Chapter 1

THROTTLE VALVE, TYPES T.V.A.3 AND T.V.B.

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

General

1. The instructions given in this chapter are for throttle valves which are basically the same. Differences will occur, however, due to the various calibrations and installation fittings and sometimes to design features. These differences will be noted at the appropriate places in the text. The unit number in each case is made up of the type number followed by a stroke and the installation code number and calibration letter.

2. During reconditioning extreme cleanliness must be observed, and every precaution must be taken to ensure that all parts are thoroughly clean. To prevent damage to nuts, bolts, etc., by rounding off the flats and corners, box spanners must be used whenever possible.

3. All paper joints or gaskets, banjo washers etc., must be replaced by new ones whenever the seal is disturbed, and new split pins and locking wire must always be used. Parts which are not interchangeable are detailed under " Replacements " (*para.* 47).

4. The special tools required for dismantling and assembling the throttle valve are illustrated in the appropriate section in the text, and full details of the tools to be manufactured from local resources are given in fig. 1.

5. To ensure that sound parts are fitted on final assembly, it is recommended that slave nuts, washers, etc,, should be used in those instances where components are only assembled temporarily.

6. To prevent the interchange of parts between units suitably partitioned trays should be used. Each tray should be

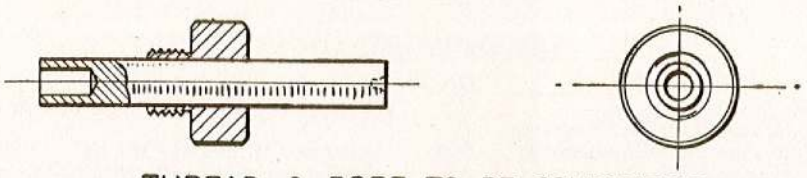
arranged to hold all the components of the throttle valve in such a way that shortages are easily noticeable.

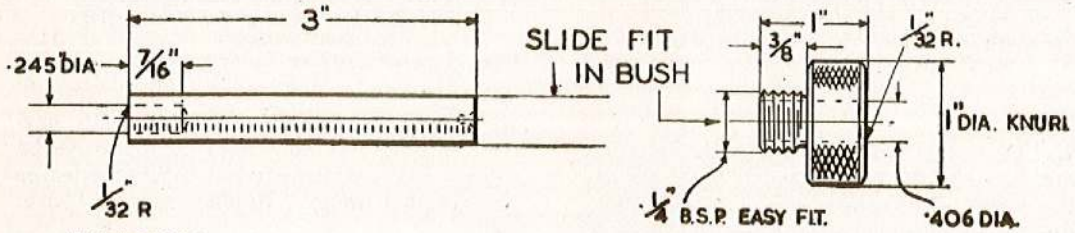
SPECIAL TOOLS

7. The repair of throttle valves necessitates the use of special tools and rigs and these are of two categories, (a) those which are provisioned and (b) those which are to be manufactured from local resources. All the special tools required are detailed in the following "List of Tools", and fully dimensioned drawings are given for those tools to be manufactured locally (*fig.* 1).

LIST OF SPECIAL TOOLS REQUIRED DURING OVERHAUL

TOOLS TO BE SUPPLIED		TOOLS TO BE MANUFACTURED LOCALLY (*fig.* 1)
Part No.	Nomenclature	Nomenclature
T.154353	Adjusting spanner for adjusting screw and piston assembly	Tool, for insertion of orifice plate for slow-running control
R.36	Test rig	Drift, for removal of orifice plate for slow-running control
T.155048 or T.182557	Extractors, for removing operating lever	
T.181033	Box driver, for serrated plug	
T.191782	Sheath, for assembling pinion shaft to sleeve (with seal)	





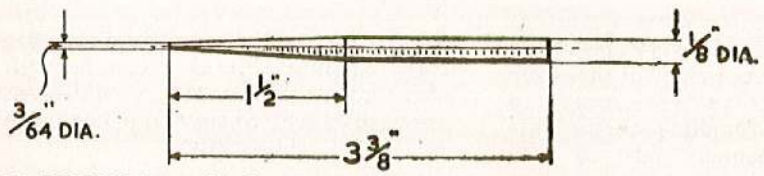


Fig. 1. Tools to be made from local resources

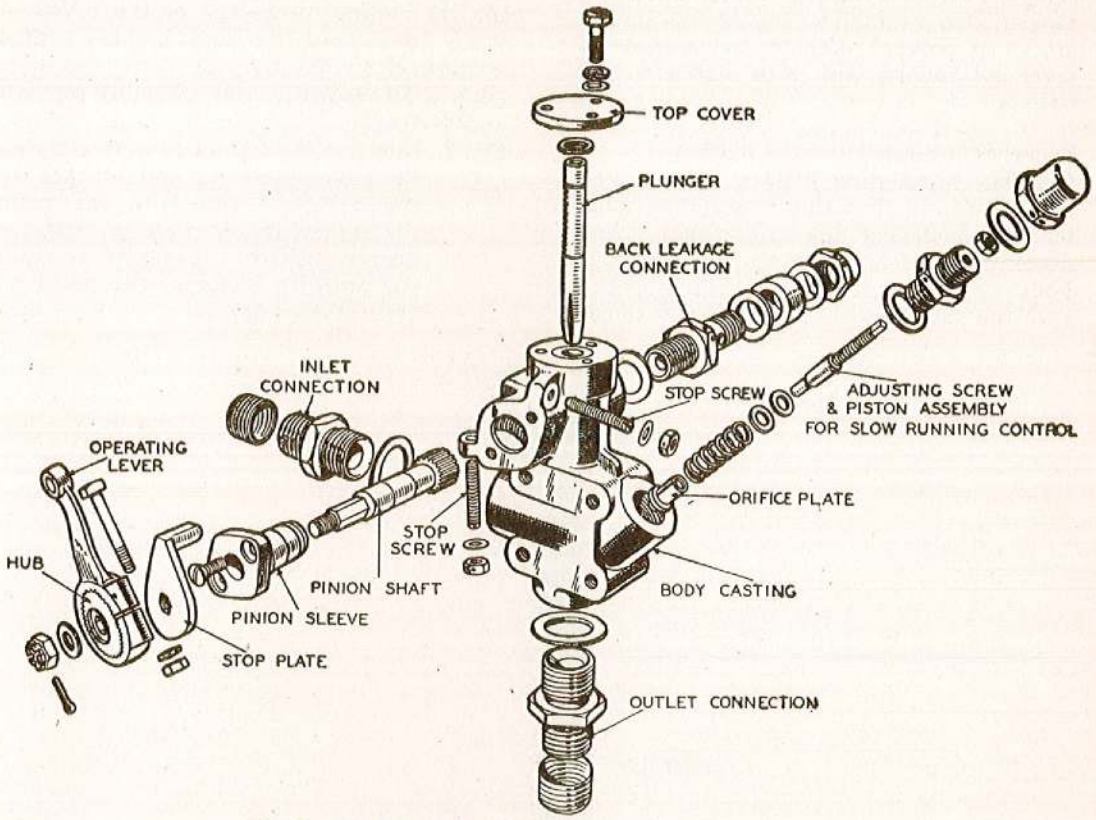


Fig. 2. T.V.A.3/1A throttle valve, completely dismantled

CHECKS AND PRECAUTIONS BEFORE DISMANTLING

8. Study any complaints reported with the throttle valve, and carefully examine the exterior of the unit for visible signs of damage, e.g., broken locking wire. Check that all parts have been securely covered to prevent the entry of any foreign matter into the interior of the valve. Examine all exposed threads to ascertain if damage has been caused in transit.

