SECTION E

CLUTCH

Section No. E.1. Description

Section No. E.2. Adjustments in vehicle

Section No. E.3. Clutch assembly

Section No. E.4. Clutch pedal

Section No. E.5. Master cylinder

Section No. E.6. Slave cylinder

Section No. E.7. Bleeding the clutch system

Section No. E.8. Fault diagnosis

Section E.1

DESCRIPTION

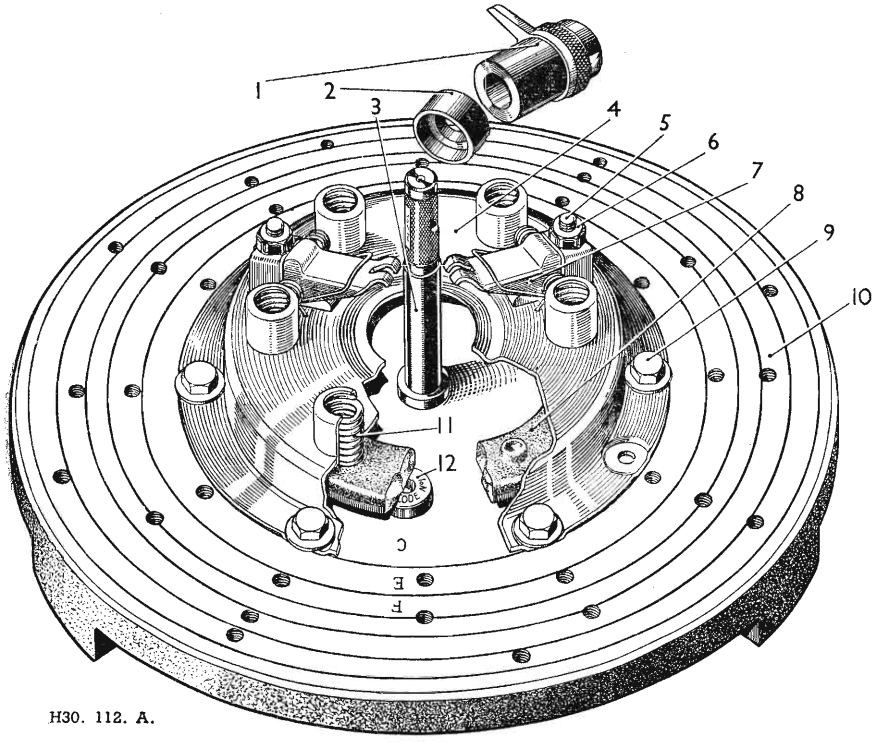
The clutch is a Borg & Beck single dry-plate-type operated hydraulically. A steel cover bolted to the flywheel encloses the driven plate, the pressure plate, the pressure springs, and the release levers. The driven plate, to which the friction linings are riveted, incorporates springs assembled around the hub to absorb power shocks and torsional vibration. The pressure springs force the pressure plate against the friction linings, gripping the driven plate between the pressure plate and the engine flywheel. When the clutch pedal is depressed, the release bearing is moved forward against the release plate which bears against the three levers Each release lever is pivoted on a floating pin, which remains stationary in the lever and rolls across a short flat portion of the enlarged hole in the eyebolt. The outer ends of the eyebolts extend through holes in the clutch cover and are fitted with adjusting nuts, by means of which each lever is located and locked in position. The outer or shorter ends of the release levers engage the pressure plate lugs by means of struts which provide knife-edge contact between the outer ends of the levers and the pressure plate lugs, so eliminating friction at this point. Pressure applied by the release bearing causes the pressure plate to be pulled away from the driven plate, compressing the pressure springs which are assembled between the pressure plate and the clutch cover. As the friction linings wear, the pressure plate moves closer to the flywheel face and the outer or shorter ends of the release levers follow. This causes the inner or longer ends of the levers to travel farther towards the gearbox and decreases the clearance between the release lever plate and the release bearing. This is automatically compensated unless the master cylinder has been disturbed.

When the clutch pedal is depressed, fluid pressure is transmitted through the master cylinder to the slave cylinder, which is mounted on the clutch housing, moving the slave cylinder piston, and push rod. As the push-rod is connected to the lower arm of the clutch withdrawal lever, thereby the clutch is released. The push rod is non-adjustable.

