

## SECTION M

### THE BRAKING SYSTEM

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# M THE BRAKING SYSTEM

## GENERAL DESCRIPTION

The system used is the Girling "Autostatic", fully hydraulic and incorporating a vacuum operated booster to assist the driver in depressing the pedal. The vacuum unit provides progressive assistance, proportionate to the driver's effort, up to the maximum vacuum available when the brakes are applied. The system is arranged to allow the driver's effort to apply the brakes directly when no vacuum is available—when the engine is not running, or for any other reason.

A separate supply tank is mounted on the right-hand side of the dash and delivers fluid to a master cylinder operated directly from the brake pedal.

### Brake-shoes—Front

Two trailing shoes in each front assembly are expanded by individual, single-acting hydraulic cylinders connected by tubing and bolted to the back plate. Each shoe pivots on one of the cylinders with its opposite end in contact with the piston of the

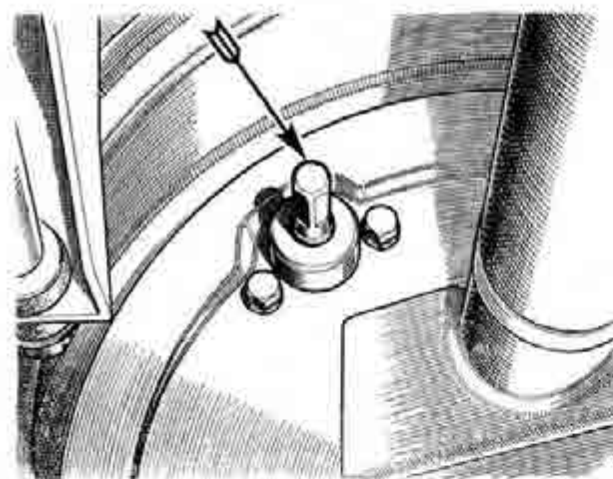


Fig. M.1.

The square adjuster for a rear-brake shoe.

cylinder diametrically opposite. No pull-off springs are fitted and the shoes are normally held in light contact with the drum by fluid pressure in the system, obviating the need for adjustment. A bias spring is fitted at the fulcrum end of each shoe, connected at one end to the shoe web and at the other to the back plate. The bias spring serves to counteract the fluid pressure holding the shoes in contact with the drum so that the contact is light and without appreciable braking effect when the brake is not applied.

An adjustable steady post and stabiliser control the movement of each shoe without interfering with its normal braking function.

### Brake-shoes—Rear

One trailing and one leading shoe is expanded in each assembly by a double-acting hydraulic cylinder floating on the back-plate.

As in the front assemblies, the trailing shoe is held in light contact with the drum.

Two springs are fitted to each assembly; a light spring between the leading end of the leading shoe and the brake plate, and a heavier one between the shoe-webs at the adjuster end.

Application of the hand brake expands the shoes through wedge-operated sliding tappets incorporated in the hydraulic cylinder but independent of the hydraulic system.

Adjustment is by means of wedge and tapered links, and effected by the squared end of the wedge protruding through the back-plate.

Adjustable, felt-bushed steady posts control the movement of the shoes due to vibration, etc.

## Section M.1

### BRAKE PEDAL FREE MOVEMENT

It is essential that the master cylinder plunger should return fully when the pedal is released to avoid the build-up of excessive pressure in the system. To ensure this there must be at least  $\frac{3}{8}$  in. free movement of the pedal before the push-rod begins to move the plunger.

To adjust, slacken the locknut and rotate the push-rod in the clevis until the correct amount of free movement is obtained. Excessive pedal travel indicates the need for adjustment of the rear leading shoes.

## Section M.2

### ADJUSTING THE BRAKE SHOES

The front shoes are not adjustable.

To adjust the rear shoes, jack up the wheels and turn the square-ended adjuster in a clockwise direction until the shoes are in hard contact with the drums, then slacken off two "clicks" to free the drum. Remember that a slight drag may be felt owing to the trailing shoe being in continual contact with the drum.

Centralise the shoes in the drum by hard application of the foot brake.

## Section M.3

### BLEEDING THE SYSTEM

Fill the supply tank with Girling hydraulic brake fluid and maintain it at least half-full during bleeding.

Attach the bleeder tube to each wheel cylinder in turn and allow the free end of the tube to be submerged in a small quantity of clean fluid in a clean glass jar. With the tube in position, open the bleeder one full turn and pump the pedal steadily until the fluid emerging is free from air bubbles. Depress the pedal and hold it down while the bleeder is tightened.

Do not replace the fluid bled from the system.

## Section M.4

### REMOVING THE MASTER CYLINDER

Unhook the pedal return spring from the push-rod clevis pin ; remove the clevis pin.

Unscrew the union nuts and disconnect the inlet and outlet pipes from the master cylinder.

Unscrew and remove the three nuts and bolts securing the master cylinder to the frame and remove the cylinder.

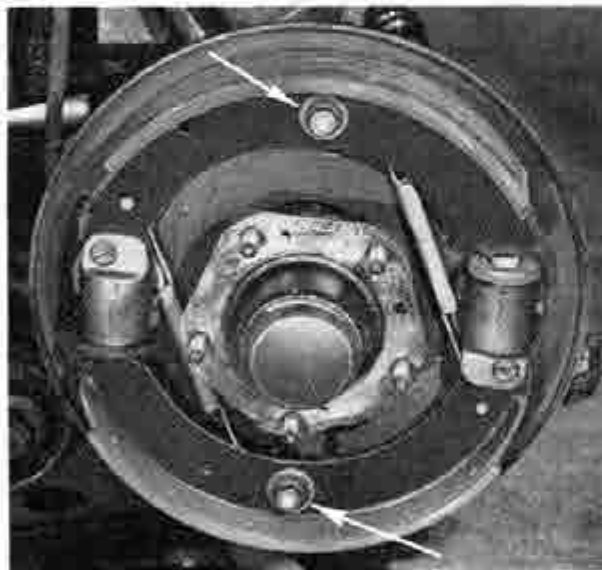


Fig. M.2.

A front brake assembly showing the adjustable steady posts.

## Section M.5

### DISMANTLING AND REASSEMBLING THE MASTER CYLINDER

Pull back the dust-excluding rubber and extract the circlip retaining the push-rod and plunger in the cylinder. Withdraw the push-rod and jaw assembly, together with the rubber boot and retaining washer. Onto a clean surface withdraw the plunger and seal assembly and the plunger return spring.

Secure the master cylinder in a vice : unscrew the end cap and remove it complete with the copper gasket. Withdraw the outer seal and the shim washer.

Carefully examine all the parts and renew any which are worn or distorted. It is especially important that the seal be renewed if it lacks resilience.

After washing all parts in clean brake fluid, place the shim washer in position and then the outer seal with its lip away from the shim. Replace and secure the end cap with its copper gasket.

Replace the plunger return spring. Fit the recuperating seal to the plunger with the lip edge towards the plunger barrel.

Press the plunger assembly into the cylinder and insert the push-rod ball and retaining washer. Replace the circlip and rubber boot.

## Section M.6

### REMOVING AND REPLACING THE BRAKE SHOES

#### Front

Jack up and remove the wheel and brake-drum.

Slacken the two stabiliser nuts.

Lift the leading end of a shoe from the abutment on the wheel cylinder and the trailing end from the piston of the opposite cylinder ; detach the spring and shoe. Repeat with the other shoe. Prevent the pistons from falling out of the cylinders by the use of rubber bands or wire.

Before refitting the shoes, lightly smear the steady posts and both ends of the shoes with white brake grease, but take care to keep all grease from the rubber parts and pistons, and from the linings.

Fit the shoes : the long ends of the springs should be hooked to the shoes and the short ends to the pegs on the back-plate.

