

## **SECTION M**

### **THE BRAKING SYSTEM**

General Description.

Maintenance.

The Master Cylinder and Supply Tank Assembly.

Section No. M.1 Adjusting the brake pedal.

Section No. M.2 Brake-shoe adjustments.

Section No. M.3 Bleeding the system (expelling air).

Section No. M.4 Removing the master cylinder and supply tank assembly.

Section No. M.5 Dismantling the master cylinder and supply tank assembly.

Section No. M.6 Assembling the brake master cylinder.

Section No. M.7 Replacing the master cylinder and supply tank assembly.

Section No. M.8 Brake assembly.

Section No. M.9 Removing a wheel cylinder.

Section No. M.10 Dismantling a wheel cylinder.

Section No. M.11 Assembling a wheel cylinder.

Section No. M.12 Replacing a wheel cylinder.

Section No. M.13 Removing the flexible hose.

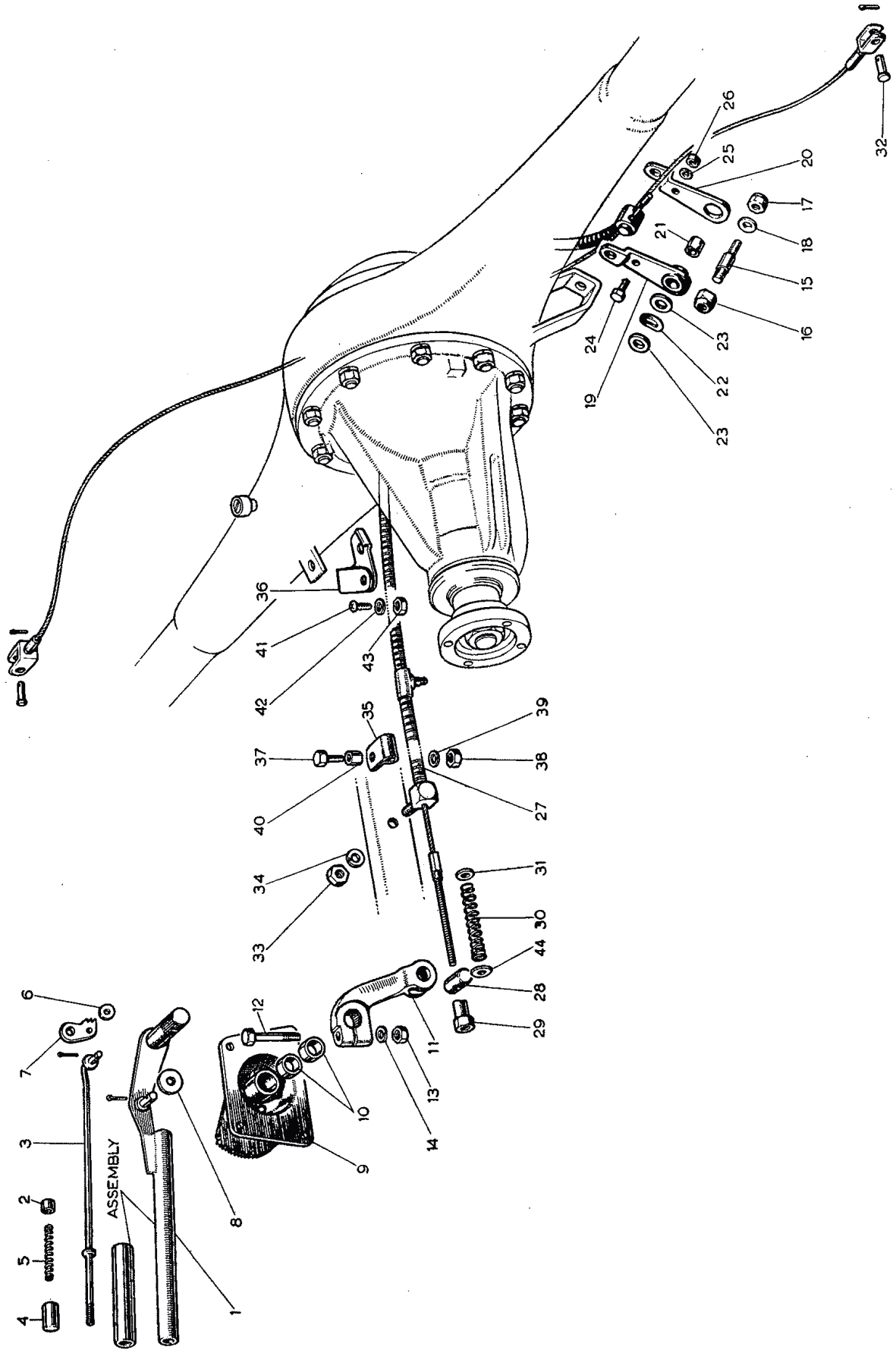
Section No. M.14 Removing and replacing brake-shoe assemblies.

Section No. M.15 Relining the brake-shoes.

Section No. M.16 The hand brake cable.

Section No. M.17 Braking irregularities and their causes.

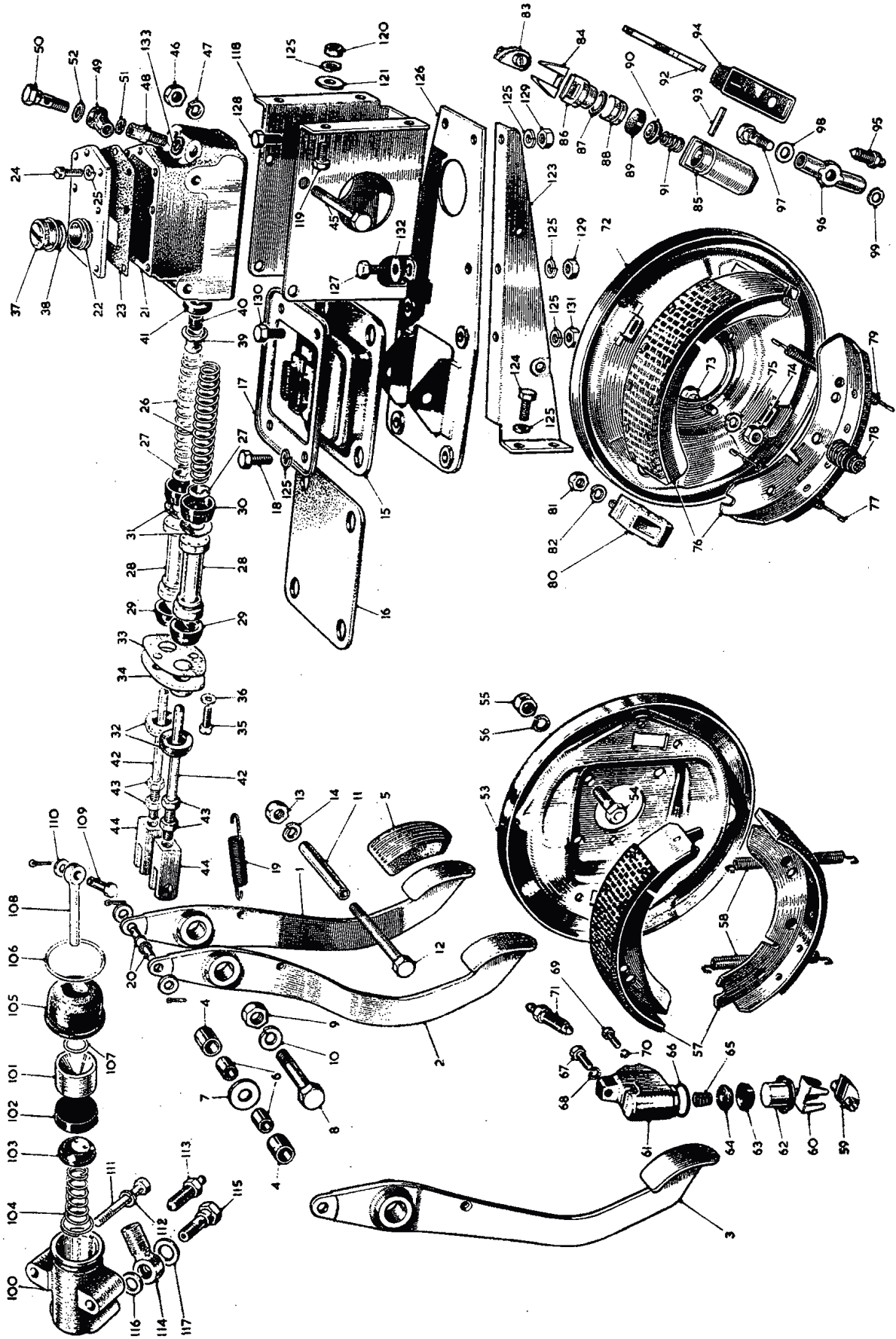
## THE HAND BRAKE



**KEY TO THE HAND BRAKE**

<i>No.</i>	<i>Description</i>	<i>No.</i>	<i>Description</i>	<i>No.</i>	<i>Description</i>
1.	Handle plate and shaft assembly.	16.	Nut—fulcrum to axle.	31.	Washer—plain—cable spring.
2.	Bush—handle plate and shaft.	17.	Nut—compensator to fulcrum.	32.	Clevis pin.
3.	Pawl rod assembly.	18.	Washer—compensator to fulcrum.	33.	Abutment nut.
4.	Knob—pawl rod.	19.	Lever—inner compensating.	34.	Washer—spring.
5.	Spring—pawl rod.	20.	Lever—outer compensating.	35.	Clip—cable to battery carrier.
6.	Washer—plain.	21.	Bush—compensating lever.	36.	Clip—cable to 3-way piece—axle brackets.
7.	Pawl.	22.	Washer—anti-rattle—compensating.	37.	Screw—clip.
8.	Washer.	23.	Washer—plain—compensating lever.	38.	Nut—clip screw.
9.	Fulcrum and ratchet assembly.	24.	Screw—compensating lever.	39.	Washer—spring—battery carrier clip.
10.	Bush.	25.	Washer—spring—compensating lever.	40.	Distance tube—battery carrier clip.
11.	Operating lever—hand brake.	26.	Nut—compensating lever.	41.	Screw—clip—3-way piece.
12.	Bolt—operating lever.	27.	Cable—hand brake.	42.	Washer—spring—3-way piece clip screw.
13.	Nut—operating lever.	28.	Trunnion—cable.	43.	Nut—3-way piece clip screw.
14.	Washer—spring.	29.	Adjuster nut.	44.	Washer—plain—cable spring front.
15.	Fulcrum—hand brake compensator.	30.	Spring—cable.		