9. After removal, carefully examine the interior of all dust caps for foreign matter. If it is suspected that foreign matter has entered the valve it should be mounted on the rig and flushed with fuel. The valve will contain inhibiting oil, and this should be drained into a container before testing the unit on the test rig.

10. If the locking wire on the operating lever stop studs is broken, check that the fuel flow and the movement of the operating lever are as specified under " Idling setting and range of lever movement " (*para.* 59).

11. Whether or not this locking wire is broken, a leakage test, as described in para. 53, and a torque test (*para.* 56), must be made. These tests may be of considerable assistance in diagnosing any faults which may exist in the unit. All time-expired units must then be dismantled, but other units which satisfactorily pass the idling and maximum flow tests as detailed under " Flow characteristics " (*para.* 61), and the leakage and torque tests, may be despatched as fit for service use without dismantling and strip inspection.

DISMANTLING THE THROTTLE VALVE

12. The following instructions for dismantling the throttle valve are listed in the recommended sequence, but where the stripping of an assembly is not considered advisable the complete assembly is to be replaced by a new one from stores. Defective throttle valves must be dealt with according to their reported complaint. Complete stripping will not be essential in

every instance, i.e., where units have completed short running times, the stripping of sub-assemblies may be discretionary. To prevent damage to components sever all locking wire with standard wire cutters.

Removing the installation connections

13. The installation fittings are not normally removed, but this may be necessary in some instances due to damage. When necessary, unscrew the unions from the body casting and remove them, together with the joint washers and various fittings.

Removing the plunger and operating lever assembly

14. It is first necessary on the T.V.B. 4 types to remove the end bracket which accommodates the by-pass valve and solenoid. To dismantle this assembly proceed as follows :—

Op. 1. Unscrew the screws or nuts securing the cover plate (or end bracket on the T.V.B. 4 types) to the main casting and remove together with the grover washers. Take care to retain the transfer bobbins with seals on the T.V.B. 4 types.

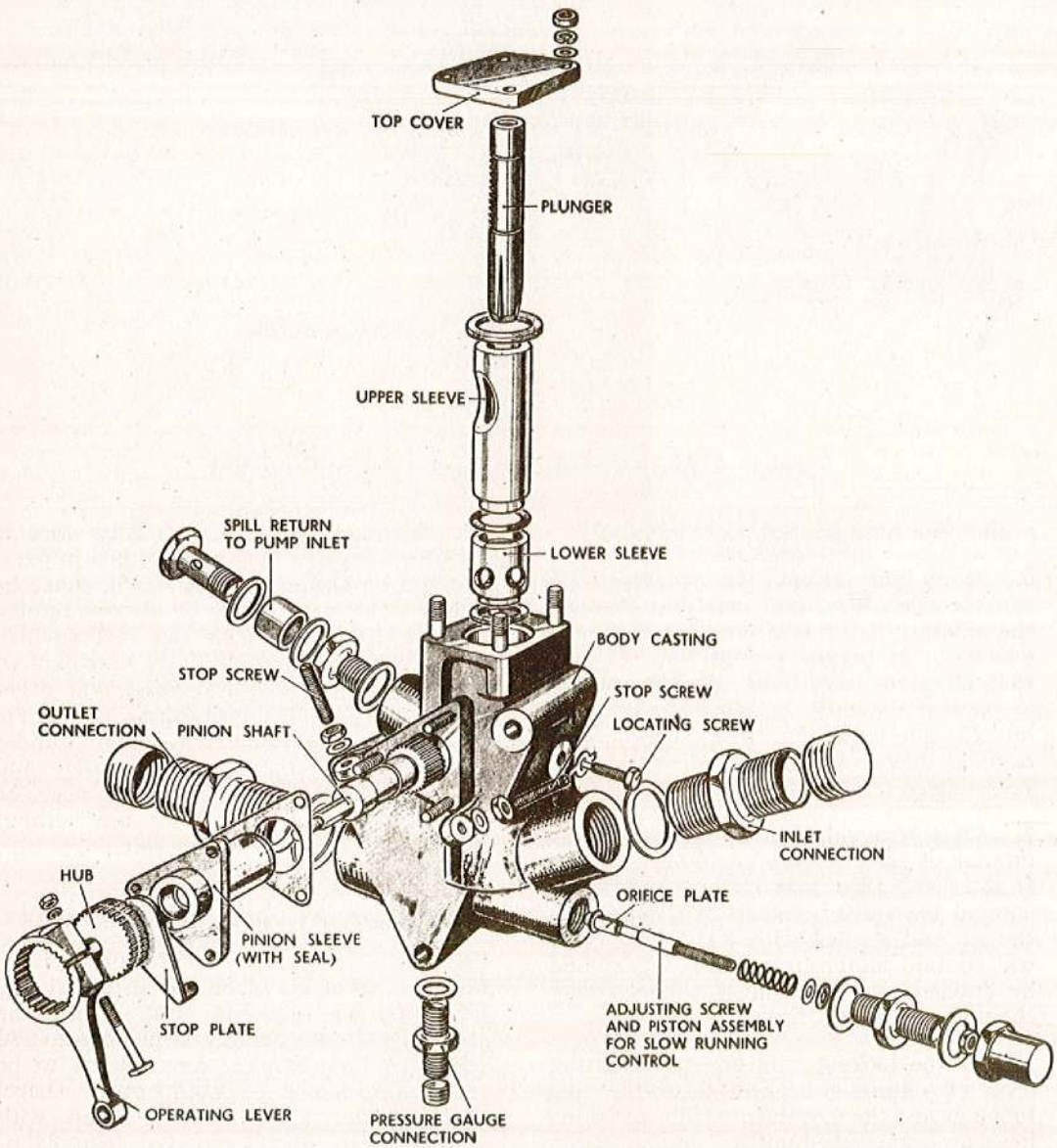


Fig. 3(a). T.V.B.1/4D throttle valve completely dismantled

Op. 2. Lift off the cover plate (or end bracket on the T.V.B. 4 types) together with the rubber seals located in its recess.

Note . . .

It is not necessary to separate the solenoid valve assembly (fitted to the T.V.B. 4 types) from the end bracket providing the valve passes the functioning test (para. 60, Op. 4) and the insulation test (para. 65). If not it is possible that foreign matter is trapped between the half-ball and the orifice. Access may be obtained to the orifice by opening the tab washers and removing the nuts securing the solenoid valve to the end bracket and lowering the valve unit clear. The spring retainer may then be separated from the orifice housing and the faces of both the half-ball and the orifice examined. The orifice is not normally removed from its housing. If necessary remove the housing complete with orifice, seals and strainer; clean, refit and re-test.