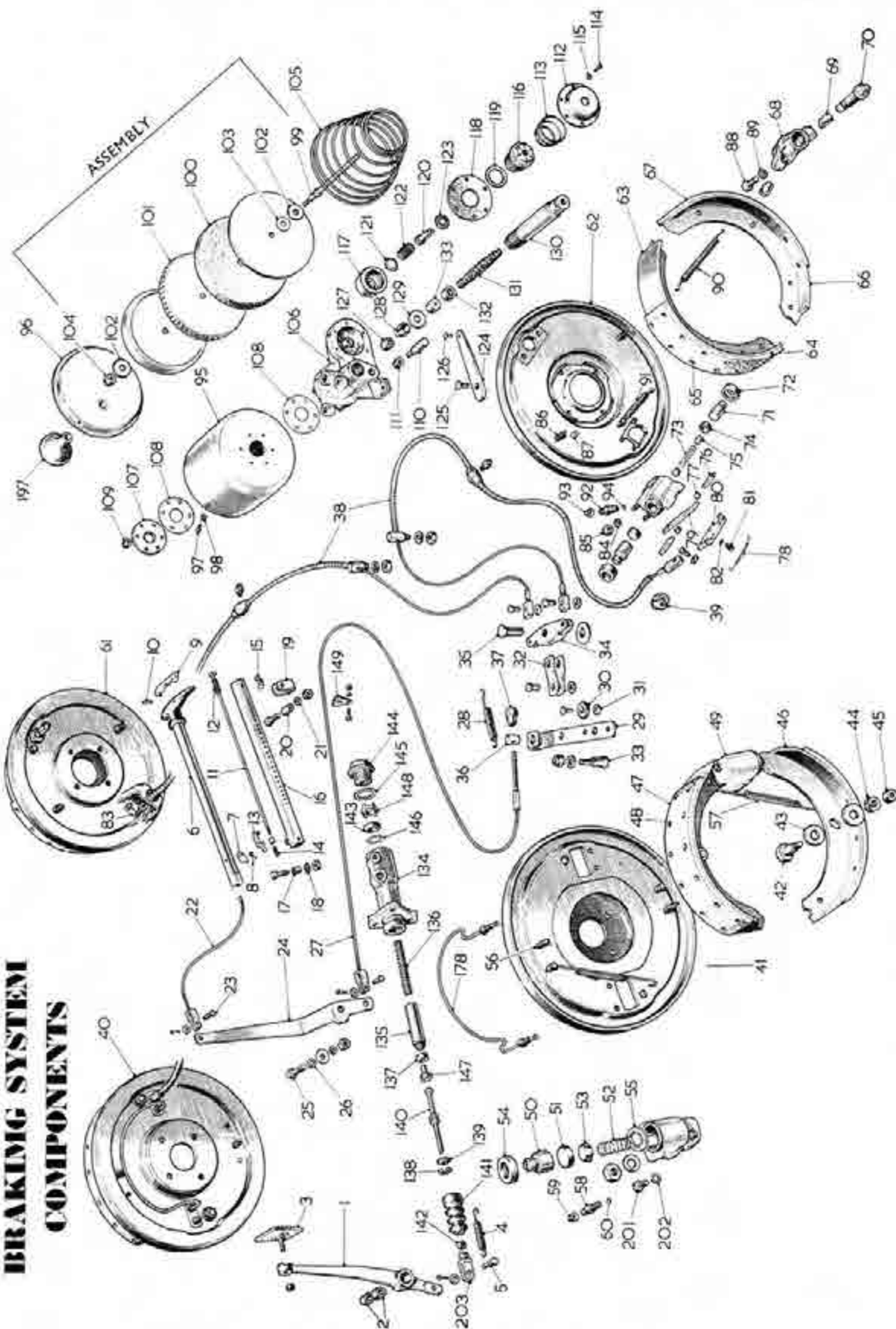
The steady posts will not require adjustment unless replacement shoes have been fitted or there are signs of uneven wear across the face of the linings. To adjust, see Section M.10.

#### Rear

Jack up and remove the wheel and brake-drum ; it may be necessary to slacken off all the adjustment in order to fit replacement shoes. Note that the lining of the leading shoe is fitted towards the trailing end, and that of the trailing shoe towards the leading end. Note also that the light spring is hooked to the peg on the back-plate and to the leading end of the leading shoe.

Before fitting the shoes, lightly smear the steady posts and both ends of the shoes with white brake

## BRAKING SYSTEM COMPONENTS



## KEY TO THE BRAKING SYSTEM COMPONENTS

No.	Description	No.	Description	No.	Description
1.	Pedal—brake assembly.	52.	Spring.	103.	Washer—fibre.
2.	Bush—brake assembly.	53.	Excluder—air.	104.	Nut—piston rod.
3.	Pad—brake pedal.	54.	Cover—dust.	105.	Spring—piston return.
4.	Spring—brake pull-off.	55.	Excluder—air.	106.	Body—booster valve.
5.	Pin—clevis—pedal to master cylinder.	56.	Post—steady.	107.	Plate—valve body clamping.
6.	Sleeve—inner and handle.	57.	Spring—shoe to backplate.	108.	Joint—valve body.
7.	Pawl.	58.	Screw—brake bleed.	109.	Nut—valve body.
8.	Spring.	59.	Cap—dust.	110.	Plunger—hydraulic.
9.	Trigger.	60.	Ball—steel.	111.	Seal—hydraulic plunger.
10.	Pivot—trigger.	61.	Brake—rear—R, H—complete.	112.	Cover—valve.
11.	Push-rod—trigger.	62.	Plate—back—L, H.	113.	Spring—valve.
12.	Spring—push-rod.	63.	Shoe and lining—rear brake—loading.	114.	Screw—valve cover.
13.	Wedge—pawl operating.	64.	Lining—brake-shoe.	115.	Washer—spring—valve cover.
14.	Spring—wedge.	65.	Rivet—brake-shoe lining.	116.	Cap—diaphragm.
15.	Spring—inner sleeve.	66.	Shoe and lining—rear brake—trailing.	117.	Seat—valve.
16.	Sleeve—outer assembly.	67.	Lining—brake-shoe.	118.	Diaphragm.
17.	Tube—distance—bottom.	68.	Adjuster unit.	119.	Washer—diaphragm.
18.	Washer—spring.	69.	Tappet—R, H.	120.	Spindle—valve.
19.	Clip—support—bracket.	70.	Wedge.	121.	Valve.
20.	Distance-piece—clip.	71.	Piston.	122.	Spring—valve.
21.	Washer—spring.	72.	Cover—dust.	123.	Gauze—breather.
22.	Cable—hand brake control lever.	73.	Spring.	124.	Lever—valve operating.
23.	Pin—clevis.	74.	Seal.	125.	Pin—pivot—lever.
24.	Lever—intermediate.	75.	Excluder—air.	126.	Pin—pivot—valve spindle.
25.	Pivot—intermediate lever.	76.	Tappet—hand brake mechanism.	127.	Seal—piston rod.
26.	Washer—intermediate lever pivot.	77.	Roller—hand brake mechanism.	128.	Retainer—piston rod seal.
27.	Cable—front.	78.	Spring—tappet return—hand brake mechanism.	129.	Washer—copper.
28.	Spring—return.	79.	Drawlink—hand brake mechanism.	130.	Cylinder—hydraulic.
29.	Lever—hand brake.	80.	Plate—cover—hand brake mechanism.	131.	Spring—hydraulic cylinder.
30.	Pad—anti-rattle.	81.	Screw—hand brake mechanism.	132.	Seal—hydraulic cylinder.
31.	Washer.	82.	Washer—hand brake mechanism.	133.	Cap—hydraulic cylinder.
32.	Link—connecting.	83.	Plate—dust cover—wheel cylinder.	134.	Master cylinder.
33.	Pin—lever pivot.	84.	Washer—wheel cylinder.	135.	Plunger.
34.	Link—balance.	85.	Nut—wheel cylinder.	136.	Spring—return plunger.
35.	Pin—clevis—balance link.	86.	Post—steady.	137.	Seal—outer end.
36.	Trunnion—balance link.	87.	Bush—felt—steady post.	138.	Circlip.
37.	Mut—adjuster.	88.	Set bolt—brake adjuster.	139.	Washer—retaining.
38.	Cable assembly—rear.	89.	Washer—girdler.	140.	Push-rod and collar.
39.	Bracket—abutment.	90.	Spring—brake-shoe return—adjuster end.	141.	Cover—dust.
40.	Brake—front—R, H—complete.	91.	Spring—brake-shoe return—cylinder end.	142.	Locknut.
41.	Backplate assembly—L, H.	92.	Screw—brake bleed.	143.	Seal—recuperating.
42.	Clamp bolt.	93.	Cap—dust.	144.	Cap—end.
43.	Washer—friction.	94.	Ball—steel.	145.	Gasket.
44.	Spring.	95.	Cylinder.	146.	Washer—shim.
45.	Locknut.	96.	Cover—cylinder end.	147.	Retainer—seal.
46.	Shoe and lining assembly—brake—L, H.	97.	Screw—cylinder end cover.	148.	Spacer—seal.
47.	Lining—brake-shoe.	98.	Nut—cylinder end cover.	149.	Bracket—cable guide.
48.	Rivet—brake-shoe lining.	99.	Rod—piston.	197.	Grommet—booster breather.
49.	Wheel cylinder assembly—L, H.	100.	Seal—air—leather.	201.	Set bolt—wheel cylinder.
50.	Piston.	101.	Ring—air seal spring.	202.	Washer—shakeproof—wheel cylinder.
51.	Seal.	102.	Washer—plain.	203.	Fork end.