THE HYDRAULIC SYSTEM



## KEY TO THE HYDRAULIC SYSTEM

No.	Description	No.	Description	No.	Description
1.	Brake pedal.	45.	Bolt—master cylinder to box.	89.	Cup—piston.
2.	Clutch pedal—right-hand drive.	46.	Nut—master cylinder to box bolt.	90.	Filler cup.
3.	Clutch pedal—left-hand drive.	47.	Washer—spring.	91.	Spring—filler.
4.	Bush.	48.	Adaptor—master cylinder.	92.	Lever—hand brake.
5.	Rubber pad—pedal.	49.	Banjo—master cylinder.	93.	Pin—lever.
6.	Distance-piece—pedal.	50.	Bolt—banjo.	94.	Boot—hydraulic cylinder.
7.	Distance washer—pedal.	51.	Gasket—banjo connection.	95.	Screw—bleeder.
8.	Bolt—pedal bracket.	52.	Gasket—banjo connection.	96.	Banjo connection—wheel cylinder.
9.	Nut—pedal bracket bolt.	53.	Plate—L/H front brake.	97.	Bolt—banjo connection.
10.	Washer—spring.	54.	Bolt—brake back-plate.	98.	Gasket—banjo connection—large.
11.	Distance tube—pedal stop.	55.	Nut—brake back-plate.	99.	Gasket—banjo connection—small.
12.	Distance tube—bolt.	56.	Washer—spring—brake back-plate.	100.	Body.
13.	Nut—distance tube bolt.	57.	Shoe—lined—brake.	101.	Piston.
14.	Spring washer.	58.	Spring—shoe pull-off.	102.	Cup—piston.
15.	Fume excluder—brake and clutch pedal.	59.	Adjuster.	103.	Filler—piston cup.
16.	Rubber—blanking piece.	60.	Mask—adjuster.	104.	Spring—cup filler.
17.	Cover—blanking piece.	61.	Body—L/H.	105.	Boot.
18.	Cover screw.	62.	Piston and dust cover.	106.	Clip—large—boot.
19.	Spring—pedal pull-off.	63.	Cup—piston.	107.	Clip—small—boot.
20.	Clevis pin.	64.	Filler—piston cap.	108.	Push-rod.
21.	Body.	65.	Spring—filler.	109.	Clevis pin—slave cylinder to clutch fork.
22.	Cover—body.	66.	Sealing ring.	110.	Washer—plain.
23.	Gasket—cover.	67.	Bolt—cylinder to brake plate ( $\frac{1}{8}$ ").	111.	Bolt—slave cylinder to gearbox.
24.	Screw—cover to body.	68.	Spring washer—cylinder bolt.	112.	Washer—spring.
25.	Washer—shakeproof.	69.	Bolt—cylinder to brake plate ( $\frac{1}{4}$ ").	113.	Bleeder screw.
26.	Spring—piston return.	70.	Spring washer—cylinder bolt.	114.	Banjo—slave cylinder.
27.	Retainer—spring.	71.	Screw—bleeder.	115.	Bolt—banjo—slave cylinder.
28.	Piston.	72.	Plate—L/H rear brake.	116.	Gasket—banjo.
29.	Cup—primary—piston.	73.	Bolt—brake back-plate.	117.	Gasket—banjo.
30.	Cup—secondary—piston.	74.	Nut—brake back-plate.	118.	Master cylinder box.
31.	Washer—primary clip to piston.	75.	Washer—spring—brake back-plate.	119.	Screw box—master cylinder.
32.	Boot—push-rod.	76.	Shoe—lined—brake.	120.	Nut.
33.	Gasket—boot fixing plate.	77.	Spring—shoe pull-off.	121.	Washer—plain.
34.	Plate—boot fixing.	78.	Spring—shoe steady.	123.	Support bracket—L/H master cylinder box.
35.	Screw—plate.	79.	Spring—shoe tension.	124.	Screw—bracket to topping plate.
36.	Washer—shakeproof.	80.	Abutment strip—brake-shoe.	125.	Washer—spring.
37.	Cap—filler.	81.	Nut—abutment strip.	126.	Base plate assembly.
38.	Seal.	82.	Washer—spring.	127.	Screw.
39.	Body—valve.	83.	Adjuster.	128.	Screw—box to bracket rear.
40.	Cup.	84.	Mask—adjuster.	129.	Nut.
41.	Washer.	85.	Body—with abutment strip.	130.	Screw—bracket to base plate.
42.	Push-rod.	86.	Piston—with dust cover.	131.	Nut—bracket to base screw.
43.	Nut—locking.	87.	Seal.	132.	Plain washer.
44.	Yoke—push-rod—to pedal.	88.	Piston—hydraulic.	133.	Gasket—adaptor.



### GENERAL DESCRIPTION

The Lockheed hydraulic equipment includes a master cylinder and supply tank assembly in which two separate cylinders are supplied with fluid from a common supply tank. Hydraulic pressure generated in one of the cylinders operates the brakes through the wheel cylinders, while pressure in the other operates the clutch withdrawal mechanism through a slave cylinder, piston, and push-rod connected to the clutch lever.

The master cylinder and supply tank assembly is mounted on the engine side of the bulkhead just above the level of the pedal pads.

Steel pipe lines, unions and flexible hoses convey the hydraulic pressure from one of the master cylinders to each wheel cylinder and from the other to the clutch slave cylinder.

Each brake-shoe in the front drums has a separate wheel cylinder, thus providing two leading shoes. In the rear drums a single wheel cylinder, operated both hydraulically and mechanically, floats on the brake plate and operates the two shoes, giving one leading and one trailing shoe in either direction of rotation to provide adequate braking in reverse.

### MAINTENANCE

Periodically examine the quantity of brake fluid in the master cylinder. It should never be less than half-full or closer than  $\frac{1}{2}$  in. (13 mm.) to the bottom of the filler neck. The necessity of frequent topping up is an indication of over-filling or a leak in the system, which should at once be traced and rectified.

Adjust the brake-shoes to compensate for wear of the linings. The need for this is shown by the pedal going down almost to the floorboards before solid resistance is felt. For brake-shoe adjustments see Section M.2.

Adjustment of the brake-shoes in the manner indicated also adjusts the hand brake automatically, and no separate adjustment is required or permitted.

### THE MASTER CYLINDER AND SUPPLY TANK ASSEMBLY

#### *The brake master cylinder*

Within the cylinder is a piston, backed by a rubber cup, normally held in the "off" position by a piston return spring. Immediately in front of the cup, when it is in the "off" position, is a compensating orifice connecting the cylinder with the fluid supply. This port allows free compensation for any expansion or contraction of the fluid, thus ensuring that the system is constantly filled; it also serves as a release for additional fluid drawn into the cylinder during brake applications. Pressure is applied to the piston by means of the push-rod attached to the brake pedal. The push-rod length is adjustable and should give a slight clearance when the

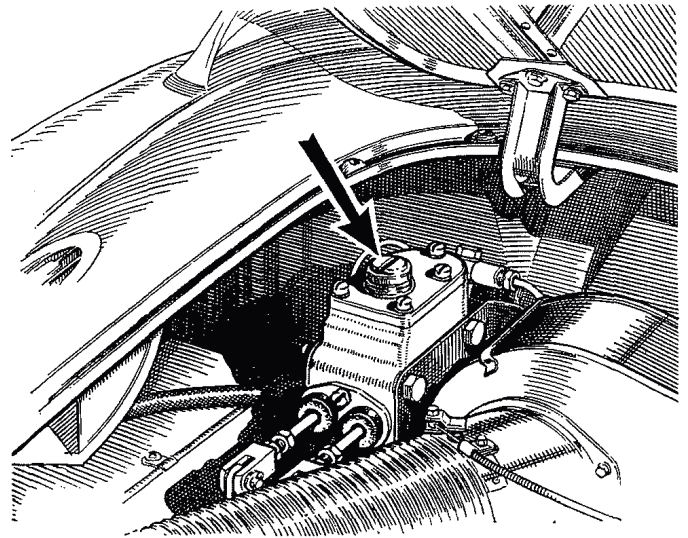


Fig. M.1.

*The master cylinder filler cap.*

system is at rest to allow the piston to return fully against its stop. Without this clearance the main cup will cover the by-pass port, causing pressure to build up within the system, and produce binding of the brakes on all wheels. The reduced skirt of the piston forms an annular space which is filled with fluid from the supply tank via the feed hole. Leakage of fluid from the open end of the cylinder is prevented by the secondary cup fitted to the flange end of the piston. On releasing the brake pedal, after application, the piston is returned quickly to its stop by the return spring, thus creating a vacuum in the cylinder; this vacuum causes the main cup to collapse and pass fluid through the small holes in the piston head from the annular space formed by the piston skirt. This additional fluid finds its way back to the reserve supply under the action of the brake return springs, when the system finally comes to rest, through the outlet valve and compensating orifice. If the compensating orifice is covered by the piston cup when the system is at rest, pressure will build up as a result of the brake application. The combination inlet and outlet check valve in the head of the cylinder is provided to allow the passage of fluid under pressure from the master piston into the pipe lines and control its return into the cylinder, so that a small pressure of approximately 8 lb. per square inch (.56 kg./cm.<sup>2</sup>) is maintained in the pipe lines to ensure that the cups of the wheel cylinders are kept expanded; it also prevents fluid pumped out from the cylinder when "bleeding" from returning to the cylinder, thus ensuring a fresh charge being delivered at each stroke of the pedal.

#### *The clutch master cylinder*

The components and operation of the clutch master cylinder are, in the main, similar to those of the brake

master cylinder, but with one important difference: the combination inlet and outlet check valve used in the brake cylinder is not incorporated in the clutch cylinder, and therefore no pressure is maintained in the clutch line when the clutch pedal is released.

## Section M.1

### ADJUSTING THE BRAKE PEDAL

The correct amount of free movement between the master cylinder push-rod and piston is set during erection of the vehicle, and should never need alteration.

In the event of the adjustment having been disturbed, reset the effective length of the rod connecting the cylinder to the pedal until the pedal pad can be depressed approximately  $\frac{1}{2}$  in. (13 mm.) before the piston begins to move. The clearance can be felt if the pedal is depressed by hand.

#### Adjusting the clutch pedal

See Section E.

