

Chapter 2

ACCUMULATOR (FLUID) TYPES A.2/1A, A.2/2A

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GENERAL

1. The A.2/1A type accumulator unit, a dismantled view of which is given in fig. 1, derives its designation from the basic type A.2, the installation code number 1 and the calibration code letter A. Accumulator units of this type are fitted to de Havilland Goblin Mk. 2 engines. The A.2/2A accumulator is identical to the type A.2/1A with the exception that the top cover drain connection is as shown inset in fig. 1 and the inlet elbow is omitted. Type A.2/2A accumulators are fitted to the Goblin Mk. 3 engines.

2. During the repair of the accumulator unit, it is essential that all parts are kept clean. All components must be stored in

suitable containers, thus reducing the possibility 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 the section Replacements (*para.* 35).

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.

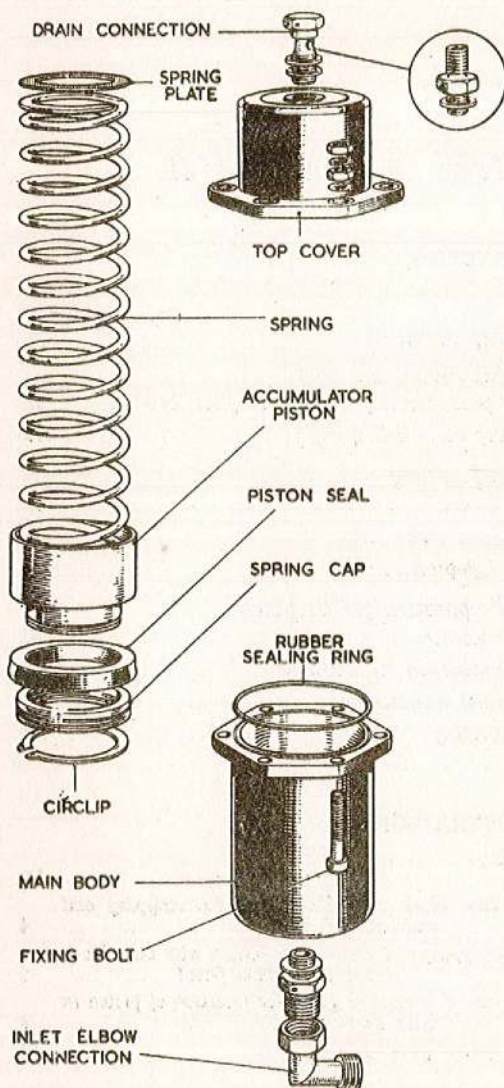


Fig. 1. Dismantled view of accumulator units, Type A2/1A and A2/2A. (The type A2/2A unit has straight unions, the upper one is shown inset, and the inset elbow is omitted)

SPECIAL TOOLS

5. Special tools and a test rig are required for the repair and overhaul of the accumulator unit. The tools required are listed below, and fully dimensioned drawings are given in fig. 2 and 4 for the tools which are to be manufactured locally. It should be noted that the assembling, dismantling jig, the protective guide and indicator rod bush and locking ring are the same as those described in Chapter 1 of this section. When using the assembling and dismantling jig, it will be necessary to use in conjunction with it the V guide and base illustrated in fig. 4.

*Provisioned
Part No.
R.44
Manufactured
Locally*

*Nomenclature
Test rig*

Nomenclature

Assembling and Dismantling fixture for piston assembly. Base block and side pillars for assembling and dismantling fixture.

Protective guide, for insertion of piston assembly in cylinder. Indicator rod, locking ring and bush for measuring piston travel.

CHECKS AND PRECAUTIONS BEFORE DISMANTLING

6. Study any complaints reported with the unit and carefully examine externally for any visible signs of damage or interference, e.g., broken locking wire, and check that all ports have been securely covered to prevent the entry of any foreign matter into the interior of the unit.

7. Remove the adhesive tape binding the grease-proof paper around the drain connection fitted to the top cover. Carefully remove and examine the dust cap blanking off the high-pressure elbow connection in the base of the cylinder for the presence of foreign matter, which may seriously damage the unit if checked in a dirty condition. Examine all exposed threads to ascertain whether damage has been caused in transit.

8. If the unit appears to be sound externally, carry out the following functional tests:—

- (1) Check the piston travel.
- (2) Check the charge and discharge pressures.

Checking the piston travel

Note . . .