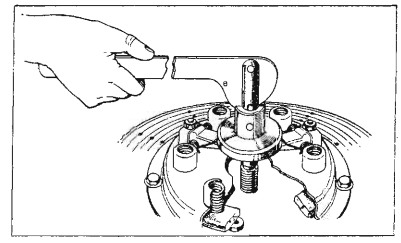
Section E.2

ADJUSTMENTS IN VEHICLE

A free movement of $\frac{5}{32}$ in. must be maintained at the clutch pedal pad. This clearance is adjusted by means of the hexagon on the master cylinder push rod.



H30. 112. A.



H30. 110. A.

Fig. E.1. Clutch assembly tool 18G 99A.

1. *Height finger.*
2. *Distance piece*
3. *Centre pillar*
4. *Clutch cover.*
5. *Shoulder stud.*
6. *Adjusting nut.*
7. *Release lever.*
8. *Pressure plate.*
9. *Setpins.*
10. *Base plate.*
11. *Thrust spring.*
12. *Spacing washer.*

Inset shows the clutch actuating mechanism in use.

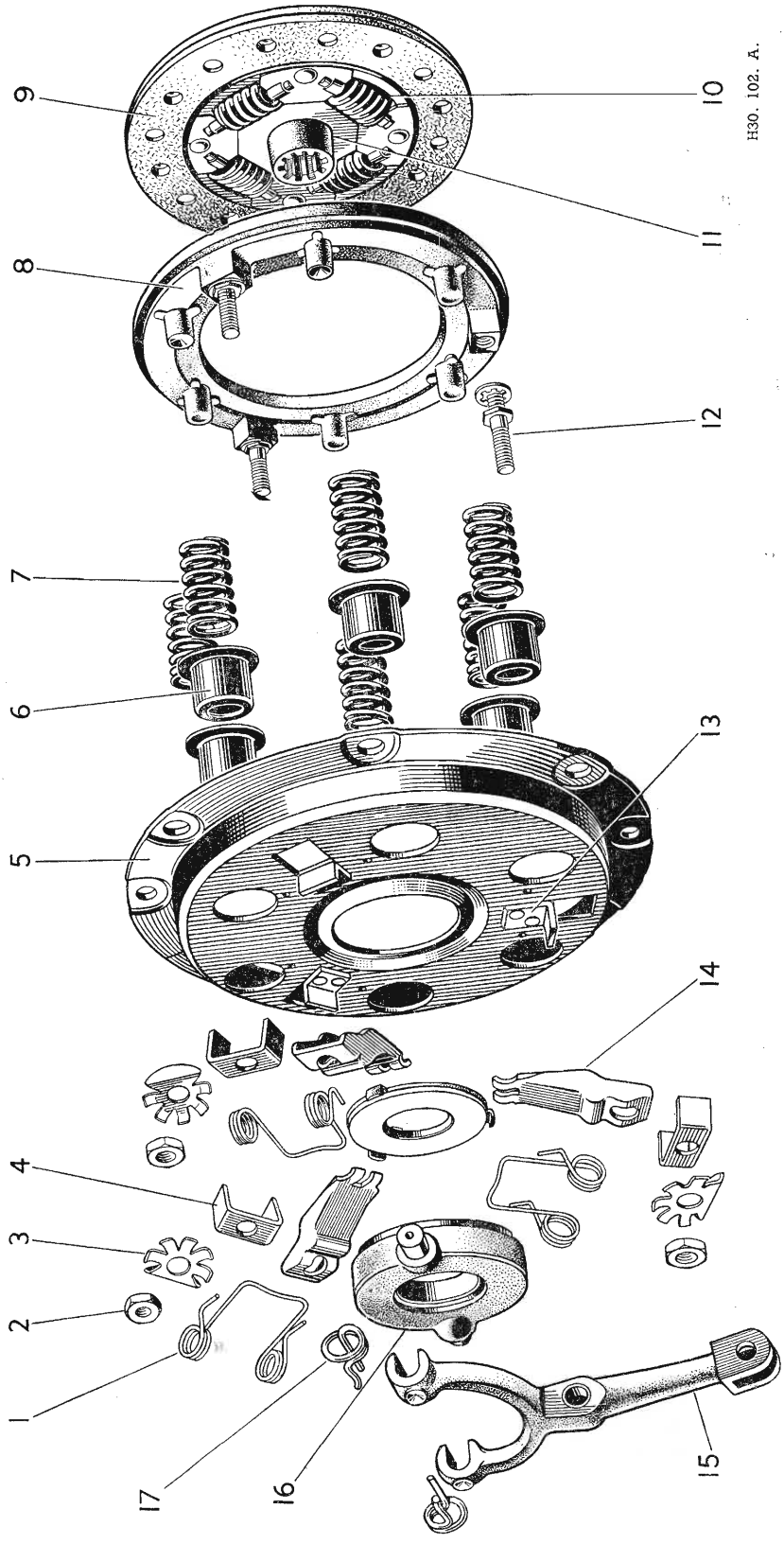
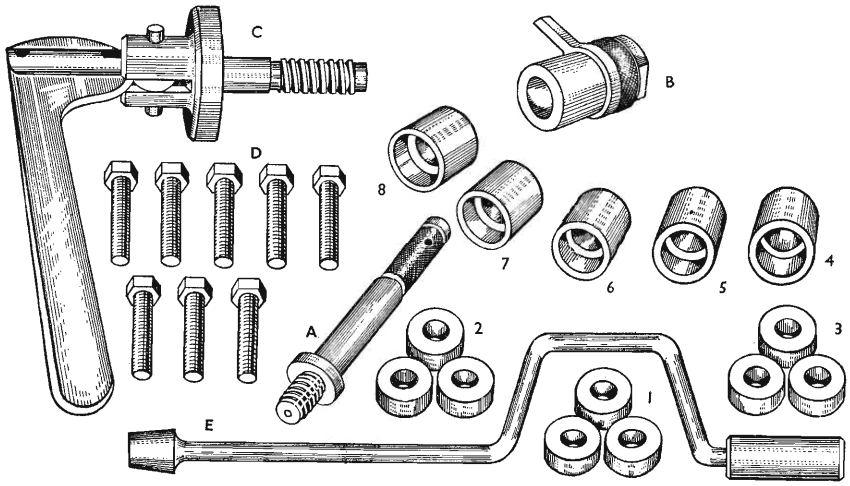