## Section M.2

### BRAKE-SHOE ADJUSTMENTS

As the linings wear, the pedal will travel farther before the brakes come into action. When the travel becomes excessive the brake-shoes should be adjusted.

A hole sealed with a rubber plug is provided in the wheel and in the drum to allow adjustment without removal of the wheel. The hole in the drum is sealed by a neoprene tubular seal between the wheel and drum. When the wheel is replaced after removal for any purpose, take care to refit it with the holes in the wheel and drum in line and with both seals in position.

### Front shoe adjustment

Jack up the front of the car and remove the wheel disc and rubber plug from the hole in the wheel.

Turn the wheel until one of the two adjustment screws is visible through the hole in the wheel and drum.

Insert a screwdriver and turn the adjustment screw in a clockwise direction until the drum is locked and then turn it anti-clockwise one notch. Rotate the drum until the other screw is visible and repeat the adjustment.

The drum should then be free to rotate without the shoes rubbing and the adjustment on that wheel is complete.

### Rear shoe adjustment

The procedure is similar to that detailed for the front wheels except that there is only one adjuster controlling both shoes and hand brake.

## Section M.3

### BLEEDING THE SYSTEM (Expelling Air)

Bleeding the system is not a routine maintenance job, and should only be necessary when some portion of the hydraulic equipment has been disconnected or the fluid drained off.

Fill the master cylinder with Lockheed Genuine Brake Fluid (if this fluid is not available an alternative fluid conforming to S.A.E. Specification No. 70.R1 should be used) and keep it at least half-full throughout the operation, otherwise air will be drawn into the system, necessitating a fresh start.

Attach the bleeder tube to the wheel cylinder bleeder screw and allow the free end of the tube to be submerged in a small quantity of fluid in a clean glass jar.

Open the bleeder screw one full turn.

Depress the brake pedal quickly, and allow it to return

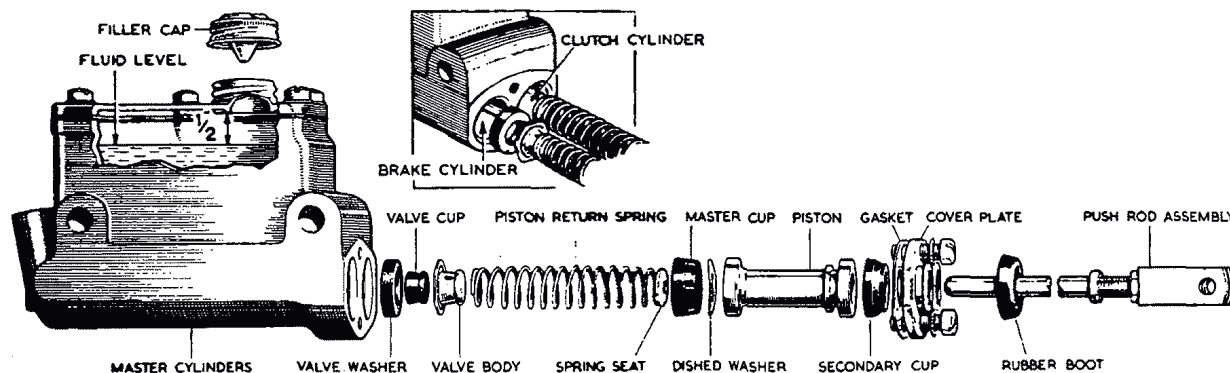


Fig. M.2

Illustrating the master cylinders for brake and clutch operation, and their components. Note that no valve is used in the clutch master cylinder

without assistance. Repeat this pumping action with a slight pause before each depression of the pedal.

Watch the flow of fluid into the glass jar, and when air bubbles cease to appear, hold the pedal firmly against the floorboards while the bleeder screw is securely tightened.

Repeat the operation on each wheel.

**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.4

### REMOVING THE MASTER CYLINDER ASSEMBLY

Extract the push-rod split pins and clevis pins.

Unscrew the union nut and disconnect the clutch pipe from the rear end of the master cylinder.

Unscrew the brake pipe at the three-way union on the chassis side-member.

Remove the bolt securing the brake pipe clip to the front of the mounting plate.

Remove the two bolts passing through the bracket and master cylinder and lift out the assembly complete with the brake pipe and clip.

## Section M.5

### DISMANTLING THE MASTER CYLINDER AND SUPPLY TANK ASSEMBLY

Remove the filler cap and drain the Lockheed fluid from the unit.

Unscrew the two retaining screws and remove the end cover.

Withdraw the two pistons, piston cups, return springs and one valve cup assembly. Note that no valve assembly is fitted to the clutch cylinder.

To remove the secondary cups from the pistons, carefully stretch each one over the end flange of the piston, using only the fingers.

## Section M.6

### ASSEMBLING THE BRAKE MASTER CYLINDER

Clean all parts thoroughly, using Lockheed Genuine Brake Fluid for all rubber components. All traces of petrol (gasoline), paraffin (kerosene) or trichlor-ethylene 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 re-

building the cylinder. Dip all the internal parts in brake fluid and assemble them wet.

Stretch the secondary cup over the end flange of the piston with the lip of the cup facing towards the opposite end of the piston. When the cup is in its groove, work it round gently with the fingers to make sure it is correctly seated.

Fit the valve washer, valve cup and body onto the return spring, and insert the spring, valve first, into the cylinder. See that the spring retainer is in position.

Insert the master cup, lip first, taking care not to damage or turn back the lip, and press it down onto the spring retainer.

Insert the piston, taking care not to damage or turn back the lip of the secondary cup.

Push the piston down the bore and replace the end plate, rubber boots and push-rods.

Test the master cylinder by filling the tank and by pushing the piston down the bore and allowing it to return; after one or two applications fluid should flow from the outlet.

### Assembling the clutch master cylinder

The procedure is similar to that for the brake cylinder, omitting the valve assembly.

## Section M.7

### REPLACING THE MASTER CYLINDER AND SUPPLY TANK ASSEMBLY

The replacement procedure is the reverse of the removal instructions given in Section M.4 with the following additions:

Replace the union in its correct position and fully tighten before replacing the master cylinder in its housing.

Check the shoe adjustment as detailed in Section M.2.

Connect the fluid pipes and bleed the system (including the slave cylinder) as in Section M.3.

Check the system for leaks with the brakes fully applied.

## Section M.8

### BRAKE ASSEMBLY

Two leading shoes are incorporated in the front wheel braking system and take the greater percentage of the braking load. The rear brakes are of the leading and trailing shoe type, giving the advantage of equal braking action when the brakes are used in reverse.

All the shoes have a floating anchorage, each front shoe utilizing the closed end of the other shoe actuating



cylinder as its abutment. The two rear shoes share one common abutment stop.

The hand brake lever operates the rear brakes mechanically through a linkage operating on the piston of the rear wheel cylinder, which is made in two halves. The outer half of the piston applies the leading shoes when actuated by a lever pivoted in the cylinder body. The trailing shoe is applied by the movement of the cylinder body, which slides on the brake plate as a result of the reaction of the mechanically operated lever on the pivot.

When operated hydraulically the inner half of the piston is forced outwards, carrying with it the outer half, thus applying the leading shoe, and the trailing shoe is applied by the floating cylinder body as a result of the reaction of the fluid pressure on the body.

## Section M.9

### REMOVING A WHEEL CYLINDER

#### Front cylinders

Raise the front of the car and remove the hub cap and road wheel.

Remove the brake-drum as detailed in Section K.7.

Draw the brake-shoes apart until the assembly can be removed from the back-plate.

Release the flexible hose as detailed in Section M.13.

Unscrew the hose from the wheel cylinder.

Unscrew the unions and remove the link pipe from both cylinders.

Unscrew the set bolts securing the cylinders to the back-plates and remove the cylinders.

#### Rear cylinder

Raise the rear of the car and remove the wheel.

Remove the brake-drum as detailed in Section H.1.

Turn and withdraw the brake-shoe steady springs.

Draw the brake-shoes apart until they can be removed from the brake-plate.

Unscrew the pipe union from the cylinder, noting the positions of the copper washers.

Remove the clevis pin from the hand brake cable yoke to disconnect the cable from the lever on the cylinder.

Remove the rubber boot.

Slide the cylinder upwards, push the lower end through the back-plate and slide the cylinder downwards and away from the back-plate.

## Section M.10

### DISMANTLING A WHEEL CYLINDER

#### Front cylinders

Withdraw the piston, the rubber cup, the cup filler and the spring.

#### Rear cylinders

Tap out the hand brake lever pivot pin and withdraw the lever. Withdraw the upper half of the piston, the rubber cup, the cup filler and the spring.

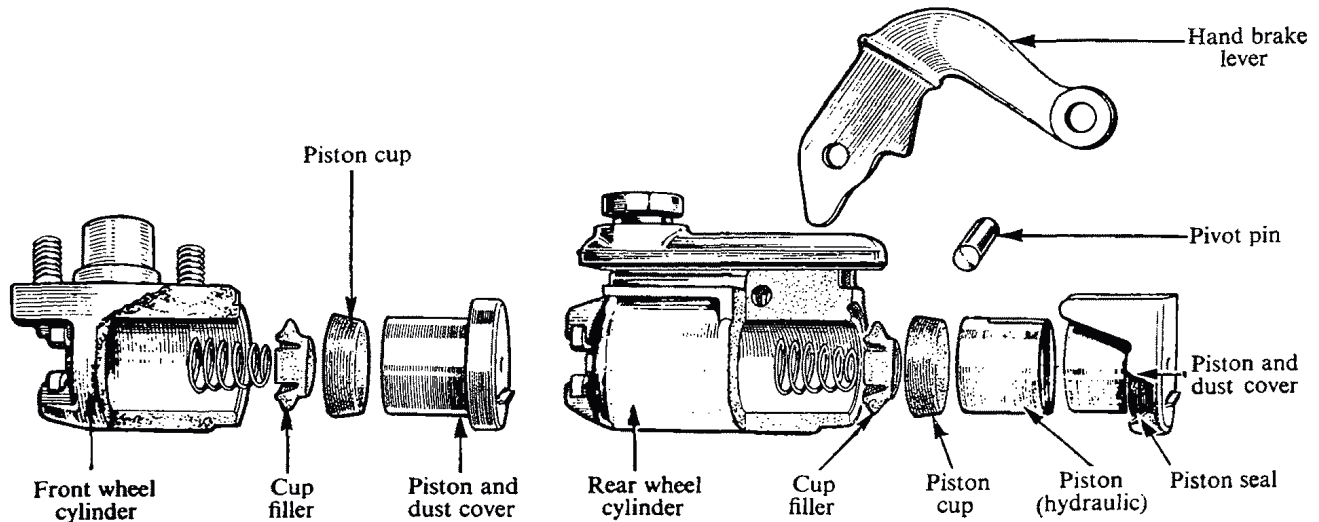


Fig. M.3.

