seal down until it locates in the housing counterbore and is seated on the small sealing ring. *The seal has a small lip inside one end of the bore; this lip is the sealing edge and must be fitted towards the plunger.* On no account may the seal be fitted the other way round with the sealing edge towards the retaining plate and end cover. Fit a square-section sealing ring to the circular groove in the face of the seal retaining plate and slip this plate, sealing ring side first, over the plunger pilot. Register the four counterbored holes with the four small holes in the seal housing and with the four tapped holes in the distributor body face and fit the four retaining setscrews, first placing a spring washer and a plain washer over each screw. Run the setscrews down until the plates are nipped lightly then tighten the screws evenly a little at a time until they are tightened fully.

Whilst tightening the setscrews move the metering plunger in and out gently, taking care to avoid withdrawing it sufficiently to disengage the pilot from the carbon seal; the constant moving of the plunger will provide a check on the correct alignment of the seal, any sudden tightness indicating that the seal is being tightened unevenly. In this event slacken whichever screw was tightened immediately prior to the tightness occurring to the plunger and tighten the opposite screw, adjusting the set screws similarly until they are all tight with the plunger free from interference.

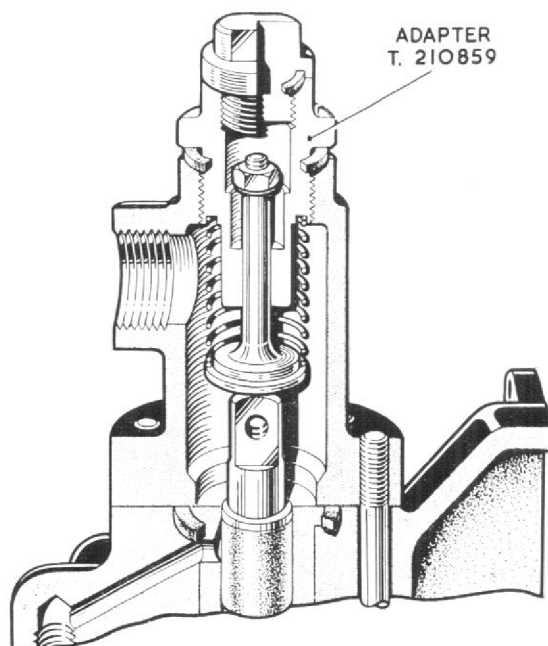


Fig. 6. Port calibration plunger-loading adapter.

If it is not possible to tighten the screws down without causing the seal to interfere with the plunger free movement, remove the screws and rotate the seal through 90 degrees or 180 degrees, reassemble and tighten down again under similar conditions. Should the interference still be apparent it will be necessary to remove the screws again and rotate either or both the seal housing and retaining plate until the required freedom of the plunger is obtained with all setscrews tightened fully.

FITTING THE PORT CALIBRATION ADAPTERS

In order to measure the flow through the metering ports it is necessary to fit a micrometer adapter to the distributor to measure the amount of plunger travel and a plunger loading adapter to maintain the plunger in contact with the end of the micrometer at low fuel inlet pressures.

Fit a sealing ring over the large thread of the plunger loading adapter T.210859 (Fig. 6) and screw the adapter into the end of the spring housing. A slave spring housing may be used if available, when the housing and adapter may be kept assembled permanently. Assemble the housing and adapter

