Chapter 1

MINIMUM BURNER PRESSURE VALVE

Type R.V.1/1.A

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General

1. The R.V.1/1.A type minimum burner pressure valve, a dismantled view of which is given in fig. 1, derives its designation from the basic type R.V.1, the installation code number 1 and the calibration letter A. Pressure valves of this type are fitted to Derwent Mk. 5 engines.

2. During the repair of the valve unit it is important that all parts are kept clean. All components must be stored in suitable containers, thus reducing the likelihood of losses, damage and corrosion. To prevent damage to nuts and bolts during dismantling and reassembly, box and ring spanners should be used wherever possible.

3. Whenever a joint or seal is broken, the gasket, joint washer or seal must be replaced. New split pins and lock-wire must always be fitted during reassembly. A list of parts which are separately interchangeable is given in Replacements (para. 63).

4. Slave nuts, washers, gaskets and screws should be used when temporarily assembling components. This will prevent damage to sound parts and reduce unnecessary scrap.

SPECIAL TOOLS

5. Special tools and a test rig are required for the repair and overhaul of the minimum burner pressure valve. These tools are to be provisioned and are enumerated in the following list. It should be noted that earlier type valves will require spanner T.160988 and later types T.161466 for adjusting the capsule stack.

Part No.	Nomenclature
—	Rig, test.
G.47532	Gauge, for setting lever stop
T.161466 or T.160988	Spanners for tightening capsule stack lock-nut.

CHECKS AND PRECAUTIONS BEFORE DISMANTLING

6. Study any complaints reported with the unit and carefully examine its exterior for any visible signs of damage and interference such as broken locking wire.