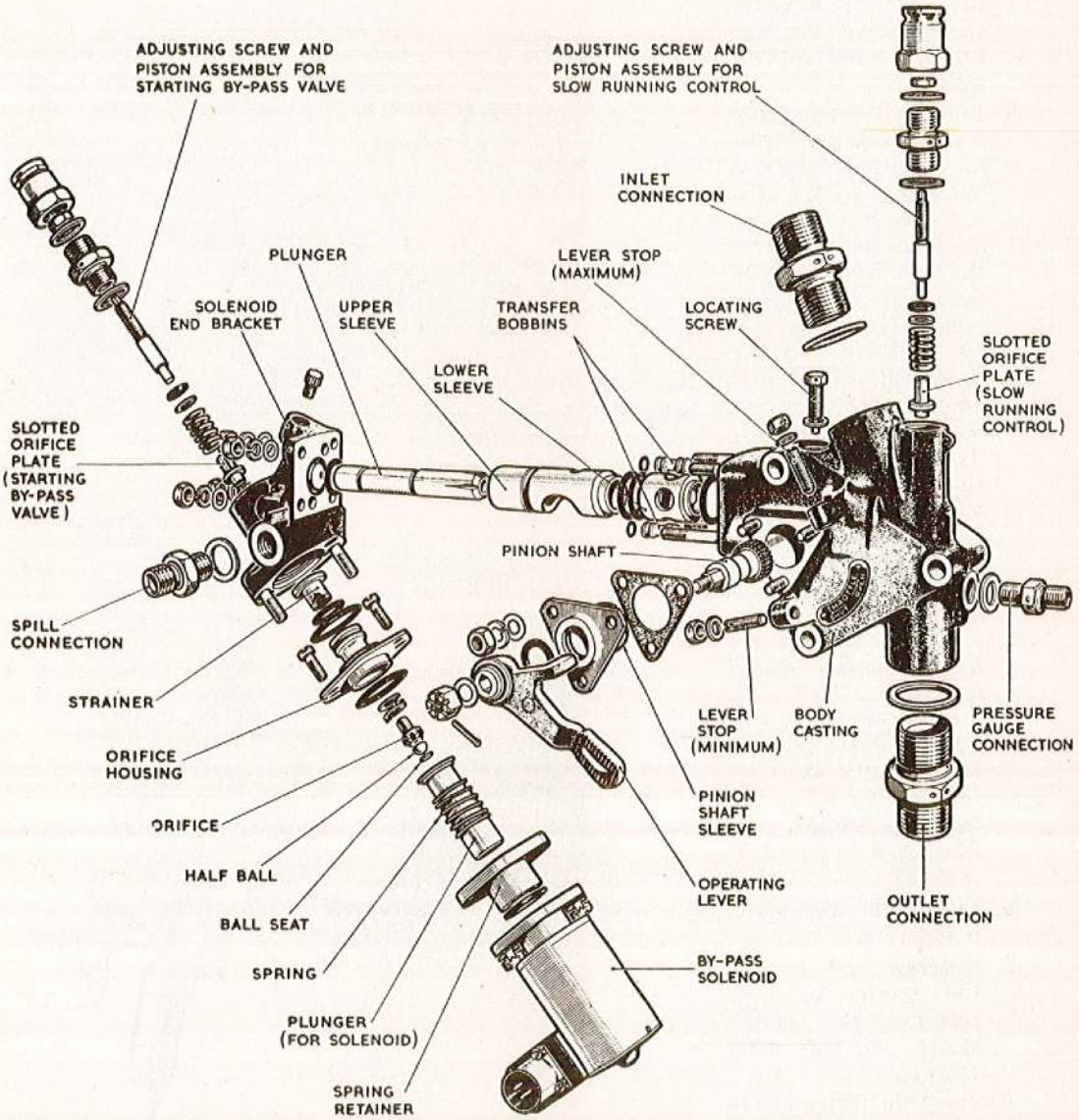


Fig. 3(b). T.V.B.4/7E throttle valve completely dismantled

If the unit is still unsatisfactory the solenoid must be removed and returned to the stores and a replacement unit fitted.

Op. 3. Move the operating lever and retain it in the fully open position, to raise the plunger and allow a slave screw to be inserted into its tapped bore; this will facilitate withdrawal of the plunger at a later stage. Note the distance from the face of the sleeve to the top of the plunger.

4. Extract the split pin locking the ¼ in. B.S.F. castellated nut securing the operating lever to the pinion; unscrew and remove the nut together with its plain washer.

5. Remove the operating lever, together with hub, using the special extractor (*fig.* 4). *It is not normally necessary to remove the hub from the lever but if this is done do not attempt to remove the hub merely by slackening off the pinch bolt, for the latter locates with a groove in the periphery of the hub. To remove the hub the bolt must be completely withdrawn; this will allow the operating lever to be sprung open to free the hub which can then be removed. Mark both the hub and the lever to ensure correct reassembly. The T.V.B. 4 types have a new design of operating lever incorporating an integral stop for which extractor T.182557, also illustrated in fig. 4 is required.*

6. Lift off the stop plate, if separate.

7. Unscrew and remove the screws or nuts securing the pinion sleeve to the main casting.

8. Mark the flange of the pinion sleeve and the main casting to ensure correct re-assembly of the sleeve, then grip the pinion shaft between thumb and forefinger and withdraw the pinion complete with sleeve, seal and gasket from the main casting. Remove the plunger by inserting a slave screw in the tapped end and withdrawing the plunger.

Note . . .

When dealing with T.V.B. types, unscrew and remove the locking screw with plain washer which locates in the slot in the upper sleeve from the main casting.

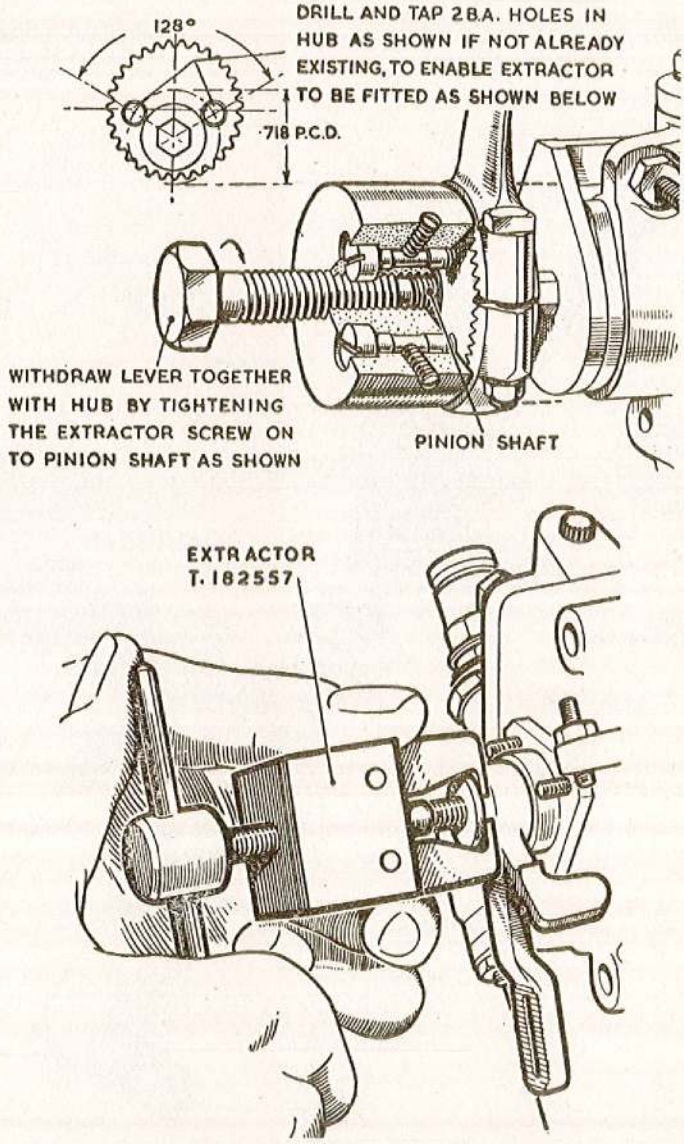


Fig. 4. Extractors for removal of operating lever

Removing the slow-running control

15. These instructions also apply to the by-pass starting valve on the T.V.B. 4 types. To remove the slow running control proceed as follows :—

Op. 1. Unscrew the cap nut from the slow-running control adapter and remove the nut together with the plain washer.