Front and rear wheel cylinder components.

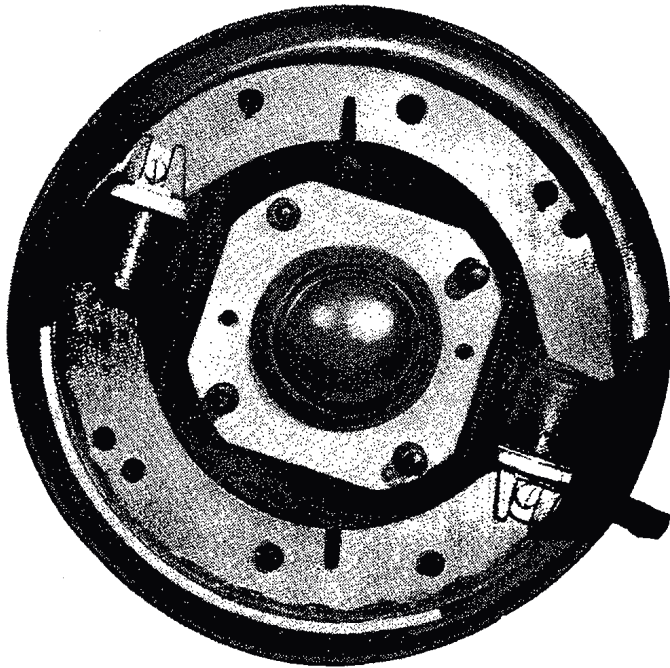


Fig. M.4.  
A front brake assembly.

## Section M.11

### ASSEMBLING A WHEEL CYLINDER

Clean all parts thoroughly, using only Lockheed hydraulic brake fluid for the rubber components. All traces of petrol, paraffin or trichlorethylene used for cleaning the metal parts must be completely removed before assembly.

Examine the rubber cups for damage, wear, or distortion. Dip all parts in brake fluid and assemble wet.

Insert the cup filler and spring, and the rubber cup concave side first.

Replace the piston, and in the case of the rear cylinders insert the hand brake lever and its pivot pin.

## Section M.12

### REPLACING A WHEEL CYLINDER

The procedure for replacing the wheel cylinder is a reversal of the sequence of operations given in Section M.9, but attention must be given to the following important points:—

#### Front

The front brake wheel cylinders are interchangeable but the link pipe banjo unions must be fitted to them so that the flexible hose is connected to the rear cylinder and the bleeder screw to the forward cylinder. The link pipe must pass below the centre line of the stub axle.

M.10

The brake-shoes are interchangeable but the recessed ends must engage the "Micram" shoe adjusters.

#### Rear

The wheel cylinder must be fitted on the rear side of the axle casing with the bleeder screw pointing downwards.

The brake-shoes are interchangeable but the recessed end of the upper or leading shoe must engage the "Micram" shoe adjuster. The other shoe should also be fitted with its recessed end against the wheel cylinder.

## Section M.13

### REMOVING THE FLEXIBLE HOSE

Do not attempt to release a flexible hose by turning either end with a spanner. It should be removed as follows:—

Unscrew the metal pipe line union nut from its connection to the hose.

Remove the locknut securing the flexible hose union to the bracket and unscrew the hose from the wheel cylinder. Note that a distance-piece is fitted at the rear of the bracket securing the front hoses.

## Section M.14

### REMOVING AND REPLACING BRAKE-SHOE ASSEMBLIES

Jack up the car and remove the wheel.

Remove the brake-drum as detailed in Section K.7 (*Front*) and Section H.1 (*Rear*).

Turn and withdraw the steady springs (rear only).

Draw the shoes apart until they can be removed from the back-plate.

Replacement is a reversal of the above procedure, but note the correct fitting of the shoes and springs.

#### Front springs

Both springs are fitted between the shoes and the back-plate.

The shoes are fitted with the recessed ends on the adjusters.

The rear spring is fitted to the rear hole in the upper shoe and the inner of the two holes in the lower shoe.

#### Rear springs

Both springs are fitted between the shoes and the back-plate.

The lighter spring is fitted at the abutment end of the shoes.

Both springs are fitted to the end holes in the shoes.

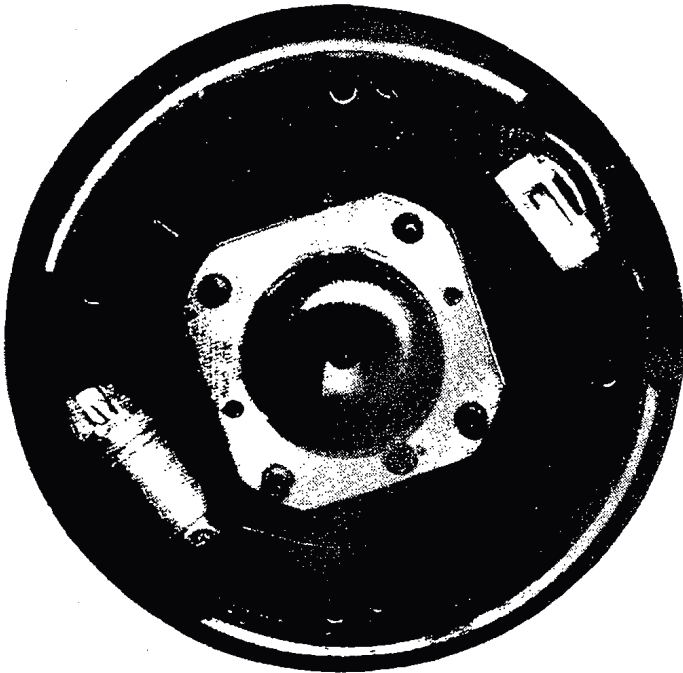


Fig. M.5  
A rear brake assembly.

## Section M.15

### RELINING THE BRAKE-SHOES

Owing to the need for the brake linings to be finished so that they are perfectly concentric with the brake-drums, special precautions must be taken when relining the shoes.

It is imperative that all brake linings should be of the same make, grade, and condition to ensure even braking.

When brake linings are in need of renewal they must always be replaced in axle sets, and the relining of the shoes in one brake-drum must be avoided.

Any variations from this will give an unequal and unsatisfactory braking performance.

After riveting the new brake linings to the brake-shoes it is essential that any high-spots should be removed before replacement of the backplate assembly.

When new shoes and linings are fitted it must be appreciated that considerable adjustment has to be made on the foot brake mechanism, and it is necessary to return the Micram adjusters to their fully anti-clockwise position before attempting to refit the brake-drums over the new linings. The hand brake must also be in the fully released position.

Do not allow grease, paint, oil or brake fluid to come into contact with the brake linings.

Do not clean the rubber parts with anything other than Lockheed hydraulic brake fluid. All traces of petrol, paraffin, etc., used for cleaning metal parts must be removed before reassembly.

Do not allow the fluid in the master cylinder and supply tank assembly to fall below the half-full mark. When full the fluid should be  $\frac{1}{2}$  in. (13 mm.) below the bottom of the filler neck, with the brakes in the 'off' position.

**IMPORTANT.**—Do not use any substitute for Lockheed Super Heavy Duty Brake Fluid unless this is completely unobtainable: in such conditions use a fluid to Specification S.A.E. 70.R3.

## Section M.16

### HAND BRAKE CABLE

The amount of slack in the cable and therefore the amount of movement of the lever is adjustable by means of the nut on the screwed end of the cable located beneath the car in the centre.

#### To remove

Unscrew and remove the adjustment 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 cylinders.

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

## Section M.17

### BRAKING IRREGULARITIES AND THEIR CAUSES

#### Pedal travel excessive (requires pumping)

- (1) Brake-shoes require adjusting.
- (2) Leak at one or more joints.
- (3) Master cylinder cup worn.

#### Pedal feels springy

- (1) System requires bleeding.
- (2) Linings not bedded in.
- (3) Master cylinder fixing loose.
- (4) Master cylinder cup worn.

#### Brakes inefficient

- (1) Shoes not correctly adjusted.
- (2) Linings not bedded in.
- (3) Linings greasy.
- (4) Linings wrong quality.
- (5) Drums badly scored.
- (6) Linings badly worn.
- (7) Wrongly fitted cup fillers.

### **Brakes grab**

- (1) Shoes require adjusting.
- (2) Drums distorted.
- (3) Greasy linings.
- (4) Broken or loose road spring.
- (5) Scored drums.
- (6) Worn suspension linkage.

### **Brakes drag**

- (1) Shoes incorrectly adjusted.
- (2) Shoe springs weak or broken.
- (3) Pedal spring weak or broken.
- (4) Hand brake mechanism seized.
- (5) Wheel cylinder piston seized.
- (6) Locked pipe line.
- (7) Filler cap vent hole choked.

### **Brakes remain on**

- (1) Shoes over-adjusted.
- (2) Hand brake over-adjusted.
- (3) No free movement on pedal.
- (4) Compensator port in master cylinder covered by swollen rubber cup, or incorrect adjustment of push-rod.
- (5) Swollen wheel cylinder cups.
- (6) Choked flexible hose.

### **Unbalanced braking**

- (1) Greasy linings.
- (2) Distorted drums.
- (3) Tyres unevenly inflated.
- (4) Brake-plate loose on the axle.
- (5) Worn steering connections.
- (6) Worn suspension linkage.
- (7) Different types or grades of lining fitted.

## **SECTION MM**

### **THE BRAKING SYSTEM**

**(MGA 1600 and MGA 1600 [Mk. II])**

General description.

Maintenance.

- |                   |  |
|-------------------|--|
| Section No. MM.1  | Priming and bleeding the brake system. |
| Section No. MM.2  | Removing a brake unit.                 |
| Section No. MM.3  | Replacing a brake unit.                |
| Section No. MM.4  | Dismantling a brake unit.              |
| Section No. MM.5  | Assembling a brake unit.               |
| Section No. MM.6  | Removing the friction pads.            |
| Section No. MM.7  | Replacing the friction pads.           |
| Section No. MM.8  | Removing a brake disc.                 |
| Section No. MM.9  | Replacing a brake disc.                |
| Section No. MM.10 | Modified calliper units.               |
| Section No. MM.11 | Disc brake dust covers.                |



## GENERAL DESCRIPTION

The braking system consists of two Lockheed calliper-type disc brakes on the front wheels with conventional Lockheed drum brakes at the rear. The rear brakes are similar to those described in Section M and are serviced in the same way.

