

SECTION M

THE BRAKING SYSTEM

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GENERAL DESCRIPTION

The braking system consists of four Dunlop calliper-type disc brakes hydraulically controlled by means of a foot-operated master cylinder.

Steel pipe lines, unions, and flexible hoses convey the hydraulic pressure from the master cylinder to each wheel cylinder.

The cable-actuated hand brake mechanism is entirely separate in operation from the hydraulic system and operates on the rear wheels only. Each brake consists of two carriers to which friction pads are riveted. The carriers are mounted on the top of the rear callipers, one each side of the disc, by means of hinge bolts.

BRAKE UNITS

Each wheel brake unit comprises a hub-mounted disc rotating with the wheel and a braking unit rigidly attached to the axle at the rear and to the swivel pin at the front. The brake unit consists of a calliper which straddles the disc and houses a pair of rectangular friction pad assemblies. Cylinder blocks bolted to the outer faces of each calliper accommodate piston assemblies keyed to the friction pad and securing plate assemblies. A spigot formed on the outer face of each piston locates in the bore of a backing plate with an integral boss grooved to accommodate the collar of a flexible rubber dust seal. When the piston is assembled to the cylinder block the seal engages a lip on the block face and so protects the assembly from intrusion of moisture and foreign matter. The central blind bore of the piston inner face accommodates the end of a retractor pin and its friction bush. A piston seal is located between the piston inner face and a plate secured to the piston by peen-locked screws. The piston assembly when pressed into the cylinder bore locates on the retractor pin assembly, which is peened into the base of the cylinder bore. This assembly comprises a retractor stop bush, two spring washers, a dished cap, and the retractor pin; it functions as a return spring and maintains the 'brake-off' working clearance of approximately $\cdot008$ to $\cdot010$ in. ($\cdot203$ to $\cdot254$ mm.) between the pads and the disc throughout the life of the pads.

MASTER CYLINDER

The components of the master cylinder are housed within the bore of a cylinder body with an integral reservoir. The reservoir is fitted with a detachable cover which incorporates the filler orifice and is secured by means of six bolts and spring washers. A fluidtight joint is maintained by a cork gasket between the cover and reservoir faces. The enclosed end of the cylinder is bored to provide communication between the reservoir and the

cylinder; a housing for an outlet connection is provided by an internally threaded boss integral with the cylinder. Formed around the opposite end of the cylinder is a flange with two holes for the master cylinder attachment bolts. In the unloaded condition a spring-loaded piston carrying a rubber 'O' ring in a groove is held against the under side of a dished washer retained by a circlip at the head of the cylinder. A hemispherically ended push-rod seats in a similarly formed recess at the head of the piston. The head of the master cylinder is shrouded by a rubber dust excluder, the lip of which seats in a groove in the cylinder body.

A cylindrical spring support is fitted around the inner end of the piston and a small drilling in the end of the support is engaged by the stem of a valve. The larger-diameter head of the valve is located in a central blind bore in the piston. The valve passes through the bore of a vented spring support and protrudes into the fluid passage which communicates with the reservoir. Interposed between the spring support and an integral flange formed on the valve is a small coiled spring. A rubber seal is fitted between the end of the cylinder body and the under side of the valve flange. This assembly forms a recuperation valve which controls fluid flow to and from the reservoir.

When the foot pedal is in the 'off' position the master cylinder is fully extended and the valve is held clear of the base of the cylinder by the action of the main spring. In this condition the master cylinder is in fluid communication with the reservoir, thus permitting recuperation of any fluid loss sustained, particularly during the priming and bleeding operation of the brake system.

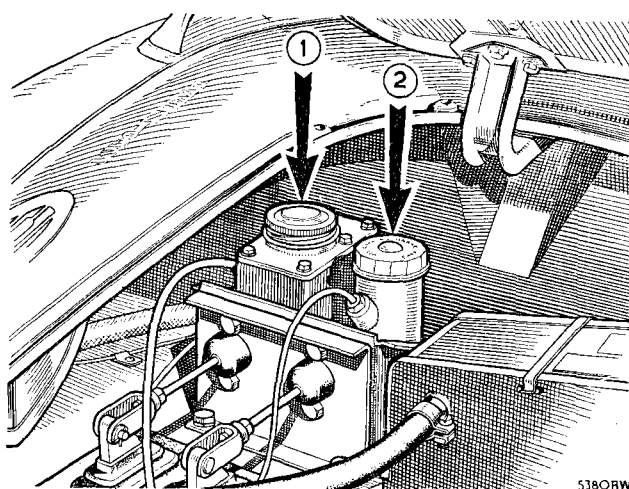


Fig. M.1

Periodically examine the quantity of fluid in the brake master cylinder reservoir (arrow 1). The clutch master cylinder reservoir is indicated by arrow 2

