Chapter 6

ACCELERATION CONTROL AND METERING VALVE
BA. 21231 BA. 46932

LIST OF CONTENTS

APPENDIX A

Test Schedule

LIST OF ILLUSTRATIONS

Preliminary information

1. The importance of maintaining the internal cleanliness of the units at all times cannot be over emphasized, and to ensure that the parts are not contaminated with foreign matter during reconditioning, the exterior of the units should first be cleaned. Check that all orifices are effectively blanked then externally wash the units in clean kerosine.

2. The sequence of operations for dismantling and rebuilding the A.C.U. and M.V.U. must be strictly adhered to, otherwise damage to parts may result, this applies in particular to the work necessary before the separation of the air pressure diaphragm casing and the half-ball valve housing is possible.

Special tools

3.

HW.15840	Bench fixture
HW.16053	Adapter, for attaching valve housing to HW.15840
HW.30376	Vice block, for fuel pressure diaphragm assembly
HW.30377	Vice block, for air pressure diaphragm assembly
HW.30378	Special tool, for fuel strainer
HW.15317	Vice block, for rocker lever assembly (pre-Mod. 217)
HW.16478	Gauge, for selecting air pressure diaphragm adjusting plate
HW.30373	Gauge (not go) checking diameter of fuel pressure
HW.30374	Gauge (go) diaphragm
HW.30375	Special tool, for half-ball valve orifice plate
HW.11469	Withdrawing tool, for metering valve sleeve
HW.15310	Withdrawing tool, for by-pass valve sleeve
HW.15311	Spring compressing tool, for removing and fitting collet to metering valve
HW.15312	Spring compressing tool, for removing and fitting collet to by-pass valve
GT.6965	Vice block, for assembling rocker lever (post-Mod. 217)

DISMANTLING THE A.C.U.

4. Attach the unit to the fixture HW.15840 fitted with the adapter plate HW.16053.

Fuel pressure diaphragm assembly

5. Position the unit with the appropriate assembly uppermost and proceed as follows. Unlock and remove the $\frac{1}{4}$ in. capnut, washer, locknut and second washer from the spring adjusting screw. Unscrew the adjusting screw then the spring housing and remove the spring carrier and the pressure drop spring. Unscrew the 2 B.A. nuts, plain and grover washers and remove the diaphragm housing. Remove the centre piece then withdraw the diaphragm and sleeve assembly from the sandwich piece, and the sandwich piece from the valve housing; a hide mallet may be used with moderation to break the joint. From the sandwich piece remove the plunger, plunger seal and the two locating dowels.

6. Remove the stabilizing diaphragm from the auto-bleed sleeve by detaching it from the button on the end of the fuel pressure diaphragm bolt. Withdraw the fuel pressure diaphragm assembly from the auto-bleed sleeve and secure it in the fixture HW.30376. Withdraw the split pin and slacken off the diaphragm retaining nut (*fig.* 3), remove the assembly from the fixture and separate the nut, clamping collar, diaphragm and bolt.

Air pressure diaphragm assembly

7. Remove the $\frac{1}{4}$ in. capnut, washer, locknut and second washer from the spring adjusting screw. Unscrew the adjusting screw to release the spring pressure, then unscrew the 2 B.A. nuts, plain and grover washers and lift off the diaphragm casing cover.

8. Remove the spring carrier, spring air pressure diaphragm assembly and adjusting plate; on pre-Mod. 772 units, remove the steel ring from the recess in the cover.

9. Unlock and unscrew the $\frac{1}{4}$ in. capnut, washer, locknut, second washer and rocker lever stop screw from the base of the diaphragm casing.

10. Place the air pressure diaphragm assembly in the vice block HW.30377. Withdraw the split pin securing the $\frac{5}{16}$ in. castellated nut, unscrew the nut and separate the clamping collar, diaphragm and centre pin.

Diaphragm casing and valve housing

11. Unscrew the 2 B.A. nuts, plain and grover washers securing the diaphragm casing to the valve housing. Separate the

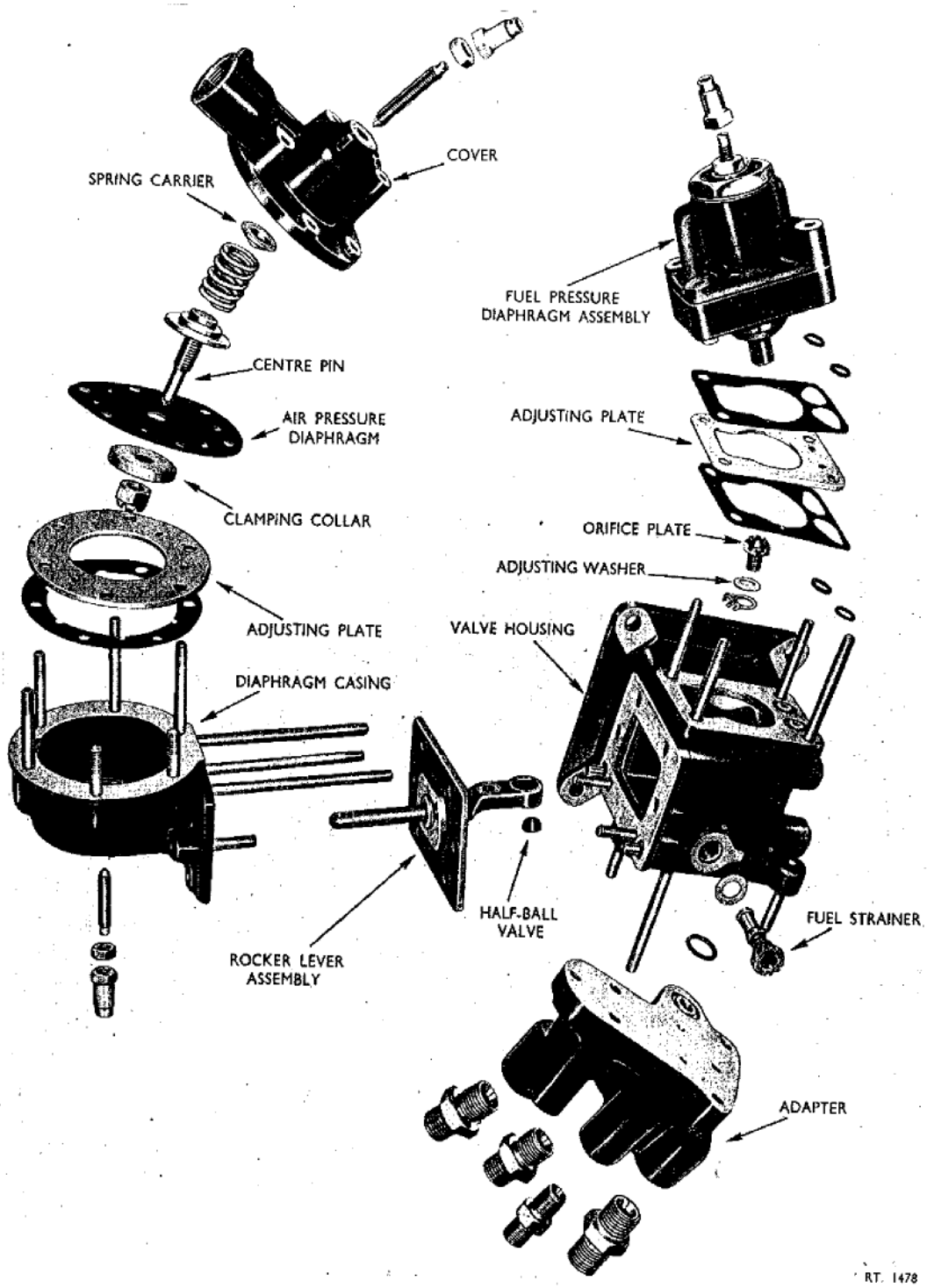

Fig. 1. Exploded view of A.C.U.