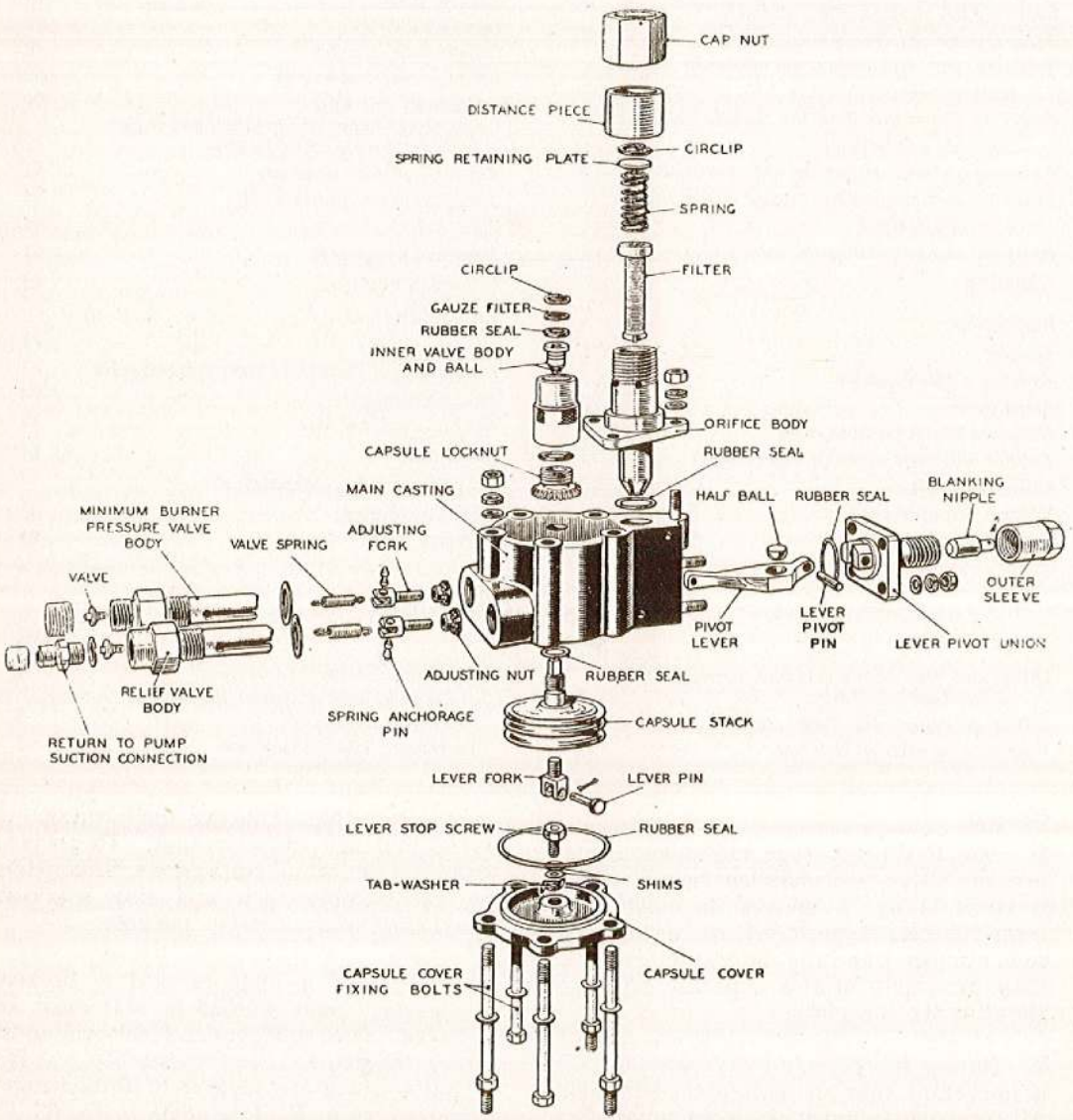

Fig. 1. Dismantled view of the minimum burner pressure valve, Type R.V.I/I.A

Ascertain that all connections that open to atmosphere have been securely covered with dust caps, blanking plugs or masking tape. Examine all exposed threads to ensure that no damage has been caused in transit.

DISMANTLING THE UNIT

7. A suitably partitioned tray must be available for holding the component parts of each minimum burner pressure valve unit. To prevent the accidental interchange of component parts of units during dismantling and reassembly, only the component parts of one valve unit may be on the bench at one time. Under no circumstances are parts from one unit to be stored in the same tray as those from other units.

8. Remove all dust caps and blanking plugs and cut and remove all locking wire.

Removing the blanking nipple assembly

9. Unscrew the outer sleeve from the lever pivot union in the main casting and remove the complete blanking nipple assembly comprising outer sleeve, nipple plug and split pin.

10. The blanking nipple assembly is not normally dismantled unless it is damaged or leakage is suspected due to the nipple plug not seating correctly. If dismantling is considered necessary proceed as follows :—

Extract the split pin from the nipple plug, remove the latter from the outer sleeve and empty all flushing oil from the unit through the open lever pivot union.

Removing and dismantling the relief valve

11. Unscrew the return to pump suction connection from the relief valve body and remove together with aluminium washer. Unscrew the relief valve body from the main casting and remove the complete relief valve assembly comprising the valve body, valve, valve spring, adjusting fork, adjusting nut, anchorage pin, and the aluminium washer.

12. Fully unscrew the adjusting nut off the fork, taking care not to extend the spring unduly. Release the fork into the valve body until the anchorage pin is in alignment with the holes at the inner extremities of the slots in the valve body and push out the pin through the hole in the valve body after ensuring that it is clear of the spring eye and fork. This will allow the fork to be removed from the one end of the valve body, and the valve together with spring, from the other end. Detach the eye of the spring from the valve.

Removing and dismantling the minimum burner pressure valve

13. The procedure for removing and dismantling the minimum burner pressure valve is the same as for the relief valve above (para. 11) with the exception that the dust cap screws directly on to the valve body, and there is no additional connection and aluminium washer.

Removing and dismantling the capsule ball-valve assembly and lock-nut

14. Unscrew the outer valve body from the capsule lock-nut and remove complete with aluminium washer (early types only), circlip, gauze filter, rubber oil seals, inner valve body and ball valve. Compress and remove the circlip, lift out the gauze filter, inner valve body together with ball, and rubber seal. Using special spanner (para. 5), unscrew and remove the capsule lock-nut from the capsule stack insert. (*fig.* 5.)

Removing and dismantling the orifice assembly

15. Unscrew and remove the cap-nut from the orifice body and lift off the distance piece. Compress and remove the circlip, lift off the spring retaining plate, and invert the unit to allow the spring and cylindrical filter to be lowered clear from the main casting. Unscrew and remove the three nuts and washers which secure the triangular flanged orifice body to the main casting.

16. To remove the orifice body from the main casting refit the cap-nut and gently tap, with a hide hammer, the nut away from the main casting. Care should be taken during this operation to ensure that the body comes evenly away from the casting. To facilitate the removal of the half-ball valve seating, smear some petroleum jelly on the blunt end of a pencil and remove the seating by sticking it to the greased end of the pencil. If the seating is displaced from its socket the half-ball can be removed by removing the capsule cover (para. 17). Remove the rubber seal from the underside of the orifice body flange.