When a load is applied to the foot pedal the piston moves down the cylinder against the compression of the main spring. Immediately this movement is in excess of the valve clearance the valve closes under the influence of its spring and isolates the reservoir. Further loading of the pedal results in the discharge of fluid under pressure from the outlet connection via the pipe lines to the brake system.

Removal of the load from the pedal reverses the sequence; the action of the main spring returns the master cylinder to the extended position and restores the open condition between the cylinder and reservoir previously described.

MAINTENANCE

Periodically examine the quantity of brake fluid in the master cylinder. It should never be less than half-full nor closer than $\frac{1}{2}$ in. (13 mm.) to the bottom of the filler neck. The necessity for frequent topping up is an indication of overfilling or of a leak in the system which should be traced and rectified at once.

If the travel of the hand brake lever becomes excessive the mechanism should be adjusted as detailed in Section M.14.

The friction pads should be checked for wear at frequent intervals by visual observation and measurement. When wear has reduced the pads to the minimum permissible thickness of .250 in. (6.35 mm.) the pads must be renewed.

Every 1,000 miles (1600 km.) apply three or four strokes of the grease gun filled with grease to Ref. C (page P.7) to the nipple provided on the brake cable.

Section M.1

ADJUSTING THE BRAKE PEDAL

The correct amount of free movement between the master cylinder push-rod and piston is set during the erection of the vehicle and should not require adjustment during normal service.

In the event of the adjustment having been disturbed a check should be made to ensure that there is no pre-loading of the master cylinder piston when the brake pedal is in the fully 'off' position. In this position the piston should be held against the dished washer at the head of the master cylinder unit by the pressure of the piston return spring, thus forming a return stop, and a free axial movement of approximately .015 to .020 in. (.381 to .508 mm.) should be felt at the master cylinder push-rod. If necessary, the effective length of the push-rod should be reset to this figure.

Section M.2

PRIMING AND BLEEDING THE BRAKE SYSTEM (Expelling Air)

The following procedure should be adopted either for initial priming of the system or to bleed in service if air has been permitted to enter the system. Air may enter the system if pipe connections become loose or if the level of fluid in the reservoir is allowed to fall below the recommended level. During the bleeding operation it is important that the reservoir be kept at least half-full to avoid drawing air into the system.

- (1) Check that all connections are tightened and all bleed screws closed.
- (2) Fill the reservoir with brake fluid. The use of Wakefield Crimson Brake Fluid is recommended, but if this is not available an alternative fluid conforming to Specification S.A.E. 70.R1 should be used.
- (3) Attach the bleeder tube to the bleed screw on the near-side rear brake and immerse the open end of the tube in a small quantity of brake fluid contained in a clean glass jar. Slacken the bleed screw and operate the brake pedal slowly backwards and forwards through its full stroke until fluid pumped into the jar is reasonably free from air bubbles. Keep the pedal depressed and close the bleed screw. Release the pedal.
- (4) Repeat for each brake in turn.
- (5) Repeat the complete bleeding sequence until the brake fluid pumped into the jar is completely free from air bubbles.
- (6) Lock all bleed screws and top up the fluid level in the reservoir.
- (7) Apply a normal working load on the brake pedal for a period of two or three minutes and examine the entire system for leaks.

NOTE.—Clean fluid bled from the system must be allowed to stand until it is clear of air bubbles before it is used again. Dirty fluid should be discarded.

Section M.3

REMOVING THE MASTER CYLINDER

Remove the split pin and washer and withdraw the clevis pin from the push-rod yoke. Remove the push-rod.

Remove the two bolts, nuts, and washers securing the front end of the master cylinder to the mounting plate and disconnect the brake pipe at the rear of the cylinder. On right-hand-drive vehicles this operation will be eased if the brake pipe securing clip on the bulkhead is released first.