## Front brake units

Each front wheel brake unit comprises a hub-mounted disc rotating with the wheel and a braking unit rigidly attached to the swivel pin. The brake unit consists of a calliper manufactured in two halves—the mounting half and the rim half—which are held together by three bolts. A cylinder in each calliper half houses a self-adjusting hydraulic piston, a fluid seal, a dust seal, and a seal retainer. Each piston is located on a guide post securely held in the back of each cylinder. A friction stop and a sleeve are permanently located in each piston. The pistons are interchangeable side for side.

The friction pad assemblies are fitted adjacent to the pistons and are retained in position by a retainer spring and pin.

Fluid pressure generated in the master cylinder enters the mounting half of each calliper and passes through the internal fluid ports into the rim half. An even pressure is therefore exerted on both hydraulic pistons, moving them along the cylinder bores until the friction pad assemblies contact the disc. In order to compensate for wear of the pads the pistons move progressively along each corresponding guide post, and the friction stops, which grip the posts, provide a positive datum to which the pistons return. The movement of the piston deflects the fluid seal in the cylinder bore, and on releasing the pressure the piston moves back into its original position (see Fig. MM.2), thus providing the required clearance for the friction pads.

## MAINTENANCE

Periodically examine the quantity of brake fluid in the master cylinder. The correct level is  $\frac{1}{2}$  in. (13 mm.) below the bottom of the filler neck. The necessity for very frequent topping up is an indication of overfilling or of a leak in the system which should be traced and rectified at once.

Adjust the rear brake-shoes to compensate for wear of the linings. The need for this will be indicated by excessive pedal travel. For rear brake-shoe adjustment see Section M.2. The front disc brakes automatically compensate for wear of the brake pads. The pads should be checked for wear every 6,000 miles (10,000 km.) by visual observation and measurement. When wear has reduced the pads to the minimum permissible thickness of  $\frac{1}{8}$  in. (1.59 mm.) the pads must be renewed.

MM.2

## Section MM.1

## 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 is 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 Lockheed Super Heavy Duty Brake Fluid is recommended, but if this is not available an alternative fluid conforming to Specification S.A.E. 70.R3 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

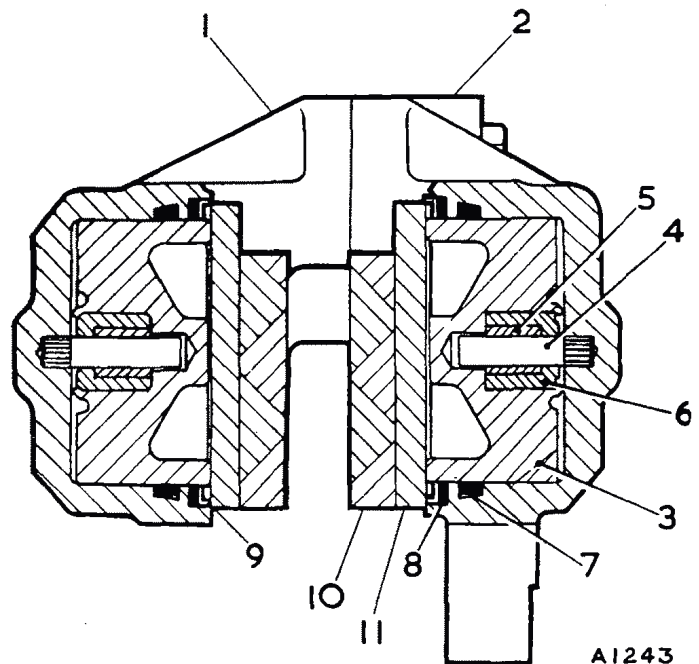


Fig. MM.1

A disc brake in section

- |                            |                        |
|----------------------------|------------------------|
| 1. Calliper—rim half.      | 7. Fluid seal.         |
| 2. Calliper—mounting half. | 8. Dust seal.          |
| 3. Hydraulic piston.       | 9. Dust seal retainer  |
| 4. Guide post.             | 10. Friction pad.      |
| 5. Friction stop.          | 11. Pad backing plate. |
| 6. Sleeve.                 |                        |

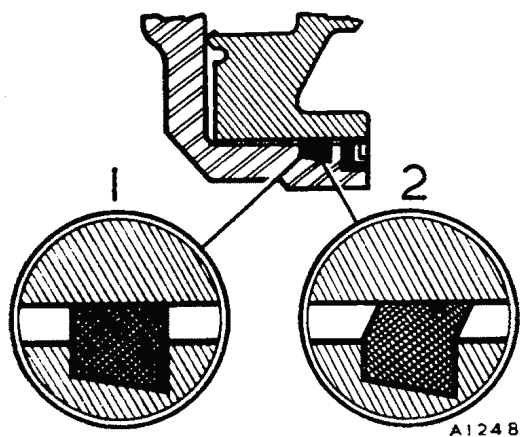


Fig. MM.2

*As the piston moves outwards from its static position (1) the fluid seal is deflected (2). When the hydraulic pressure is released the fluid seal regains its static position, moving the piston back and providing clearance at the friction pads,*

forwards through its full stroke until fluid pumped into the jar is completely free from air bubbles. Close the bleed screw on a down stroke of the pedal. Release the pedal.

- (4) Repeat on the off-side rear brake.
- (5) Two bleeder screws are fitted to each front disc brake unit. Attach the bleeder tube to the inner bleed screw on the near-side brake unit. Slacken the bleed screw and bleed as described above. Repeat the operation on the outer bleed screw.
- (6) Bleed the off-side front brake in the same way.
- (7) Top up the fluid level in the reservoir.
- (8) If the disc brake callipers have been disturbed it will be necessary to pump the brake pedal several times to restore the automatic adjustment of the friction pad clearance.
- (9) 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 MM.2

### REMOVING A BRAKE UNIT

Apply the hand brake, place chocks under the rear wheels, and jack up the front of the vehicle. Remove the road wheel. Withdraw the brake friction pads as detailed in Section MM.6.

Remove the two nuts and spring washers securing the brake hose support bracket and remove the bracket.

Unscrew the two calliper securing bolts and swing the calliper clear of the disc. **Do not disconnect the fluid hose if the calliper is to be subsequently dismantled.** Support the brake unit carefully to avoid straining the hose.

## Section MM.3

### REPLACING A BRAKE UNIT

The replacement procedure is a reversal of the instructions given in Section MM.2. It is essential that the two calliper securing bolts are tightened to the correct torque figure of 45 to 50 lb. ft. (6.22 to 6.91 kg. m.). If the unit has been dismantled or the brake hose uncoupled the system must be bled as described in Section MM.1.

## Section MM.4

### DISMANTLING A BRAKE UNIT

Remove the brake unit from the swivel pin as detailed in Section MM.2, leaving the brake hose in position to enable the pistons to be removed from the cylinders, using hydraulic pressure.

Only one piston can be removed at a time and this must be replaced before the other piston can be withdrawn. Using a suitable clamp, retain one piston in the calliper and remove the other piston by gently applying the foot brake until the piston has been pushed out far enough to allow removal by hand. It is advisable to carry out this operation over a receptacle to catch the fluid as the piston is withdrawn.

With the aid of a blunt-nosed tool remove the fluid seal from the cylinder bore, taking great care not to damage the base of the seal groove or cylinder bore.

Should the dust seal require renewal, the seal retainer can be removed by placing the blade of a screwdriver between the retainer and seal and carefully prising the retainer from the mouth of the bore.

After assembling the piston into its cylinder as described in Section MM.5 the other piston can be removed by the method described above.

**IMPORTANT.**—The two halves of the calliper should not be separated unless it is absolutely essential. If separation cannot be avoided then the following points must be borne in mind during assembly.

- (1) New bolts, lock plates, and fluid channel seal must be used. The bolts are manufactured from special high tensile steel and only the correct replacements should be employed. Failure to use the correct bolts could have serious results.
- (2) Ensure that the calliper faces are clean and that the threaded bolt holes are thoroughly dry. Make

certain that the new fluid channel seal is correctly located in the recessed face before assembling the two calliper halves.

- (3) The bolt threads must be perfectly dry on assembly and they must be tightened to the correct torque readings detailed below.

Large bolts .. ..	65 lb. ft. (8.99 kg. m.)
Small bolt .. ..	10 lb. ft. (1.38 kg. m.)

### Section MM.5

#### ASSEMBLING A BRAKE UNIT

Thoroughly lubricate a new fluid seal with Lockheed Disc Brake Lubricant (the seal must be dry before applying this lubricant) and locate it in its groove in the cylinder.

Gently work round the seal with the fingers to ensure correct seating.

Ensure that the piston and bore are quite clean; if it is necessary to clean either, use only methylated spirit or Lockheed Brake Fluid.