Removing and dismantling capsule cover, fittings and capsule stack

17. Unscrew, and remove together with the grover washers the five nuts from the

pivot pin holes and the blanking nipple seat for damage and wear. Inspect the lever pivot pin for wear and sharp edges.

40. Ensure that the half-ball valve swivels freely in its socket in the pivot lever and that the seating face of the half-ball is flat. This should be checked by means of an optical flat.

Capsule stack

41. Inspect the capsule stack for punctures, leaks, corrosion, and the presence of foreign matter between the capsules. Ensure that the upper square end of the capsule stack is undamaged, also the threads in both upper and lower inserts are clean and sound and that the inlet hole in the upper insert is clean and unobstructed. Examine the lever fork, its threads and pivot pin holes for wear and damage and ensure that the fork screws easily into the lower threaded insert of the capsule stack. Inspect the rubber ring for swelling, distortion and damage.

Remaining details

42. Carefully examine the main casting for damage. Ascertain that the five studs screwed into the main casting are clean and undamaged. Ensure that all sealing faces are clean, free from damage and scores. Inspect all internal tappings for cleanliness and condition of threads. Ensure that the nameplate is clearly stamped with the serial number of the unit.

REBUILDING THE UNIT

Note . . .

All parts must be thoroughly cleaned (para. 21) before reassembling.

Setting the capsule cover lever stop-screw

43. In order to set the capsule cover lever stop-screw, it will first be necessary temporarily to assemble the lever pivot union, complete with lever and half ball valve, and orifice body, to the main casting (*fig.* 2). The filter, spring, retaining plate, circlip, distance piece and cap-nut should not be fitted at this stage.

44. Place the setting gauge G.47532 on the capsule cover joint face of the inverted main casting. With the half ball in position depress the pivot lever until the half ball is pressing firmly on its orifice seating. Place the centre spindle of the gauge on the upper face of the pivot lever and securely tighten in position with the knurled locking screw of the gauge. Invert the setting gauge and locate the long legs on to the main casting mating face of the capsule cover, then measure the gap, using either feeler or slip gauges, between the centre spindle of the gauge and the spherical end of the lever stop-screw. This gap should be between 0·060 and 0·080 in., adjustment being made by the insertion or removal of shim(s) between the screw and the cover. If the lever screw has been disturbed care should be taken to refit initially the same number of shims as those which were removed during dismantling.

45. After the gap has been finally set, lock the tab-washer against the head of the stop screw. Remove the orifice body, half-ball and lever pivot union together with lever from the main casting.

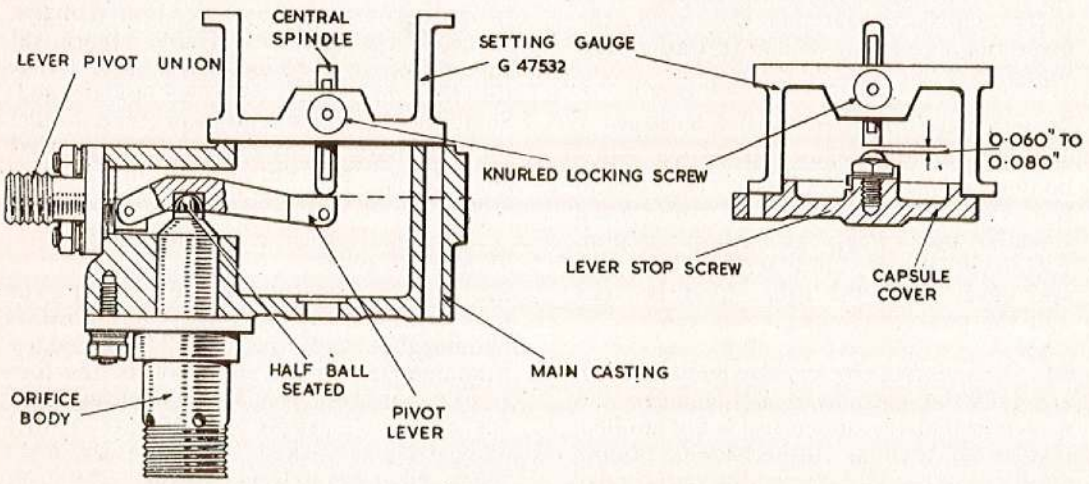

Fig. 2. Setting the capsule cover lever stop-screw

Capsule stack

46. Screw the lever fork into the lower insert of the capsule stack, but do not tighten, this will allow the fork to be screwed further in or out as required when adjusting the capsule stack. Place the rubber seal over the upper insert of the capsule stack, locate the stack correctly with the main casting while screwing the capsule lock-nut on to the upper threaded insert from the outside of the unit. It is only necessary at this stage to assemble the lock-nut finger tight. Arrange the position of the fork correctly to receive the free end of the pivot lever.