2. Unscrew and remove the adapter complete with the adjusting screw and piston assembly.

3. Withdraw the rubber sealing ring, washer and helical spring from the slow-running orifice plate in the valve body casting.

4. Invert the body casting and insert a hollow drift (*fig.* 1 *and* 5), of slightly larger diameter than the orifice itself, through the by-pass hole connecting the slow-running by-pass with the main outlet, in the case of the T.V.A. 3 type. On the T.V.B. types the drift is passed through the outlet tapping, but for the by-pass starting valve on the T.V.B. 4 types it is passed through the end of the end bracket remote from the cap-nut position.

5. Gently tap the end of the drift to free the orifice plate from the main casting, but take care not to damage the orifice.

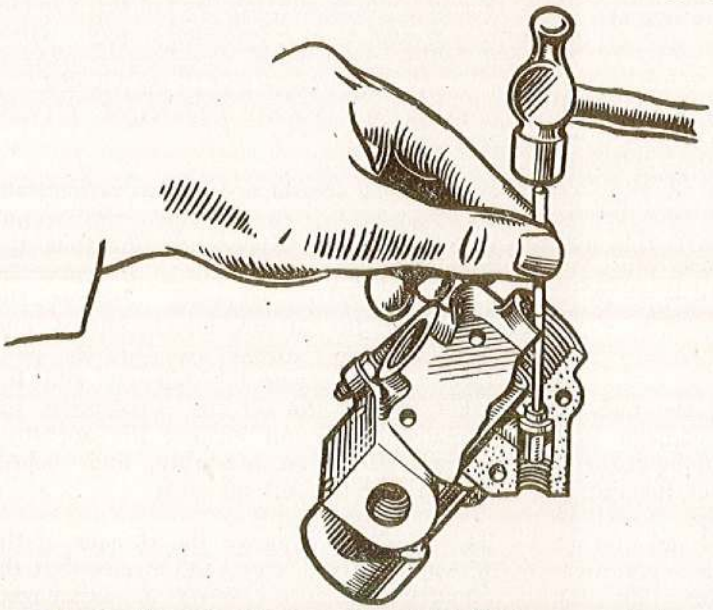


Fig. 5. View showing use of special drift for removal of orifice plate in slow-running control

Remaining details

16. If it is considered necessary to dismantle the slow running control or by-pass control valve further, due to evidence or suspicion of damage, unscrew and remove the 2 B.A. lock-nut from the piston adjusting screw ; this will allow the piston adjusting screw to be detached from the adapter. In the event of damage to stop screws, these may be removed by slackening the lock-nuts and removing the screws together with lock-nuts and plain washers. It is not necessary normally to remove the knurled plug sealing the by-pass duct in the end bracket casting, but if essential box driver T.181033 similar to that illustrated in fig. 3, Chap. 2 must be used.

CLEANING

17. It is important that the work bench be kept scrupulously clean and free from all dirt, swarf, etc. It is recommended that the bench be covered with zinc sheeting or linoleum to facilitate cleaning, and that several clean containers be available in which to keep the various parts removed.

18. All parts (except solenoid valve details) must be thoroughly cleaned and washed before reassembly, using a parawash machine having a kerosine bath and spray gun. *Hard brushes or abrasives of any kind must not be used, neither must rag as this is likely to cause clogging.*

INSPECTION

19. With the exception of dimensional detail checks, which are dealt with in Part 2 of this Volume, all viewing and inspection checks are described in this section.

20. For convenience of reference the detail components are grouped as nearly as possible into sub-assemblies. Separate details which do not form part of a sub-assembly are dealt with nearest to their associated group, and the viewing and inspection checks are listed to correspond with the normal dismantling sequence of operations.

Distortion checks

21. Distortion checks are not normally necessary.

Permissible wear

22. All parts subject to wear should be checked in accordance with the Schedule of Fits and Clearances, Part 2 of this Volume.

Redundant and consumable parts

23. It is usual, during inspection, to reject all parts rendered redundant by the embodiment of essential modifications, and the inspector must thus have complete information concerning modifications so that new parts can be introduced and redundant parts rejected. Tab-washers, split pins, gaskets and other consumable parts must be rejected during dismantling.

Scores and surface damage

24. Scores on moving parts or joint faces will impair the operational efficiency of the unit, and may cause leakage ; consequently all such parts which are damaged must be renewed. Very slight surface scoring, insufficient to affect seriously the efficiency and safety of the unit, may be permissible at the discretion of the inspector-in-charge.

Installation connections

25. Examine the threads of the inlet adapter for cleanliness and freedom from damage, and ascertain that the washer is not cracked or damaged.

26. Inspect the threads of the outlet adapter for cleanliness and freedom from damage, and ensure that the washer is not cracked or damaged.

27. Examine the remaining installation fittings, which in the case of the T.V.A.3 type of valve, will be the back leakage connection, washers, distance piece, and cap-nut. When dealing with the T.V.B. types, the fittings will consist of the spill return connection and fittings, and the pressure gauge connection. All these parts must be clean and free from damage.

Plunger and pinion details

28. Examine the threads of the nuts or screws for freedom from damage and for cleanliness, and check that the hexagon heads are undamaged. Inspect the grover and plain washers for damage. Carefully examine the cover or solenoid end bracket casting generally for cleanliness and freedom from damage. Ensure that the seating face is sound. Discard the rubber sealing ring.

29. Examine the $\frac{1}{4}$ in. B.S.F. castellated nut for damage to threads and flats, also the plain washer for cracks and damage. Inspect the operating lever generally for damage, and ascertain that the hexagon hole in its centre retains its flats, which must not be worn in any way. Ensure that the threads of both the pinch bolt and nut, if fitted, are not damaged or the flats worn.

30. Carefully examine the flats of the hexagon hole in the centre of the stop plate or operating lever. Discard the plate or lever (with integral stop) if the flats are badly worn. *It is recommended that replacement stop plates be fitted to all time-expired units.*

31. Ensure that the pinion teeth are not cracked, chipped or worn. Check that the flats on the hexagon portion of the spindle are undamaged, and that the plain cylindrical portion is not corroded. Ensure that the threaded portion of the shaft is undamaged.

32. Check that the pinion spindle is a smooth push fit in its sleeve. Carefully examine the plunger for general condition, and ensure that the rack teeth are not worn, especially at either end, or a tendency to over-ride may result. Ensure that the axial hole is clean and that the flutes on the contoured end are clean and undamaged. *Do not polish the flutes or the contour of plunger as polishing may cause the flow calibration to be adversely affected. Check that the rubber seal in the reversed bore of the plunger sleeve is undamaged* (T.V.B. *types*).