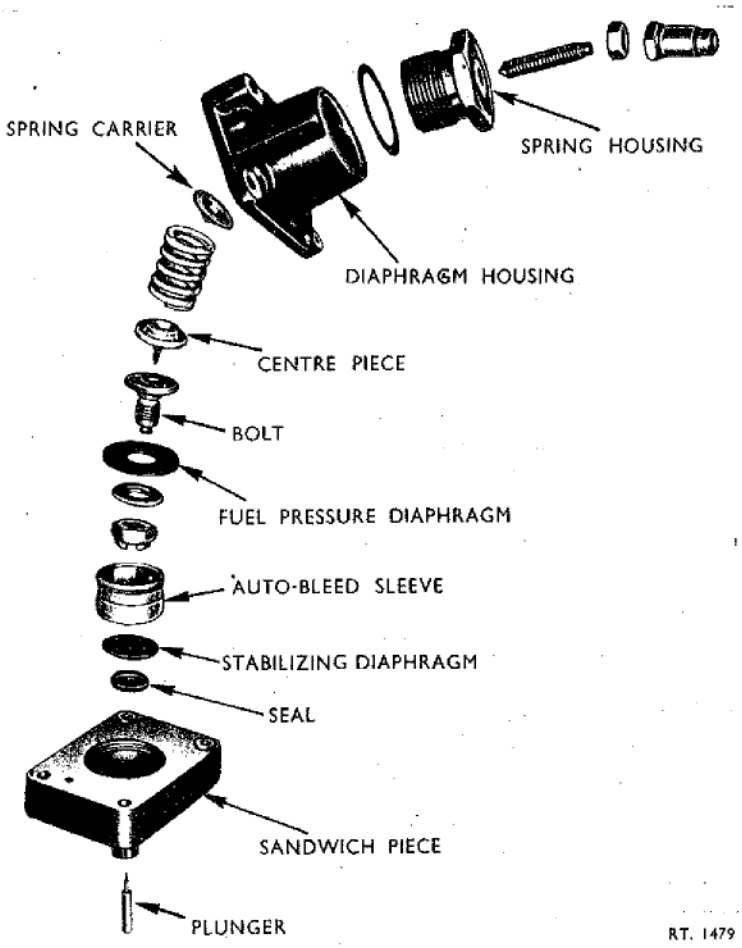

Fig. 2. Exploded view of fuel pressure diaphragm assembly

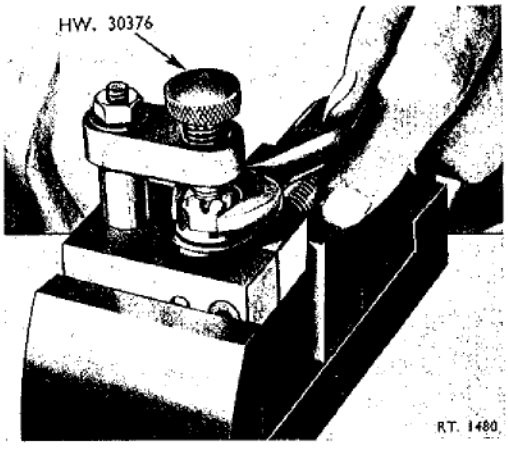

Fig. 3. Dismantling the fuel pressure diaphragm

casing and the housing then remove the rocker lever assembly and the half-ball valve.

12. Bend back the locking tabs and using the spanner HW.30375 unscrew the orifice plate and remove the adjusting washer and tabwasher.

13. Using the tool HW.30378, unscrew the slotted capnut and withdraw the fuel strainer assembly from the valve housing.

14. Invert the valve housing on the bench fixture. Unscrew the fuel connections from the adapter then unscrew the 2 B.A. nuts plain and grover washers and remove the adapter from the base of the valve housing.

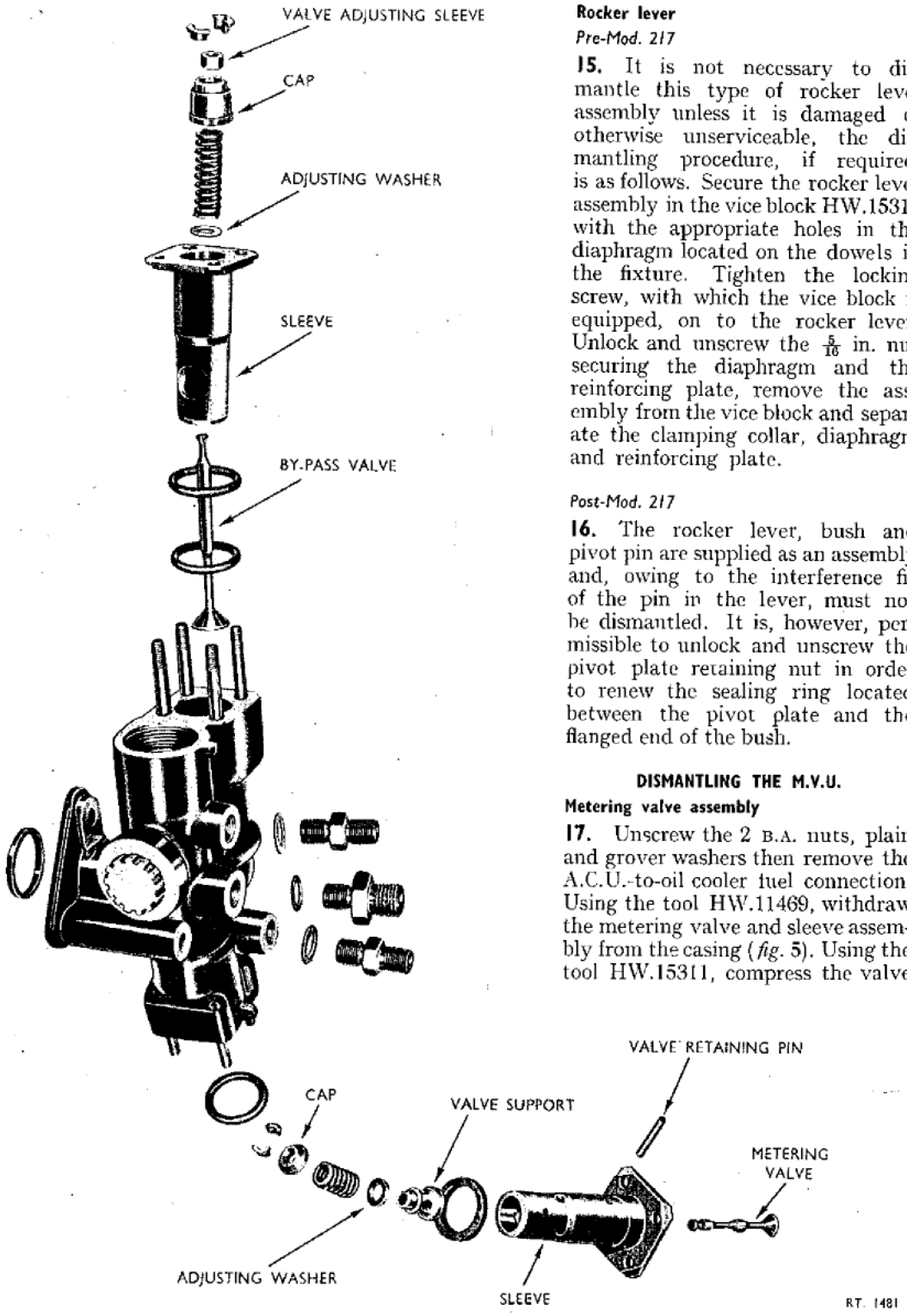

Fig. 4. Exploded view of metering valve unit

Rocker lever

Pre-Mod. 217

15. It is not necessary to dismantle this type of rocker lever assembly unless it is damaged or otherwise unserviceable, the dismantling procedure, if required, is as follows. Secure the rocker lever assembly in the vice block HW.15317 with the appropriate holes in the diaphragm located on the dowels in the fixture. Tighten the locking screw, with which the vice block is equipped, on to the rocker lever. Unlock and unscrew the $\frac{5}{16}$ in. nut securing the diaphragm and the reinforcing plate, remove the assembly from the vice block and separate the clamping collar, diaphragm and reinforcing plate.