The indicator rod illustrated in fig. 2 must be used for checking the piston travel of this type accumulator. The indicator rod bush and locking ring are the same as those shown in Chapter 1 of this section.

9. Remove the installation connections comprising the banjo bolt or straight unions and joint washers from the top cover, and the high-pressure elbow comprising elbow, union nut, union and joint washer from the base of the main body.

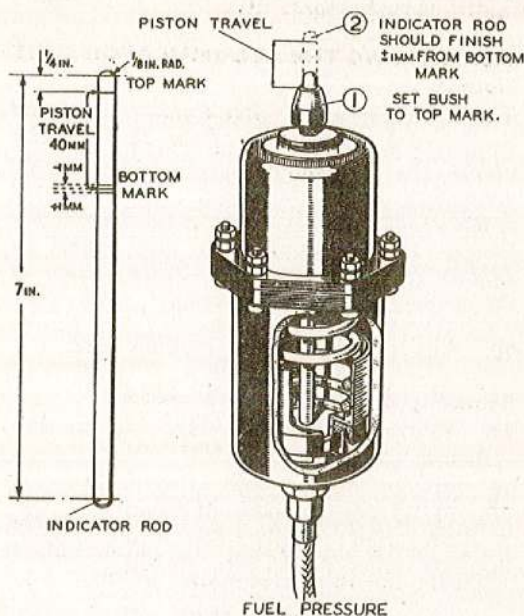


Fig. 2. Indicator rod and view of piston travel check

10. Mount the unit on the rig and connect up as shown in fig. 2 and 3. Screw the indicator rod bush together with locking ring a few threads into the top cover. Ensure that the accumulator piston is at the bottom of its stroke, lower the indicator rod, with its graduations uppermost, through the bush into the unit, until the lower end rests inside the accumulator piston. Raise or lower the bush by turning either counter-clockwise or clockwise until its top face is in alignment with the upper graduation on the rod. Lock bush by screwing the ring nut on the cover.

11. Gradually increase the inlet pressure to allow the piston to rise in its cylinder until it reaches the top of its stroke, at which point the indicator rod should rise to the third graduation down from the top. The distance between the first and third graduations is 40 mm. and represents the stroke of the piston, which should be within the permissible tolerance of ± 1 mm. of this reading.

12. A piston stroke in excess of 41 mm. may occur if the abutment on the cover, which forms the piston stop, wears during service. Slight excess piston travel is permissible providing the stop is not too badly worn or damaged, in which case the

cover must be replaced. In the event of the piston stroke being too short a new accumulator spring must be fitted and the stroke of the piston rechecked.

13. Similarly check the stroke of the piston in the reverse direction.

Checking the charge and discharge pressures

14. With the unit mounted on the rig as for the previous test, adjust the inlet pressure to approximately 15 lb. per sq. in. Increase the inlet pressure steadily and note carefully the pressure at which the accumulator commences to charge, namely, when the piston commences to move upwards; this can be observed by noting the pressure on the gauge as the indicator rod just commences to rise. This point is known as "A" and the inlet pressure observed should be between 25 and 30 lb. per sq. in.

15. Continue to increase the inlet pressure until the accumulator is fully charged, namely, when the piston has just completed its upward stroke, which will be denoted by the indicator rod ceasing to move upwards; this point is known as "B." Observe the pressure on the gauge at this point which must be between 38 and 45 lb. per sq. in.

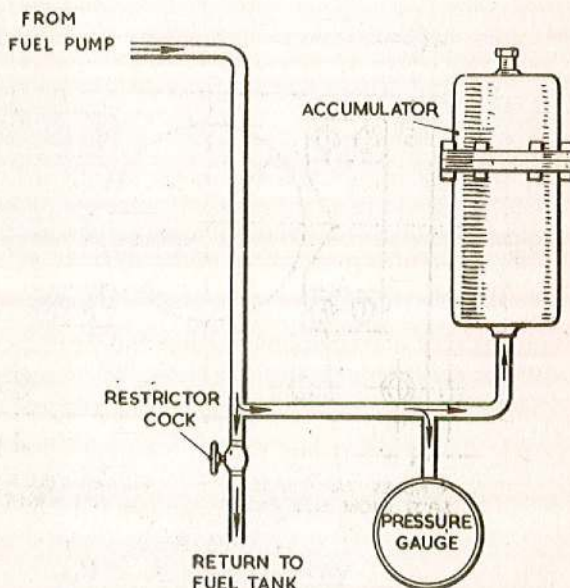


Fig. 3. Diagrammatic layout of test rig

16. Steadily decrease the inlet pressure until the accumulator commences to discharge, that is, when the piston and indicator rod begin to move back; this point is known as "C." The pressure observed must be within 8 lb. per sq. in. of that obtained at "B."