Lever pivot union

47. If the lever pivot union and lever have been dismantled align the lever with the securing lug on the lever pivot union and secure with the lever pin. Ensure that the lever pivots freely. Place the rubber seal correctly on the inside face of the flange of the lever pivot union and lower the lever through the main casting, correctly aligned with the capsule stack and orifice body port. Using a hide hammer, carefully tap the pivot union fully home into position against its face on the main casting, ensuring that the lever does not foul the capsule stack during this operation. Align the holes in the lever with those in the fork with a slave pin, then press the lever pin into position at the same time removing the slave pin from the unit. Secure the pivot union to the main casting with the four nuts, plain and grover washers, and the lever pin with a split pin.

Orifice body assembly

48. First assemble the cylindrical filter, the helical spring, and the spring retaining plate, into the orifice body, ensuring that the spring retaining plate is correctly located with the spring, and secure the filter assembly into position with the circlip. Locate the rubber seal correctly in the groove on the underside of the triangular flange of the orifice body assembly.

49. Secure the half-ball valve seating to the blunt end of a pencil with some petroleum jelly and lower the half-ball into its socket in the assembled pivot lever through the orifice body port in the main casting. Lower the orifice body into position, correctly locating it with the single stud in the main casting. Fit a plain and a grover washer over the stud and screw on a nut, but do not tighten the nut at this stage.

Capsule cover and fittings

50. Fit the rubber seal to the cover and lower the cover on to its mating face on the main casting ensuring that the bolt holes in the cover are correctly aligned with those of the main casting. Insert the two hexagon headed and the three extended thread mounting bolts ensuring that bolts of correct length are used for the respective holes (para. 17). Fit plain and grover washers to the bolts, screw and tighten the bolt nuts into position, using two spanners, one for the bolt head and the other for the nuts. Tighten the stud nut securing the orifice body (para. 49).

Preliminary leak tests

51. Two preliminary leak tests must be effected, one to test the back-leakage past the half-ball and orifice and the other to test the main casting joints; these are effected as follows :—

Back leakage past the half-ball and orifice

(1) Insert slave blanking plugs and washers into the main casting ports, which house the relief valve and the minimum burner pressure valve. Connect a suitable air-line to the lever pivot union ; adjust the air pressure to 80 lb. per sq. in. and submerge the unit in a paraffin tank. Watch for any leakage, which will be indicated by air bubbles escaping through the orifice body. Initial leakage may be substantial but once the air already present in the orifice body has been ejected, the half-ball should practically seal the orifice body seating, a slight leakage at this point is, however, permissible. In the event of excessive leakage examine both half-ball and orifice body seating faces and replace if necessary.

Leakage at main casting joints

(2) Blank off as in previous leakage test, but in addition blank off the orifice body by means of rubber sealing rings on either side of the distance piece and secure the whole assembly with the cap-nut. Connect the air-line as in para. 51(1), submerge in a paraffin tank and adjust the air pressure to 80 lb. per sq. in. Carefully watch for indications of leakage at the joints, particularly

at the capsule cover joint, lever pivot union joint, orifice body joint and capsule stack joint. Should leaks be observed, replace the rubber sealing rings of the part or parts which are defective.

Capsule ball-valve assembly

52. Locate the rubber sealing ring with the groove in the inner valve body and lower the inner valve body (complete with ball) into the outer valve body. Lower the rubber sealing ring on to the inner valve body, then the gauze filter and secure in position with the circlip.

53. Connect the fuel supply line of the rig to the underside of the capsule ball-valve, and with the assembly held in the vertical position (as on the unit) ensure that the leakage does not exceed 5 cc. per minute over a range of inlet pressures from 10 to 50 lb. per sq. in. If the leakage exceeds this amount fit a new rubber sealing ring and re-test. If the leakage is still excessive fit a new inner valve body assembly and re-test.