Post-Mod. 217

16. The rocker lever, bush and pivot pin are supplied as an assembly and, owing to the interference fit of the pin in the lever, must not be dismantled. It is, however, permissible to unlock and unscrew the pivot plate retaining nut in order to renew the sealing ring located between the pivot plate and the flanged end of the bush.

DISMANTLING THE M.V.U.

Metering valve assembly

17. Unscrew the 2 B.A. nuts, plain and grover washers then remove the A.C.U.-to-oil cooler fuel connection. Using the tool HW.11469, withdraw the metering valve and sleeve assembly from the casing (*fig.* 5). Using the tool HW.15311, compress the valve

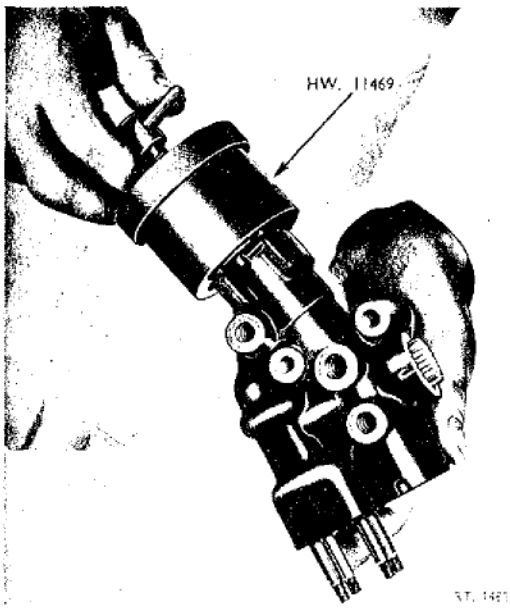

Fig. 5. Withdrawing metering valve assembly

spring and remove the split collet, release the spring pressure, push out the valve retaining pin then separate the spring retaining cap, spring, adjusting washer, valve support, valve sleeve and valve.

By-pass valve assembly

18. Unscrew the 2 B.A. nuts, plain and Grovet washers then remove the by-pass valve housing cover. Using the tool HW. 15310, withdraw the by-pass valve and sleeve assembly from the casing. Using the tool HW.15312, compress the valve spring (*fig.* 6) and remove the split collet, release the spring pressure and separate the adjusting washer, spring retaining cap, spring, valve sleeve and valve.

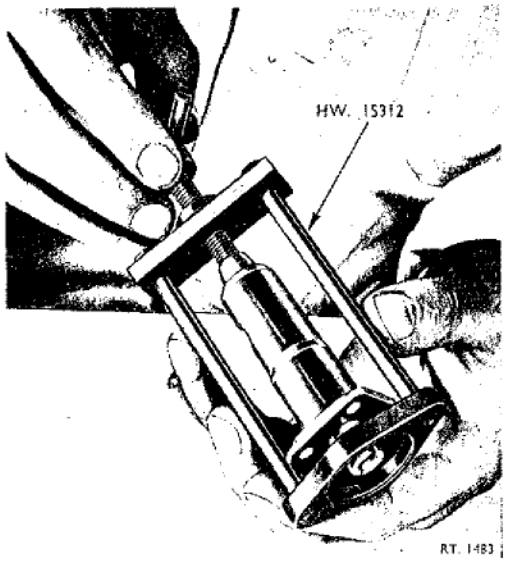

Fig. 6. Compressing by-pass valve spring

CLEANING

19. The A.C.U. and the M.V.U. will normally be clean internally and it is most important to maintain this condition. The work bench must be scrupulously clean and to facilitate this it should be covered with zinc sheeting or linoleum. A clean container in which to put the parts will also be required. All parts must be thoroughly cleaned and washed before re-assembling; a kerosine bath and spray gun is recommended for this purpose. No hard brushes or abrasives of any kind must be used. After washing, all parts must be dried by compressed air; rag must not be used for this purpose.

INSPECTION

General

20. All parts made redundant by the embodiment of modification must be rejected during inspection.

21. The following parts must be discarded during dismantling irrespective of their condition.

Joint washers

Rubber seals and sealing rings

Tabwashers

Locking wire and aluminium washers

22. Two inspectional checks are common to all parts of the unit. Firstly, the visual inspection for obvious signs of damage, and secondly, as all internal parts are in contact with kerosine, the inspection of parts for corrosion. Damage or excessive corrosion will entail the rejection of the part or parts, very slight corrosion may be acceptable but this will depend on the location of the affected surface and must be left to the discretion of the inspector.

23. Parts which are subjected to wear must be dimensionally checked and must be within the limits specified in the Schedule of Fits and Clearances and Repair Tolerances, A.P.4282D, Vol. 6, Part 3, Sect. 3.

24. Visually examine the casings for corrosion, cracks and damage, paying particular attention to joint faces and spigots. Check that all studs are in good condition. Check the fuel passages for obstruction and damage. Ensure that all locking-wire holes are unbroken.

25. Examine all springs for cracks, corrosion and distortion. Test the loading of each spring in accordance with Vol. 6, Part 3.

26. Signs of deterioration or flaking of the plating on any part will render it unserviceable and a replacement must be fitted. The rejected part must be sent for re-plating.

Rocker lever assembly

27. Inspect the assembly generally for damage and distortion. Examine the half-ball valve seat, operating plunger seating face and air diaphragm pin seating for undue wear; slight indentation or scoring may be removed by polishing, but if excessive, lapping of the affected area will be necessary or, if this is not practicable, the rejection of the part.

28. On pre-Mod. 217 assemblies, check that there is no deterioration on the rubberised surface of the diaphragm or indentations at the outer edges; if either or both of these defects are apparent the diaphragm must be rejected.

Valves

29. Inspect the metering and by-pass valves and valve seats for damage, scoring and corrosion. Check the valve stems for distortion and ensure that the bearing surface of each stem is blended to the remainder of the stem. Valves or valve seats which are deeply scored must be rejected. Check that the half-ball valve is undamaged and is optically flat on the one side, and that it moves freely in the rocker lever socket. Examine the orifice plate body for cracks and damage and ensure that its seat is optically flat. Inspect the bores in the metering and by-pass valve sleeves for fretting; this may be removed by polishing.

Fuel pressure diaphragm assembly

30. Examine the parts for corrosion and damage. Inspect the operating plunger for fretting and belling of the small end, check the large end for undue wear and scoring; slight score marks may be removed by polishing.

31. Examine the contact button on the end of the diaphragm bolt for excessive indentations, and the bore of the bolt for scoring or corrosion, polish the button and the bore if necessary.

Air pressure diaphragm assembly

32. Examine all parts for damage. Check the diaphragm centre piece for distortion, and ensure that the end which makes contact with the rocker lever is in good condition, polish if necessary.

Remaining details

33. Examine the fuel strainer for broken wires and distortion; such defects entail rejection of the strainer. Examine the adjusting screws and locking nuts for stretched threads; this is a common defect on the air and fuel diaphragms adjusting screws and when apparent, replacements must be fitted. Ensure that the conical seatings, threads and hexagon flats of the unions are in good condition. The conical seatings must be in a condition which will ensure a perfect seal with the pipe nipple.