Note . . .

If the difference between the readings observed on the upward stroke and the readings observed on the downward stroke of the piston is too great, check the piston seal to ensure that it is not sticking to the cylinder wall and examine the cylinder and piston for foreign matter and the spring for faults.

17. Continue to reduce the inlet pressure until the accumulator is just fully discharged, that is, when the piston has completed its stroke and the indicator rod comes to rest. The inlet pressure at this point ("D") must be within 8 lb. per sq. in. of that recorded at "A." If this figure

is exceeded, check for sticking piston or faulty spring (para. 16).

DISMANTLING THE ACCUMULATOR UNIT
Note . . .

The top cover of the accumulator must not be loosened or removed from the cylinder unless the accumulator is installed in the assembling and dismantling fixture and the centre spindle firmly screwed down on to the cover. Failure to do this may result in serious damage, due to the sudden release of the strong accumulator spring.

18. Cut and remove all locking wire.

Removing the installation connections

19. Remove the drain connection as described in para. 9.

20. Remove the inlet elbow connection as described in para. 9 and dismantle the assembly by unscrewing the union nut to separate the inlet elbow and union.

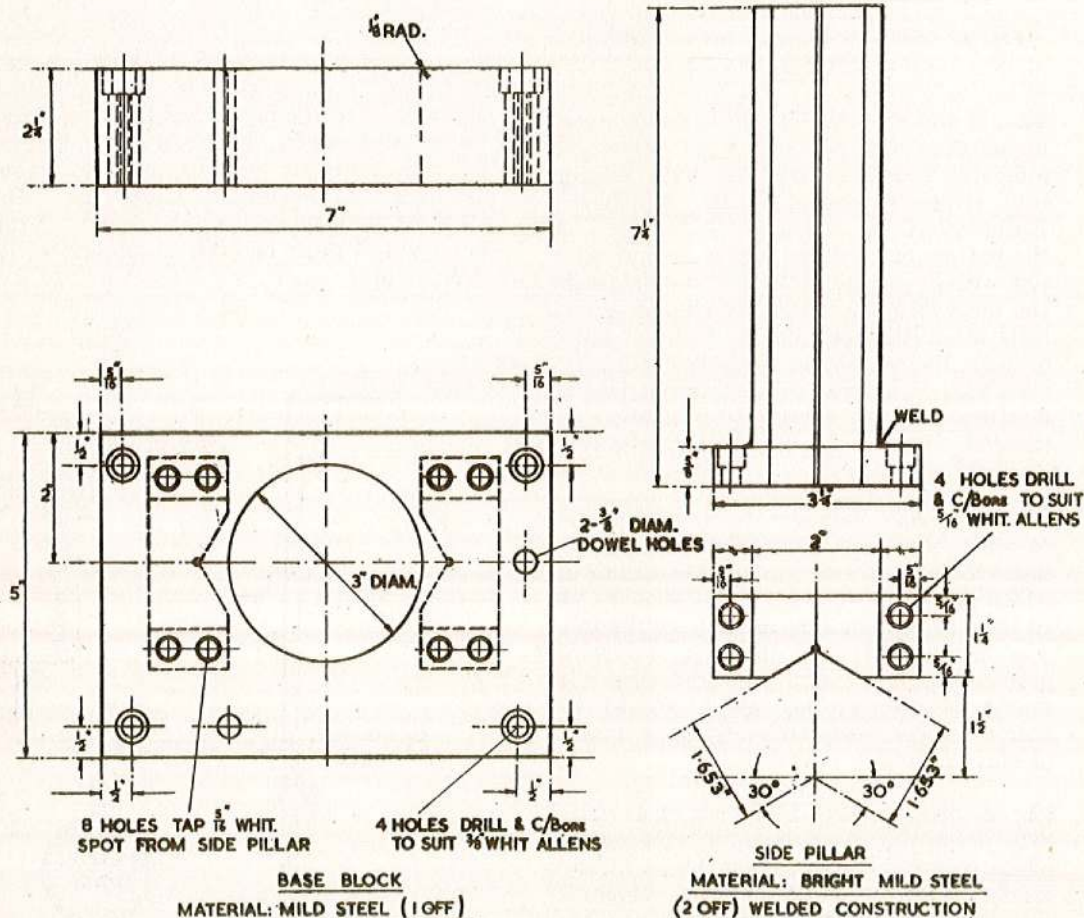


FIG. 4 BASE BLOCK AND SIDE PILLARS FOR STRIPPING AND ASSEMBLING FIXTURE

Top cover, spring and piston assembly

21. The dismantling and assembling jig, illustrated and described in Chapter 1 of this section, is used for stripping the accumulator. In addition to this jig, the base block and side pillar assembly (fig. 4 and 5) is required to locate the accumulator. This assembly is to be located on the fixture by two dowels and secured by four screws (fig. 5). The cross bar of the fixture will have to be removed when inserting and removing the accumulator. Unscrew the centre spindle of the jig and place the stand in position, place the accumulator in the stand, with the main body downwards, ensuring that the centre spindle of the jig is aligned with the central boss in the main body, and the corners of the flange correctly located with the V-shaped recesses in the locating pillars. Screw down the central spindle until it contacts the boss in the top cover.