Note . . .

Do not assemble the capsule ball-valve assembly to the unit at this stage.

Minimum burner pressure valve

54. Care should be taken when assembling the valve to avoid damaging the spherical seating faces of the valve and valve body, as damage to these parts will affect the sealing of the valve.

55. Thread one loop of the spring through the eye of the valve and lower the spring together with the valve into the valve body. Insert the adjusting fork into the other end of the valve body; using a suitable pin, align the free end of the spring with the slot of the fork and with its locating holes. Locate this assembly correctly with the holes at the top of the slots in the valve body in order that the spring anchorage pin can be inserted. Carefully insert the spring anchorage pin through the hole in the valve body, the fork and the spring. This operation can be facilitated by screwing a barrel nut of smaller diameter than the valve body a few threads on to the spring fork before feeding into the valve body, to enable the fork to be more easily manipulated for the insertion of the spring anchorage pin.

56. Remove the barrel nut and place the adjusting nut on the end of the spring anchorage fork. Tighten the adjusting nut until three or four threads project through the fork, and lock the notches on the nut with the lips on the valve body.

57. All readings observed during the following tests should be carefully recorded.

58. Connect the fuel supply line from the rig to the body of the suitably blanked off minimum burner pressure valve unit supplied with the rig. Carefully raise the body pressure to 26 to 27 lb. per sq. in. and with the flow at 2 gallons per hour, at which pressure the valve should open; this will be indicated by fuel passing through the relief valve. If the valve commences to open *below* 26 lb. per sq. in. extend the spring by screwing in the adjusting nut as required—note that one notch movement is equivalent to approximately 1 lb. per sq. in. Conversely, if the valve commences to open *above* 27 lb. per sq. in.; unscrew the adjusting nut as required. Always ensure that the notches of the adjusting nut are correctly engaged with the lips on the valve body after resetting.

59. Adjust the fuel flow to 22 gallons per hour and note that the maximum pressure drop must not exceed 30 lb. per sq. in. (para. 73). Unscrew the valve body complete with valve from the minimum burner pressure valve unit.

60. Exert a back pressure on the valve of 1,000 lb. per sq. in. and allow the leakage through the valve to fall vertically into a measuring cylinder for a period of one minute, during which period this leakage should not exceed 30 c.c. On completion of the test disconnect the valve from the rig fuel supply line.

Relief valve

61. Proceed as described for the minimum burner pressure valve (para. 54 to 60), except that, during assembly the adjusting nut is screwed approximately twice as far down the fork and during the check test the pressure at which the relief valve commences to open is to be 45 to 50 lb. per sq. in., while the maximum back leakage permissible at 40 lb. per sq. in., body pressure is 10 c.c. per minute. Screw and tighten both minimum burner pressure valve and relief valve in to their corresponding ports in the main casting, inter-

posing an aluminium joint washer between valve body and main casting.

External leakage test

62. Secure the union and aluminium washer to the relief valve body and blank off all connections except the lever pivot union. Connect an air line to the lever pivot union and exert a pressure of 80 lb. per sq. in. to the body, submerge the unit in a paraffin tank and ensure that there is no leakage. On completion of the test disconnect the air-line (*fig.* 3).

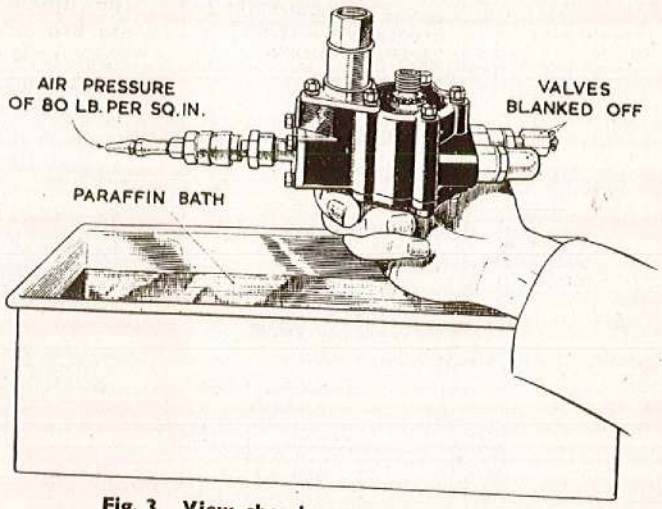

Fig. 3. View showing external leak test

Note . . .