REPAIR

34. The repair of the A.C.U. and the M.V.U. is mainly effected by the renewal of unserviceable parts. Before fitting a new part, ensure that it bears the correct part number, that it is in good condition and fits correctly.

35. Studs should not be removed unless they are damaged or loose. When fitting a new stud, if the required interference fit cannot be obtained by fitting one of the same part number and nominal diameter, an oversize stud may be fitted. For detailed instructions reference should be made to A.R.S.59 and 60 in A.P.4321, Vol. 6, Part 2.

ASSEMBLING THE A.C.U.

Rocker lever

36. If it has been necessary to strip the pre-Mod. 217 type rocker lever or partially strip the Mod. 217 type rocker lever, the assembling procedure is as follows.

Pre-Mod. 217

37. Fit the diaphragm then the reinforcing plate to the vice block HW.15317, locating the appropriate holes in the diaphragm and reinforcing plate on the dowels in the vice block. Pass the rocker lever through the hole in the centre of the diaphragm and reinforcing

(A.L.19, Mar. 57)

plate. Tighten the vice block clamping screw down on to the rocker lever, thereby holding it in the correct relative position to the diaphragm. Pass the clamping collar, chamfered face first, over the rocker lever and locate it on the square section of the lever. Secure the assembly with the castellated $\frac{5}{16}$ in. nut and align the locking holes. Do not fit the split pin at this stage.

Post-Mod. 217

38. Secure the rocker lever in the vice block GT.6965. Fit a new sealing ring, the pivot plate, tabwasher and retaining nut onto the rocker lever from the half-ball valve end. Position each part on the bush with the appropriate holes in the pivot plate and joint washer located on the dowels in the vice block. Fully tighten the retaining nut, but do not lock it at this stage.

Leakage test

39. The following leakage test must be made on rocker lever assemblies. It is recommended that a B.P.C. slave valve housing, with the top cover fitted and all ports with the exception of one blanked, as used for the diaphragm leakage test on B.P.C. rocker levers, be used for this test.

40. Remove the rocker lever assembly from the vice block and fit it to the slave valve housing. Place a suitable metal sealing plate over the diaphragm or pivot plate; in the latter case, a new joint washer must be fitted to each side of the plate. Secure the sealing plate to the valve housing with 2 B.A. nuts, bolts and washers. Connect an air line to the open port and apply an air pressure of 40 lb. per sq. in. with the unit immersed in kerosine. Any leakage must be rectified and the test repeated. On the satisfactory completion of the test, lock the diaphragm or pivot plate retaining nut by respectively, fitting a new split pin, or, bending up the locking tabs.

Half-ball valve pre-load setting

41. This check is to ensure that the setting of the half-ball valve, relative to the orifice plate face, gives the required 'nip' as specified in Vol. 6, Part 3, Sect. 3.

Pre-Mod. 217

42. To check the setting the three measurements listed below and illustrated in fig. 7 must be obtained.

A = Distance from joint faces to orifice face.

B = Combined thickness of rocker lever and half-ball valve.

C = Distance from joint face to end of rocker lever in free set position i.e. the position in which the diaphragm holds the rocker lever.

43. Attach the valve housing to the bench fixture HW.15840 fitted with the adapter plate HW.16053. With the single tab already bent down to fit in the slot in the casting and the remaining tabs bent up slightly, fit the orifice plate tabwasher into the base of the valve housing. Fit two adjusting washers of a combined thickness of 0·040 in. to the rear face of the orifice plate. Using the tool HW.30375, screw the orifice plate into the base of the valve housing and fully tighten, but do not lock at this stage. Using a micrometer depth gauge, obtain and record measurement (A).

44. Place the half-ball valve into its seating in the rocker lever and, using a micrometer, obtain and record measurement (B).

45. Fit the rocker lever to the valve housing, omitting the half-ball valve. Fit the air

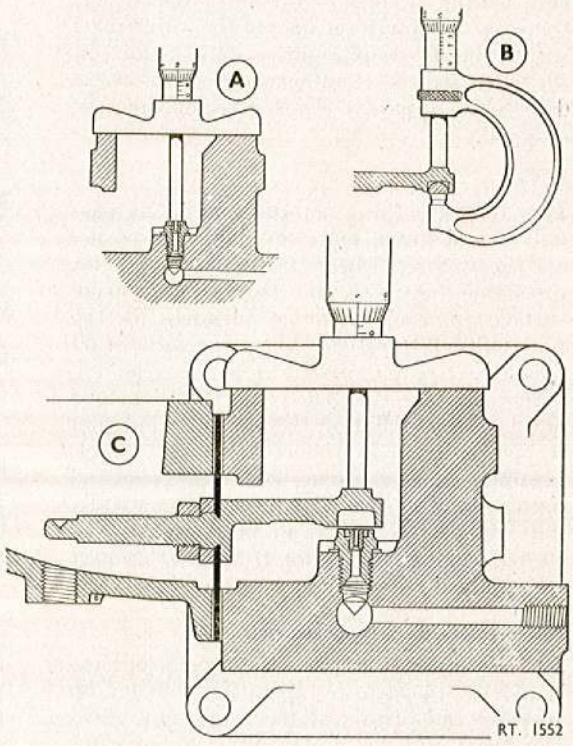

Fig. 7. Method of checking half-ball valve setting (pre-Mod. 217)

diaphragm casing to the valve housing and temporarily secure it with two 2 B.A. nuts, plain and grover washers. Using a micrometer depth gauge, obtain and record measurement (C).

46. To calculate the pre-load, add reading (B) to reading (C) and subtract reading (A). Adjustment is made by the addition or removal of orifice plate adjusting washers, the maximum combined thickness of which must not exceed 0·050 in.

47. On completion of the check, separate the air diaphragm casing and the valve housing and remove the rocker lever. Fit the half-ball valve into the seat in the rocker lever. Bend up the locking tabs to secure the orifice plate, then re-assemble the rocker lever and the air diaphragm casing to the valve housing. Secure the casing with the complete set of 2 B.A. nuts, plain and grover washers.

Post-Mod. 217

48. Attach the valve housing to the bench fixture HW.15840 fitted with the adapter plate HW.16053. With a new joint washer fitted on each side of the pivot plate, fit the rocker lever to the valve housing omitting the half-ball valve and the orifice plate. Temporarily secure the air diaphragm casing to the valve housing with two 2 B.A. nuts, plain and grover washers.

49. Using the micrometer depth gauge, measure the distance from the joint face of the valve housing to the seating face on the rocker lever, first with the lever in the 'up' position and then in the 'down' position as shown in fig. 8.

50. Subtract the figure obtained in the up position from that obtained in the down position; the result is the full movement of the rocker lever. Add half of this figure to the measurement obtained in the up position; this is dimension A and is equivalent to the neutral position of the rocker lever. Record this dimension for future reference.

51. Remove the air diaphragm casing and the rocker lever from the valve housing.

(1) With the single tab already bent down to fit in the slot in the casting and the remaining tabs bent slightly, fit the orifice plate tabwasher into the base of the valve housing.

(2) Fit two new adjusting washers of a combined thickness of 0·040 in. to the rear face of the orifice plate and, using the tool HW.30375, screw the orifice plate into the base of the valve housing. Tighten, but do not lock it at this stage.

(3) Fit the half-ball valve into its seating in the rocker lever, then re-assemble the rocker lever and the air diaphragm casing to the valve housing.

(4) Screw the stop screw into the base of the housing until it is in contact with the lever and the half-ball valve is held on the orifice under very light load.

(5) With the micrometer depth gauge positioned as before, measure the distance from the joint face of the valve housing to the face on the rocker lever and call this figure dimension B.