# M THE BRAKING SYSTEM

grease, but take care to keep all grease from the rubber parts and pistons, and from the linings.

Fit the shoes and drum and adjust as detailed in Section M.2.

## Section M.7

### REMOVING A WHEEL CYLINDER

#### Front

Jack up and remove the wheel, drum and shoes.

Disconnect the pipe unions from the cylinder.

Unscrew the large nut and two securing set screws and remove the cylinder(s).

After refitting, bleed the brakes.

#### Rear

Jack up and remove the wheel drum and shoes.

Disconnect the hand brake cable at the clevis behind the back-plate and unscrew the pipe union. Remove the bleeder screw ; do not lose the valve ball.

Unscrew the three self-locking securing nuts and remove the double coil spring washers ; withdraw the cylinder.

Reverse the above procedure to replace ; tighten the three nuts fully and then slacken them about a three-quarter turn so that the cylinder will be centralised.

After refitting, bleed and adjust the brakes.

## Section M.8

### DISMANTLING A WHEEL CYLINDER

#### Front

Remove the cylinder as detailed in Section M.7.

Remove the rubber dust cover ; withdraw the piston, seal, spreader and spring ; use air pressure to push the internal components from the cylinder.

#### Rear

Remove the cylinder as detailed in Section M.7.

Remove both the rubber dust covers, with the pistons, seals, spreaders and spring.

Disconnect the hand brake wedge return spring.

Unscrew the four set screws, remove the cover and withdraw the drawlink and tappets.

To reassemble, reverse the dismantling procedure.

## Section M.9

### REMOVING A FLEXIBLE HOSE

Hoses must be disconnected at the support bracket. Unscrew the pipe union nut and disconnect the metal pipe. Hold the hexagon on the flexible hose

and unscrew the locknut at the opposite side of the bracket.

Withdraw the hose from the bracket ; allow the hose to turn as it is unscrewed at the other end.

## Section M.10

### ADJUSTING A STEADY POST

If replacement brake-shoes are fitted or if there is any sign of uneven wear across the surface of the linings, it will be necessary to adjust the steady posts.

Slacken the locknut at the rear of the back-plate and unscrew the post about three or four turns.

Apply the brakes hard and then rotate the post in a clockwise direction until it contacts the shoe-web ; hold the post and tighten the locknut.

## Section M.11

### THE VAC-HYDRO BRAKE SERVO

When the pedal is depressed, the force exerted is transmitted by the hydraulic fluid through the connection (B) on the servo unit to the chamber (14) and (when no vacuum is available) through the connection (C) to the brake pipe lines.

Pressure in the chamber (14) forces the plunger (13) outwards to operate the valve lever (11). The upper end of the valve lever carries the release valve (6) which is moved first to seal off the atmosphere and then to open the vacuum valve (7). When the engine is running, air is therefore withdrawn from the vacuum cylinder (4) through the passages (9) and (5) and the manifold connection (A).

The resulting depression in the vacuum cylinder causes the piston (1) and the rod (2) to move inwards and seal off the valve (10), thus the hydraulic line pressure acting on the rear of the valve is boosted by the vacuum assistance. If a steady pressure is maintained on the brake pedal, the vacuum reaction on the diaphragm (8) increases until it balances the thrust of the plunger (13), when the vacuum valve is resealed and pressure in the wheel cylinders is sustained.

Further pressure on the pedal increases the pressure on the plunger (13), the vacuum valve is re-opened and the cycle of operations is repeated.

The greater the pressure on the pedal the greater is the depression required to operate the diaphragm, balance the plunger thrust and close the vacuum valve. Thus the depression in the vacuum cylinder is proportional to the effort applied on the brake pedal.

## Section M.12

### REMOVING THE SERVO FROM THE CHASSIS

The servo is located inside the right-hand side of the chassis just forward of the rear axle. To remove, proceed as follows:—

- (a) Brush away all dirt in the vicinity of the pipe unions.
- (b) Unscrew the union nuts and disconnect the two hydraulic connections and the vacuum connec-

A reduction in the pressure on the brake pedal reduces the hydraulic pressure on the plunger (13) and allows the effort exerted on the diaphragm by the depression in the vacuum cylinder to unseat the release valve. The depression is then partially released until a balance between the plunger pressure on the operating arm and the vacuum effort on the diaphragm is once more attained.

Complete release of the brake pedal relieves the hydraulic pressure on the plunger (13) and allows the release valve to open.