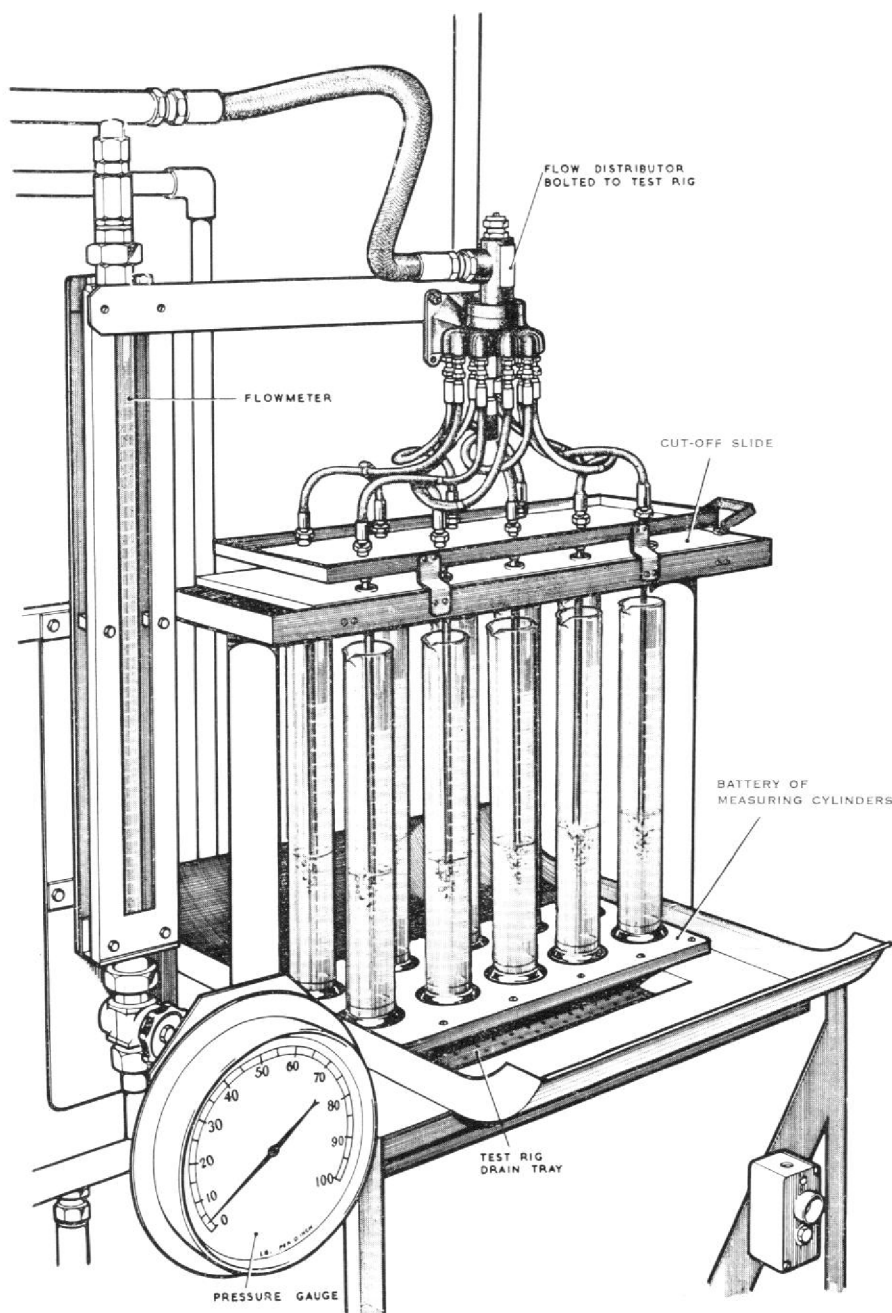


Fig. 7. Calibrating the ports.

to the distributor body when the adapter loading plunger will rest on the end of the plunger fork.

Adjust the micrometer in the special adapter T.167552 to a reading of 0.500 in. and fit a rubber sealing ring to the annular groove in the face of the adapter. Locate the adapter so that the micrometer stem enters the central hole in the carbon seal retaining plate, register the holes in the adapter with the spring housing studs protruding from the seal retaining plate, press together firmly and fit plain washers, spring washers and retaining nuts to the studs. Tighten the nuts evenly

and firmly to secure the assembly as shown in Fig. 8.

Fit slave unions complete with sealing washers to the distributor body outlet ports and assemble the test-rig inlet adapter T.190008, complete with sealing ring, to the inlet connection on the spring housing.

PRELIMINARY RIG-TEST

The purpose of the preliminary test is to check the individual and collective calibration of the

metering ports; the specific calibration values being given in the calibration tables.

Throughout the tests the fuel used is to be Aviation Turbine fuel to Specification D.Eng.R.D. 2482 and the fuel temperature must be maintained at between 20 deg. C. and 26 deg. C.

LEAKAGE TEST

Connect the unit to the metering port calibration rig as shown in Fig. 7.