(6) Subtract B from the dimension A previously obtained, and the result will be equal to the pre-load setting of the half-ball valve; this must be within the limits given in Vol. 6, Part 3.

(7) Adjustment is made by the addition or removal of orifice plate adjusting washers,

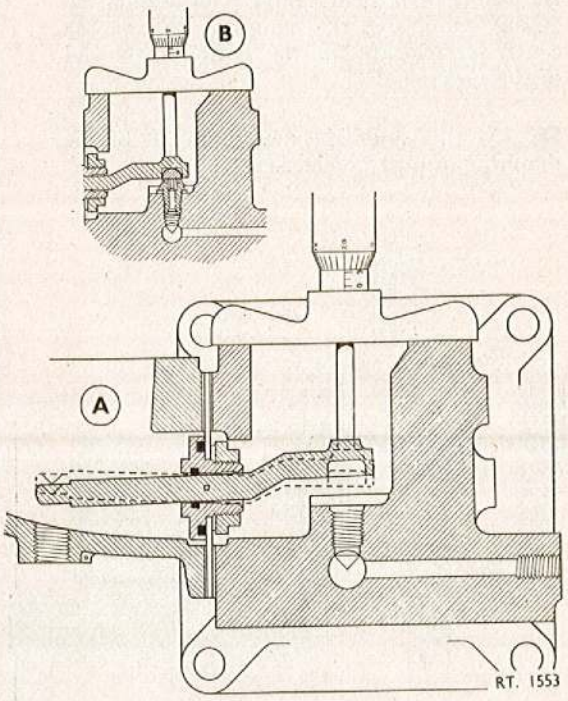

Fig. 8. Method of checking half-ball valve setting (post-Mod. 217)

(A.L.19, Mar. 57)

the maximum combined thickness of which must not exceed 0·050 in.

52. On completion of the check, unscrew the stop screw in the base of the air diaphragm casing a few turns and remove the casing and the rocker lever from the valve housing. Bend up the locking tabs to secure the orifice plate then, with the half-ball valve in position, re-assemble the rocker lever and the air diaphragm casing to the valve housing. Secure the casing with the complete set of 2 B.A. nuts, plain and grover washers.

Air pressure diaphragm assembly

53. Place the centre piece in the vice block HW.30377. Fit the diaphragm then the clamping collar on to the centre piece and secure the assembly with the castellated $\frac{5}{16}$ in. nut and a new split pin.

54. Screw in the rocker lever stop screw until it is in contact with the rocker lever, and the half-ball valve is held on the orifice plate under very light load.

55. Place a new joint washer then the adjusting plate on to the joint face on the casing. Lower the diaphragm assembly into the casing with the diaphragm located on the casing studs and the coniform end of the centre piece located on the seating in the end of the rocker lever.

56. At this stage the maximum lift of the diaphragm must be checked.

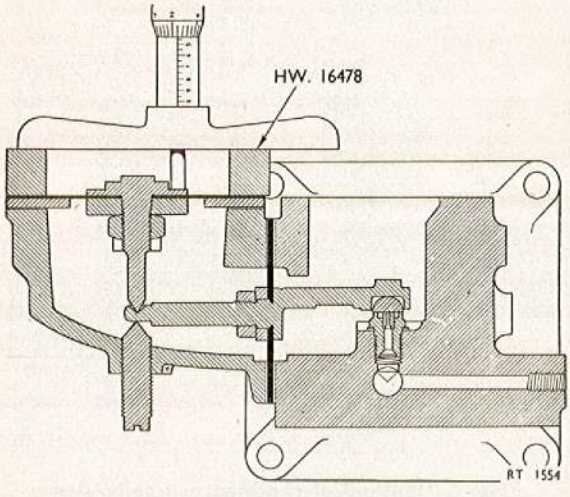

Fig. 9. Checking air pressure diaphragm lift

(1) Place the checking gauge HW.16478 over the air pressure diaphragm and secure it with suitable distance pieces and two 2 B.A. nuts.

(2) Using a micrometer depth gauge placed on the top face of the gauge, measure the distance to the flange on the centre piece (*fig.* 9) at four diagonally opposite positions. The four measurements must be within 0·010 in. of each other to enable the unit to conform to rig test requirements; if they do not it will be necessary to replace the diaphragm or diaphragm assembly until the measurements are satisfactory.

(3) Record the average reading of the four measurements and subtract this from the thickness of the gauge (0·50 in.), the resulting figure being equal to the projection of the flange above the air diaphragm.

(4) Subtract this figure from the thickness of the steel ring which fits into the casing cover on pre-Mod. 772 units or, the corresponding depth of the recess in the casing cover on post-Mod. 772 units. The final figure obtained is equal to the maximum lift of the diaphragm and must conform to the limits specified in Vol. 6, Part 3.

(5) Adjustment is made by selection of the adjusting plate from the range provided.

57. To complete the build of the air pressure diaphragm assembly proceed as follows. Remove the gauge HW.16478. Place the spring carrier on one end of the diaphragm spring and locate the other end of the spring on the centre piece. On pre-Mod. 772 units, fit the steel ring into the casing cover. Screw the spring adjusting screw into the casing cover until the pointed end projects about $\frac{1}{4}$ in. internally. With the end of the adjusting screw located in the centre of the spring carrier, fit the cover to the casing and secure it with the 2 B.A. nuts, plain and grover washers. Turn the stop screw in the base of the casing out a few turns then fit the locknut and capnut to the stop screw and the spring adjusting screw.

Fuel pressure diaphragm assembly

58. Fit two new sealing rings into the grooves encircling the fuel passages in the joint face of the valve housing. Next fit a joint washer, the adjusting plate and a second joint washer; ensure that the holes in the plate and washers are adjacent to the fuel passages in the housing.

59. Measure and record the length of the small end of the plunger, i.e. from the end of the plunger to the first shoulder; this measurement is required for the plunger projection check.

60. Insert the plunger into the sandwich piece then fit the seal, flat face uppermost, to the small end; although it will be necessary to remove the seal again, it will, at this stage, prevent the plunger from slipping out of the sandwich piece when this is fitted. Fit two new sealing rings into the grooves encircling the fuel passages in the sandwich piece flange. Insert the locating dowels into the appropriate holes in the flange, then fit the sandwich piece to the valve housing, taking care to locate the fuel passages in the flange adjacent to those in the housing. Temporarily secure the assembly with distance pieces and 2 B.A. puts.

61. At this stage the projection of the plunger must be checked i.e. the distance the first shoulder of the plunger projects above the well-base of the sandwich piece. Remove the seal from the small end of the plunger and press the plunger down to ensure that it is seated correctly on the rocker lever. Using a micrometer depth gauge placed on the top face of the sandwich piece, first measure the distance to the well-base of the sandwich piece then the distance to the end of the plunger. Subtract the second reading from the first then subtract the length of the small end of the plunger from the result. The figure obtained is equal to the projection of the shoulder and this must conform to the limits given in Vol. 6, Part 3. Adjustment is made by fitting a thicker or thinner adjusting plate from the range provided.

62. Fit the fuel pressure diaphragm, recessed face uppermost, and the clamping collar, chamfered face uppermost, to the bolt. Screw on the castellated $\frac{5}{16}$ in. nut and secure the assembly in the vice block HW.30376. Tighten the nut, aligning the split-pin hole in the bolt with two of the slots in the nut. Do not fit the split pin at this stage.

63. Using the 'Go' and 'Not Go' gauges HW.30373 and HW.30374, check that the diameter of the diaphragm is within the limits specified in Vol. 6, Part 3. If the diameter of the diaphragm does not conform to the limits, it must be rejected and a replacement fitted and checked; this procedure must be repeated until a diaphragm of acceptable diameter is obtained. On completion of the check, lock the nut with a new split pin.