Fig. E.2. The components of the clutch.

1. *Anti rattle spring.*
2. *Adjusting nut.*
3. *Tab washers.*
4. *Bearing plates.*
5. *Clutch cover.*
6. *Flanged caps.*
7. *Thrust springs.*
8. *Pressure plate.*
9. *Clutch driven plate.*
10. *Driven plate springs.*
11. *Splined hub.*
12. *Shoulder stud.*
13. *Fulcrum.*
14. *Release lever.*
15. *Clutch withdrawal lever.*
16. *Release bearing and cup assembly.*
17. *Retaining spring.*



ST. 132. A.

Fig. E.3. Parts of clutch assembly tool.

A. *Centre pillar.*
B. Height finger.
C. *Actuating mechanism.*
D. *Setpins.*
E. *Speedbrace.*
1. 2. 3. } *Spacing washers.*
4. 5. 6. 7. 8. } *Distance pieces.*

Section E.3

CLUTCH ASSEMBLY

To Remove

(1) Remove the gearbox as described in Section F.

(2) Slacken the clutch cover screws a turn at a time by diagonal selection until the spring pressure is relieved, when the screws can be taken out and the clutch removed.

To Dismantle

When dismantling the clutch cover assembly the following parts should be suitably marked so that they can be reassembled in exactly the same relative positions to each other to preserve the balance and adjustment—the cover, the lugs on the pressure plate, and the release levers.

The clutch Tool No. 18G 99A provides an efficient and speedy means of dismantling, reassembling and adjusting the clutch with a high degree of accuracy. The tool is universal, and a chart detailing the sizes of spacing washers and distance-pieces for particular types of clutch is provided on the inside of the metal container lid. Proceed as follows:

(1) Detach the retaining springs from the release lever plate and remove the springs and plate.

(2) Rest the tool base plate on a flat surface, ensure that it is clean, and place upon it spacing washers as directed by the chart. For this $6\frac{1}{4}$ in. (15·88 cm.) clutch select three washers and place them in position 'A' on the base plate.

(3) Position the clutch on the three spacing washers so that the hole in the clutch cover aligns with the tapped holes in the base plate, with the release levers as close to the spring washers as possible.

(4) Insert the tool setscrews, tightening them a little at a time in a diagonal pattern, until the cover is firmly and evenly secured to the base plate. This is most important if the best results are to be achieved.

(5) Remove the three eyebolt adjusting nuts, sheering away the peening by initial pressure.

(6) Unscrew the setscrews securing the clutch cover to the base plate in a diagonal pattern, releasing the pressure on the clutch springs gradually and evenly. Lift off the cover and remove the pressure springs.

(7) To remove the release levers, remove the anti-rattle springs, grasp the lever and eyebolt between the thumb and fingers, so that the inner end of the lever and the threaded end of the eyebolt are as near together as possible, keeping the eyebolt pin seated in its socket in the lever. The strut can then be lifted over the ridge onto the end of the lever, making it possible to lift the eyebolt off the pressure plate.