Check that the rig pump delivery control is set to minimum flow, that the delivery pressure cock is set to minimum restriction, that the low-range flowmeter cock is closed and that the high-range flowmeter cock is open. Switch on the rig pump motor and allow the rig to run for a few minutes to stabilize and attain its working temperature.

Move the plunger to close the ports by screwing the micrometer thimble in until the fuel delivery is reduced to droplets and adjust the rig pump delivery control until the inlet pressure is 5 lb. per sq. in. Screw the micrometer head in gently, 0.001 in. at a time, until the flow ceases completely, indicating that the metering edge of the plunger has sealed off the ports. *Record the exact micrometer setting; this is the datum from which the calibration is obtained and must be found accurately since any error will affect the calibration throughout the range.*

Screw the micrometer head in a further 0.025 in. from the datum point and re-adjust the rig

pump to produce an inlet pressure of 30 lb. per sq. in. Maintain this condition for 15 minutes.

After fifteen minutes have elapsed, place the empty measuring cylinders in position beneath the outlet nozzles and move the sliding cut-off plate to allow any fuel emanating from the nozzles to fall into the cylinders, checking the time with a stop-watch as the slide uncovers the nozzles. After one minute move the slide to the cut-off position. The leakage per port must not exceed 10 c.c.

CALIBRATING THE PORTS

Screw the micrometer head out to the datum point again, adjust the rig pump control to provide the inlet pressure given in the appropriate port calibration table, change over to the low-range flowmeter and screw the micrometer head out gently until the specified flow is indicated on the flowmeter.

NOTE.—The value specified in the table is the flow per port and must be multiplied by the number of ports in the unit to obtain the total quantity to be indicated on the flowmeter.

When the test-rig indicators are steady at the specified values, record the micrometer reading, then move the cut-off slide over to permit the fuel delivery from the ports to enter the measuring cylinders.

Watch the measuring cylinders constantly and immediately the level in any one cylinder reaches the larger of the values in the 'maximum variation' column move the slide to cut off the flow to the

PORT CALIBRATION TABLE—SCHEDULE 'J'

Inlet pressure (lb. per sq. in.)	Mean flow per port (g.p.h.)	Plunger travel from opening point datum (in.-micrometer reading)	Maximum variation between measuring cylinders (c.c. per min.)
50	1.0	0.025 to 0.045	100–75
20	1.1	0.045 to 0.065	100–85
10	1.6	0.080 to 0.100	100–91
5	2.2	0.135 to 0.160	100–94
5	3.35	0.175 to 0.210	100–95
5	4.5	0.210 to 0.250	200–190
5	5.6	0.240 to 0.270	200–190
5	6.7	0.265 to 0.295	200–190

PORT CALIBRATION TABLE—SCHEDULE 'L'

Inlet pressure (lb. per sq. in.)	Mean flow per port (g.p.h.)	Plunger travel from datum (in.-micrometer reading)	Maximum variation between increasing cylinders (c.c. per min.)		
			Normal	No. 4 port	No. 9 port
50	9.5	0.025–0.045	100–75	76–57	87–65
20	10.8	0.045–0.065	100–85	76–65	87–74
10	15.2	0.080–0.100	100–91	76–69	87–79
5	21.5	0.130–0.155	100–94	76–71	87–82
5	32.3	0.170–0.205	100–95	76–72	87–82.5
5	43.1	0.210–0.250	200–190	152–144	174–165
5	53.9	0.240–0.270	200–190	152–144	174–165
5	46.7	0.270–0.295	200–190	152–144	174–165