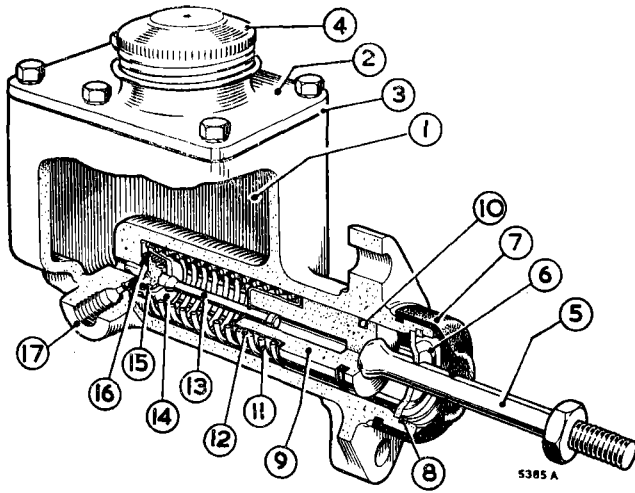


Fig. M.2

The brake master cylinder components

- | | |
|-------------------|------------------------|
| 1. Reservoir. | 10. 'O' ring. |
| 2. Cover. | 11. Return spring. |
| 3. Cork gasket. | 12. Spring support. |
| 4. Filler cap. | 13. Valve. |
| 5. Push-rod. | 14. Spring support. |
| 6. Dished washer. | 15. Valve spring. |
| 7. Dust excluder. | 16. Seal. |
| 8. Circlip. | 17. Outlet connection. |
| 9. Piston. | |

Section M.4

DISMANTLING THE MASTER CYLINDER

Remove the master cylinder filler cap and drain the brake fluid from the unit.

Ease the dust excluder clear of the head of the master cylinder. Remove the retaining circlip with a suitable pair of pliers and withdraw the push-rod complete with dished washer. Draw out the piston and remove the rubber 'O' ring. The valve assembly complete with springs and supports can then be extracted and the valve sealing ring removed from the seal bush.

Section M.5

ASSEMBLING THE MASTER CYLINDER

Clean all parts thoroughly, using only the recommended brake fluid for all rubber components. All traces of petrol (gasoline), paraffin (kerosene), or trichlorethylene used for cleaning the metal parts must be removed before assembly.

Examine all the rubber parts for damage or distortion. It is usually advisable to renew the rubbers when rebuilding the cylinder. Dip all the internal parts in brake fluid and assemble them wet. Fit the valve seal around the seal bush and the 'O' ring in the groove on the piston.

Place the seal bush in position on the valve stem and insert the piston into the spring support, ensuring that the head of the valve engages the piston bore. Slide the complete assembly into the cylinder body, taking particular care not to damage or twist the 'O' ring.

Position the push-rod and depress the piston sufficiently to allow the dished washer to seat on the shoulder at the head of the cylinder. Fit the circlip and check that it fully engages in the groove.

Fill the dust excluder with Wakefield No. 3 Rubber Grease and reseal the excluder around the head of the master cylinder.

Section M.6

REPLACING THE MASTER CYLINDER

The replacement procedure is the reverse of the removal instructions given in Section M.3.

After replacement, bleed the brake system as detailed in Section M.2. Finally, check for leaks with the brakes fully applied.

Section M.7

REMOVING A BRAKE UNIT

Front

Unscrew the brake pipe union nut below its support bracket and disconnect and blank off the pipe. Remove the two nuts securing the brake hose support bracket and remove the bracket.

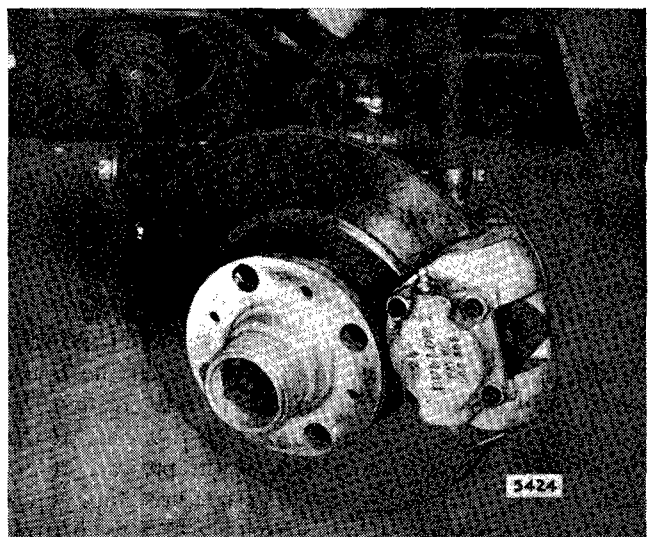


Fig. M.3

A front disc brake caliper

Unscrew the two calliper retaining bolts and remove the calliper assembly complete with cylinders.