Atmospheric pressure then destroys the depression

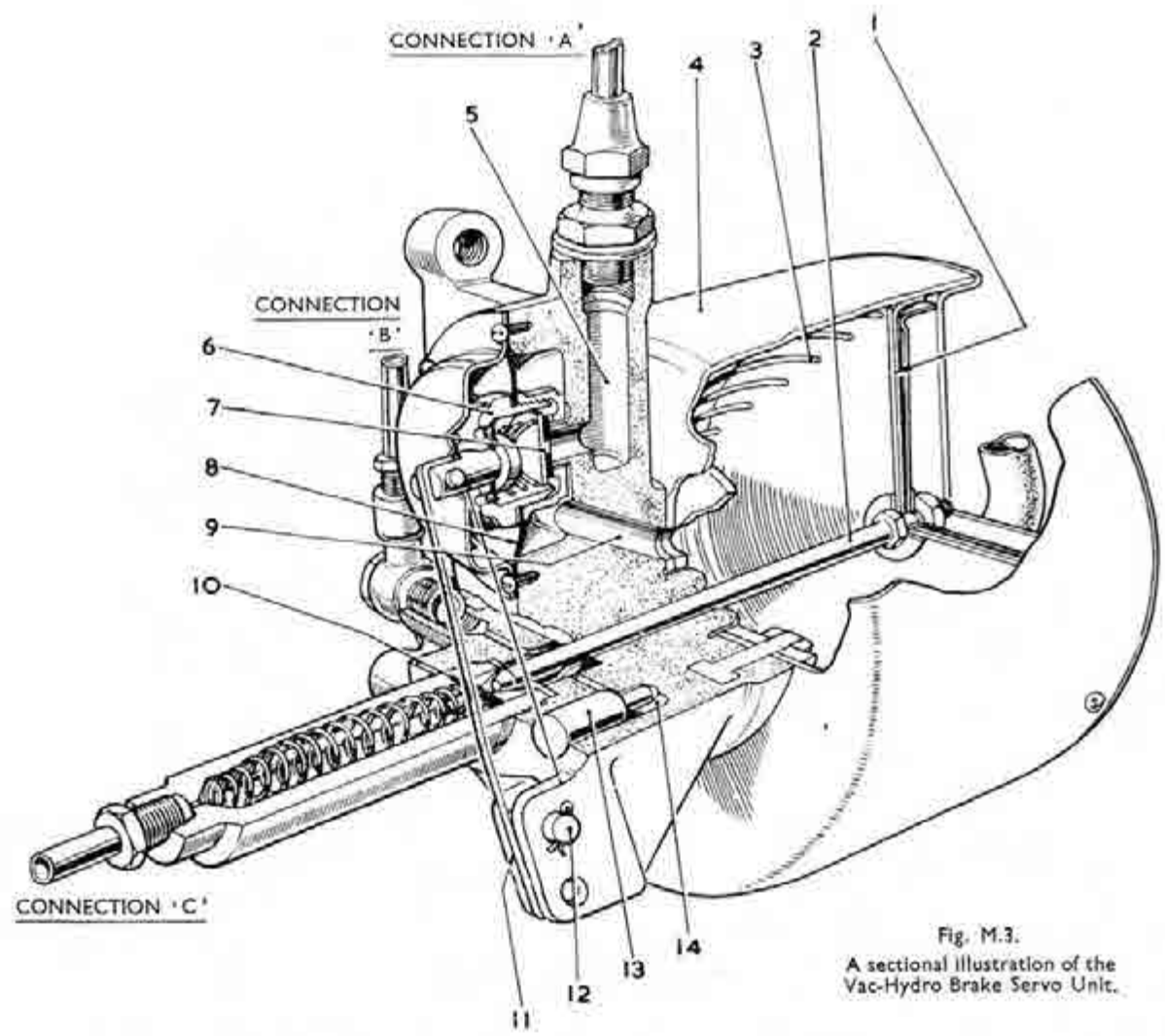


Fig. M.3.  
A sectional illustration of the Vac-Hydro Brake Servo Unit.

in the cylinder (4); the piston (1) and rod (2) move to the right, assisted by the spring, and the hydraulic valve (10) is opened, permitting recuperation to take place between the fluid in the brake pipe lines and the master cylinder.

- (c) Remove the three set screws securing the unit to the chassis; lower the unit and remove it from the car.

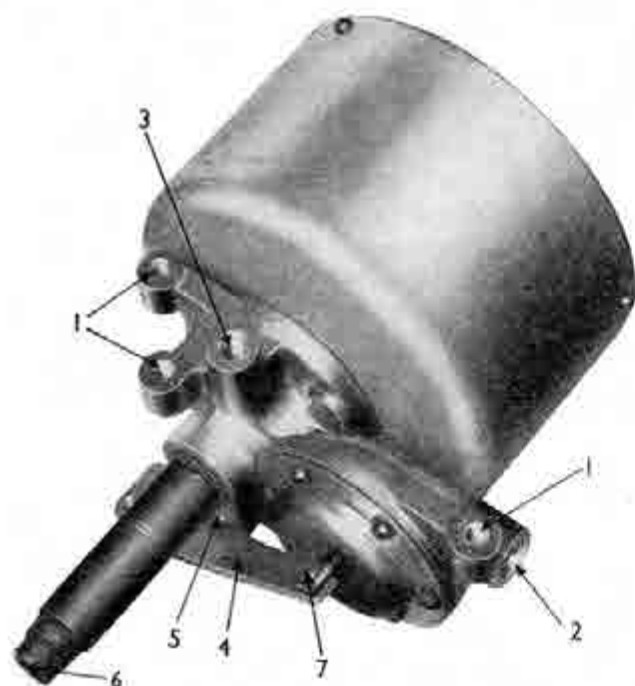


Fig. M.4.

- |   |   |
|---|---|
| 1. Fixing bosses.                           | 5. Spherical-headed plunger.            |
| 2. Vacuum connection to induction manifold. | 6. Connection to wheel cylinders.       |
| 3. Connection to hydraulic master cylinder. | 7. Lever pin (fit with head uppermost). |
| 4. Valve lever.                             |   |

## Section M.13

### CLEANING AND EXAMINATION

The following points are important:—

- (1) In earlier models the piston leather was lubricated with a mixture of castor oil and brake fluid. This lubricant is no longer used.
- (2) Later models are lubricated with MS.4 Silicone Compound, Part No. 17H4177 and no other lubricant is now permissible. Servos in which this lubricant has been used are identified by a spot of yellow paint between the fixing bosses, and/or by a month name-plate (11/55, 12/55, etc.). Units not bearing this identification should be serviced as detailed below (a).
- (3) A leather gaiter is available and should be fitted in all cases to protect the valve mechanism. See Figs. M.11 and M.12.

Normally it should be unnecessary to dismantle the servo and, after examination for external damage, the following procedure should be sufficient to ensure satisfactory operation between major overhauls.

Immediately after removal, plug the servo connections to prevent the entry of dirt, and then clean the exterior, using rag lightly dipped in trichlorethylene.

Do not drench the unit or immerse it in a bath of cleaning fluid. Extreme care must be taken during

the whole time the servo and its components are being handled to prevent the seals from coming into contact with mineral oil of any type. The utmost cleanliness is essential.

- (a) Earlier models lubricated with castor oil and brake fluid. Stand the unit with the hydraulic cylinder upright and allow the fluid to drain from the vacuum cylinder through the breather pipe in the end cover. (See Fig. M.3). Service the cylinder and piston leather as detailed in Section M.14, paragraph 3, *Remedy*.
- (b) Check the valve lever for freedom of movement, cleanliness etc., and lubricate the axis pins. If the lever and pins are removed, replace the pins with the heads towards the servo fixing bosses. The wide clearances of the valve lever assembly are deliberate and should not be confused with excessive wear.
- (c) When the spherical head of the plunger is depressed, a .020 in. (.5 mm.) feeler should pass freely between the lever face and the head of the plunger.
- (d) Check the split pins for security.

### Bleeding

Bleed the brakes in the normal manner, but note that the hydraulic unit of the servo will be refilled during this bleeding operation and the volume of air at the wheel cylinders will be more than is normally encountered; it is essential, therefore, to ensure that the fluid in the supply tank is adequately maintained during this operation.

After bleeding, start the engine and apply the brake several times; then re-bleed the system to clear any air pockets which may have remained in the servo passages.

## Section M.14

### SERVICING THE BRAKE SERVO

Assuming that the procedure already described is carried out correctly, the servo should require no

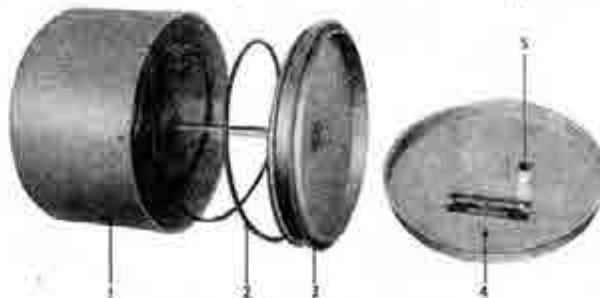


Fig. M.5.

- |                          |               |
|--------------------------|---------------|
| 1. The servo cylinder.   | 4. End cover. |
| 2. Piston return spring. | 5. Breather.  |
| 3. Piston assembly.      |               |



other attention for long periods. If trouble is experienced, it is recommended that the unit be returned to the manufacturer. It is appreciated that this is not always possible, and the following information may be of assistance when servicing faulty units in these conditions.

### 1. Insufficient or incorrect lubrication

#### Symptoms

- (a) Loss of power—hard brake pedal.
- (b) Engine may race when the brakes are applied with the car stationary.
- (c) Brakes released slowly, jerkily or not at all.

#### Remedy

Re-lubricate as in "Cleaning and Examination." Operate the brakes with the engine running until the symptoms disappear. See also paragraph 8.

### 2. Damaged or dented servo cylinder

#### Symptoms

As in (a) and (c) of paragraph 1 above.