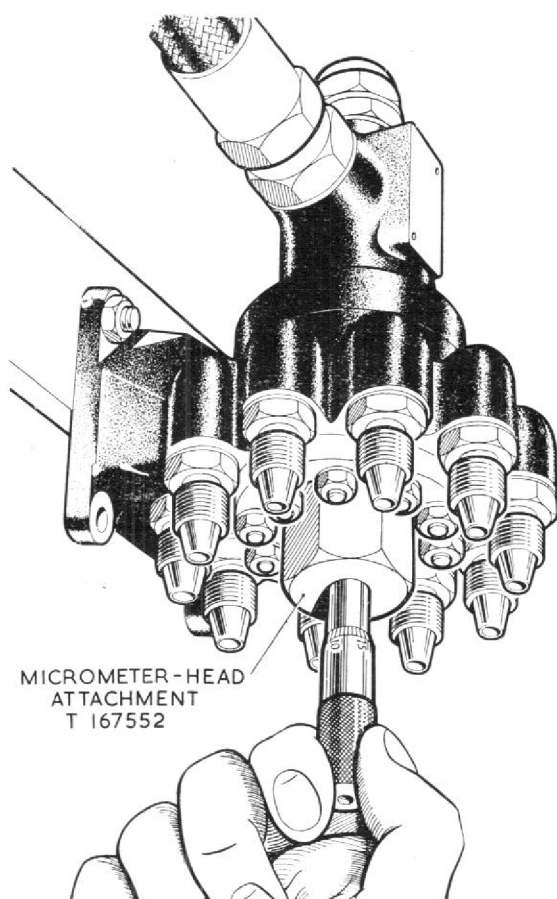


Fig. 8. Port calibration micrometer adapter.

cylinders; the level of the fuel in each of the other cylinders must be within the limits stated, whilst the micrometer reading must be within the specified minimum and maximum measurements from the datum point. Record the quantity of fuel in each cylinder against the inlet pressure, flow and micrometer readings. Empty the measuring cylinders.

Repeat the procedure at each of the inlet pressure and flow values stated in the table, recording the micrometer reading and measuring cylinder readings at each check.

Should any readings be outside the limits stated in the third and fourth columns of the table, return the unit to the assembly bench, dismantle the assembly and examine the metering slots in the sleeve bore for slight burrs, nicks in the edges and foreign matter. Flush the delivery drillings thoroughly to ensure that these are quite clean and see that there is no damage in the delivery union bores. See that there is no obstruction in the bores of the flexible pipes connecting the distributor to the delivery nozzles on the test-rig, renewing these pipes if suspected to be defective.

Rebuild and re-test the distributor and if there is no improvement the body and sleeve assembly and the metering plunger must be rejected and replaced by new components. The rejected com-

ponents must be returned to the manufacturer for repair. The rebuilt unit must be subjected to a complete re-test including the leakage test.

When the test results are satisfactory record the figures on the test certificate, which must be approved and signed by the inspector. Return the unit to the assembly bench for final assembly.

FINAL ASSEMBLY

Remove the retaining nuts and washers from the test-rig micrometer adapter, remove the adapter and draw off the spring housing from the distributor body. Unscrew the plunger loading adapter and remove the test-rig adapter from the inlet port. Do not disturb the carbon seal retaining plate set-screws otherwise the alignment of the seal will be affected.

ASSEMBLING THE SPRING AND PLUNGER

Position the tension spring so that one end loop is between the clevis fork on the metering plunger, insert a clevis pin, place a thin steel washer