(8) Clean the clutch parts carefully. If the linings are to be used again they should not be allowed to come in contact with cleaning fluids.

(9) Examine the friction linings for wear or loose rivets and check the driven plate for uneven or worn splines, distortion or signs of fatigue cracks. Generally, it is not desirable to fit new friction linings on the original driven plate because refaced driven plates often are distorted or otherwise impaired and produce unsatisfactory clutch action. If renewing old worn linings, the rivets should be drilled out, not punched out.

(10) After refacing, mount the driven plate on a mandrel between centres and check for 'run-out' by means of a dial gauge, set as near to the edge

as possible. Where the 'run-out' exceeds 0·15 in. (·38 mm.), true the plate by prising it in the requisite direction after finding the high spots.

(11) Examine the machined face of the pressure plate. if this is badly grooved and rough, the surface may be reground until the grooves disappear.

(12) Examine the machined surface of the release lever plate. If this is badly grooved, renew the plate. A new plate will also be necessary if the surfaces on the reverse side of the plate, which are in contact with the tips of the release levers, are worn down.

(13) Examine the tips of the release levers which bear on the back of the release lever plate. A small amount of worn flat surface is permissible, but if this is excessive the lever should be renewed. Check for excessive wear in the groove in which the strut bears. Examine carefully the 'U'-shaped depression in the lever into which fits the eyebolt floating pin. If the metal here has worn at all thin, the lever must be renewed as there is a danger of it breaking under load with disastrous results to the whole clutch mechanism.

(14) Examine each eyebolt for flats on the surface which fits into the pressure plate. If it is a loose fit, it must be renewed. The same applies to the eyebolt floating pin where it passes through the eyebolt. It should be a free fit, but not too loose.

(15) Examine the release bearing for cracks or bad pitting, also measure the amount of bearing standing proud of the metal cup. If the bearing is cracked or badly pitted, or there is $\frac{1}{16}$ in. (1·6 mm.) or less of bearing standing proud of the cup, the cup and bearing must be renewed.

(16) Examine the pressure springs for weakness or distortion and renew if necessary. Renew in sets only.

(17) Examine the clutch withdrawal shaft for slackness in the bushes. Renew the bushes if necessary.

To Reassemble

Before reassembly note the positions of the marked parts and make sure to replace them in their original locations to preserve balance, unless the parts have been renewed. Using Tool No. 18G 99A, proceed as follows:

(1) Position the pressure plate on the three spring washers on the base plate as described under 'To dismantle'.

(2) Install the release lever, eyebolt and eyebolt pin, holding the threaded end of the eyebolt and the inner end of the lever as close together as possible. With the other hand insert the strut in the slots in the pressure plate sufficiently to allow the plain end of the eyebolt to be inserted in the hole provided in the pressure plate. Move the strut upwards into the slots in the pressure plate lug, over the ridge on the short end of the lever, and drop it into the groove formed in the lever. Fit the remaining release levers in a similar manner. A very slight smear of grease should be applied to the release lever pins, contact faces of the struts, eyebolt seats in the clutch cover, drive lug sides on the pressure plate and the plain end of the eyebolts.

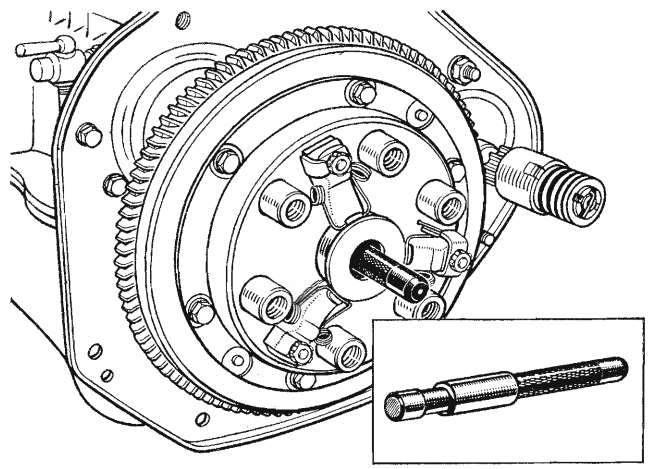
(3) Place the pressure springs on the bosses on the pressure plate.

(4) Lower the cover over the assembled parts, ensuring that the anti-rattle springs are in position and that the tops of the pressure springs are directly under their seats in the cover. In addition the machined portions of the pressure plate lugs must be directly under the slots in the cover through which they will pass.