If the valves are subsequently removed or the unit dismantled the above leakage test must be repeated.

REPLACEMENTS

63. The following units are normally available as built-up assemblies, though individual items in the assemblies are separately interchangeable unless stated to the contrary. Other items not mentioned are all separately interchangeable.

64. The blanking nipple assembly comprises the outer sleeve, blanking nipple and split pin.

65. The relief valve and minimum burner pressure valve assemblies comprise the valve body, valve, spring, spring fork, spring anchor pin and adjusting nut.

66. The capsule ball valve assembly consists of the outer sleeve, circlip, gauze strainer, rubber sealing rings, and the inner valve assembly (with ball). The inner valve assembly is supplied complete with ball.

67. The orifice assembly comprises the circlip, spring retaining plate, spring, cylindrical filter and orifice body.

The capsule cover assembly consists of the cover, lever stop, shim washer(s) and tab-washer.

68. The lever pivot union assembly comprises the lever, lever pivot union and lever pivot.

69. The capsule stack assembly consists of the capsule stack, upper insert and lower insert.

70. The main casting assembly comprises the main body together with four studs for securing the lever pivot union and one stud for locating the orifice body.

RIG TESTING

General

71. Carefully record all calibration test results for subsequent entry into the official test record sheet. Unless stated otherwise the fuel used throughout these tests is to be paraffin to specification D.Eng.R.D.2482 latest issue and the limits of its temperature to be between 20 deg. C minimum and 26 deg. C maximum. Checks should be made at regular intervals to ensure that the fuel used for the following tests conforms to these standards.

Final setting of minimum burner pressure valve

72. Mount the unit on the rig as shown in fig. 4 and connect the orifice body of the unit as follows:—Place a banjo over the orifice body with a joint washer on either side of the banjo and tighten the cap nut to the body. Connect the pipe lines as shown in this figure to the banjo, lever pivot union and minimum burner pressure valve, leaving the relief valve open to atmosphere.

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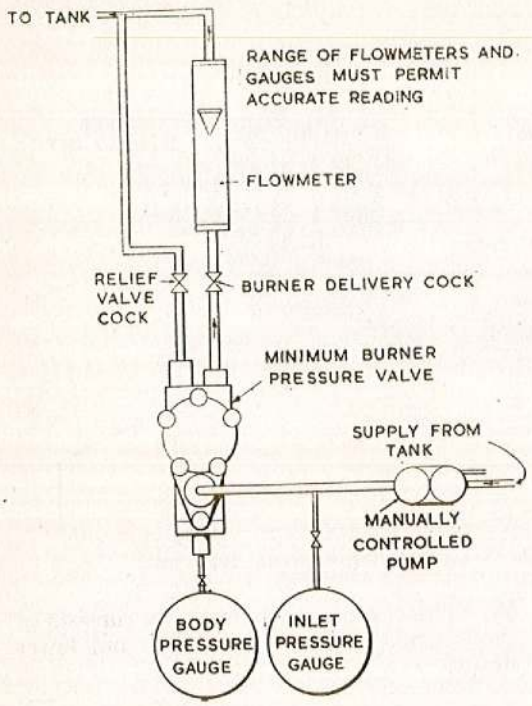

Fig. 4. Diagrammatic layout of test rig

73. Using the special spanner (para. 5) release the capsule lock-nut (*fig.* 5). Raise the body pressure to 26 to 27 lb. per sq. in., and with the flow at 2 gallons per hour check that the relief valve commences to open. Adjust the flow to 22 gallons per hour and ensure that the maximum pressure drop does not exceed 30 lb. per sq. in. Where the pressure drop is excessive, adjustment should be made to the capsule stack. Using the same spanner slacken the lock-nut and turn the inner spanner in a clockwise direction until the body pressure is within the permissible limits, when satisfactory tighten lock-nut.

Final calibration

74. Connect the unit on the rig as shown in fig. 4. Open the relief valve and body pressure cocks and close the minimum burner pressure cock. Adjust the flow to 5 gallons per hour at an inlet pressure of 300 lb. per sq. in. Slowly close the body pressure cock until the body pressure becomes constant at approximately 43 lb. per sq. in.

75. Where the results obtained during these tests are not within the permissible tolerances it will be necessary to vary the pressure at which the reducing valve operates. By screwing the square end of the upper insert in or out, the capsule stack is rotated to vary the position of the lever fork at the lower end of the capsule stack and consequently the pressure at which the reducing valve operates. Adjustment is made by using the special spanner as described in para. 73.