Take care not to misplace the shims which are fitted behind the mounting lugs on the calliper body. **The shims must be retained for reassembly and replaced in their original positions.**

Rear

Unscrew the fluid supply pipe union (below the inner cylinder block) and disconnect and blank off the pipe. Remove the split pin and clevis pin from the hand brake cable yoke to disconnect the cable from the calliper lever.

Tap back the tab washers and unscrew the two set screws securing the calliper to the mounting flange on the axle. The calliper complete with parking mechanism may now be removed from the vehicle.

The shims taken from behind the calliper body mounting lugs must be retained and **replaced in their original positions on reassembly.**

Section M.8

DISMANTLING A BRAKE UNIT

The brake must be thoroughly cleaned before proceeding with the dismantling. It is recommended that a new dust seal should be fitted whenever the unit is dismantled.

Withdraw the brake pads as described in Section M.11. Disconnect and blank off the supply pipe (if the unit is being dismantled on the vehicle) and remove the bridge pipe.

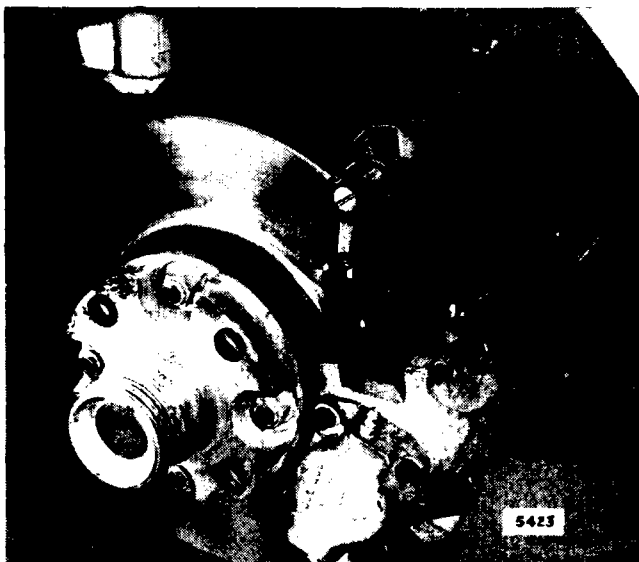


Fig. M.4

A rear disc brake caliper with hand brake carriers

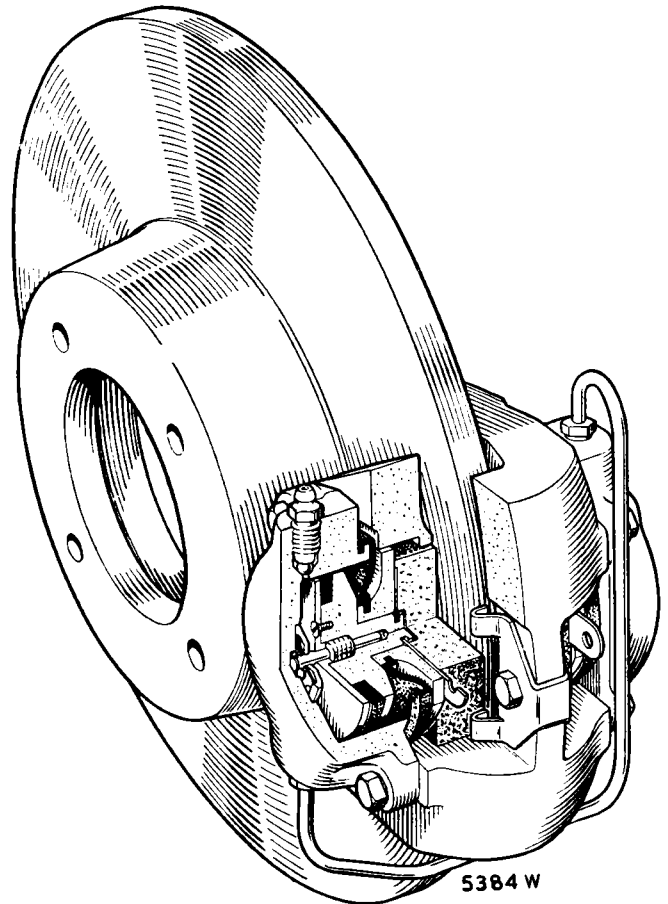


Fig. M.5

Sectioned view of a brake caliper

Remove the bolts securing the cylinder blocks to the calliper and withdraw the cylinder blocks.