64. Insert the diaphragm bolt into the auto-bleed sleeve with the end of the sleeve containing the bleed hole adjacent to the diaphragm. Attach the stabilizing diaphragm, chamfered face uppermost, to the contact button on the end of the bolt and press the periphery of the diaphragm into the bore of the sleeve until it is in contact with the spigot.

65. Fit the seal to the small end of the plunger, then insert the fuel pressure diaphragm assembly into the sandwich piece. Fit a new sealing ring into the groove encircling the fuel passage in the joint face of the diaphragm housing, then fit the housing on to the sandwich piece, positioning the appropriate holes on the two locating dowels. Lower the centre piece into the diaphragm housing with the pointed section located in the central bore of the bolt. Insert the spring into the housing and locate it on the centre piece. Place the spring carrier on the upper end of the spring. Screw the adjusting screw into the spring housing until the pointed end projects about $\frac{1}{4}$ in. internally then, with a new sealing washer fitted, screw the spring housing into the diaphragm housing, the pointed end of the adjusting screw locating in the centre of the spring carrier. Fully tighten the spring housing and screw the locknut and capnut, finger-tight, on to the adjusting screw.

Fuel strainer

66. With a new sealing washer fitted, and using the special spanner HW.30378, screw the fuel strainer assembly into the valve housing and tighten it.

Fuel connection adapter

67. Invert the unit on the bench fixture. Fit new sealing rings to the fuel passages in the joint faces of the valve housing and the adapter. Fit the adapter to the valve housing and secure it with the 2 B.A. nuts, plain and grover washers. With new sealing washers fitted, screw the unions into the threaded bosses on the adapter and tighten them.

ASSEMBLING THE M.V.U.

Metering valve assembly

68. Insert the valve into the flanged end of the sleeve until the valve face and the valve seating are in contact. Hold the valve in position by placing a finger on the face of the valve head, then insert the valve support, adjusting washer, spring, and with the chamfered face uppermost, the cap. Using the tool HW.15311, compress the valve spring and insert the split collet into the groove under the valve stem head. Unscrew the tool and at the same time ensure that the two halves of the collet are equally-spaced and correctly located. Fit the valve retaining pin. Fit two new sealing rings, one over the sleeve and adajcent to the flange and one into the groove mid-way down the bore in the valve housing. With the unequally spaced holes in the flange aligned to receive the casing studs, press the valve assembly into the valve housing. Fit a new sealing ring into the groove in the joint face of the inlet connection and secure the connection to the casing with the 2 B.A. nuts, plain and grover washers.

By-pass valve assembly

69. Insert the valve into the end of the sleeve not equipped with a flange. Hold the valve in position by placing a finger on the face of the valve head then insert the adjusting washer and spring into the flanged end of the sleeve and over the valve stem. Insert the valve adjusting sleeve into the small diameter end of the cap then place the cap, with the sleeved end uppermost, on the end of the spring. Using the tool HW.15312, compress the spring and insert the split collet into the groove under the end of the valve stem head. Unscrew the tool and at the same time ensure that the two halves of the collet are equally-spaced and correctly located. Fit two new sealing rings, one over the sleeve and adjacent to the flange and the other into the groove mid-way down the bore in the valve housing. With the unequally-spaced holes in the flange aligned to receive the casing studs, press the valve assembly into the housing. Fit a new sealing ring into the groove in the joint face of the valve housing cover, then secure the cover to the casing with the 2 B.A. nuts, plain and grover washers.

70. With new sealing washers fitted, screw the three unions into the threaded bosses on the side of the casing and tighten them.

TEST PROCEDURE

General

71. The data required for the complete rig test of the A.C.U. and the M.V.U. is contained in the test schedule (Appendix A) at the end of this chapter. The units are to be fitted to the approved test rig.

72. The A.C.U. and the M.V.U. must be tested as a pair in conjunction with two 'GB' size Lucas fuel pumps or one 'GC' size fuel pump. A test certificate is to be compiled recording performance during final calibration, and must include graphs of both the 'metering and by-pass valves' and the 'A.C.U. with metering and by-pass valves' performances. The test certificate and the units are to be approved by an inspector provided the performance is within the required limits.

73. It should be noted that the fuel pump speeds quoted in the schedule refer to 'GB' size pumps only. If a 'GC' size pump is used it must be run at a speed to give the equivalent conditions obtained when using 'GB' size pumps.

Calibration of metering and by-pass valves

74. After setting the metering valve pretension to give the required pressure drop at the fuel flow specified, set up to point (b) conditions then complete three cycles, varying the fuel flow over the range given at point (c) conditions, leaving the back pressure restrictor set.

75. Run at point (d) conditions and calibrate both valves together in the metering block. Record the pressure drop across the valves at each flow, both up and down the range of flow quoted in the schedule.

Half-ball valve seating check

76. The half-ball valve assembly must be checked for leakage as detailed in the schedule. At point (a) conditions, air leakage will be indicated by a drop in pressure on the air pressure gauge.

Fuel flow setting

77. The fuel flow setting is to be made as detailed in the schedule. It should be noted that the fuel flow setting for this particular test is dependent on the type of rig fuel pump in use.

Leakage tests

78. Run the fuel pumps and, by adjustment to the variable restrictor, obtain the back pressure specified at point (a) conditions in the schedule. Check the A.C.U. and the M.V.U. for leakage, paying particular attention to joint faces, unions and blanking plugs. Any leakage must be rectified.

79. A hand pump capable of producing the pressure specified at point (b) conditions should be used for the leakage test on the pump delivery and metered fuel passages in the A.C.U. To avoid damaging the fuel diaphragm it is of the utmost importance that an equal pressure be applied to each side of the diaphragm at all times, the two passages must, therefore, be piped to a common outlet on the hand pump.

Pressure sensitivity check

80. The pressure sensitivity of the unit must be checked by noting the change in flow when the back pressure is varied as specified in the schedule. The pressure sensitivity must fall within the limits specified, if it does not it will be necessary to remove the fuel diaphragm for examination. If the diaphragm is damaged or distorted it must be rejected and a replacement fitted.

Maximum flow check

81. Check the maximum flow at the conditions specified in the schedule.

Calibration check-ascending and descending

82. Make three complete calibrations at the conditions specified in the schedule, ascending condition being detailed at points (a) and (b) and descending conditions at point (c).

83. During the calibration it is of the utmost importance that accurate settings of P2 are made. If overshooting occurs on ascending or undershooting on descending, the calibration will be valueless and must be repeated correctly. The unit must not be tapped and the checks must be made exactly as described. If the back pressure does not fall when the P2 pressure is decreased by $2\frac{1}{2}$ lb./sq.in. at any part of the specified range the unit must be rejected.

Endurance test

84. Before commencing the endurance test the A.C.U. and M.V.U. calibrations must be within the limits previously quoted. After the endurance test, but prior to stripping the units for inspection, a complete set of calibrations must be made on both units. This ensures that any deterioration during the endurance test is noted and can be investigated.

Final calibration

85. Repeat the test specified in the schedule. Units which are rejected during any of these tests must be completely re-calibrated after rectification.

Appendix A

TEST SCHEDULE

ACCELERATION CONTROL UNIT AND METERING VALVE UNIT

Fuel:—D.Eng.R.D.2482

Fuel temperature:—15 to 25 deg. C. (59 to 77 deg. F.)