(5) Insert the tool setscrews through the cover holes and screw them into the base plate in a diagonal pattern, a little at a time, to prevent distortion. Guide the eyebolts and pressure plate lugs through the holes in the clutch cover during this gradual tightening down.

(6) Screw the adjusting nuts onto the eyebolts.

The clutch must now be adjusted still using the clutch assembly tool. With the clutch bolted to the tool base plate as on completion of assembly, proceed as follows:



H30. 114. A.

Fig. E.4. Using Service Tool 18G 139 *to centralise the driven plate. Inset shows* 18G 139

(7) Screw the actuator into the base plate and pump the handle a dozen times to settle the clutch mechanism. Remove the actuator.

(8) Screw the tool centre pillar into the base plate

and select a distance-piece, Code No. 4, as shown on the chart. Place the distance-piece over the centre pillar with its recessed face downwards.

(9) Place the gauge height finger over the centre pillar.

(10) Adjust the height of the release levers by tightening or loosening the eyebolts until the height finger, when rotated, just contacts the highest point on the tips of the release levers. Press downwards on the height finger to ensure that it bears squarely on he adaptor while rotating.

(11) Remove the height finger and pillar, and screw in the actuator to the base plate. Operate the clutch several times to enable the components to settle on their knife edges. Remove the actuator and replace the centre pillar, distance-piece and height finger. Readjust the release levers if necessary. Repeat the procedure to ensure that the release levers are finally seated, and gauge once more.

(12) Remove the centre pillar, distance-piece and height finger and peen over the release lever adjusting nuts.

(13) Fit the release lever plate on the tips of the release levers and secure it by the three retaining springs.

(14) Release the tool setscrews in diagonal sequence a little at a time, relieving pressure slowly and evenly. Remove the clutch assembly from the base plate.

To Replace

Before installing the clutch assembly the engine flywheel should be checked for misalignment (see Section A). To install the clutch proceed as follows:

(1) Hold the clutch cover assembly and driven plate on the flywheel and screw in the cover securing bolts finger-tight. Note that the splines in the hub of the driven plate are chamfered at one end to permit ready entry of the first motion shaft splines. The longer side of the driven plate hub, with the chamfered splines, should be toward the rear.

(2) Insert a pilot shaft or an aligning abor No. 18G 139, through the clutch cover and driven plate hub so that the pilot enters the spigot bearing in the rear end of the engine crankshaft. This will centralise the driven plate.

(3) Tighten the clutch cover securing bolts a turn at a time in diagonal sequence to avoid distorting the cover.

(4) Remove the pilot shaft or aligning arbor.

(5) Install the gearbox (see Section F.).

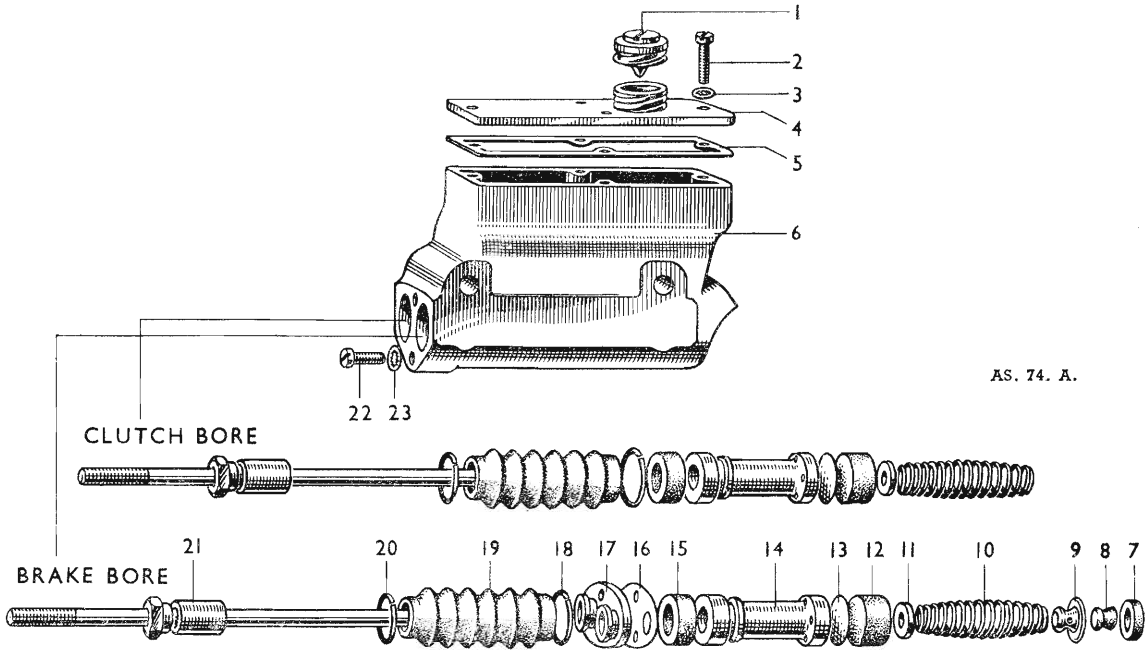


Fig. E.5. Clutch master cylinder exploded.