Coat the piston with Lockheed Disc Brake Lubricant. Open the appropriate bleed screw and offer up the piston to the calliper body. Turn the piston round until the portion which has been machined away from the outer face of the piston is adjacent to the lower end of the calliper (i.e. the end opposite the bleeder screws—see Fig. MM.4) and locate the piston squarely in the mouth of the bore. With the aid of a clamp press the piston fully home. **Great care must be taken to ensure that the piston is not allowed to tilt at any time during this operation.**

Lubricate a new dust seal and dust seal retainer with

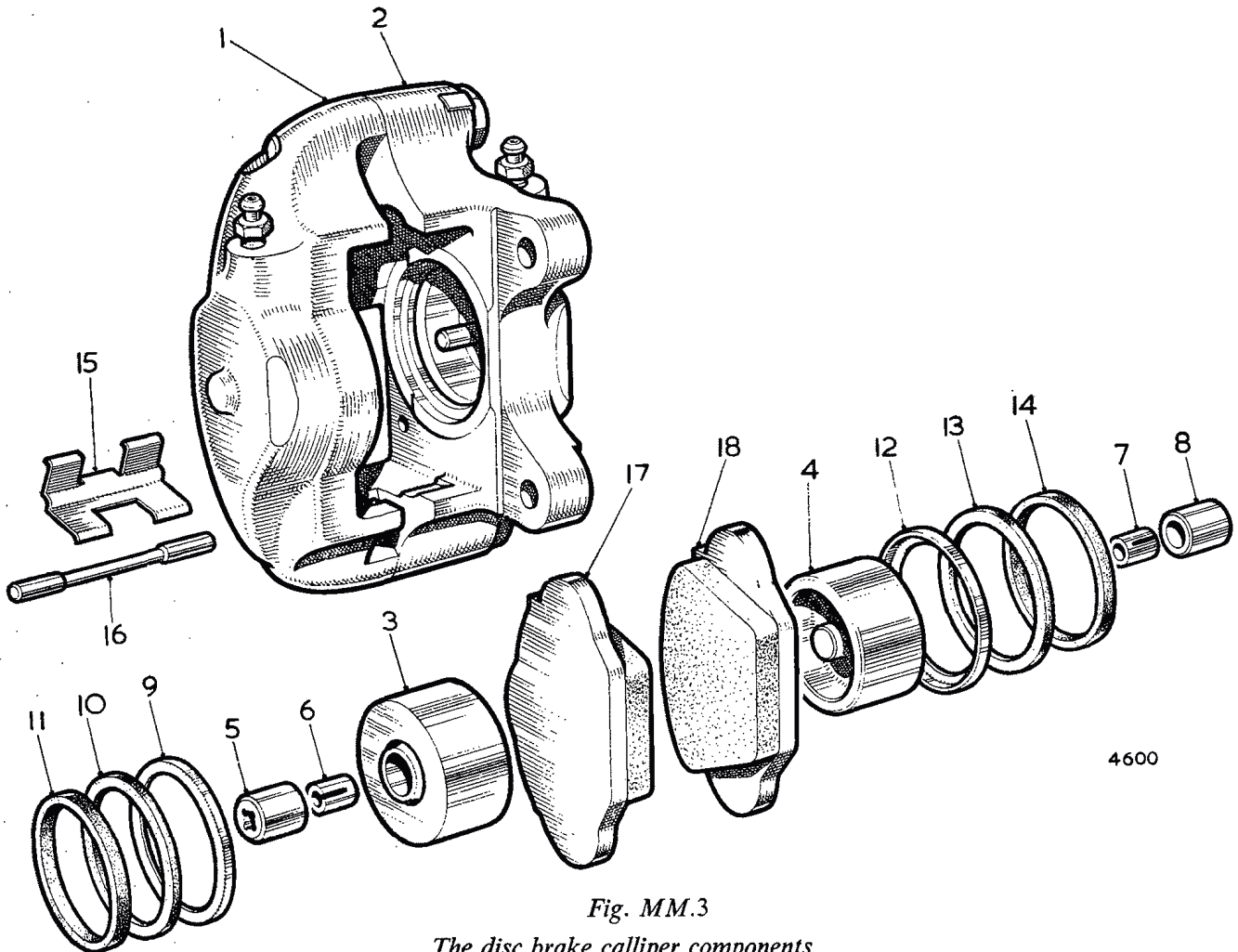


Fig. MM.3

The disc brake calliper components

- |                            |                         |                      |
|----------------------------|-------------------------|----------------------|
| 1. Calliper—rim half.      | 7. Friction stop.       | 13. Dust seal.       |
| 2. Calliper—mounting half. | 8. Sleeve.              | 14. Fluid seal.      |
| 3. Hydraulic piston.       | 9. Dust seal retainer.  | 15. Retainer spring. |
| 4. Hydraulic piston.       | 10. Dust seal.          | 16. Retainer pin.    |
| 5. Sleeve.                 | 11. Fluid seal.         | 17. Friction pad.    |
| 6. Friction stop.          | 12. Dust seal retainer. | 18. Friction pad.    |

NOTE.—Items 5, 6, 7, and 8 are locked in position during manufacture and cannot be removed for service purposes.



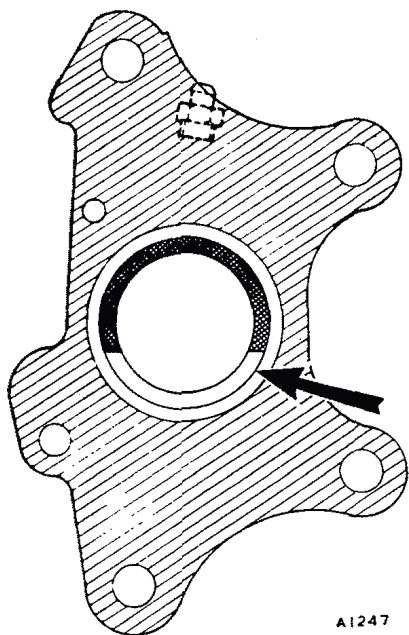


Fig. MM.4

*The cut-away portion of the piston (arrowed) must be located at the lower end of the calliper (i.e. the end opposite the bleeder screws)*

Lockheed Disc Brake Lubricant (the seal must be dry before applying the lubricant). Fit the seal in the mouth of the bore, followed by the retainer (with the recessed side outermost). Press the retainer fully home, using a suitable clamp and disc. Earlier types of calliper are fitted with a dust seal which has a 'T'-shaped cross-section; this seal fits inside the retainer. The later seal is interchangeable with the earlier type. Place a suitable clamp on the piston and restore the fluid in the system by gently depressing the foot brake until the fluid flows from the open bleeder screw. Lock the bleeder screw.

Repeat the dismantling and assembling operations on the other piston if necessary. Replace the calliper, fit the friction pads (Section MM.7), and bleed the system (Section MM.1).

**NOTE.**—Throughout the whole assembly operation it is essential that the clamp fitted to the opposite piston on dismantling is not removed.

## Section MM.6

### REMOVING THE FRICTION PADS

Jack up the front of the vehicle and remove the appropriate road wheel.

Push in the spring clip retaining the pads with a screwdriver and remove the locating pin (see Fig. MM.5).

The pads are now free to be withdrawn from the brake unit.

Thoroughly clean the surrounding area of the calliper.

## Section MM.7

### REPLACING THE FRICTION PADS

Where the original friction pads are to be refitted it is only necessary to reverse the instructions given in Section MM.6.

If wear has reduced the pads to the minimum permissible thickness of  $\frac{1}{16}$  in. (1.59 mm.) the pads must be renewed. Press the piston assemblies with a suitable clamp to the base of the cylinder bores against the resistance offered by the friction stop and sleeve. The fluid level in the master cylinder must be observed at regular intervals throughout this operation as the displaced fluid returning to the reservoir may overflow.

Check that the portion which has been machined away from the outer face of each piston is correctly positioned (see Fig. MM.4). Insert the new friction pad assemblies (which are interchangeable side for side), replace the spring clip, and fit the locating pin.

**Make certain that the clip is centrally located in the recessed portion of the pin.** Pump the brake pedal several times to readjust the brake.

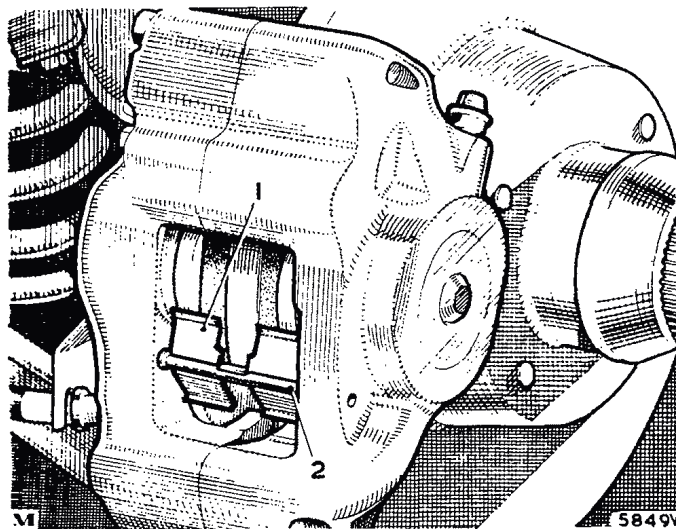


Fig. MM.5

*Depress the retainer spring (1) and withdraw the pin (2) to gain access to the friction pads*

An improved type of brake pad was introduced on the 'MGA 1600' at Car No. 78106 (wire wheels) and Car No. 78144 (disc wheels). These pads are available in sets only. If the improved pads are fitted to earlier cars it is essential that both right- and left-hand brakes are equipped. The later-type pads are colour-coded red.

**Section MM.8****REMOVING A BRAKE DISC**

Remove the brake unit as detailed in Section MM.2 and withdraw the hub by the method described in Section KK.1.

The disc is separated from the hub by removing the four securing nuts and washers.

**Section MM.9****REPLACING A BRAKE DISC**

Assemble the brake disc to the hub by a reversal of the instructions given in Section MM.8 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 .003 in. (.076 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 MM.3.

A certain amount of concentric and even scoring of the disc faces is not detrimental to the satisfactory operation of the brakes.

If it is found necessary to grind the disc faces they can be ground up to a maximum of only .040 in. (1.016 mm.) off the original thickness of .380 to .370 in. (9.65 to 9.4 mm.). This may be ground off equally each side, or more on one side than the other, provided that the total reduction does not exceed the maximum limit of .040 in. (1.016 mm.). The reground surface must not exceed 63 micro-in.

After grinding, the faces must run true to within a total clock reading of .003 in. (.076 mm.) and the thickness must be parallel to within .001 in. (.0254 mm.) clock reading.

**Section MM.10****MODIFIED CALLIPER UNITS**

A modified disc brake calliper dust seal and retainer (Fig. MM.3, items 9, 10, 12, 13) was introduced at Chassis No. 103261 (disc wheels) and Chassis No. 103834 (wire wheels).

The new seal is 'U'-shaped in cross-section and is retained in the counterbore of the calliper by a retainer having an 'L'-shaped cross-section. The seal is carried within the retainer flange and abuts the face of the calliper counterbore.

**Section MM.11****DISC BRAKE DUST COVERS**

Disc brake covers which reduce inner pad wear have been fitted to cars from Chassis No. 102589 (disc wheels) and Chassis No. 102929 (wire wheels). The covers may be fitted in sets to earlier cars.