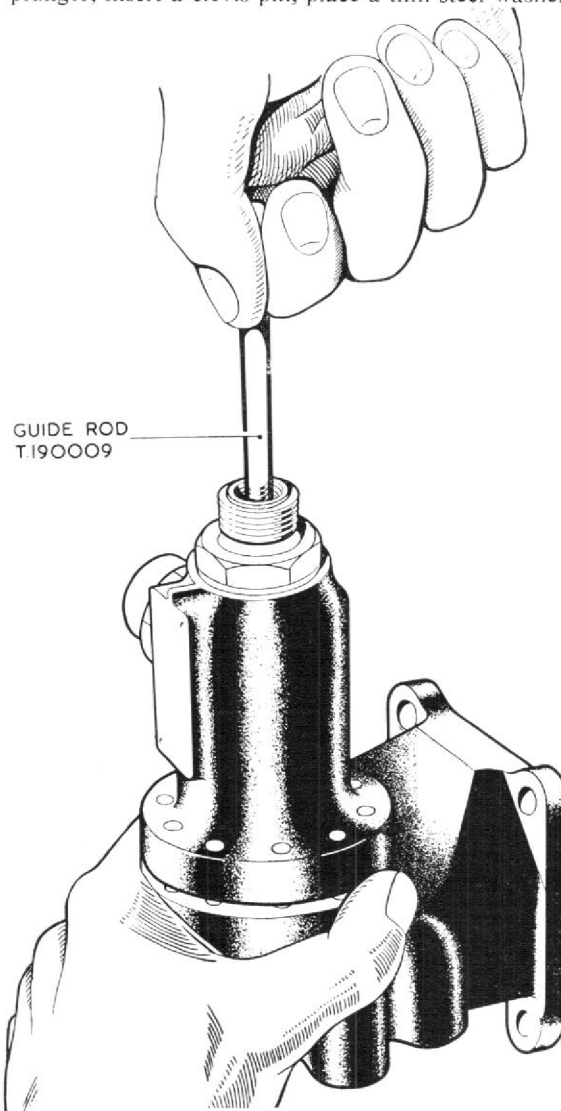


Fig. 9. Using the spring anchor guide tool.

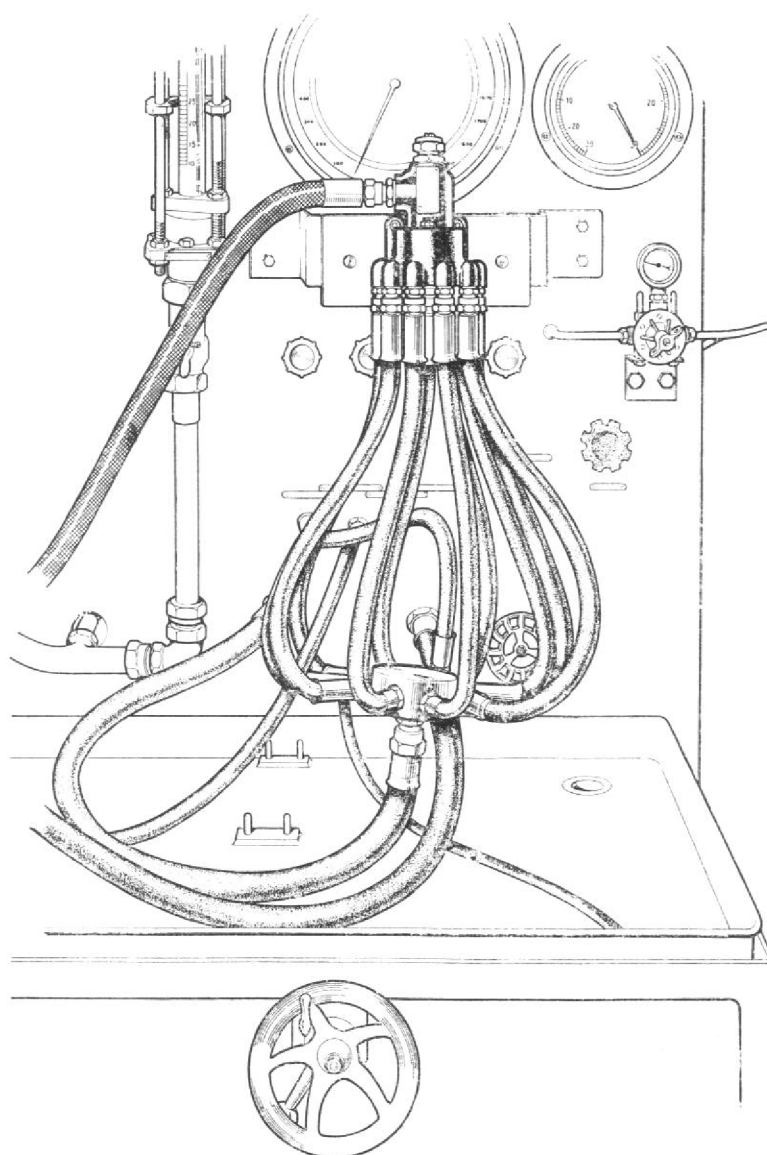


Fig. 10. Performance calibration test.

over the exposed end of the pin and secure the assembly with a new split pin, the legs of which are to be bent round the clevis pin. Fit the spring anchor likewise to the other end of the spring.