1. *Filler cap*
2. *Fixing screw.*
3. *Shakeproof washer.*
4. *Tank cover.*
5. *Tank cover gasket.*
6. *Cylinder barrel and tank.*
7. *Valve washer.*
8. *Valve cup.*
9. *Valve body.*
10. *Return spring.*
11. *Spring retainer.*
12. *Main cup.*
13. *Piston washer.*
14. *Piston.*
15. *Secondary cup.*
16. *Gasket.*
17. *Boot fixing plate.*
18. *Boot clip.*
19. *Boot.*
20. *Boot clip.*
21. *Push rod.*
22. *Fixing screw.*
23. *Shakeproof washer.*

Section E.4

CLUTCH PEDAL

To Remove

The removal of the clutch and brake pedal assembly is detailed below.

(1) Working under the bonnet disconnect the clutch and brake pedal levers from the master cylinder pushrods by removing the spring clips and withdrawing the clevis pins.

(2) Within the car remove the nut and spring washer and withdraw the fulcrum pin, noting that a distance piece separates the two pedals.

(3) Remove the pedals downwards.

It is possible, to remove the pedals combined with the clutch and brake master cylinder unit, and this operation is described in both clutch and brake master cylinder sections of this manual.

Section E.5

MASTER CYLINDER

Description

The master cylinder caters for operation of both brake and clutch. It has two bores which are side by side and, except for the fact that one has no check valve, each bore accommodates normal master cylinder parts. The bore with the check valve serves the brakes, the other serves the clutch slave cylinder.

Removal

The following removal procedure involves the withdrawal of the master cylinder unit complete with clutch and brake pedals, as it is not necessary to disconnect the pedals for normal master cylinder maintenance.

Note: Before disconnecting the master cylinder ascertain, for assembly purposes, which bore is communicated with the clutch slave cylinder.

(1) Remove the heater blower unit by first releasing the wire (green and brown) and the earth wire (white) and then unscrewing the two setpins securing the heater blower bracket to the bulkhead.

(2) Unscrew the ten setpins securing the master cylinder mounting plate to the engine bulkhead.

(3) Disconnect the two hydraulic pipes at their unions with the rear of the master cylinder unit.

(4) Withdraw the master cylinder unit upwards and at the same time manipulate the clutch and brake pedals through the aperture in the bulkhead.

(5) Disconnect each pedal from their master cylinder pushrods by removing the spring clips and withdrawing the clevis pins.

(6) The master cylinder unit is attached to its mounting plate by two bolts, nuts and washers, and when these are unscrewed and withdrawn the master cylinder unit is free to be disconnected.

Dismantling the Clutch Cylinder

(1) Unscrew the set screws securing the boot fixing plate to the master cylinder body.

(2) Detach the fixing plate from the master cylinder leaving the boots and push rods attached to the clutch and brake pedals.

(3) Unscrew the common filler cap and drain the fluid into a clean container.

(4) Withdraw the piston (14) Fig. E.5, piston washer (13), main cup (12), spring retainer (11) and return spring (10).

(5) Using only the fingers to prevent damage, remove the secondary cup (15) by stretching it over the end flange of the piston.

(6) Examine all parts, especially the washers, for wear or distortion, and replace with new parts where necessary.

Assembling the Clutch Cylinder

(1) Fit the secondary cup (15) on the piston (14), so that the lip of the cup faces the piston head and gently work the cup round the groove with the fingers to ensure that it is properly seated.

(2) Assemble the retainer (11) on the smaller end of the return spring and insert the assembly into the cylinder.

(3) Install the main cup (12) into the cylinder, lip foremost, taking care not to damage or turn back the lip of the cup.

(4) Follow up with the piston washer, pay particular attention to the illustration showing method of assembly.

(5) Press the piston (14) into the cylinder taking care not to damage or turn back the lip of the secondary cup (15).

(6) Insert the push rod in the piston and manoeuvre the boot fixing plate into position. Secure the plate by its two set screws and then ascertain that the rubber boots are seating correctly. The vent holes in each boot should be at the bottom where the cylinder is mounted on the vehicle.