Slow-running control and by-pass valve details

33. Ensure that the threads of the cap-nut are clean and undamaged and that the flats on the nut are not worn. Examine the plain washer for damage. Inspect the threads of the adapter for cleanliness, and freedom from damage ; examine the joint faces and hexagon for damage, and the plain washer for cracks. Examine the threads of the nut locking the adjusting screw and piston assembly, and inspect the flats of the nut for wear.

34. Carefully examine the threads of the piston adjusting screw, and ensure that the squared end of the screw is undamaged. Ensure that the piston slides freely in the orifice plate, and that the plain lower

portion of the screw is free from corrosion. Carefully pull the flexibly-mounted piston to ensure that the connecting wire is secure and unbroken.

35. Inspect the orifice plate, and ensure that the orifice is clean and undamaged and that its slot and interior contain no foreign matter. Examine the rubber seal for swelling and distortion. Ensure that the plain washer is not cracked or damaged. Ascertain that the helical spring is not fractured and that no sharp edges exist.

Remaining details

36. Carefully examine the main casting for damage generally. Ensure that all internal tappings are sound and clean, and that joint faces are not scratched or damaged, otherwise some leakage may result.

37. Inspect the plunger sleeve (upper and lower on T.V.B. types) for damage or scores likely to affect the flow setting of the unit. Ensure that the holes connecting the inlet connection and the slow-running by-pass, the starting by-pass passage and the return to suction passages in both main casting and end bracket casting on T.V.B. 4 types are clean.

38. Ascertain that the bore of the main casting, into which the pinion sleeve is fitted, is undamaged and clean.

39. Examine the seating for the orifice plate and ensure that it is clean and undamaged. Ascertain that no sharp edges exist at either end of the duct in the casting connecting the slow-running by-pass with the main connection.

40. Visually inspect the orifice, half-ball, ball seat helical spring, orifice housing and seals and strainer for cleanliness and freedom from damage.

41. Examine the threads of the operating-lever stop screws for cleanliness and freedom from damage, and ensure that its end stop is smooth otherwise damage may be caused to the stop plate or operating lever with integral stop to produce an enlarged angle of movement of the operating lever. Inspect the threads of the lock-nut and its flats for damage, and ensure that the washer is not cracked or damaged.

Magnetic crack detection

42. Parts are not normally crack detected.

RE-BUILDING THE THROTTLE VALVE

43. *During initial assembling all moving parts of the throttle valve are carefully selected, and when re-building the unit great care must be taken to ensure that these parts operate smoothly, see " Replacements " (para. 47).* Thoroughly clean all parts as described in para. 17.

Plunger and pinion assembly

44. The fitting of the plunger sleeves in Op. 1 applies to T.V.B. types of throttle valve only.

Op. 1. Fit a sealing ring into the sleeve bore in the body casting and follow with the lower sleeve. Place a sealing ring on the top face of the lower sleeve, then add the upper sleeve with the small hole in the wall in line with the locating screw in the body casting. Insert a screw of convenient size in the tapped inner bore of the plunger, and carefully lower the plunger into its sleeve in the main casting. Insert the tab-washer for the locating screw in the side of the body casting and after locating the sleeve and plunger, tighten the screw and lock the tab-washer.

2. Smear a thin coating of grease of the zinc oxide type on to the periphery of the pinion normally in contact with the sleeve, position the seal in the inner bore of the sleeve on T.V.B. types and insert the pinion into the sleeve. On T.V.B. types a special sheath T.191782 is required. Carefully insert both pinion and sleeve into the main casting, *noting that if the existing pinion sleeve is refitted it is placed in the same position as before (para. 14, Op. 8).* If necessary, in the case of the T.V.A.3 type, the mesh of the pinion shaft with the plunger rack may be altered by pushing the pinion shaft further through the main casting (when the hollow bolt for the back leakage connection is removed), turning the shaft and pulling it back into engagement again with the plunger rack. This adjustment may be required in

order to obtain the correct depth of plunger in relation to the position of the operating lever stops.

Note . . .

Do not attempt to force the pinion into engagement with the rack teeth of the plunger; the pinion should slide freely into mesh in order to allow the flange of the pinion sleeve to rest securely on the corresponding boss of the main casting.

Op. 3. Secure the pinion sleeve to the main casting by tightening the two 2 B.A. countersunk-head screws, (T.V.A.3) or three 2 B.A. plain nuts and grover washers (T.V.B.).

Note . . .

Op. 4 *and* 5 *are not applicable to the T.V.B. types.*

4. Place a slave stop plate on to the pinion shaft ensuring that its hexagon hole locates correctly with the hexagon portion of the pinion shaft, and that its stop is aligned correctly to correspond with the position of the stop screws when the plunger is at the correct depth in the plunger sleeve (*para.* 14, *Op.* 3).

5. Check that the clearance between the stop plate and the adjoining face of the pinion sleeve is as stated in the Schedule of Fits and Clearances, when measured with a feeler gauge (*fig.* 6).

6. Ensure that the pinion and the rack teeth of the plunger engage freely over the whole plunger range with complete absence of binding.

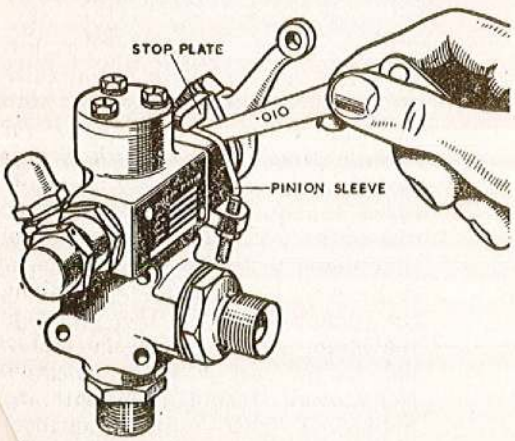


Fig. 6. Measuring the end float between the stop plate and the adjoining face of the pinion sleeve

Op. 7. Remove the screw from the tapped axial bore of the plunger.

8. Fit a sealing ring into the recess of the top cover (or end bracket casting on T.V.B.4 types) and retain with white petroleum jelly. On T.V.B.1 types the ring is located in the body casting around the plunger.

9. Fit the cover (or end bracket complete with solenoid), with screws or nuts, grover washers and plain washers, fitting the transfer bobbins on the T.V.B.4 types.

Slow-running details

45. To assemble the slow-running control proceed as follows :—

Op. 1. Insert the orifice plate into the slow-running chamber of the main casting using the special tool as shown in fig. 7.

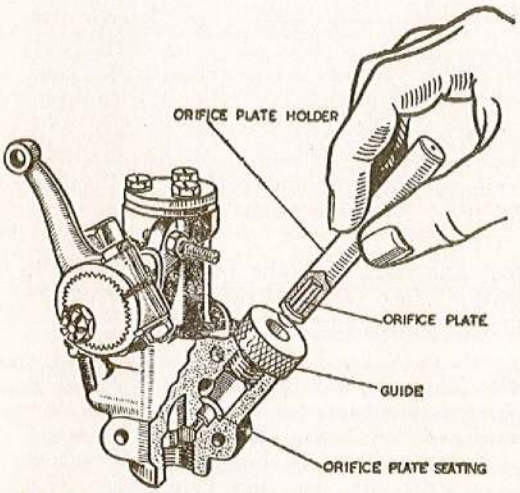


Fig. 7. Use of special tool for insertion of orifice plate in the slow-running control chamber

Op. 2. Lower the helical spring into position round the orifice plate.