Test	Fuel flow (Imp.gall./hr.)	Back pressure (lb./sq.in.)	Pressure drop (lb./sq.in.)	Remarks
1.	Calibration of metering and by-pass valves			
(a)	175 to 185		100	Set metering valve spring pre-tension by shim adjustment to give pressure drop at flow quoted.
(b)	800 min.	1,250		Carry out 3 cycles varying fuel flow over range given in Test (c), leaving back pressure restrictor set.
(c)	100 to 800	1,250		
(d)	100	250	66 to 70	Pressure drop limits quoted apply to the 'up' line only. Between 100 and 300 g.p.h., the 'up' and 'down' lines must be within 3 lb./sq. in. of each other. By pass valve slope need not be parallel to slope of unit lines but hysteresis above 300 g.p.h. must not exceed 10 lb./sq. in. Using the 'Combined metering and by-pass valve calibration graph' fig. 1, plot flow/pressure drop to ascertain 'kink' point i.e. point at which by-pass valve opens. By adjustment to by-pass valve spring shims set 'kink' point to between 240 and 260 g.p.h. If any waviness or deviation from true slope of graph when plotting flow/pressure drop is found, denoting stiction of the valves, the unit should be rejected.
	150	250	86½ to 90½	
	200	250	107 to 111	
	225	250	117 to 121	
	250	250	125 to 131	
	300	250	127 to 137	
	400	250	133 to 143	
	500	250	139 to 149	
	600	250	145 to 155	
	700	250	151 to 161	
	800	250	157 to 167	

Acceleration control unit and metering valve unit—*continued*

Test	Pump speed (r.p.m.)	Fuel flow (Imp.gall./hr.)	Back pressure (lb./sq.in.)	P.2 air pressure (lb./sq.in.)	Remarks
	P.2. = Air pressure acting on the air diaphragm. Throughout the tests the fuel inlet pressure is to be 10 to 15 lb./sq.in.				
2.	Half-ball valve seating check.				
(a)	—	—	—	100	Check that there are no air leaks across pivot diaphragm assembly into low pressure fuel compartment.
(b)	Apply a fuel pressure of 1,000 lb./sq.in. to servo pressure tapping and inspect for leakage from pump return connection.				No leakage permissible over a period of 3 minutes.
3.	Fuel flow setting.				
(a)	—	150	250	5	With pressure drop screw set $\frac{1}{2}$ turn from coil-bound, adjust P.2 screw to give flow at conditions quoted, when using 2 'GB' size pumps. If 1 'GC' size pump is used flow should be 130 g.p.h. at these conditions.
(b)	—	100	250	5	With flow set as quoted, screw up backstop until flow starts to rise then screw back $1\frac{1}{2}$ turns.
4	Leakage tests.				
(a)	Pressure test A.C.U. with metering block at 1,800 lb./sq.in. back pressure. No external leakage is permissible.				These leakage tests must be repeated if the unit is stripped.
(b)	Pressure test pump delivery and metered fuel passages in the A.C.U. only, at 2,500 lb./sq.in. No leakage is permitted.				

Acceleration control unit and metering valve unit—*continued*

Test	Pump speed (r.p.m.)	Fuel flow (Imp.gall./hr.)	Back pressure (lb./sq.in.)	P.2 air pressure (lb./sq.in.)	Remarks
5.	Pressure sensitivity check.				
(a)		As Test 3	250	5	With unit running at point (a) conditions increase back pressure to point (b) figure and record change in flow. Maximum permissible variation from flow as set in Test 3 is +10 to− 3 g.p.h. Reduce back pressure to point (a) figure (not below), then increase again to point (b) figure and record flow. Repeat this cycle 3 times.
(b)			1,250	5	
6.	Maximum flow check at 100 lb./sq.in. P.2 pressure				
(a)		900	1,000	As reqd.	Apply sufficient P.2 pressure to give point (a) flow. then slowly increase P.2 pressure to point (b) figure and check flow. No decrease in flow is permitted at point (b) P.2 pressure.
(b)			1,000	100	
(c)	max.		1,250	75 min.	Apply P.2 pressure and set back pressure restrictor to figure given at point (c). Carry out 3 cycles varying P.2 pressure from point (d) to point (c) figure, leaving back pressure restrictor set.
(d)	max.		1,250	zero	
7.	Calibration check, ascending and descending.				
(a)	5,000		250	zero	Adjust back pressure to figure quoted, hold for 30 seconds to stabilize, and record flow. Reduce back pressure to zero, apply 2½ lb./sq.in. P.2 pressure, reset back pressure, hold for 30 sec. to stabilize, and record flow. Continue this sequence in 2½ lb./sq.in. steps over the range given, as follows:—Reduce back pressure to zero, increase P.2 to next check point, re-adjust back pressure, allow 30 sec. to stabilize, record flow. After recording flow at 17½ lb./sq.in. increase P.2 pressure to point (b) value, with back pressure setting valve fully open.
	5,000		250	2½	
	5,000		250	5	
	5,000		250	7½	
	5,000		250	10	
	5,000		250	12½	
	5,000		250	15	
	5,000		250	17½	
(b)	5,000			75 min. 110 max.	

Acceleration control unit and metering valve unit—*continued*

Test	Pump speed (r.p.m.)	Fuel flow (Imp.gall./hr.)	Back pressure (lb./sq.in.)	P.2 air pressure (lb./sq.in.)	Remarks
(c)	5,000		250	17½	Reduce P.2. pressure to figure quoted, re-adjust back pressure hold for 30 sec. to stabilize and record flow. Reduce P.2. pressure to next check point re-set back pressure, allow 30 sec. to stabilize and record flow. Continue this sequence down to zero P.2. pressure, recording flow after 30 sec. for stabilization at each check point. If back pressure does not fall when P.2. pressure is reduced by 2½ lb./sq.in. at any part of the range, the unit should be rejected.
	5,000		250	15	
	5,000		250	12½	
	5,000		250	10	
	5,000		250	7½	
	5,000		250	5	
	5,000		250	2½	
	5,000		250	zero	
	Up to the 'kink' point, i.e. by-pass valve opening, maximum variation in flow between any of the three ascending flows at the same check point must not exceed 8 g.p.h., and must not exceed 15 g.p.h. between any pair of ascending and descending flows. Using 'A.C.U. with metering and by-pass valve calibration graph' fig. 2, plot flow/P.2. pressure to check that correct slope has been obtained. If any waviness or deviation from true slope of graph is found the unit should be rejected.				
8.	Endurance test.				
(a)	5,000		1,250	75 to 110	With unit set as in point (a) make 2 complete cycles per minute for 2 hours, varying P.2. pressure from point (b) to point (a) and back. Units rebuild after 100% strip for inspection and/or repair should be given 1 hour only.
(b)	5,000		1,250	zero	
Final calibration.					
9.	Metering and by-pass valve assembly.				Repeat calibration as in Test 1 points (b), (c) and (d). If calibration falls outside stipulated limits, valve springs must be reset. If the adjustment exceeds 20 g.p.h. at any given pressure drop, a further 1 hour endurance test must be made. Final results must be recorded.

Acceleration control unit and metering valve unit—*continued*

Test	Pump speed (r.p.m.)	Fuel flow (Imp.gall./hr.)	Back pressure (lb./sq.in.)	P.2 air pressure (lb./sq.in.)	Remarks
10.	Acceleration control unit with metering block.				
(a)		Fuel flow setting			As a result of endurance test it may be necessary to re-adjust P.2. settings as in Test 3 complete.
(b)		Leakage test.			Repeat Test 2 complete.
(c)		Pressure sensitivity check.			Repeat Test 5 complete, and record results.
(d)		Maximum flow check.			Repeat Test 6 complete, and record results.
(e)		Calibration check, ascending and descending.			Repeat Test 7 complete, and record results.