If the boots are damaged or perished, new ones should be fitted.

(7) Fill the reservoir with clean Lockheed brake fluid and test the clutch cylinder by pushing the piston inwards and allowing it to return unassisted. After a few applications, fluid should flow from the outlet connection in the cylinder barrel.

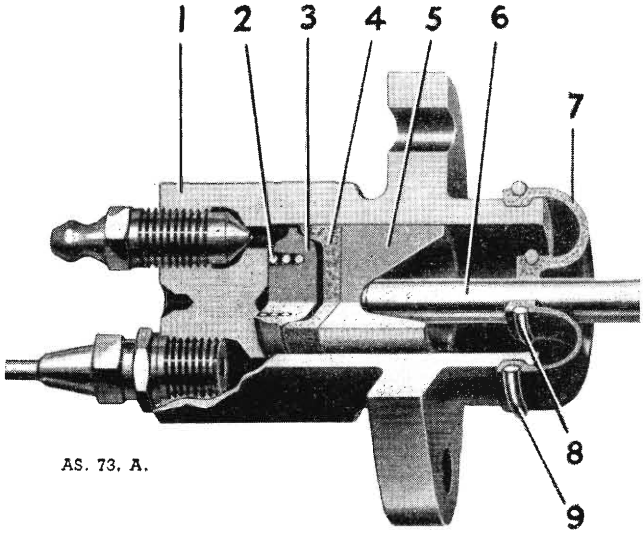


Fig. E.6. Slave cylinder.

1. *Body.*
2. *Spring.*
3. *Cup filler.*
4. *Cup.*
5. *Piston.*
6. *Push rod.*
7. *Boot.*
8. *Boot clip (small).*
9. *Boot clip (large).*

Replacement

The installation of the master cylinder unit is the reversal of the removal procedure.

If no further maintenance of the clutch is necessary remember to bleed the system.

Section E.6

SLAVE CYLINDER

Description

The cylinder is bolted to the underside of the clutch housing and comprises a piston, rubber cup, cup filler, return spring, push rod and bleeder screw. Fluid from the master cylinder is delivered via a metal pipe.

To Remove

(1) Place a receptacle to catch the fluid and remove the flexible hose from the slave cylinder.
(2) Remove the split pin and clevis pin from the clutch withdrawal lever jaw end, thus freeing the slave cylinder push rod.

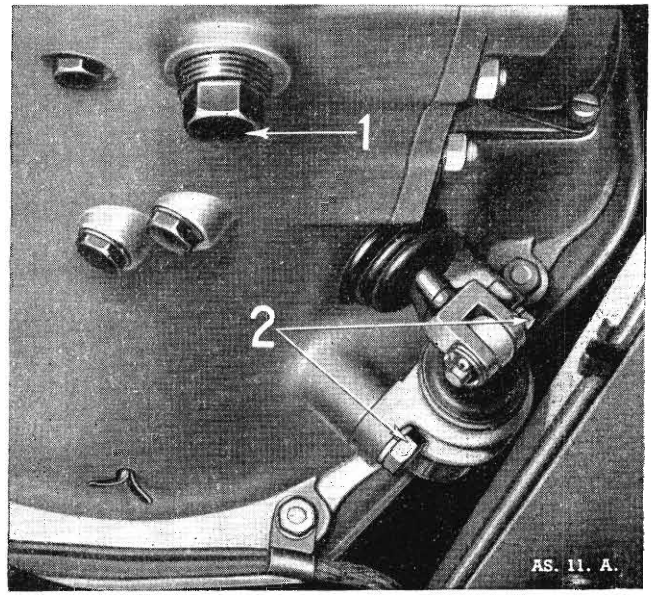


Fig. E.7. Gearbox drain plug (1). *Slave cylinder setpins* (2).

(3) Unscrew the two setpins securing the slave cylinder to the clutch housing.

To Dismantle (Fig. E.6)

(1) Remove all dirt from the exterior of the cylinder.
(2) Remove the large boot clip (9) and if an air line is available—apply a **low** pressure to the fluid connection to expel the internal parts.
(3) Clean the slave cylinder components, **using only hydraulic fluid or alcohol.** The main casting may be cleaned with any of the normal cleaning fluids, but all traces of the cleaning fluid must be dried out.
(4) Dry off and examine all rubber components and renew them if they are swollen, distorted or split. If there is any doubt as to their condition they must be renewed.
(5) Inspect the piston and cylinder bore for wear and scores, and renew them as necessary.