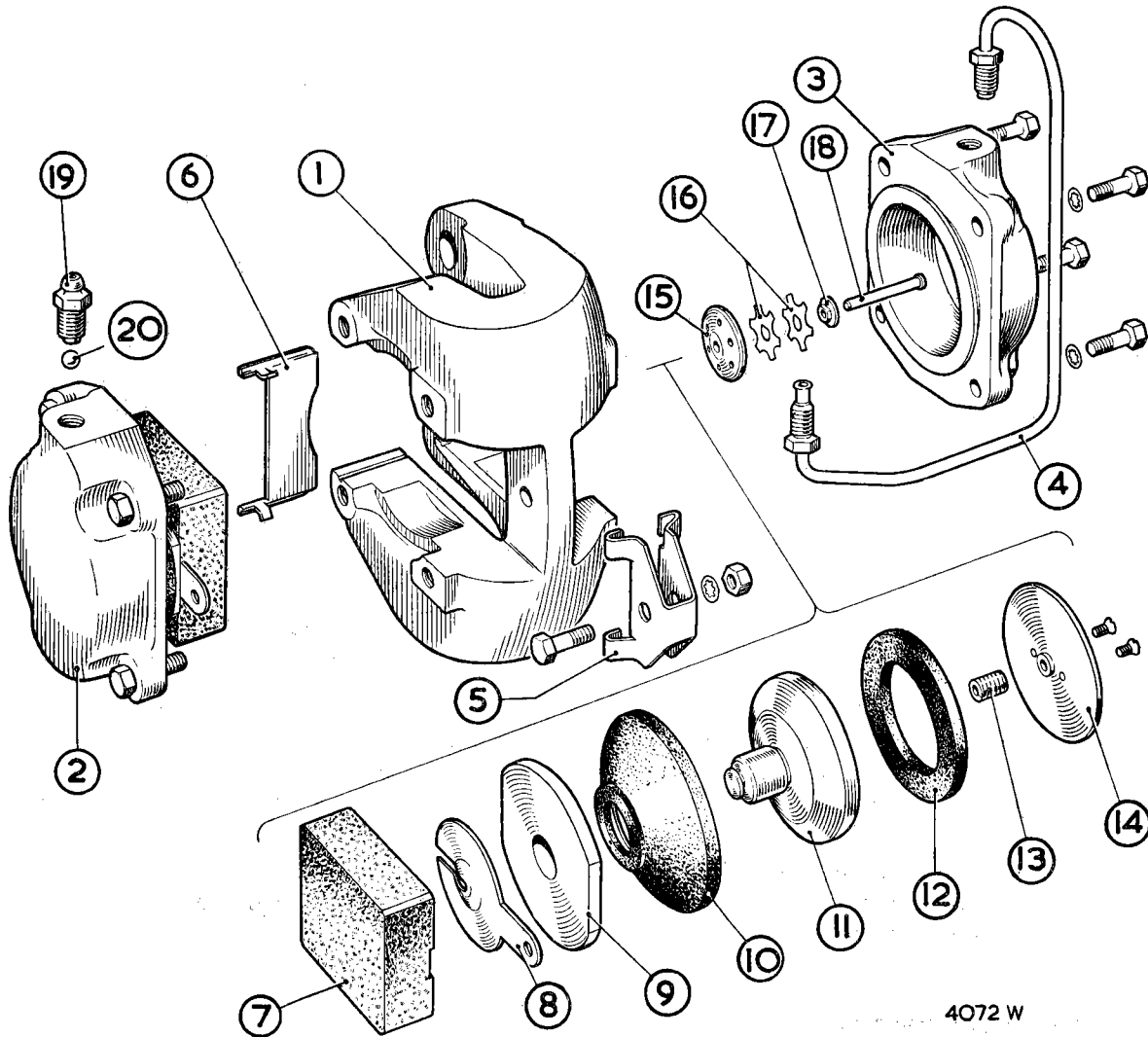
Disengage the dust seal from the lip on the cylinder block face, connect the cylinder to a source of fluid supply, and apply pressure to eject the piston assembly. Remove the screws securing the plate to the piston, lift off the plate and piston seal, and withdraw the retractor bush from within the piston bore. Carefully cut away and discard the dust seal.