3. Assemble the piston adjusting assembly into the adapter, lower the plain washer and the rubber sealing ring into the slow-running chamber, and secure the adapter (with plain sealing washer) into the main casting.

4. Tighten the piston fully down against the orifice plate, and loosely assemble the lock-nut on to the threaded portion of the piston. Fit a slave cap-nut and a plain washer to the adapter.

Note . . .

If the by-pass valve details on T.B.V. 4 types (which are similar to the slow running details) are removed these may be assembled as described above.

Remaining details

46. If the following details have been removed they should be replaced at this stage. Loosely assemble the two stop screws, plain washers and lock-nuts to the main casting. Where applicable assemble the hub into the operating lever with the serrations correctly engaged (*para.* 14, *Op.* 5) and temporarily secure with the 2-B.A. pinch bolt, nut and grover washer.

Note . . .

The operating lever and the back-leakage connection are not assembled to the main casting until the unit is tested on the rig.

REPLACEMENTS

47. *During the initial assembling of the throttle valve, extreme care is taken in the selection of moving and mating parts, hence it must not be thought that separate parts are readily interchangeable. If a replacement body casting is necessary for the T.V.A.3 type of valve, it will be supplied with the plunger sleeve already fitted. No attempt should be made to interchange a sleeve when dealing with this type. The T.V.B. types of plunger sleeves and body castings are supplied separately and either part can be fitted to an existing part.*

48. Replacement plungers must be lapped to suit the plunger sleeves. The pinion shaft and sleeve, and the pinion and plunger are selective assemblies. The idling control adjusting screw and piston assembly also similar details in the by-pass valve are supplied as separate units. The solenoid valve and associated parts are supplied only as a unit. All remaining parts are separately interchangeable.

49. On time-expired units all existing plain washers, joint washers, and castellated nut (for securing the operating lever), must be scrapped and replacement parts fitted.

50. Existing locking wire and split pins must always be scrapped and replacement parts fitted.

TEST PROCEDURE

51. Carefully record all test results on the approved record sheet. Unless stated otherwise the fuel used throughout the following tests is to be fuel turbine aviation to specification D.Eng. R.D. 2482, the limits of its temperature to be between 20 deg. C. and 26 deg. C. The fuel should be checked at regular intervals to ensure that it complies with the above specification.

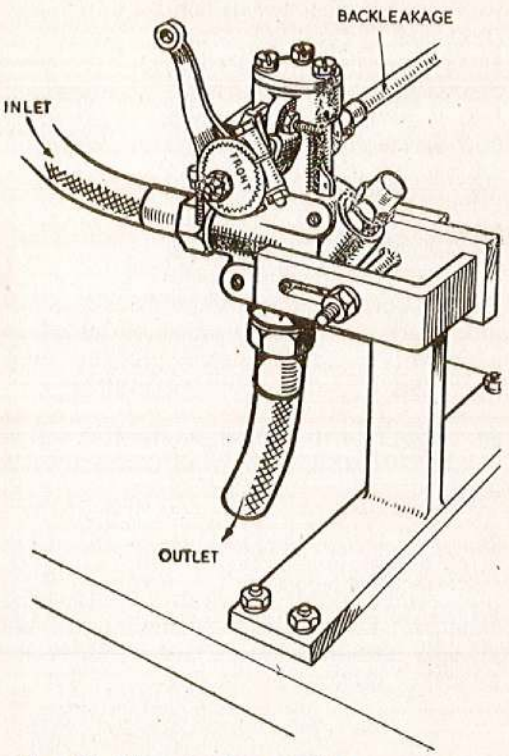


Fig. 8(a) View showing a T.V.A. 3 throttle valve mounted on the test rig

52. Mount the throttle valve on the test rig as shown in fig. 8(a). Assemble a slave operating lever (complete with hub) to the pinion spindle temporarily, but do not secure with plain washer and nut. Fit the back leakage adapter, together with joint washer, to the main casting. In dealing with the T.V.B. type of valve, the spill return-to-pump inlet connection and pressure gauge connection will be blanked off and the R.36 test rig will be used.

Leakage test (internal)

53. Mount the unit on the rig as shown in fig. 8 (a), and if a flow number is quoted in the following tables, set the restriction orifice in the fuel delivery line of the test rig (*fig.* 8 (b)), to the number specified. The flow number is obtained by dividing the flow in gall. per hour by the square

root of the pressure drop in lb. per sq. in. across the throttle valve, and it must remain constant over the full flow range. If difficulty is experienced in maintaining the flow number, it must be set at each flow measured. If a pressure drop is quoted in an appropriate table instead of a flow number, connect up the inlet and outlet pipes of the rig by a straight union, and check the pressure drop in the rig pipe work. This figure must be added as a correction, to the listed pressure drop figures given in the following tables.

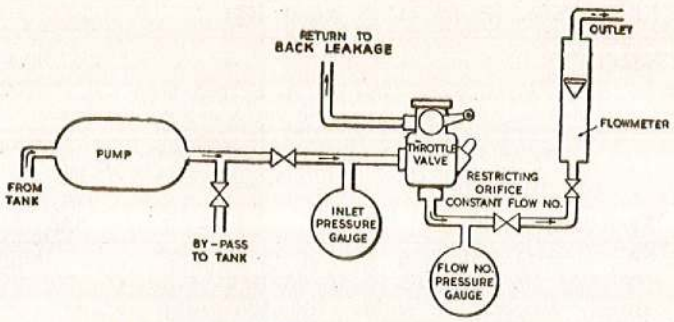


Fig. 8(b) Diagrammatic layout of test rig

54. Regulate the pump on the test rig to give a constant input pressure to the throttle valve.

55. Allow the leakage from the back leakage connection or the spill return-to-pump connection to drain into a measuring cylinder. Over a period of one minute, the leakage must not exceed that given in the following table :—

Type	Fuel inlet pressure lb. per sq. in.	Lever position in degrees	Minimum fuel flow g.p.h.	Leakage cc per min.
T.V.A.3/2A	1,000	0 to 100	—	40 max.
T.V.A.3/1B	1,000	0 to 100	—	40 max.
T.V.B.1/4D	1250	90	700	100 max.
T.V.B.4/7E	1250	90	700	100 max

If the leakage is in excess of that stated, a scored plunger sleeve or loose plunger is indicated, and the unit must be dismantled for examination and if necessary the subsequent changing of parts (*para.* 47 *and* 48).

Torque test

56. Ensure that the operating lever moves freely with minimum backlash (*para.* 59, *Op.* 9), thus indicating ease of movement of the plunger, with good meshing of the teeth on the pinion and the rack teeth on the plunger.