#### Remedy

Remove the end cover screws and the cover, the piston assembly and the return spring. Slight high-spots in the bore may be removed by stoning. Where the damage is too severe to be dealt with in this manner, the complete unit should be changed as the cylinder assembly is jig built to ensure concentricity.

### 3. Damaged or worn piston leather

#### Symptoms

As in paragraph 1, items (a) and (c) above.



Fig. M.6.

1. Piston rod.
2. Piston leather.
3. Expander ring.

#### Remedy

Remove the piston as in paragraph 2 above.

Completely dismantle the piston assembly; clean out the cylinder and all metal parts of the piston assembly with trichlorethylene. Do not allow any cleaning fluid to enter the piston rod entry hole at the rear of the vacuum cylinder as this will cause irreparable damage to the slave cylinder seal and piston cup.

Soak the piston leather in trichlorethylene to remove all traces of brake fluid and wax impregnation.

Lubricate the interior of the cylinder and the piston leather with silicone compound, type MS.4, Part No. 17H4177.

Remove all roughness from the ends of the compression spring.

Smear a small quantity of the silicone compound around the fitting face of the cylinder cover.

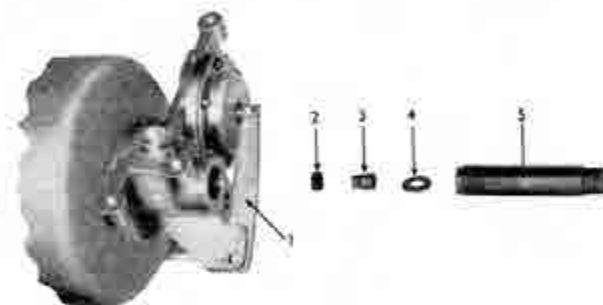


Fig. M.7.

1. Valve lever.
2. Piston rod seal.
3. Seal spreader.
4. Copper washer.
5. Hydraulic cylinder assembly.

Slightly flatten the bronze spreader and reassemble the piston. Refit the piston assembly to the bore and work it up and down several times to ensure concentricity before finally tightening the stop nut.

Refit the end cover.

Push down the piston to the extremity of its travel by inserting a rod through the breather tube; when released, the piston should return rapidly and audibly contact the cylinder end cover.

Refit the leather gaiter.

Reassemble to the car.

### 4. Damaged piston rod seal

#### Symptoms

- (a) The master cylinder supply tank requires continual refilling.
- (b) Spongy brakes.
- (c) Traces of brake fluid in the vacuum pipe.
- (d) Excessive brake fluid in the vacuum cylinder on the vacuum side of the piston.

#### Remedy

Remove the piston and drain the servo. Unscrew the hydraulic cylinder from the servo body; the return spring will eject the internal components of the hydraulic cylinder. Remove the copper washer, seal spreader and faulty seal. Insert a new seal and replace the spreader and copper washer. Screw the hydraulic cylinder tightly into the body. Bleed the system.

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Fig. M.8.

- |               |                       |
|---------------|-----------------------|
| 1. Seal.      | 4. Return spring.     |
| 2. Plunger.   | 5. Domed valve cover. |
| 3. Diaphragm. |                       |

## 5. Damaged seal for lever plunger

### Symptoms

- (a) Slight reduction of power assistance.
- (b) No power assistance evident at light pedal pressures.

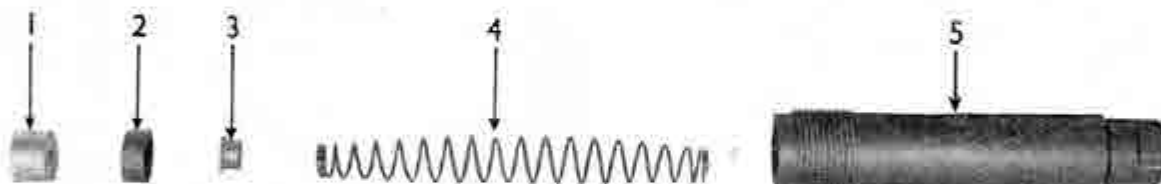


Fig. M.9

- |                   |                   |
|-------------------|-------------------|
| 1. Cone seat      | 4. Spring.        |
| 2. Seal.          | 5. Cylinder body. |
| 3. Seal spreader. |                   |

(See Section M.17).

- (c) Brake fluid leaking at the periphery of the spherical-headed plunger. (A slight weep at this point is permissible.)

### Remedy

Disconnect the valve lever and remove the plunger by lightly depressing the brake pedal. Renew the seal and refit the plunger, taking care not to damage the lip of the seal. Refit the valve lever and bleed the system.

## 6. Damaged seal in the hydraulic cylinder (see Fig. M.9)

### Symptoms

Reduction or loss of power assistance.

### Remedy

Unscrew the hydraulic cylinder from the servo body. Note that the return spring will eject the internal components. Replace the faulty seal, refit the cone seat and screw the hydraulic cylinder tightly into the servo body. Bleed the system.

## 7. Faulty diaphragm valve assembly (see Fig. M.8)

### Symptoms

- (a) The engine tends to race when the pedal is depressed.
- (b) Loss or reduction of power assistance when the brakes are applied, accompanied by an audible leak at the centre of the domed valve cover.

### Remedy

Remove the valve lever and the domed valve cover. Renew the faulty diaphragm and valve assembly. Refit the domed cover and spring. Refit the valve lever.

## 8. Damaged or faulty cone seat in the hydraulic cylinder

### Symptoms

- (a) Brakes remain on after the pedal has been released.  
(Not to be confused with a sticking piston: see paragraph 1(c).)
- (b) Power assistance intermittent.

### Remedy (see Fig. M.10)

Unscrew the hydraulic cylinder and allow the spring to eject the cone seat. Remove the end cover from the servo cylinder and push the piston so that the rod projects through the body sufficiently to expose



Fig. M.10.

Grinding in the cone seat on the piston rod.

the cone end. Using fine grinding paste, lap the two cones together until there is no tendency for the two parts to cling together. Remove all traces of grinding paste and refit the vacuum cylinder end cover. Replace the cone seat in the hydraulic cylinder and screw the cylinder tightly into the servo body. Re-lubricate the servo and bleed the system.

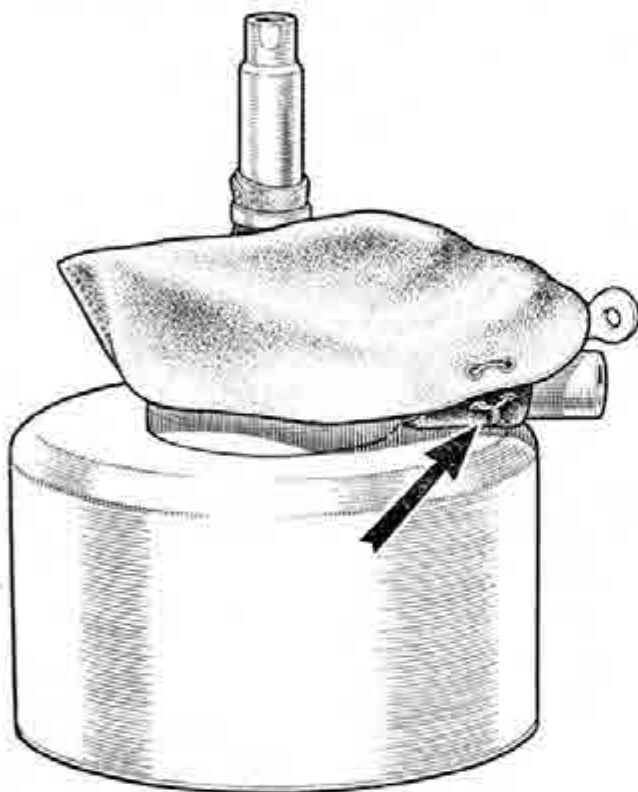


Fig. M.11.

The leather gaiter. The arrow indicates the securing wire.