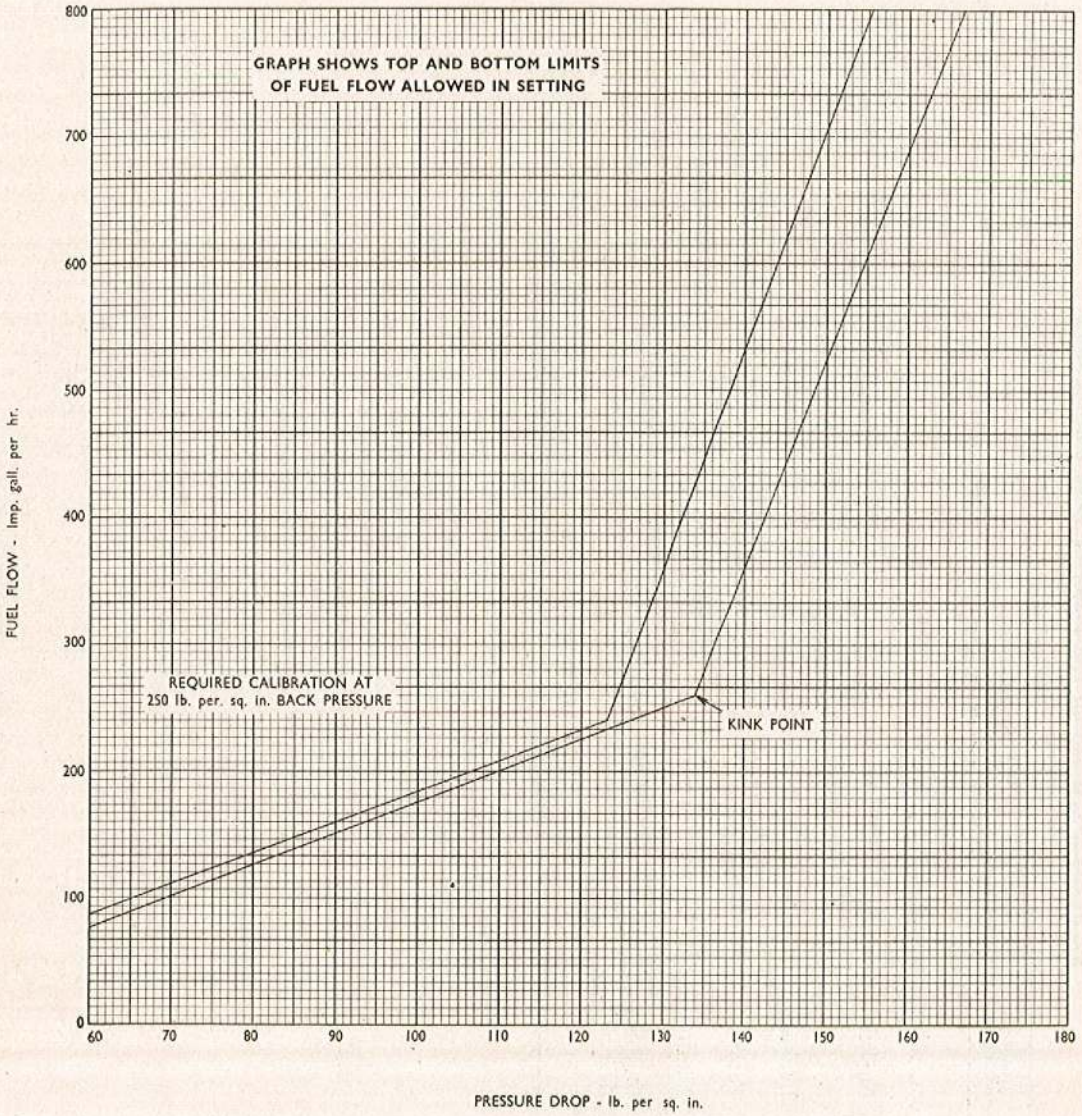

Fig. 1. Combined metering and by-pass valve calibration graph

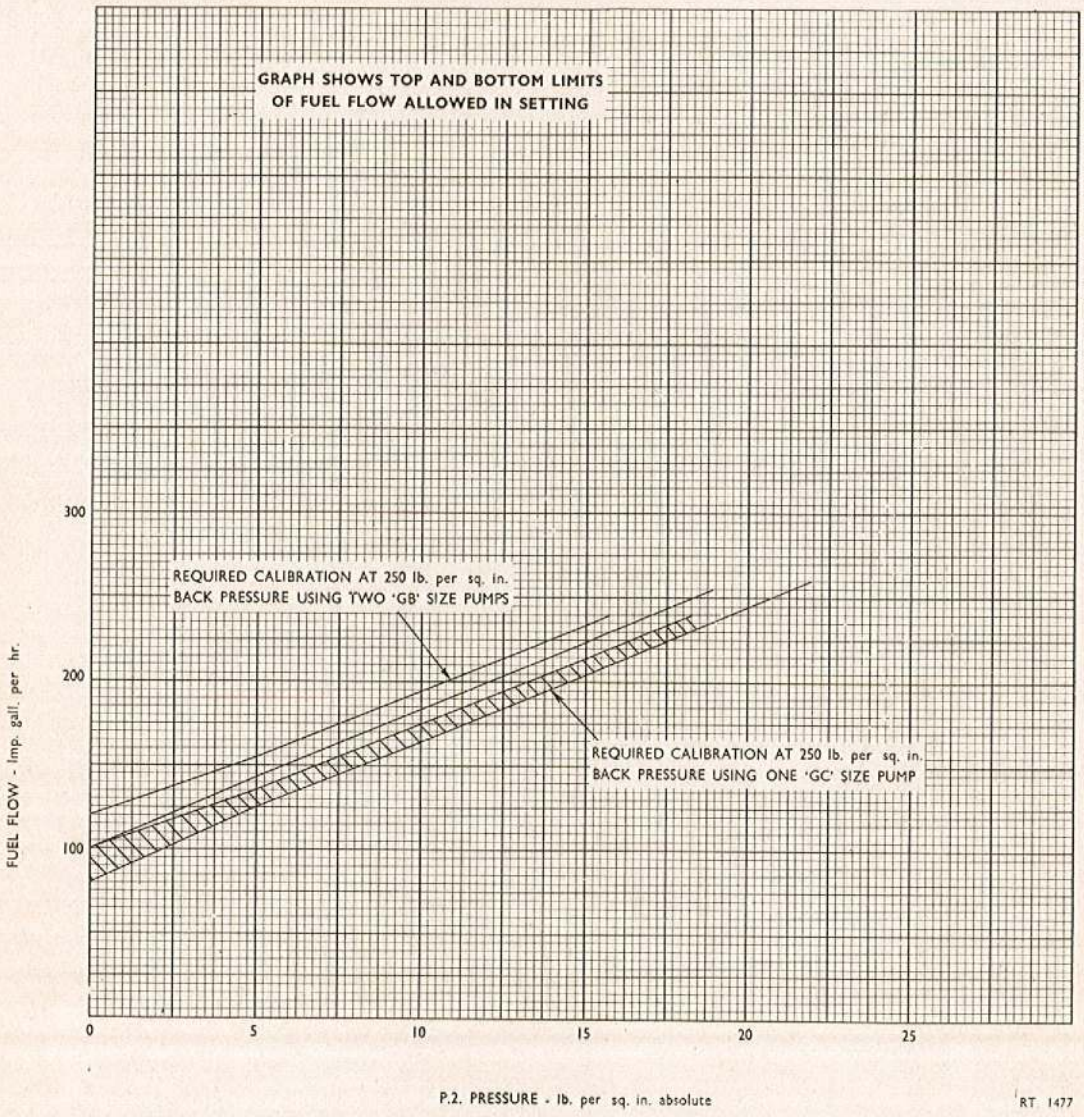

Fig. 2. A.C.U. with combined metering and by-pass calibration graph

P27268 177313/1299 5/57 1750 C & P Gp. 1