It will be found that in some units the inner end of the anchorage is extended and, when assembled, abuts the end of the plunger fork to pre-load the spring. In this case, to insert the anchorage clevis pin, the spring must be extended slightly; a number of thin packing plates 0.010 in. to 0.020 in. thick may be inserted between the spring coils to hold the spring in the extended position whilst the clevis pin is inserted. It must be understood that the packing plates must be spaced at regular intervals around and along the spring to avoid any possibility of distortion. *Count the plates as they are removed and ensure that all are accounted for after fitting and securing the anchor.*

ASSEMBLING THE SPRING HOUSING

Assemble the spring housing and spring anchor guide belonging to the unit. Fit a rubber sealing washer and steel outer washer over the large thread on the spring anchor guide and screw the guide into the housing. Ensure that the steel washer is located correctly around the rubber ring and pull the guide down tightly on to the steel washer. Fit a similar sealing ring and steel washer to the inlet union and screw tightly into the housing inlet boss.

FITTING THE SPRING HOUSING

NOTE.—When fitting the spring housing to the distributor body on final assembly it is essential that the inlet port on the spring housing is in the correct relationship to the mounting flange on the distributor body to suit the par-

ticular engine installation for which the distributor will be required. Once the unit has been calibrated the housing and body must not be separated otherwise it will be necessary to re-calibrate the unit.

Place the screwed end of the guide rod T.190009, see Fig. 9, into the spring anchor guide, passing the rod through as far as possible. Insert the assembled metering plunger carefully into the metering sleeve, taking care to avoid damaging the carbon surface on the edge of the sleeve bore whilst pushing the plunger fully into the sleeve. Offer up the spring housing until the end of the guide rod can be screwed into the tapped stem of the spring anchor. Register the spring housing studs with the holes in the distributor body and lower the housing gently whilst exerting a slight upward pull on the guide rod. When the housing is lowered sufficiently for the anchor guide in the housing to foul the anchor stem rotate the guide rod slightly to register the square section anchor stem with the square hole through the guide. When the anchor stem can be felt to have entered the guide lower the housing fully on to the distributor body.

Hold the spring housing in position, invert the unit and fit the distributor body end cover, which must have a sealing ring located in the groove on the inner face and the plunger travel stop plug located firmly in the counterbore. Fit the plain washers, spring washers and retaining nuts and tighten evenly and fully.

Invert the unit again, remove the guide rod from the spring housing and fit a small sealing ring to the groove in the end face of the spring anchor guide. Screw in the spring adjusting screw until the underside of the flange contacts the sealing ring, fit the retaining nut and tighten finger tight as the screw will require adjustment on the test-rig.

Fit rubber sealing rings and steel outer washers to the appropriate delivery unions and screw the unions tightly into the distributor body delivery ports.

Complete the assembly by fitting the drain union, with its appropriate sealing ring, to the drain port in the centre of the body end cover. Tighten the union securely. Unless the unit is to be rig-tested immediately seal all open connections with dust caps to exclude foreign matter.

FINAL RIG TEST

The purpose of the following test is to check the relationship of applied pressure to collective flow from the delivery ports.

Throughout the test the fuel is to be Aviation Turbine fuel to Specification D.Eng.R.D.2482 and its temperature is to be maintained at between 20 deg. C. to 26 deg. C.

In this rig-test, as shown in Fig. 10, the distributor delivery unions are connected to a common collecting box having a single outlet pipe which returns the fuel through a pressure gauge tapping

point and a manually variable restricting cock to the rig tank. The pressure gauge indicates the fuel delivery pressure whilst the cock enables a controllable pressure to be applied downstream of the flow distributor so as to simulate the combined restriction imposed by the burners in an actual engine installation.

CALIBRATING THE DISTRIBUTOR

Install the unit on the test rig as shown in Fig. 10 and see that the high range flowmeter cock is open with the low range flowmeter cock closed. Check that the flow control is set to LOW and that the delivery pressure cock is open. Start the rig pump and allow it to run for a few minutes to stabilize and attain its working temperature.

Open the low range flowmeter cock, close the high range cock and adjust the flow to provide the value stated against (A) in the performance calibration table, noting that the value specified is for a single port and must be multiplied by the number of ports in the unit to obtain the value to be indicated by the flowmeter. Adjust the delivery restricting cock to raise the delivery pressure to the relevant value stated in the second column in the table, re-adjust the flow if necessary, as this may have fallen slightly, then note the indicated inlet pressure.