## 9. Plunger sticking (5, Fig. M.4.)

### Symptoms

As in paragraph 8.

### Remedy

Check the operation of the plunger in the following manner:—

Place a finger tip on the head of the plunger and note whether it responds immediately to application and release of the brake pedal. The total movement of the plunger is approximately  $\frac{1}{8}$  in. (3.2 mm.).

If any sign of stiffness can be felt or if corrosion is apparent around the head of the plunger it should be replaced. Remove the split pin and clevis pin from one end of the operating lever and depress the brake pedal to eject the plunger. The effort required on the pedal will depend on the degree of stiffness of the plunger and it is advisable to hold a piece of rag over

the plunger as it may be ejected with some force. Place a drip tray below the servo to catch the brake fluid released through the plunger recess.

Fit a new plunger, entering the lip of the seal carefully; replace the clevis pin with its head uppermost; replace the split pin and smear the lever and head of the plunger with good quality grease.

Fit the leather gaiter (see Figs. M.11 and M.12, and "Cleaning and Examination").

## Section M.15

### ADJUSTING THE HAND BRAKE

Adjustment of the rear brake-shoes automatically adjusts the hand brake. Excessive slack in the hand brake cable, leading to considerable movement of the control in application, should be taken up in the following manner.

Jack up the rear wheels and turn the shoe adjusters until the shoes are in hard contact with the drums.

Disconnect the hand brake cable from the balance mechanism by withdrawing the clevis pin; do not touch the individual cables from the balance link to the drums.

Pull the hand brake control three notches back.

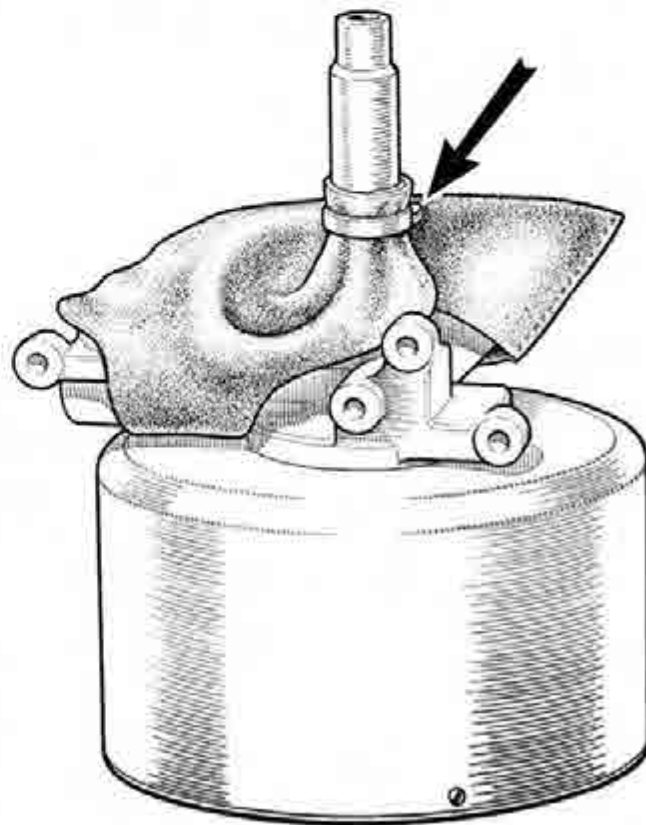
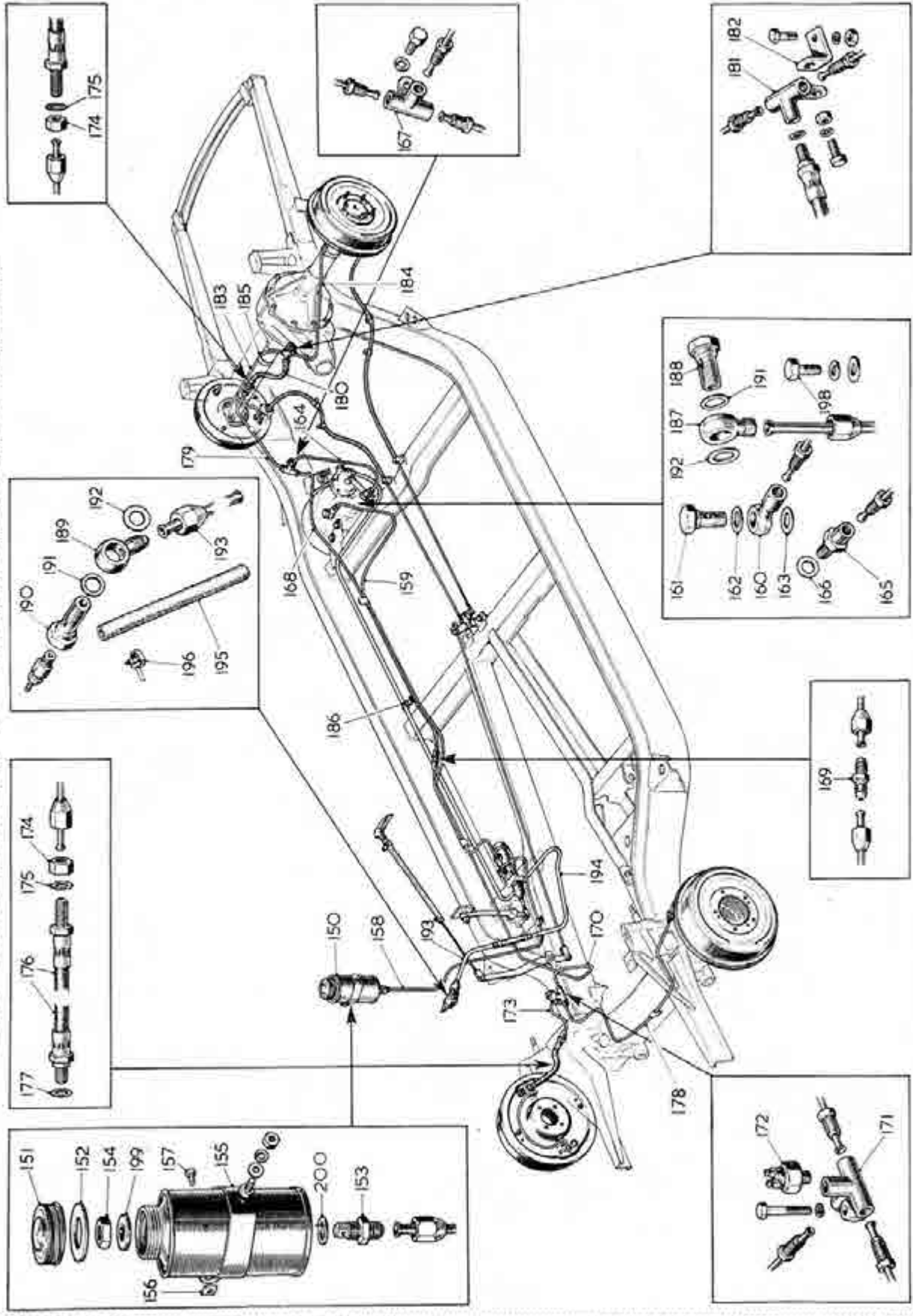


Fig. M.12.

Another view of the gaiter, showing the position of the clip.