Support the backing plate on a bush of sufficient bore just to accommodate the piston; with a suitable tubular distance piece placed against the end of the piston spigot around the shouldered head press out the piston from the backing plate. Care must be taken during the operation to avoid damaging the piston.

Section M.9

ASSEMBLING A BRAKE UNIT

Clean all components thoroughly, using only the recommended brake fluid for all rubber parts.



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Fig. M.6

The disc brake caliper components

- | | | | |
|--------------------|--------------------|---------------------|--------------------------|
| 1. Caliper. | 6. Support plate. | 11. Piston. | 16. Spring washer. |
| 2. Cylinder block. | 7. Friction pad. | 12. Piston seal. | 17. Retractor stop bush. |
| 3. Cylinder block. | 8. Securing plate. | 13. Retractor bush. | 18. Retractor pin. |
| 4. Bridge pipe. | 9. Backing plate. | 14. Plate. | 19. Bleed screw. |
| 5. Keep plate. | 10. Dust seal. | 15. Cap. | 20. Bleed screw ball. |

Engage the collar of a new dust seal with the lip on the backing plate on the piston spigot, and with the piston suitably supported press the backing plate fully home.

Insert the retractor bush into the bore of the piston. Lightly lubricate the piston seal with brake fluid (if there is any doubt about the condition of this component it should be renewed) and fit it to the piston face. Attach and secure the plate with the screws, and peen-lock the screws.

Check that the piston and the cylinder bore are thoroughly clean and show no signs of damage. Locate the piston assembly on the end of the retractor pin, and

with the aid of a hand press slowly apply an even pressure to the backing plate and press the assembly into the cylinder bore. Ensure that the piston assembly is in correct alignment in relation to the cylinder bore and that the piston seal does not become twisted or trapped as it enters the cylinder bore. Engage the lip of the dust seal with the lip on the cylinder block face.

Reassemble the cylinder blocks to the calliper and fit the bridge pipe, ensuring that it is correctly positioned (with the near-vertical part of the pipe farthest from the wheel). If the complete brake unit has been removed it should be replaced as detailed in Section M.10.

Remove the blank, replace the supply pipe, and fit the friction pads as described in Section M.12.

Finally, bleed the system (Section M.2) and check for leaks with the brakes fully applied.

Section M.10

REPLACING A BRAKE UNIT

The replacement procedure is a reversal of the instructions given in Section M.7 with the exception of the following details. Replace the brake pads as detailed in Section M.12.

Check the gap between each side of the calliper and the disc. The difference should not exceed .010 in. (.254 mm.) and the shims may be altered to obtain this figure. Bleed the system as detailed in Section M.2 and, finally, check for leaks with the brakes fully applied.

Section M.11

REMOVING THE FRICTION PADS

Remove the nut, washer, and bolt securing the keep plate and withdraw the plate. Withdraw the pad assemblies with a suitable hooked implement engaged in the hole in the lug of the securing plate.

Thoroughly clean the backing plate, dust seal, and the surrounding area of the calliper.

Section M.12

REPLACING THE FRICTION PADS

Where the original friction pads are to be refitted it is only necessary to reverse the instructions given in Section M.11.

If wear has reduced the pads to the minimum permissible thickness of .025 in. (.635 mm.) the pads must be renewed. Press the piston assemblies with a suitable lever to the base of the cylinder bores against the resistance offered by the retractor pin and bush. Insert the new friction pad assemblies, replace the keep plate, and secure it with the bolt, washer, and nut.

Section M.13

RELINING THE HAND BRAKE

Unscrew and remove the adjuster bolt and locknut and swing the pad carriers away from the disc. Extract the split pin and withdraw the lever pivot pin (see Fig. M.7).