22. Remove the six lock-nuts securing the top cover to the main body together with Grover washers, and remove four of the remaining six nuts, washers and fixing bolts, leaving two bolts and nuts diametrically opposite in position. Carefully ease these remaining two nuts off a little at a time, correspondingly lifting the central spindle by unscrewing the wheel on the top of the fixture but still taking the load of the spring with the centre spindle. Remove the two nuts and unscrew the centre spindle until the spring is fully extended to its free length, at the same time steadying the cover by hand. Remove cross bar, lift out the top cover, spring plate and spring. Then remove the main body together with the accumulator piston assembly. Remove the rubber seal interposed between the jointing flanges of the top cover and main body.

23. Invert the main body and carefully push the accumulator piston assembly into the hand by applying pressure to the piston with a length of rod through the hole in

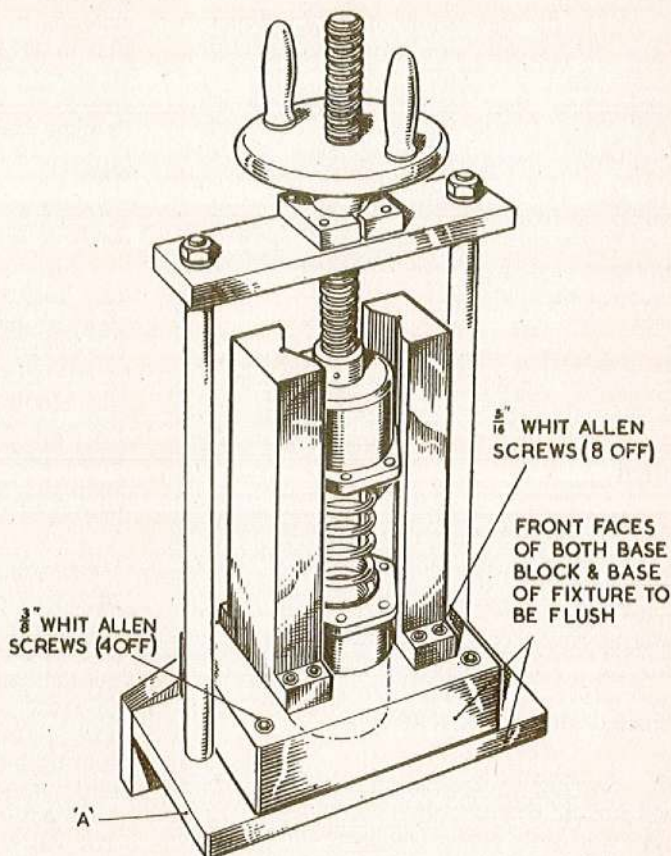


Fig. 5. Stripping and assembling fixture with base block and side pillars fitted

the base of the main body. Spring open the circlip from the groove in the piston, and remove the circlip, spring cap and seal from the piston.

CLEANING

24. To facilitate cleaning, the bench upon which the work is to be carried out should be covered with zinc sheeting or linoleum. Containers, which must be clean and of a suitable size, must be available for storing the dismantled parts. All parts must be thoroughly washed and cleaned, for which purpose a paraffin bath having a pressure spray-gun should be used. Under no circumstances may hard brushes or abrasives be used for cleaning. Compressed air should be used for drying the parts after washing; rag must not be used for this purpose. When all parts are thoroughly clean and dry they are to be laid out ready for inspection.