57. Adjust the position of the operating lever by adjustment of the stop screw and lock-nut until, with the operating lever in the fully open position (i.e. with the plunger at the top of its stroke), the flow of fuel and inlet pressure are as follows :—

Type	Fuel inlet pressure lb. per sq. in.	Minimum fuel flow g.p.h.
T.V.A.3/2A	1,000	505
T.V.A.3/1B	1,000	405
T.V.B.1/4D	1,250	735
T.V.B.4/7E	1,250	735

58. Use a spring balance to measure the torque required to operate the lever in either direction. The load must be applied at right angles to the lever (*fig.* 9), and the torque must not exceed that given in the following table :—

Type	Fuel inlet pressure lb. per sq. in.	Lever position in degrees	Fuel flow g.p.h.	Max. Torque lb. in.
T.V.A.3/2A	1,000	110	490 approx.	8
T.V.A.3/1B	1,000	100	400 approx.	8
T.V.B.1/4D	1,250	0 to 90	700	10
T.V.B.4/7E	1,250	0 to 90	700	10

Idling setting and range of lever movement

59. To adjust the idling setting and the range of lever movement proceed as follows :—

Op. 1. Blank off the by-pass valve. To do this tighten the adjusting screw until the piston assembly is screwed fully down.

2. With the fuel input pressure as stated in the following table, check that the flow through the valve, with the lever in the closed position, is as specified. The flow may be adjusted to the specified value by means of the idling stop-screw.

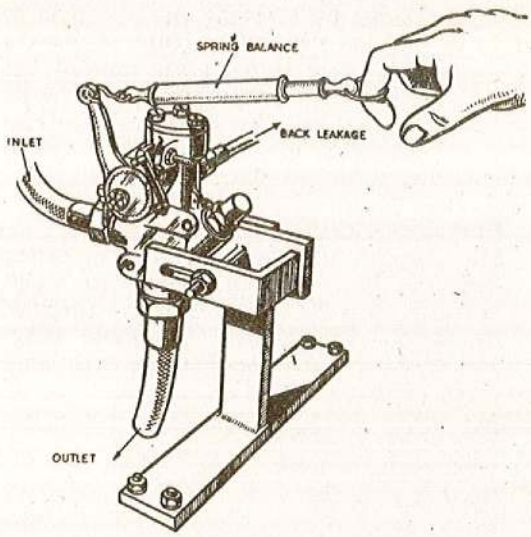


Fig. 9. View of torque test with spring balance attached to end of operating lever

Type	Fuel inlet pressure lb. per sq. in.	Pressure drop lb. per sq. in.	Fuel flow g.p.h.
T.V.A.3/2A	1,000	—	40–50 (flow No. 16·56)
T.V.A.3/1B	—	1,000	55 to 75
T.V.B.1/4D	—	950	60 to 80
T.V.B.4/7E	—	950	60 to 80

Op. 3. Remove the operating lever complete with hub (*para.* 14, *Op.* 5).

4. Fit a throttle degree plate to the pinion spindle, and secure a pointer to the throttle body in a manner shown in fig. 10. (*Special tools may be provisioned for this purpose*).

5. Note the reading in degrees on the degree plate when the stop plate is resting hard against its minimum stop screw.

6. Rotate the lever through the full range and adjust the maximum stop screw to rest against the stop on the stop plate.

Type	Maximum angle in degrees
T.V.A.3/2A	110
T.V.A.3/1B	100
T.V.B.1/4D	90
T.V.B.4/7E	90

Op. 7. Again check that the range of stop plate rotation is correct.

8. Move the stop plate from the minimum stop screw to the maximum stop screw and back again several times, and exert light and then heavy pressure to bring the stop plate against its minimum stop screw, noting the flow reading recorded in the minimum stop position in each instance. The flow reading should be within the following limits of the flow specified in Op. 2, at a closing torque of not more than 20 lb. in.

Type	Flow limit g.p.h.
T.V.A.3/2A T.V.A.3/1B	± 0·4
T.V.B.1/4D T.V.B.4/7E	± 0·5

Op. 9. Backlash must not exceed half a degree.

Setting of by-pass valve

60. The throttle valve unit normally incorporates one by-pass valve which forms

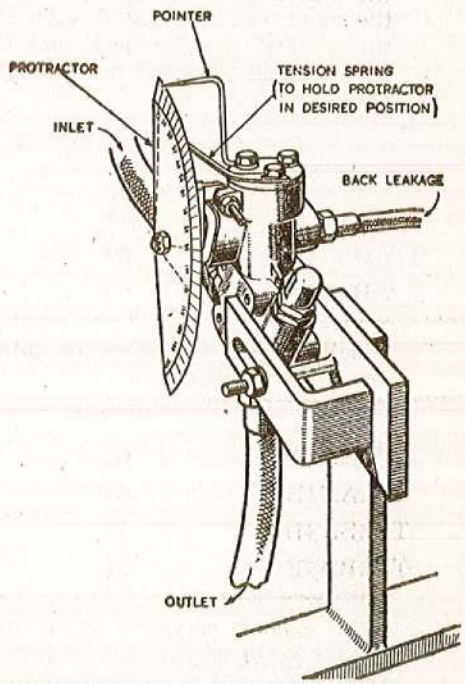


Fig. 10. View showing protractor and pointer mounted on throttle valve when mounted on test rig

the slow running control, but some types, the T.V.B. 4 for example, has an additional by-pass valve operated by a solenoid. Op. 1 to 3 inclusive apply to the slow running control by-pass while Op. 4 refers to the solenoid operated by-pass.

Op. 1. Remove the cap nut and washer from the slow-running control adapter.

2. Use the special spanner T.154353 to slacken the slow-running adjusting screw and piston assembly fully (*fig.* 11).

   Note that the flow through the throttle valve at the following conditions is within the figures stated.

Type	Fuel inlet pressure lb. per sq. in.	Pressure drop	Fuel flow g.p.h.
T.V.A.3/2A	1,000	—	70 (minimum flow No. 16·56)
T.V.A.3/1B	—	1,000	75
T.V.B.1/4D	—	950	80
T.V.B.4/7E	—	950	80

3. Fully tighten the adjusting screw of the orifice piston assembly, and at the same conditions and with the throttle still closed, check that the flow through the valve is within the following limits :—

Type	Flow g.p.h. (maximum)
T.V.A.3/2A	60
T.V.A.3/1B	55
T.V.B.1/4D	60
T.V.B.4/7E	60

Finally adjust the screw to obtain the following flows :—

Type	Flow g.p.h.
T.V.A.3/2A	62
T.V.A.3/1B	65
T.V.B.1/4D	71
T.V.B.4/7E	71

Op. 4. With solenoid energised at 24 volts, the range of adjustment to flow of this by-pass at a pressure drop of 950 lb. per sq. in. must be between 75 and 150 g.p.h. minimum. At idling conditions, the solenoid is to be energised and this by-pass adjusted by screwing the piston in or out of the orifice plate to give a total flow through the unit of 131 g.p.h. at a pressure drop of 950 lb. per sq. in. The maximum voltage required to operate the solenoid must not exceed 16 volts.

Flow characteristics

61. Operate the valve at the conditions stated in the following appropriate table. Steadily open the throttle in the specified increments throughout the whole range and record the flow readings at each stage given in the table.