76. Vary the flow and inlet pressure over the range given in the following table and ensure that the body pressure remains within the limits specified.

Flow in gallons per hour	Inlet pressure in lb. per sq. in.	Body pressure in lb. per sq. in.
1	1,250	Record the readings obtained. Each must be between 44 and 35 lb. per sq. in.
30	150	

77. With the unit still mounted on the rig and the pressure and flow adjusted to the last reading on the foregoing table, tighten the lock-nut on the capsule stack.

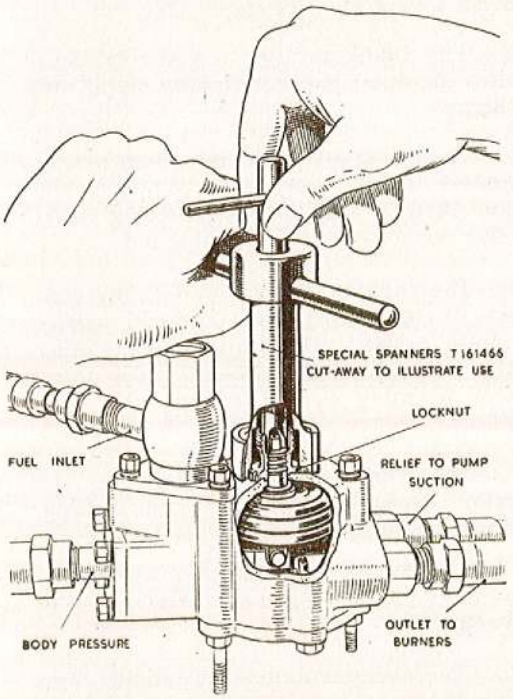

Fig. 5. View showing use of special spanners for locking the capsule lock-nut

Care must be taken to avoid overtightening this lock-nut and straining the upper insert of the capsule stack.

78. Lower the aluminium washer, fitted only to earlier types of valves, onto the lock-nut and tighten the capsule ball-valve assembly to it. On later types of valves, having a knurled outer valve body, a rubber seal is fitted in place of the aluminium washer and the valve body is tightened by hand.

Final internal leak test

79. With the unit still mounted on the rig (*fig.* 6), and with the burner and body pressure cocks closed, apply an inlet pressure of 1,500 lb. per sq. in. to the unit through a banjo fitted in place of the distance piece on the orifice body.

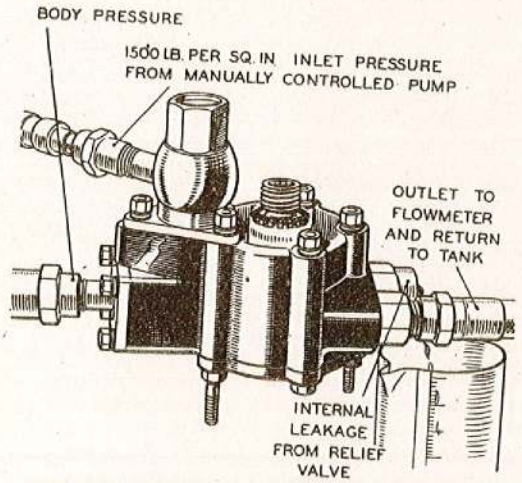

Fig. 6. View showing internal leak test

80. Allow the body pressure to build up to the relief valve pressure, denoted by the dripping from the relief valve becoming steady, then allow this leakage to flow into a measuring cylinder. The leakage past the half-ball and out of the relief valve must not exceed 40 c.c. per minute over a period of 5 minutes. After the satisfactory completion of these tests remove from the rig and empty all paraffin from the unit.

INHIBITION

81. Remove all blanking caps from all exposed connections except the lever pivot union, and in their place fit dust caps. Inject flushing oil, to specification DTD561 latest issue, under pressure into the lever pivot union until the oil runs from the holes in the orifice body. Refit the distance piece and cap-nut on the orifice body, disconnect the supply line from the lever pivot union and fit the assembled pivot union blanking nipple.

PREPARATION FOR DESPATCH

Final wire-locking

82. Ensure all connections are complete and wire-lock the unit.

Packing

83. Copy (preferably type-written) all records of the official test record sheet and place this copy together with the unit in a suitable container.

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