INSPECTION

General

25. With the exception of detail dimensional checks, all viewing and inspection checks are described in the following paragraphs. 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.

26. Distortion checks are not normally necessary. All parts subject to wear should be checked with the Schedule of Fits and Clearances, Vol. 2, Part 2 of this Publication.

27. All parts rendered redundant by the embodiment of essential modifications must be rejected during inspection. All inspectors therefore must have available all information concerning relevant modifications. Tab-washers, split pins, gaskets and other consumable parts must be rejected during dismantling.

28. Scoring on moving parts or joint faces will impair the operational efficiency of the unit, and may cause leakage, consequently all parts concerned must be replaced; very slight surface scoring, insufficient to affect the efficiency and safety of the unit, may be permissible at the discretion of the Inspector-in-Charge.

Installation connections

29. Check the threads and flats of the banjo bolt or straight union for cleanliness and damage.

30. Examine the threads of the inlet connection, ensure that the flanged nipple of the elbow, if fitted, is undamaged. Ensure that the threads and flats of the union nut are clean and free from damage. Examine the threads of the union or adapter for cleanliness and damage and ensure that the sealing face is sound. Check that the hexagon flats are undamaged.

Top cover, spring and piston assembly

31. Ensure that the threads in the centre boss of the top cover are clean and undamaged and that the sealing faces in both centre boss and jointing flange are sound.

32. Examine the spring for corrosion and fracture. Corrosion may be removed by cleaning in paraffin or by the light application of very fine glass paper. Ensure that no sharp edges exist on the end coils of the spring. Examine the spring plate for damage and fractures.

Note . . .

The spring should be replaced if there is any doubt as to its efficiency.

33. Inspect the piston for damage and signs of pick-up likely to cause scoring of the cylinder walls. Ensure that the circlip groove in the piston is not burred and that the circlip is not distorted or damaged. Examine the spring cap for damage, sharp edges and the presence of foreign matter. Inspect the piston seal, and discard if damaged or distorted.

Main body and remaining details

34. Examine the cylinder walls for scoring and the presence of foreign matter. Ensure that the threads in the centre boss of the main body are clean and undamaged, and that the sealing faces in both centre boss and jointing flange are sound. Ensure that the threads and flats of the fixing bolts and nuts are clean and undamaged. Inspect all plain and Grover washers for fractures and distortion.

REPLACEMENTS

35. All replacement parts are interchangeable. All sealing washers must be replaced by new ones whenever the seal is disturbed, and new locking wire must always be used. New rubber sealing rings between the jointing flanges of the top cover and the main body must always be fitted. If the piston seal is distorted or damaged it must be renewed.

36. Slight wear inside the top of the top cover due to rubbing of the spring will not justify a replacement top cover.

REBUILDING THE UNIT

Cylinder casting, accumulator piston and spring

37. Ensure that all components are clean and assemble as follows:—

OP. 1. Carefully locate the piston seal on the piston, ensuring that the seal faces the correct way, i.e., the closed end of the U section of the seal against the flange of the piston.

OP. 2. Assemble the spring cap into the recess in the seal and secure both seal and cap with the circlip which fits into the groove in the piston.

3. Place the protective guide on the bench with the tapered end uppermost, and place the piston, seal uppermost, in the bore of the guide. Push the piston into the guide until the lips of the seal are flush with the end face of the guide; great care must be taken during this operation not to damage the seal. The protective guide used for this operation is the same as that described in Chapter 1 of this section.

4. Invert the cylinder casting and place the tapered end of the guide into the cylinder bore, push the piston assembly through the guide into the cylinder bore and remove the guide (fig. 6).

5. Inject lubricant (specification D.T.D.472) between the piston and bore, and reciprocate the piston by hand to ensure that it is quite free in the bore.

6. There should be 0.004 in. diametral clearance between piston and bore; test this clearance with a feeler gauge.

Top cover and spring

38. Lower the main body of the accumulator, together with piston assembly, into the fixture (fig. 5) and refit the spring, spring plate and top cover by reversing the procedure described in para. 21 and 22. It is important, when assembling, to ensure that the spring locates correctly with the recessed piston and top cover. Remove the assembled unit from the fixture.