THE COMPONENTS OF THE HYDRAULIC SYSTEM



## KEY TO THE COMPONENTS OF THE HYDRAULIC SYSTEM

No.	Description	No.	Description	No.	Description
150.	Tank—brake fluid supply.	168.	Pipe—three-way joint to double-ended union.	184.	Pipe—rear axle three-way joint to rear wheel cylinder—L/H.
151.	Cap—supply tank.	169.	Union—double-ended.	185.	Clip—brake pipe to rear axle.
152.	Washer—supply tank cap.	170.	Pipe—double-ended union to four-way joint.	186.	Clip—brake and petrol pipes to frame.
153.	Adaptor—supply tank outlet.	171.	Joint—four-way.	187.	Banjo—booster vacuum port.
154.	Nut—adaptor.	172.	Switch—stop-light.	188.	Bolt—banjo—booster vacuum port.
155.	Clip—supply tank.	173.	Pipe—four-way joint to front hose—R/H.	189.	Banjo—induction manifold.
156.	Nut—supply tank clip.	174.	Nut—bulkhead.	190.	Bolt—banjo—induction manifold.
157.	Bolt—supply tank clip.	175.	Lock washer—bulk head nut.	191.	Gasket—induction manifold and vacuum port banjo.
158.	Pipe—supply tank to master cylinder.	176.	Hose—high-pressure—pipe to wheel cylinder—R/H.	192.	Gasket—induction manifold and vacuum port banjo.
159.	Pipe—master cylinder to brake booster.	177.	Gasket—wheel cylinder and hose.	193.	Pipe—induction manifold to low-pressure hose.
160.	Banjo—booster inlet.	178.	Pipe—four-way joint to front hose—L/H.	194.	Pipe—low-pressure hose to booster union.
161.	Bolt—booster inlet banjo.	179.	Pipe—rear three-way joint to rear hose.	195.	Hose—low-pressure.
162.	Gasket—booster inlet.	180.	Hose—high-pressure—chassis pipe to rear axle three-way joint.	196.	Clip—hose.
163.	Gasket—booster inlet.	181.	Joint—three-way—rear axle.	198.	Screw—booster to frame.
164.	Pipe—booster outlet to chassis three-way.	182.	Bracket—support—rear axle three-way joint.	199.	Washer—adaptor.
165.	Adaptor—booster outlet.	183.	Pipe—rear axle three-way joint to rear wheel cylinder—R/H.	200.	Gasket—adaptor.
166.	Gasket—booster outlet.				
167.	Joint—three-way—rear.				



# M THE BRAKING SYSTEM

Hold the balance link forward to take up all slack in the individual rear cables and pull the hand brake cable rearwards; adjust the yoke on the end of the main cable until the clevis pin will just enter.

Readjust the shoes and lower the car.

With the hand brake applied, the short balance link to which the individual rear cables are connected should be at right angles to the centre line of the car.

## Section M.16

### BRAKING IRREGULARITIES AND THEIR CAUSES

#### *Pedal travel excessive*

- (a) Brake-shoes require adjusting.
- (b) Leak at one or more joints.

#### *Pedal feels springy*

- (a) System requires bleeding.
- (b) Linings not "bedded in."
- (c) Master cylinder recuperating seal worn.
- (d) Damaged seal in booster valve body.

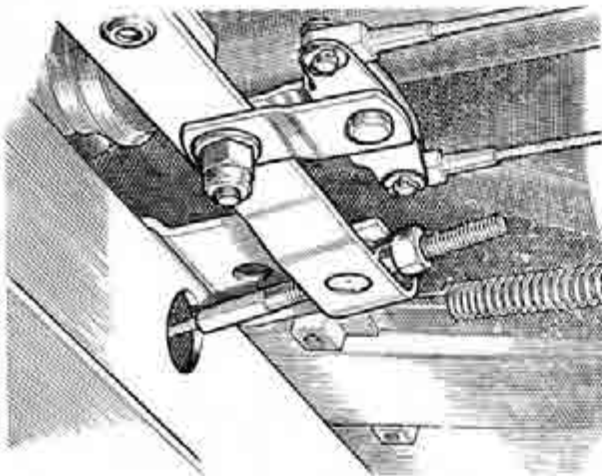


Fig. M.13.

#### *Brakes inefficient*

- (a) Shoes not correctly adjusted.
- (b) Linings not "bedded in."
- (c) Linings greasy.
- (d) Linings wrong quality.
- (e) Drums badly scored.
- (f) Linings badly worn.
- (g) Wrongly set hook up.

#### *Brakes drag*

- (a) Shoes incorrectly adjusted.
- (b) Shoe springs weak or broken.
- (c) Pedal spring weak or broken.

- (d) Hand brake mechanism seized.
- (e) Wheel cylinder pistons seized.
- (f) Blocked pipe line.
- (g) Booster unit requires lubrication.
- (h) Damaged or dented servo cylinder.
- (i) Vacuum piston leather worn.
- (j) Wax-impregnated piston leather.

#### *Brakes remain on*

- (a) Shoes over-adjusted.
- (b) Hand brake over-adjusted.
- (c) No free movement on pedal.
- (d) Swollen wheel cylinder seals.
- (e) Choked flexible hose.
- (f) Incorrect fluid.
- (g) Damaged or faulty cone seat in booster hydraulic cylinder.

#### *Unbalanced braking*

- (a) Greasy linings.
- (b) Distorted drums.
- (c) Tyres unevenly inflated.
- (d) Brake plate loose on the axle.
- (e) Worn steering connections.
- (f) Worn suspension linkage.
- (g) Different types or grades of lining fitted.

#### *Brakes grab*

- (a) Shoes require adjusting.
- (b) Drums distorted.
- (c) Greasy linings.
- (d) Scored drums.
- (e) Worn suspension linkage.
- (f) Loose pivot pin.

#### *Reduction in or loss of power assistance*

- (a) Damaged or worn vacuum piston leather (booster).
- (b) Corrosion in vacuum cylinder.
- (c) Incorrect lubricant in vacuum cylinder.
- (d) Sticking servo plunger.
- (e) Damaged valve plunger seal.
- (f) Damaged hydraulic cylinder seal (booster).
- (g) Faulty diaphragm valve assembly.
- (h) Damaged or faulty cone seat in booster hydraulic cylinder.

#### *Engine races when pedal is depressed*

- (a) Booster unit requires lubrication.

#### *Loss of fluid, fluid in vacuum pipe*

- (a) Damaged hydraulic piston seal (booster).
- (b) Damaged seal in diaphragm valve assembly.

## Section M.17

### NEW TYPE VALVE IN BRAKE SERVO

A modified valve (Part No. AJB5185), details of which are given in Fig. M.14, is fitted to some cars up to Chassis No. RMH2375.

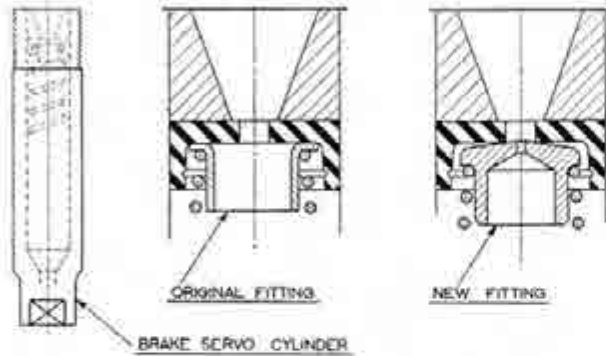


Fig. M.14.

The new type valve (Part No. AJB5185) and its location.

From Chassis No. RMH2376 the original valve (Part No. AJB5158) is again fitted.

The original type (AJB5158) should be used on all cars when a replacement part is required.

When making this change it is essential to remove the brake servo complete to ensure that the piston is pushed as far as possible into the cylinder, so that the rod connected to the servo piston compresses the slave piston into its bore.

## Section M.18

### MODIFIED REAR BRAKE CYLINDERS AND PIPES

With the introduction of the second type rear axle (from Car No. 2982) smaller ( $\frac{1}{2}$  in., 15.87 mm.) diameter rear brake cylinders are fitted, together with modified brake pipes to suit the "C" type rear axle casing.

A rear axle high-pressure hose (15 $\frac{1}{2}$  in., 393 mm. long) is also fitted. The modified pipes and hose must be used when a second type axle is fitted.

## Section M.19

### NEW BRAKE PEDAL AND MASTER CYLINDER

In order to obtain an increase in fluid displacement in the master cylinder and for increased reserve of

pedal travel, a new brake pedal and master cylinder are fitted from Chassis No. 3676.

The length of the pedal from the cross-shaft to the master cylinder piston rod yoke has been increased by  $\frac{1}{2}$  in.