T.V.A.3/2A calibration table

Inlet pressure 1,000 lb. per sq. in.
Flow No. 16·56

Lever pos. in deg.	Fuel flow gall. per hr.
0	62
10	74 to 94
30	155 to 200
50	270 to 330
70	370 to 410
90	430 to 470
110	475 to 505

T.V.A3/1B calibration table

Max. pres. drop. lb. per sq. in.	Lever pos. in deg.	Fuel flow gall. per hr.
1,000	0	64 to 65·6
800	20	145 to 155
400	50	280 to 290
160	80	350 to 365
100	100	390 to 405

T.V.B1/4D calibration table

Max. pres. drop lb. per sq. in.	Lever pos. in deg.	Fuel flow gall. per hr.
950	0	71
900	10	80 to 85
850	20	94 to 103
800	30	133 to 149
700	40	206 to 228
600	50	310 to 330
500	60	423 to 447
400	70	543 to 562
300	80	655 to 680
100	90	735 max.

TVB4/7E calibration table

Max. pres. drop lb. per sq. in.	Lever pos. ih deg.	Fuel flow gall. per hr.
950	0	71
900	10	80 to 85
850	20	94 to 103
800	30	133 to 149
700	40	206 to 228
600	50	310 to 330
500	60	423 to 447
400	70	543 to 562
300	80	655 to 680
100 max.	90	735

62. As a check for flat spots, return the stop plate against its minimum stop and steadily increase the throttle valve angle until fully open ; there should be a correspondingly progressive increase in flow throughout the range.

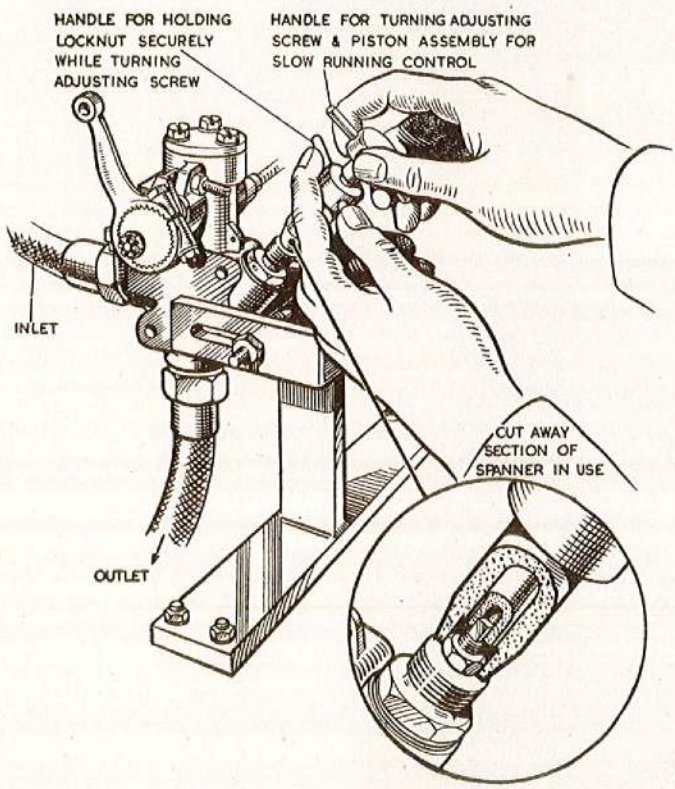


Fig. 11. View showing use of special adjusting spanner T.154353 for adjusting the slow-running screw and piston assembly

63. On completion of the flow test proceed as follows :—

Op. 1. Remove the range setting gauge and the slave stop plate.

2. Tighten the screws or nuts in the top cover.

3. Fit an existing or replacement stop plate, the operating lever complete with hub (correctly positioned), and secure the assembly with a plain washer and castellated nut.

4. If a replacement stop plate is fitted re-test the stops as described in para. 59.

5. Again check that the clearance between the top of the pinion sleeve and the adjoining stop plate face is correct.

High pressure test (external leakage)

64. Thoroughly dry the exterior of the throttle valve and raise the input pressure to 1,500 lb. per sq. in. for a period of 5 minutes. There must be no leakage during this period. Complete the drain connection by fitting the plain washers, distance piece and cap nut. In the case of the T.V.B. type an inlet pressure of 20 to 25 lb. per sq. in. must be maintained through the return to pump connection.

Solenoid insulation test

65. On units incorporating a solenoid (namely T.V.B.4 types) check the insulation resistance of the solenoid ; this should be a minimum value of 1 megohm at 500 volts.

INHIBITING

66. With the operating lever in the minimum opening position, inject flushing oil (Specification D.T.D.561) into the inlet connection until the unit is filled. Move the operating lever to lift the plunger, and allow the oil to drain from the outlet connection. Again move the operating lever into the minimum opening position, place a dust cap

on the outlet connection, and again inject flushing oil until the unit is full; operate the lever meanwhile to ensure that oil is passed round the plunger. Fit a dust cap over the inlet connection, and ensure that all remaining exposed unions are blanked off with dust caps.

PREPARATION FOR DESPATCH

Final wire-locking

67. Insert a split pin through the castellated nut and pinion to lock the operating lever, and wire-lock the stop screws and lock-nuts of the operating lever stops.

Packing

68. Throttle valves are packed in individual containers (*fig.* 11) and a copy of the test sheet is enclosed.

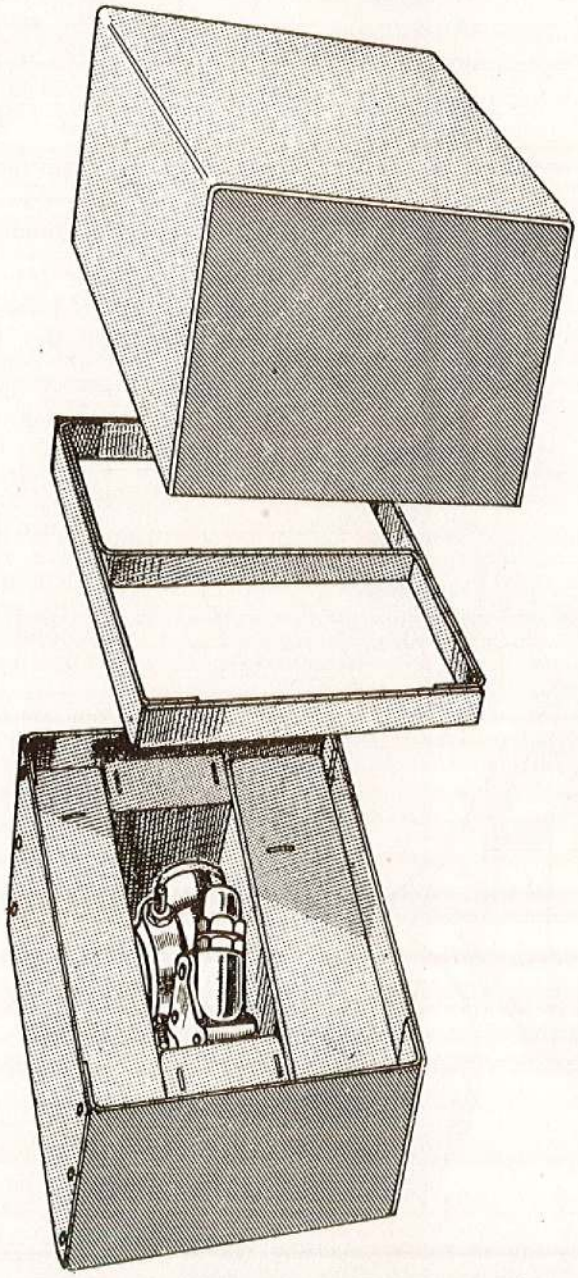


Fig. 12. View of special container for despatch