Assembling the Slave Cylinder

(1) Fit the spring (2) in the cup filler (3) and insert the parts, spring innermost, into the bore of the body (1).
(2) Follow up with the cup (4), lip leading, ensuring that the lip is not turned back or bucked.
(3) Insert the piston (5), flat face innermost, and then fit the circlip.
(4) If a new boot is being used, stretch the small end on to the push-rod and secure with the small boot clip.

To Replace

(1) Offer up the slave cylinder to its mounting, with the push-rod entering the bore.
(2) Secure the slave cylinder by means of the two setpins.
(3) Stretch the large end of the boot and secure with the boot clip (9).
(4) Screw in the hydraulic pipe union.
(5) Bleed the clutch hydraulic system as described in Section E.7.

Section E.7

BLEEDING THE CLUTCH SYSTEM

(1) Fill the master cylinder reservoir with brake fluid and keep at least a quarter full throughout the operation, otherwise air will be drawn in, necessitating a fresh start.
(2) Attach a rubber tube to the bleeder screw on the slave cylinder, allowing the free end to be submerged in a little brake fluid in a clean glass jar.

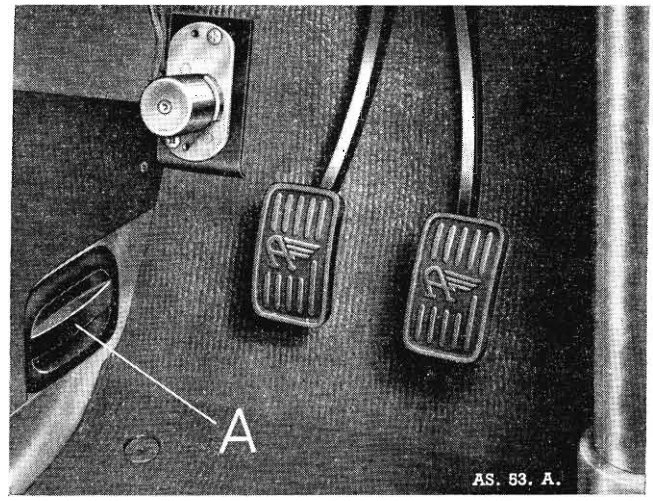


Fig. E.8. Depicting the position of the plug which must be removed in order to gain access to the slave cylinder bleed nipple.

(3) Slacken the bleeder screw and depress the clutch pedal slowly; tighten the screw before the pedal reaches the end of its stroke and allow the pedal to return unassisted.
(4) Repeat (3) until air bubbles cease to appear from the end of the tube in the jar.

Section E.8 FAULT DIAGNOSIS

Symptom	No.	Possible Fault
(a) Drag or Spin	1	Oil or grease on driven plate linings
	2	Bent engine backplate
	3	Misalignment between engine and first motion shaft
	4	Leaking operating cylinder, pipe line or air in system
	5	Driven plate hub binding on first motion shaft splines
	6	First motion shaft binding on its spigot bush
	7	Distorted clutch plate
	8	Warped or damaged pressure plate or clutch cover
	9	Broken clutch plate linings
	10	Dirt or foreign matter in clutch
	11	Air in clutch hydraulic system
	12	Bad external leak between the clutch master cylinder and slave cylinder
(b) Fierceness or Snatch		Check 1, 2 and 3 in (a)
	1	Check 4 in (a)
	2	Worn clutch linings
(c) Slip		Check 1, 2 and 3 in (a)
		Check 1 in (b)
	1	Weak thrust springs
	2	Weak anti-rattle springs
	3	Seized piston in clutch slave cylinder
(d) Judder		Check 1, 2 and 3 in (a)
	1	Pressure plate out of parallel with flywheel face
	2	Friction facing contact area not evenly distributed
	3	Bent first motion shaft
	4	Buckled driven plate
	5	Faulty engine or gearbox rubber mountings
	6	Worn shackles
	7	Weak rear springs
	8	Propeller shaft bolts loose
	9	Loose rear spring clips
(e) Rattle		Check 3 in (d)
	1	Damaged driven plate, *i.e.* broken springs, etc.
	2	Worn parts of release mechanism
	3	Excessive transmission backlash
	4	Wear in transmission bearings
	5	Release bearing loose on fork
(f) Tick or Knock	1	Worn first motion shaft bush
	2	Badly worn centre plate hub splines
	3	Out of line thrust plate
	4	Faulty bendix drive on starter
	5	Loose flywheel
(g) Driven Plate Fracture		Check 2 and 3 in (a)
	1	Drag and metal fatigue due to hanging gearbox in driven plate