The stroke of the master cylinder has been increased from 1.33 in. to 1.59 in. (33.78 mm. to 40.48 mm.)

## Section M.20

### MODIFIED BRAKING SYSTEM

A modified braking system is introduced at Car No. 3966 incorporating DM8 brake linings and Ferodo friction washers.

The Ferodo friction washers are fitted to the clamp bolt between the bolt head and the brake-shoe web. Metal friction washers are retained between the brake-shoe web and the spring washer and self-locking nut. Adjustment of the self-locking nut should be such, that a load of 65 lb. (29.48 kg.) indicated by a spring balance applied to the shoe tip at the piston end, is required to overcome the friction of the washers, with the brake-shoes assembled to the back-plates.

## Section M.21

### EXCESSIVE PEDAL MOVEMENT AND BRAKE PEDAL PULL-OFF SPRING

If the foot brake pedal has excessive movement before the brakes are fully applied, this may be due to the rear wheel cylinder hydraulic brake pipe fouling the hand brake cable bracket adjacent to the rear wheel cylinder. This prevents the brake cylinder from sliding in the back-plate and centralising the rear brake-shoes and consequently holds the front shoe forward, preventing accurate brake-shoe adjustment.

The pipe must be bent away from the edge of the bracket to give at least  $\frac{1}{4}$  in. (6.35 mm.) clearance, apply the brakes and rotate the wheels to centralise the shoes. Check the brake pedal for the correct amount of free movement and adjust the rear brakes as detailed in Section M.2. If the brake pedal does not return smartly when released, fit pedal return spring Part No. AHB5022.

This stronger brake pedal pull-off spring is introduced at Car No. 4985 to improve master cylinder recuperation. The return spring may be fitted to earlier vehicles.

# M THE BRAKING SYSTEM

## Section M.22

### MODIFIED CONTROL PEDALS

At Car No. 5372 modified brake and clutch pedals are introduced, increasing the ratio of the pedals. The new pedals are interchangeable on earlier cars in pairs only and the Part Nos. are as follows:—

Brake pedal (RHD) ... ..	AHB5149.
Brake pedal (LHD) ... ..	AHB5151.
Clutch pedal (RHD) ... ..	AHB5150.
Clutch pedal (LHD) ... ..	AHB5152.

## Section M.23

### IMPROVED BRAKING SYSTEM

Commencing at Car No. RMH5554 new front brake assemblies are fitted. The assemblies, Part No. ATC4218 R/H and Part No. ATC4219 L/H, include brake-shoes, wheel cylinders, revised shake back assemblies and back-plates.

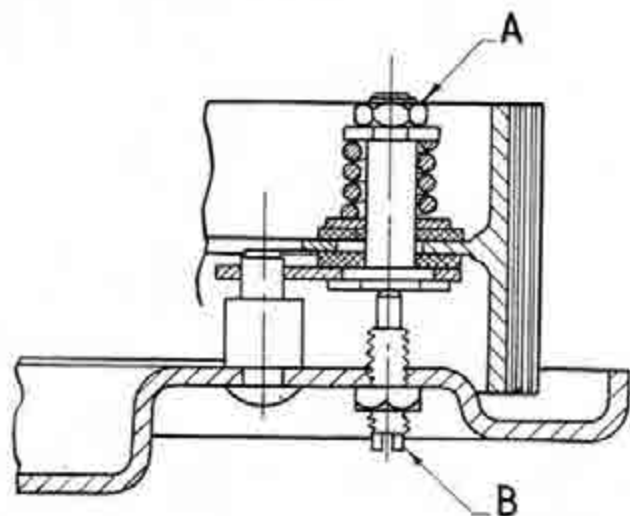


Fig. M.15.

The shake-back assembly locknut 'A', must be tightened to a torque wrench setting of 8 to 10 lb./ft. (1.1 to 1.3 kg./m.) and 'B' is the adjustable steady post.

The locknut, 'A', Fig. M.15, of the shake back assemblies must be tightened to a torque wrench setting of 8 to 10 lb./ft. (1.1 to 1.3 kg./m.) and locked by centre-punching. The adjustable steady post, 'B', Fig. M.15, is provided to maintain the brake lining surface within .006 in. (.02 mm.) of square to the brake-drum, using a set of feeler gauges and a cut-away slave brake-drum.

These modified assemblies may be fitted to earlier vehicles together with the following modifications:—

Commencing Car No. RMH3967 to Car No. RMH5553

1. Remove the front back-plate assemblies complete and replace with assemblies Part No. ATC4218 R/H and Part No. ATC4219 R/H.

Commencing Car No. RMH3677 to Car No. RMH3966

2. Follow the instructions detailed in paragraph 1 and proceed as follows:—

Replace the front brake-hoses with hoses Part No. 17H4178 and the wheel cylinder to hose bracket pipes with pipes Part No. ACB5961. Fit new brake-drums Part No. ATC4195 to the front hubs.

Commencing Car No. RMH2983 to Car No. RMH3676

3. Follow the instructions detailed in paragraphs 1 and 2 and proceed as follows:—

Remove the master cylinder and replace with master cylinder Part No. 17H4160; replace the brake pedal lever with lever Part No. AHB5910 on RHD cars and brake pedal lever Part No. AHB5912 on LHD cars.

Fit a new brake pedal return spring, Part No. AHB5022, and check the rear wheel cylinder hydraulic brake pipes for clearance to the hand-brake cable bracket, see Section M.21.

Check the brake pedal for a movement of  $7\frac{1}{4}$  in. (184.15 mm.) measured at the top of the pedal pad, and ensure that there is a clearance of  $\frac{1}{16}$  in. (.8 mm.) between the push-rod and the master cylinder plunger. It may be necessary to file out the floor to allow the brake pedal to return against its stop. Check for clearance between the master cylinder push-rod and the chassis frame cross-member.

Remove the brake servo operating lever and drill an alternative hole for the lever pivot pin, 'H' Fig. M.16,  $\frac{3}{16}$  in. (8.33 mm.) diameter, counter-sunk  $\frac{1}{16}$  in. (.79 mm.) on either side and refit the lever. Alternatively a new lever, Part No. 17H5699, which has the pivot pin hole in the new position, may be fitted.

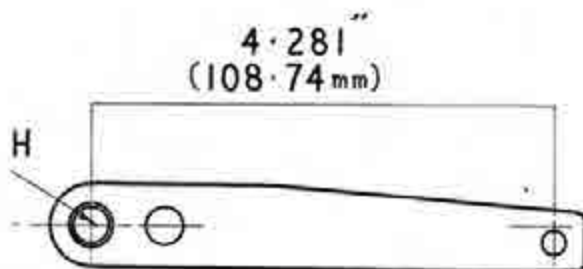


Fig. M.16.

The brake servo diaphragm operating lever may be modified by drilling a hole, 'H', as shown in this illustration.

*Commencing Car No. RMH501 to Car No. RMH2982*

4. Follow the instructions detailed in paragraphs 1, 2, and 3 and proceed as follows:—

Replace the rear wheel brake cylinders with  $\frac{1}{2}$  in. (12.7 mm.) wheel cylinders Part No. 17H4169 L/H and Part No. 17H4170 L/H.

## **Section M.24**

### **LUBRICATION OF BRAKE SERVO UNITS**

An improved type of lubricant is introduced which will maintain adequate lubrication under all climatic

conditions. This lubricant is known as Molytone 'C' and is obtainable in 8 oz. (227 gm.) tubes, Part No. 97H2009 or 1 lb. (454 gm.) tins, Part No. 97H2010.

The lubricant is for lubricating the vacuum piston leather and cylinder walls and does not require maintenance attention for 60,000 miles (100,000 km.). When servicing the servo unit the piston leather must not be immersed in spirit substances for cleaning but must be cleaned by wiping with a clean, dry cloth.

All later servo units fitted in production will be treated with this lubricant, and servo units issued in service will have the letter 'M' stamped on the end cover immediately below the end plate.