Should the inlet pressure be outside the relevant limits stated in the third and fourth columns of the table the spring adjusting screw must be altered. Slacken the locknut and, using tool T.160988, as shown in Fig. 11, rotate the adjusting screw clockwise to increase or anti-clockwise to decrease the inlet pressure, setting the adjustment so that the pressure is midway between the minimum and maximum values stated. Tighten the locknut fully and check the inlet pressure again as this may have altered slightly due to compression of the sealing ring under the adjusting screw when tightened down by the locknut. For this reason each time an adjustment is made the locknut must be tightened fully before the inlet pressure is observed.

With the inlet pressure steady within the limit stated for point 'A' increase the flow and delivery pressure to the values stated at point 'B' and again observe the inlet pressure, which must be between the limits stated at this point.

If the inlet pressure at point 'B' is outside either limit, re-adjust the spring adjustment screw to bring the inlet pressure just within the limit, reduce flow and delivery pressure to the values stated at point 'A' and check the inlet pressure again; this will probably have altered but should still be within the stated limits at this point.

Should it be found that the inlet pressure is on or below the minimum limit stated for point 'A' and on or above the maximum limit stated for point 'B', the spring rating is incorrect and the spring must be changed for one of a higher rating. Where the pressure is above the point 'A' maximum whilst being below the point 'B' minimum, a lower rated spring is required.

PERFORMANCE TEST

When the specified conditions have been obtained satisfactorily at the two points stated, the performance of the distributor is to be tested at each point in the table.

Commence the test at the lowest flow value stated in the table and record the inlet pressure obtained at each point up to the highest flow value stated. Re-check at each point whilst reducing the flow to the starting point, recording the observed inlet pressure at each point against the pressure observed previously.

Compare the two sets of figures obtained. Should there be a discrepancy between any two adjacent values and the discrepancy is such that one value is outside the corresponding limit in the Appendix table, the distributor must be dismantled and the plunger, metering sleeve bore and carbon seal examined closely for foreign matter or other defects which may cause interference with the smooth and progressive working of the plunger.

Before removing the carbon seal retaining plate, check that the plunger is sliding quite freely over the whole length of its travel. If the plunger is satisfactory in the free condition, examine the

loops of the tension spring, particularly where a new spring has been fitted to the unit. It may be found that a loop is off-centre, causing a side load to be applied to the plunger under working conditions. This may occur also if the spring loop is not a free fit within the plunger fork or if the clevis pin is too tight a fit within the spring loop. In either case a new spring must be fitted.

When the unit has been rebuilt it must be recalibrated as described on page 9 before commencing to repeat the performance test. Check the performance over the range stated in the table two or three times to ensure that the unit is quite satisfactory and record the observed results on the test certificate.

FINAL LEAKAGE TESTS

When the performance test is satisfactory the unit must be subjected to final leakage tests under the condition specified on page 14. It is important that the appropriate installation fittings are fitted to the distributor and, following a successful leakage check, these fittings should not be disturbed.

The restricting (bias) unions are to be assembled after the distributor has been calibrated. These

PERFORMANCE CALIBRATION TABLE—SCHEDULE 'J'

Mean flow per port (g.p.h.)	Outlet pressure (lb. per sq. in.)	Inlet pressure (lb. per sq. in.)	
		Minimum	Maximum
2	0.5	Record only	Record only
'A' 5	6.0	220	280
10	25.0	310	365
20	100.0	440	490
30	225.0	550	600
40	400.0	670	715
50	625.0	805	845
'B' 55	758.0	885	920
70	1250.0	—	1310

PERFORMANCE CALIBRATION TABLE—SCHEDULE 'L'

Mean flow per port (g.p.h.)	Outlet pressure (lb. per sq. in.)	Inlet pressure (lb. per sq. in.)	
		Minimum	Maximum
2	0.5	Record only	Record only
'A' 5	6.0	230	280
10	25.0	315	365
20	100.0	450	490
30	225.0	560	600
40	400.0	670	715
50	625.0	815	850
'B' 55	758.0	890	925
70	1250.0	—	1290

unions must be selected to provide the individual flows specified in the following tables.