To fit the covers proceed as follows:

- (1) Remove the front hub assembly as detailed in Section KK.1.
- (2) Remove the adaptor plate from the steering knuckle and discard the adaptor plate bolts, washers, and nuts.
- (3) Refit the adaptor plate to the steering knuckle, using bolts (Part No. HBZ0611). Assemble the distance washers (Part No. BTB386) and cover (Part No. BTB384 [R.H.] or BTB385 [L.H.]) to the bolts and secure the bolts with spring washers (Part No. LWZ206) and nuts (Part No. FNZ506). Tighten the nuts to between 35 and 40 lb. ft. (4.83 and 5.52 kg. m.).
- (4) Reassemble the front hub as detailed in Section KK.2 and ensure that the calliper securing bolts are tightened to between 45 and 50 lb. ft. (6.2 and 6.9 kg. m.).



## **SECTION MMM**

### **THE BRAKING SYSTEM**

**(MGA 1600 fitted with Dunlop disc brakes)**

General description.

Brake units.

Master cylinder.

Maintenance.

- |                    |  |
|--------------------|--|
| Section No. MMM.1  | Adjusting the brake pedal.             |
| Section No. MMM.2  | Priming and bleeding the brake system. |
| Section No. MMM.3  | Removing the master cylinder.          |
| Section No. MMM.4  | Dismantling the master cylinder.       |
| Section No. MMM.5  | Assembling the master cylinder.        |
| Section No. MMM.6  | Replacing the master cylinder.         |
| Section No. MMM.7  | Removing a brake unit.                 |
| Section No. MMM.8  | Dismantling a brake unit.              |
| Section No. MMM.9  | Assembling a brake unit.               |
| Section No. MMM.10 | Replacing a brake unit.                |
| Section No. MMM.11 | Removing the friction pads.            |
| Section No. MMM.12 | Replacing the friction pads.           |
| Section No. MMM.13 | Relining the hand brake.               |
| Section No. MMM.14 | Adjusting the hand brake.              |
| Section No. MMM.15 | Removing the hand brake cable.         |
| Section No. MMM.16 | Removing a brake disc.                 |
| Section No. MMM.17 | Replacing a brake disc.                |
| Section No. MMM.18 | Flexible hoses.                        |
| Section No. MMM.19 | Refacing brake discs.                  |

### 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 .008 to .010 in. (.203 to .254 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.

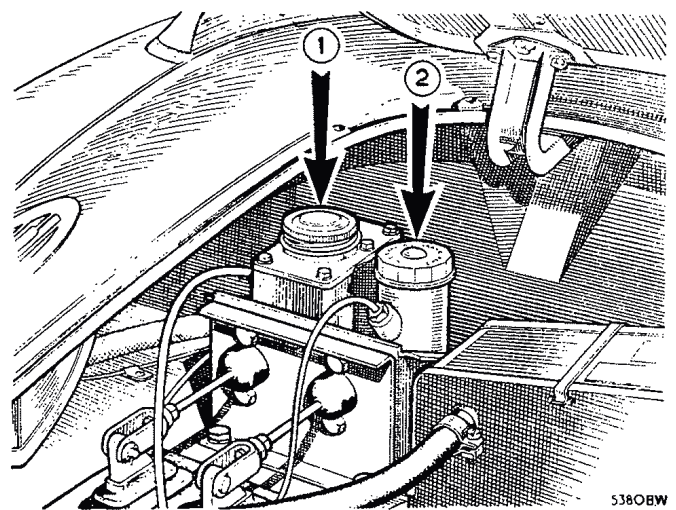


Fig. MMM.1

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  $\frac{1}{4}$  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 MMM.14.

The friction pads should be checked for wear every 6,000 miles (10000 km.) by visual observation and measurement. When wear has reduced the pads to the minimum permissible thickness of .25 in. (6.35 mm.) the pads must be renewed.

Every 3,000 miles (5000 km.) apply three or four strokes of the grease gun filled with grease to Ref. C (page P.2) to the nipple provided on the brake cable.

## Section MMM.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 MMM.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 MMM.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.



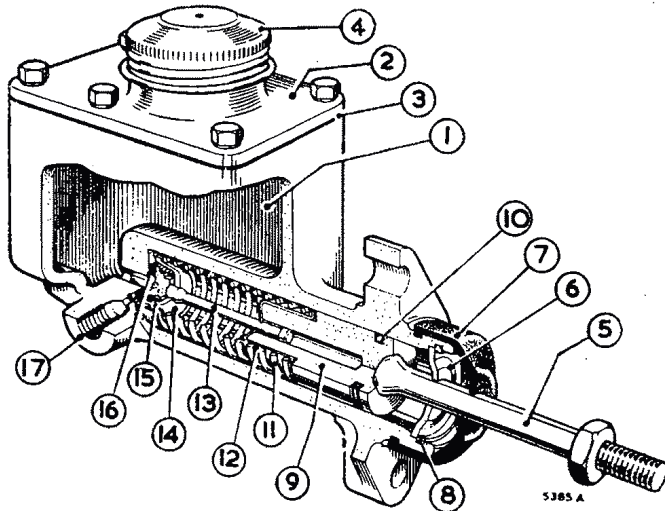


Fig. MMM.2

*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 MMM.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 MMM.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 MMM.6

#### REPLACING THE MASTER CYLINDER

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

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

### Section MMM.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.

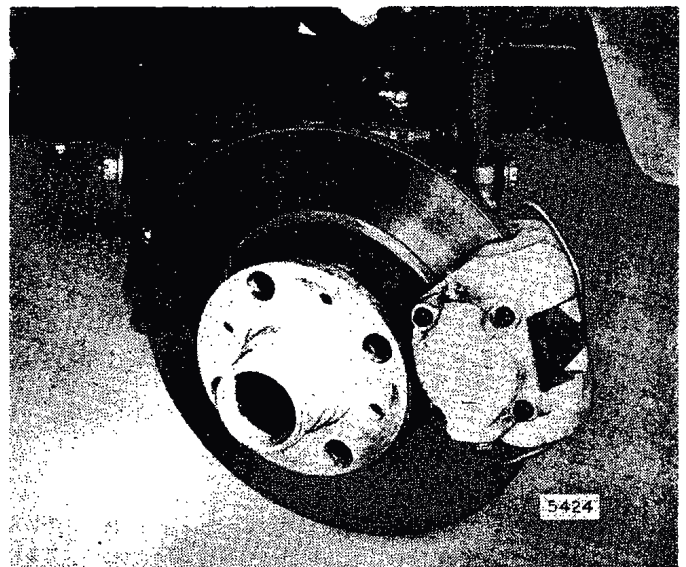


Fig. MMM.3

*A front disc brake calliper*

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.

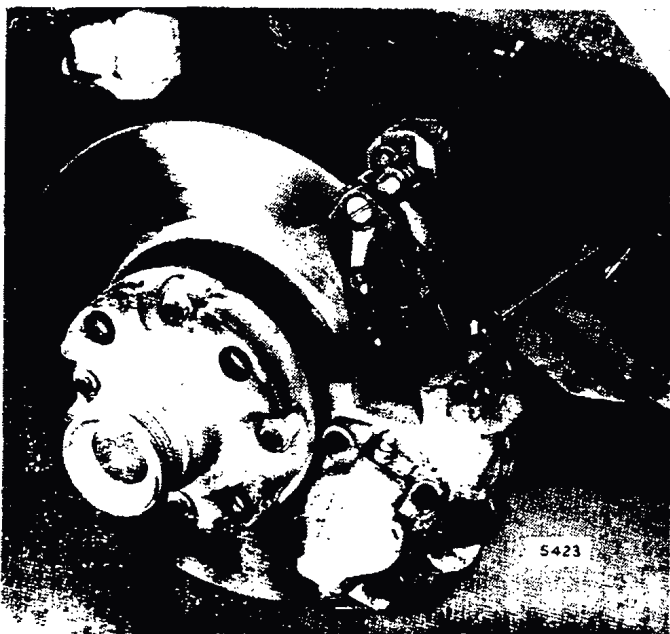
The shims taken from behind the calliper body mounting lugs must be retained and **replaced in their original positions on reassembly.**

## Section MMM.8

### DISMANTLING A BRAKE UNIT

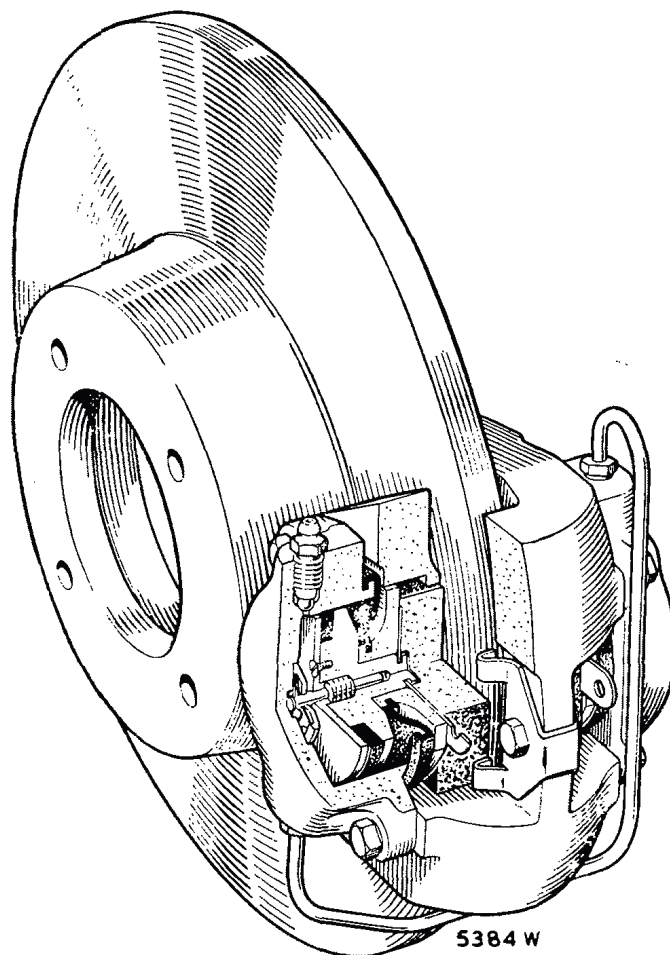
The brake must be thoroughly cleaned before proceeding with the dismantling. It is recommended that a new dust seal should be fitted whenever the unit is dismantled.

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



*Fig. MMM.4*

*A rear disc brake calliper with hand brake carriers*



*Fig. MMM.5*

*Sectioned view of a brake calliper*

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.