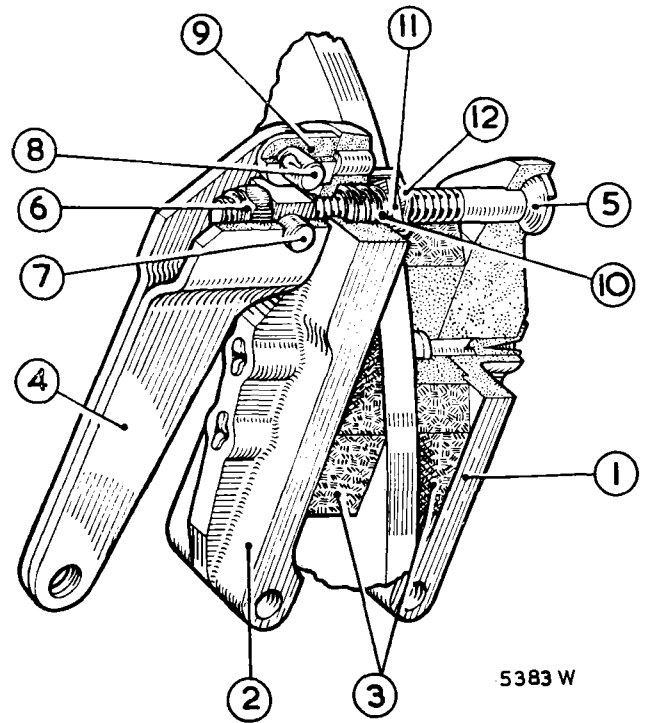


Fig. M.7

The hand brake carrier components

- | | |
|-------------------------|---------------------------|
| 1. Pad carrier (outer). | 7. Trunnion. |
| 2. Pad carrier (inner). | 8. Pivot pin. |
| 3. Pads. | 9. Pivot seat. |
| 4. Lever. | 10. Spring. |
| 5. Adjuster bolt. | 11. Spring retaining nut. |
| 6. Locknut. | 12. Spring plate. |

Remove the bifurcated rivets from both carriers and prise off the worn linings. Place the new linings in position and secure them with new bifurcated rivets.

Place the lever in the position indicated in Fig. M.8. Hold the locknut firmly against the outer face of the trunnion and screw in the adjuster bolt until three or four threads engage in the locknut. Align the holes in the lever and pivot seat, fit the pivot pin, and lock it with a split pin.

Reset the clearance as detailed in Section M.14.

Section M.14

ADJUSTING THE HAND BRAKE

Adjustment to compensate for pad wear must be made at the hand brake units and not on the relay lever adjuster. The adjustments should be made in the following manner when the travel of the hand brake lever becomes excessive.

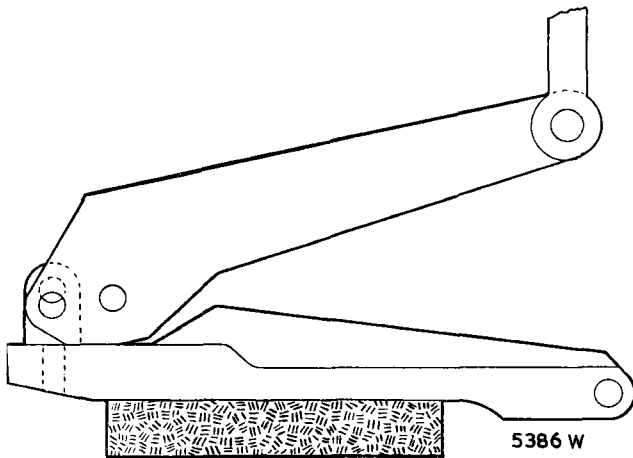


Fig. M.8

When replacing a hand brake friction pad place the lever against the inner carrier in the position shown. Hold the locknut against the trunnion and screw in the adjuster bolt three or four threads

Raise the rear of the car—making certain that the front wheels are suitably blocked to prevent the car running forward—and remove both rear wheels. The hand brake lever should be in the fully off position whilst the adjustments are made.

Slacken the brass adjuster nut fitted to the relay lever (located beside the front universal joint on the propeller shaft) so that the operating cable hangs loosely.

Tighten each adjuster bolt until the pads 'nip' the brake disc. Screw up the brass adjuster nut on the relay lever until all slackness is taken up, ensuring that there is no preload on the linkage.

Set the clearance between the pads and the brake disc by unscrewing each adjuster bolt approximately one-third of a turn. Make sure that the discs rotate freely.

Section M.15

REMOVING THE HAND BRAKE CABLE

Unscrew and remove the adjuster nut; withdraw the end of the cable from the lower end of the lever and remove the spring.