RIG TESTING

General

39. Carefully record all test results for subsequent entry on to the test record sheet. The fuel used throughout these tests is to be paraffin to specification D.R.D.2482 latest issue; the limits of temperature to be between 20 deg. C. minimum and 26 deg. C. maximum. The fuel should be checked at regular intervals to ensure that it complies with this specification (use a hydrometer to check the specific gravity).

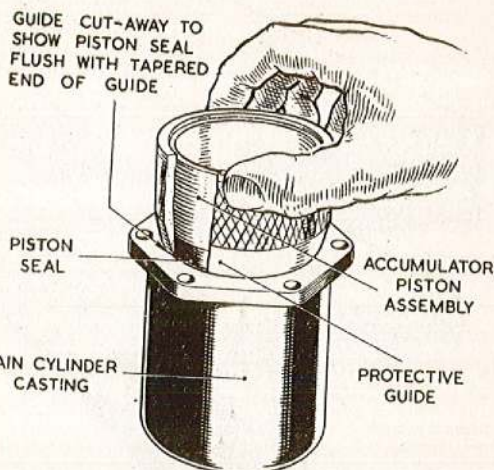


FIG.6 USE OF PROTECTIVE GUIDE FOR INSERTION OF PISTON IN MAIN BORE

Note...

Renewal of parts due to rejection during strip inspection will determine the extent to which the preliminary tests already effected must be repeated to ensure that the unit is functioning correctly.

Accumulator tests

40. Repeat the functional tests:—

- (1) Check the piston travel, and
- (2) Check the charge and discharge pressures as described in para. 8 to 17 inclusive.

High-pressure test

41. Connect the unit either to the test rig (fig. 3) or to a hand pump, and steadily increase the inlet delivery pressure until a pressure of 1,500 lb. per sq. in. is reached. This pressure is to be maintained for a minimum period of two minutes without any signs of leakage. Drop the inlet pressure quickly and ascertain that there is no leakage around the joint flanges of both top cover and main body. In the event of leakage, renew the sealing ring between these joint flanges and retest.

PREPARATION FOR DESPATCH

Inhibition

42. Inject flushing oil to specification D.T.D.44 (latest issue) both above and

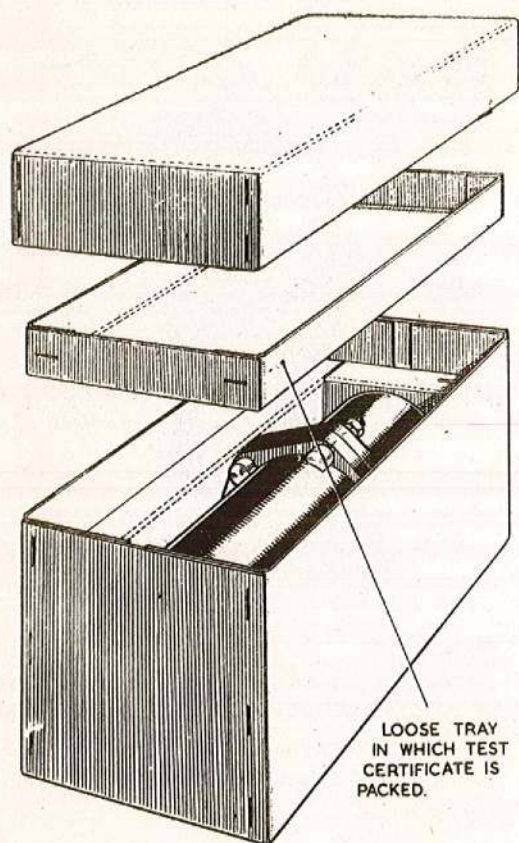


Fig. 7. Special packing box

below the accumulator piston and immediately complete and seal the installation connections as described in the following paragraph.

Installation connections

43. Insert and tighten the banjo bolt of the drain connection, complete with joint washers, into the centre boss of the top cover, and seal up this connection by wrapping in grease-proof paper and binding with adhesive tape, or if straight union is fitted seal with a dust cap.

44. To assemble the inlet elbow connection, insert and tighten the union, together with joint washer, and secure the inlet elbow to the union by means of the union nut. Seal up the inlet elbow or straight union by means of a dust cap.

Final wire-locking

45. Ensure that the unit is correctly and securely wire-locked.

Packing

46. Ensure that the test certificate is complete and satisfactory and include one typewritten copy in the special packing box (*fig. 7*) together with the unit for despatch.



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