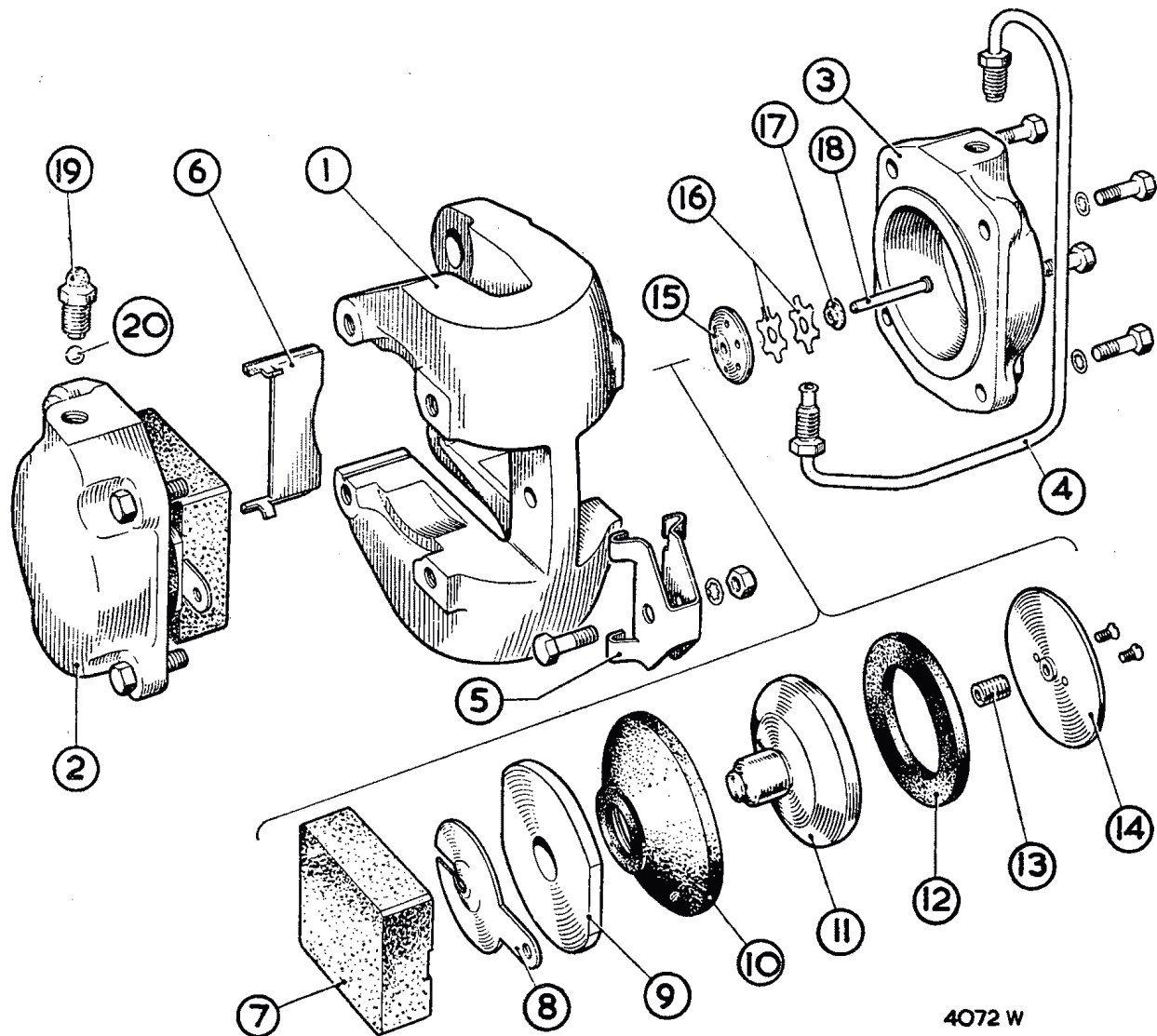
## Section MMM.9

### ASSEMBLING A BRAKE UNIT

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

Engage the collar of a new dust seal with the lip on





4072 W

Fig. MMM.6

*The disc brake calliper components*

- |                    |                    |                     |                          |
|--------------------|--------------------|---------------------|--------------------------|
| 1. Calliper.       | 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.    |

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 MMM.12.

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

## Section MMM.10

### REPLACING A BRAKE UNIT

The replacement procedure is a reversal of the instructions given in Section MMM.7, with the exception of the following details. Replace the brake pads as detailed in Section MMM.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 MMM.2 and, finally, check for leaks with the brakes fully applied.

## Section MMM.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 MMM.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 MMM.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 MMM.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. MMM.7).

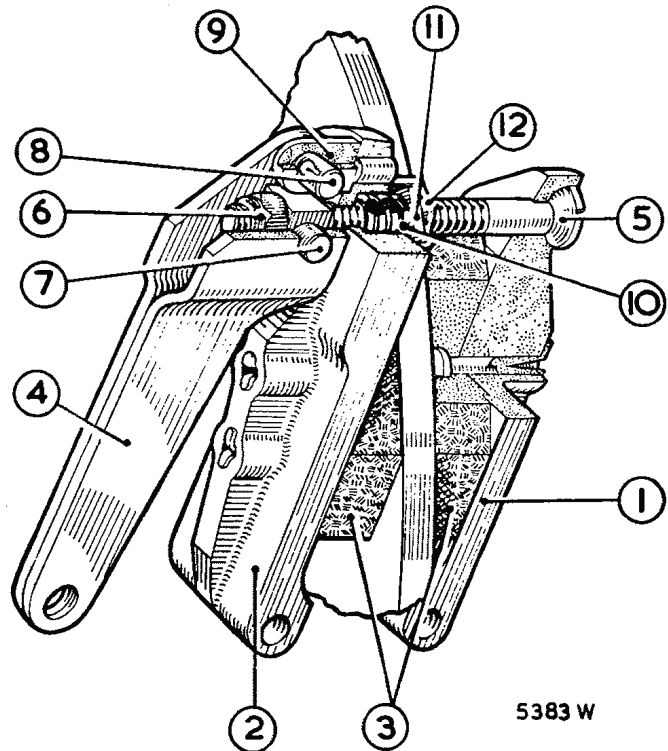


Fig. MMM.7

### 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. MMM.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 MMM.14.

## Section MMM.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.

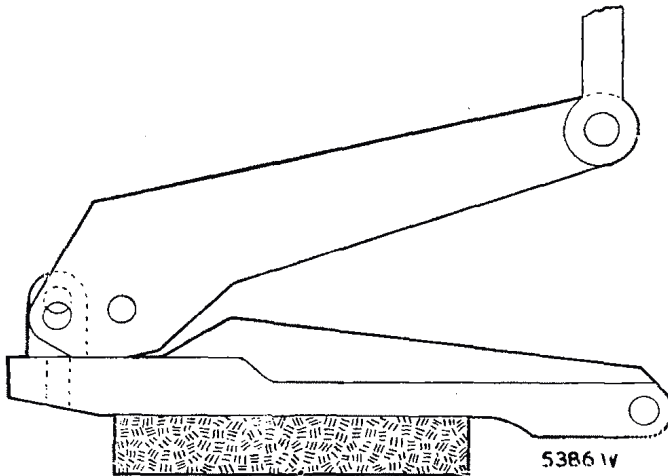


Fig. MMM.8

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 MMM.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.

MMM.8

### Section MMM.16

#### REMOVING A BRAKE DISC

Remove the brake unit as detailed in Section MMM.7 and withdraw the hub by the method described in Section KKK.1 (front) or Section HHH.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 MMM.17

#### REPLACING A BRAKE DISC

Assemble the brake disc to the hub by a reversal of the instructions given in Section MMM.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 MMM.10.

### Section MMM.18

#### FLEXIBLE HOSES

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

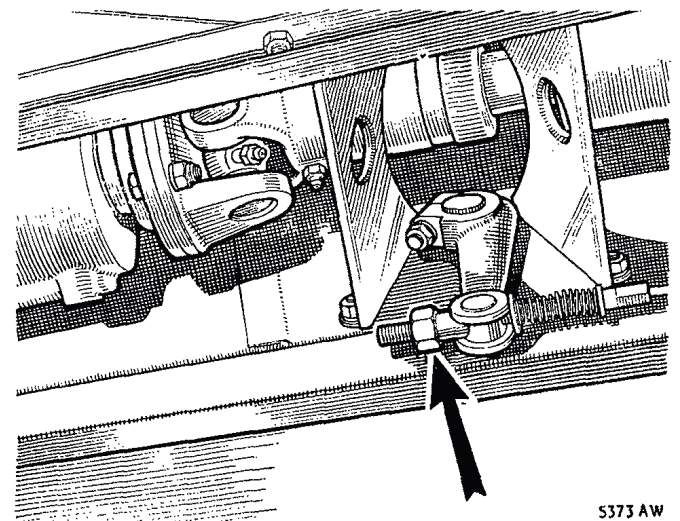


Fig. MMM.9

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

## Section MMM.19

### REFACING BRAKE DISCS

Scoring of the brake discs is not detrimental, provided that the scoring is concentric, even, and is not excessive.

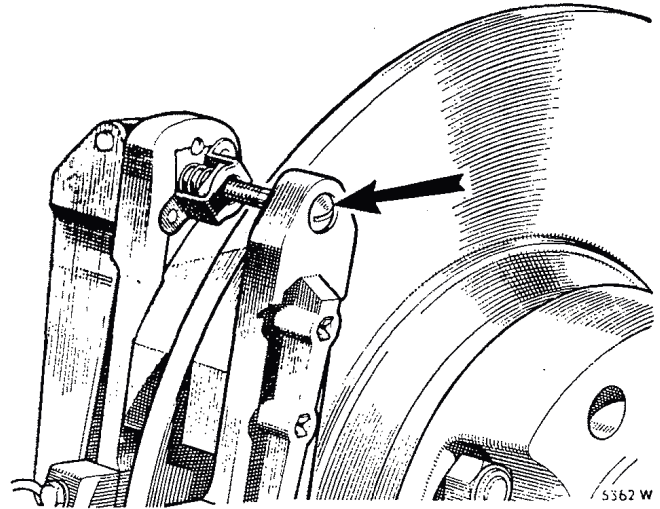


Fig. MMM.10

*The arrow indicates the hand brake carrier pad adjusting bolt*

The disc faces may be ground provided the following conditions are observed:

- (1) The final thickness of the disc must not be less than between .340 and .330 in. (8.64 and 8.38 mm.).
- (2) The disc faces must run true to within .003 in. (.076 mm.).
- (3) The faces must be parallel to within .001 in. (.025 mm.).