Disconnect the clips securing the cable assembly to the body.

Remove the clevis pins from the levers on the wheel brake units.

Unscrew the two nuts on the axle balance lever; separate the two halves of the lever and remove the cable and trunnion.

M.8

Section M.16

REMOVING A BRAKE DISC

Remove the brake unit as detailed in Section M.7 and withdraw the hub by the method described in Section K.6 (front) or Section H.2 (rear).

The rear disc is separated from the hub by removing the four securing nuts and washers. The front disc is secured to the hub by four set bolts with spring washers, and after removing these the two components may be separated.

Section M.17

REPLACING A BRAKE DISC

Assemble the brake disc to the hub by a reversal of the instructions given in Section M.16 and fit the assembly to the vehicle.

Check the disc for true rotation by clamping a dial indicator to a suitable fixed point on the vehicle with the needle pad bearing on the face of the disc. Run-out must not exceed .006 in. (.152 mm.), and in the event of the value being exceeded the components should be examined for damage and, if necessary, renewed.

Replace the brake unit as detailed in Section M.10.

Section M.18

FLEXIBLE HOSES

The flexible pipes must show no signs of deterioration or damage and the bores should be cleared with a jet of

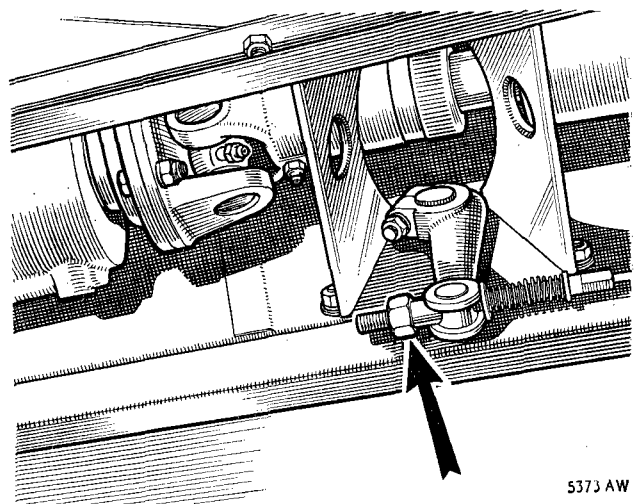


Fig. M.9

The arrow indicates the brass adjuster nut fitted to the cable relay lever

compressed air. No attempt should be made to clear a blockage by probing as this may result in damage to the lining and serious restriction to fluid flow. Partially or totally blocked flexible pipes should always be renewed. When removing or refitting a flexible pipe the end sleeve hexagon should be held with the appropriate spanner to prevent the pipe from twisting. A twisted pipe will prove detrimental to efficient brake operation.

Removing a rear hose

The front end of the rear flexible hose is held in a bracket mounted on the right-hand battery box. Unscrew the metal pipe union nut and release the pipe. Hold the hexagon on the flexible hose with a spanner and remove the large retaining nut and its shakeproof washer from the under side of the support bracket. The pipe may now be unscrewed at its rear end from the three-way piece on the rear axle.

Removing a front hose

Unscrew the metal pipe union nuts at each end of the front hose. Hold the hexagon on the flexible hose and

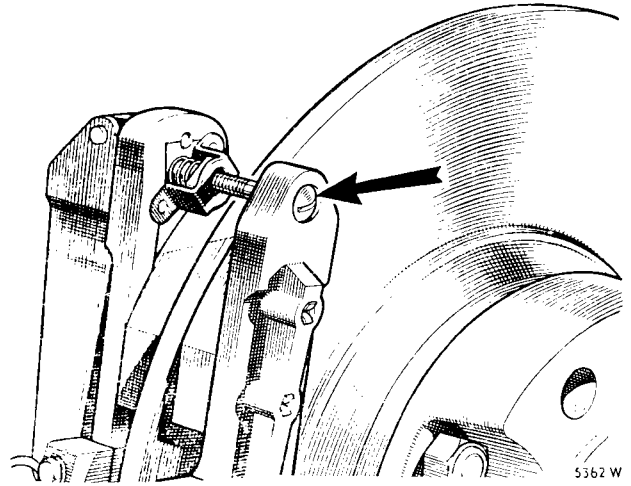


Fig. M.10

The arrow indicates the hand brake carrier pad adjusting bolt

remove the nut and shakeproof washer on the under side of the mounting brackets.