SCHEDULE 'J'

Pressure drop (lb. per sq. in.)	Flow (gal. per hour)	
	No. 4 PORT	No. 9 PORT
100	Record	Record
500	63-64	73-74
1000	Record	Record

SCHEDULE 'L'

Pressure drop (lb. per sq. in.)	Flow (gal. per hour)	
	No. 4 PORT	No. 9 PORT
200	Record	Record
600	60.5-61.5	99-101
1000	Record	Record

The leakage from the drain outlet port must not exceed 150 c.c. per minute at an inlet pressure of 1000 lb. per sq. in. and delivery pressure of 800-900 lb. per sq. in. Should this leakage exceed 150 c.c. per minute, change the carbon seal as described on page 7, and recalibrate the unit completely.

Dry the exterior of the distributor thoroughly with a compressed air blast, and connect the drain union to rig-pump inlet. There must be no external leakage during a period of five minutes at a delivery pressure of 1500 lb. per sq. in. with a rig-pump inlet pressure of 40 lb. per sq. in.

PREPARING FOR DISPATCH

LOCKING

After removing the distributor from the test-rig, drain all fuel from the unit and wire lock the spring anchor guide flange, the adjusting screw locknut and, where required, the installation fittings with 22 S.W.G. stainless steel wire.

INHIBITING

The distributor is to be flushed thoroughly with oil to Specification DTD.587, sufficient pressure being applied to move the metering plunger to uncover the ports and allow the oil to issue from the outlet ports.

After flushing remove the unit from the inhibiting rig, drain off the surplus oil and assemble dust caps or plugs to the distributor inlet, outlet and drain connections to avoid the ingress of foreign matter to the interior of the unit.

FINAL INSPECTION

Check that all connections have been blanked off, check that the name plate is attached securely and ensure that the information on the plate corresponds with the details of the actual unit.

See that the test certificate is complete and approved.

PACKING

Pack the distributor in the special transportation box provided, and enclose two copies of the test certificate.

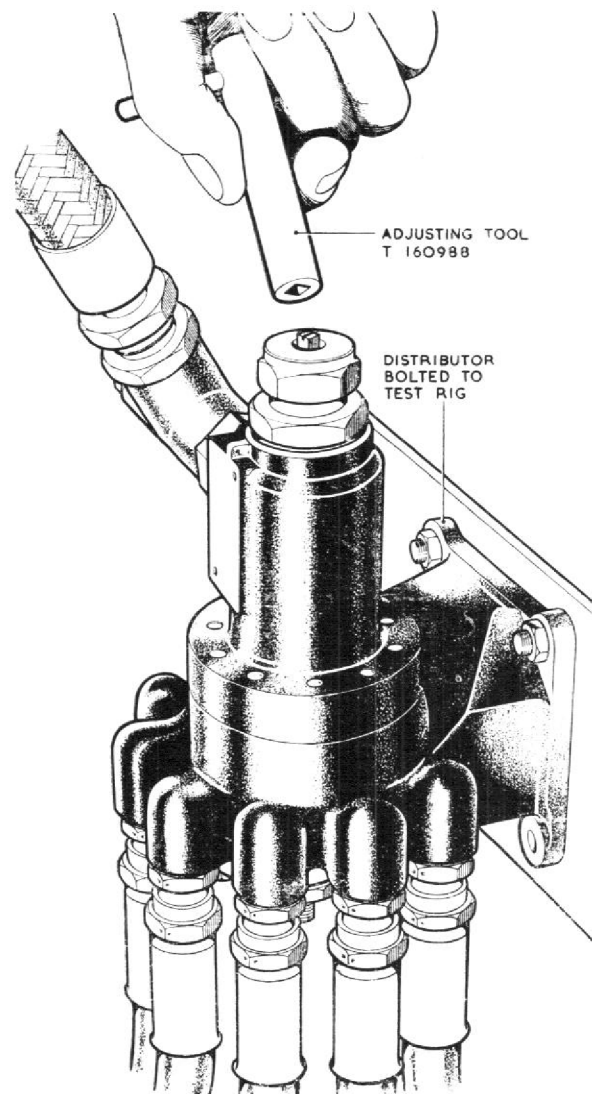


Fig. 11. Adjusting the range spring.

FITS, CLEARANCES AND REPAIR TOLERANCES FOR FLOW DISTRIBUTOR—TYPE F.D.12

(All dimensions in inches)

A table of fits and clearances for the types F.D. 18 and 20 will be issued as soon as they are available.

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