SECTION M

BRAKES
SERIES BN4

Preventive maintenance

Section No. M.1 Description
Section No. M.2 Maintenance
Section No. M.3 Front brakes
Section No. M.4 Rear brakes
Section No. M.5 Brake pedal
Section No. M.6 Master cylinder
PREVENTIVE MAINTENANCE

To safeguard against the possible effects of wear or deterioration it is recommended that:

1. Disc brake pads, drum brake linings, hoses and pipes should be examined at intervals no greater than those laid down in the Passport to Service.

2. Brake fluid should be changed completely every 18 months or 24,000 miles (40,000 kms.) whichever is the sooner.

All fluid seals in the hydraulic system and all flexible hoses should be examined and renewed if necessary every 3 years or 40,000 miles (65000 kms.) whichever is the sooner. At the same time the working surface of the pistons and of bores of the master cylinder, wheel cylinders and other slave cylinders should be examined and new parts fitted where necessary.

Care must be taken always to observe the following points:

(a) At all times use the recommended brake fluid.

(b) Never leave fluid in unsealed containers. It absorbs moisture quickly and this can be dangerous.

(c) Fluid drained from the system or used for bleeding is best discarded.

(d) The necessity for absolute cleanliness throughout cannot be over-emphasised.
Section M.1

DESCRIPTION

The brakes on all four wheels are hydraulically operated by foot pedal application, directly coupled to a master cylinder in which the hydraulic pressure of the brake operating fluid is originated. A supply tank cast integrally with the master cylinder provides a reservoir by which the fluid is replenished, and a pipe line consisting of tube, flexible hose and unions, interconnect the master cylinder and the wheel cylinders.

The pressure generated in the master cylinder by application with the foot pedal is transmitted with equal and undiminished force to all wheel cylinders simultaneously. This moves the pistons outwards, which in turn expand the brake shoes thus producing automatic equalisation, and efficiency in direct proportion to the effort applied at the pedal.

When the pedal is released the brake shoe springs return the shoes which then return the wheel cylinder pistons, and therefore the fluid back into the pipe lines and master cylinder.

An independent mechanical linkage actuated by a handbrake, mounted on the propeller shaft tunnel, operates the rear wheels by mechanical expanders attached to the rear wheel cylinder bodies.

The front brakes are of the two leading shoe types with sliding shoes which ensure automatic centralisation of the brake shoe in operation.

The rear brakes are also fitted with sliding shoes, and incorporate the handbrake mechanism.

Front Brakes

The front brakes are operated by two wheel cylinders situated diametrically opposite each other on the inside of the backplate and interconnected by a bridge pipe on the outside.

Each wheel cylinder consists of a light alloy body containing a spring seal support, seal, steel piston and edges of both shoes making initial contact with the drum. The shoes are allowed to slide and centralise during the actual braking operation which distributes the braking force equally over the lining area ensuring high efficiency and even lining wear.

Adjustment for lining wear is by means of two knurled snail cam adjusters, each operating against a peg at the actuating end of each shoe. Both adjusters turn clockwise to expand the shoes.

The brake shoes rest on supports formed in the backplate and are held in position by two return springs which pass from a hole in the abutment end of each web to a peg fixed to the backplate.

The bleed screw which is incorporated in one cylinder, is provided with a steel ball, this is normally seated firmly on a valve opening in the cylinder. A dust cover is fitted over the screw nipple to exclude dirt and with the removal of this cover and an anti-clockwise turn of the screw the fluid may escape.

Rear Brakes

The rear brake shoes are not fixed but are allowed to slide and centralise with the same effect as in the front brakes. They are hydraulically operated by a single acting wheel cylinder incorporating the handbrake mechanism. At the cylinder end the leading shoe is located in a slot in the piston while the trailing shoe rests in a slot formed in the cylinder body. At the adjuster end they rest in slots in the adjuster links. Both shoes are supported on the backplate and are held in position by two return springs fitted from shoe to shoe with the shorter spring nearer the adjuster.

The wheel cylinder consists of a light alloy die casting into the end of which moves a piston, with seal in a highly finished bore. In the other end of the housing a slot is machined to carry the trailing shoe. The pivoted handbrake lever projects through the backplate at right angles and operates on the leading shoe. The cylinder is attached to the backplate by a spring clip allowing it to slide laterally.

A bleed screw is incorporated in the cylinder housing with a rubber dust cap over the nipple end.

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Adjustment for lining wear is made by the brake shoe adjuster. This has a steel housing which is spigotted and bolted firmly to the inside of the backplate. The housing carries two opposed steel links, the outer end slotted to carry the shoes, and the inclined inner faces bearing on inclined faces of the hardened steel wedge.

The wedge has a threaded spindle with a square end which projects on the outside of the backplate, enabling a spanner to be used for adjustment purposes, by rotating the wedge in a clockwise direction, the links are forced apart and the fulcrum of the brake shoes expanded.

When the brake is applied, the piston under the influence of the hydraulic pressure, moves the leading shoe and the body reacts by sliding on the backplate to operate the trailing shoe.

The handbrake lever is pivoted in the cylinder body, and when operated the lever tip expands the leading shoe, and the pivot moves the cylinder body and with it the trailing shoe.

Handbrake

The handbrake operates on the rear wheels only and is applied by a pull-up type of lever situated on the propeller shaft tunnel. The cable from the control is attached to the compensator mounted on the rear axle. From compensator to the brake levers are transverse rods which are non-adjustable.

Before any adjustment to the handbrake is made the rear brake shoes must be adjusted to the brake drums.

The handbrake linkage is set when leaving the works and should not require any attention. Only when a complete overhaul is necessary should the handbrake linkage require re-setting.

When this is correct the rear shoes should be locked to the drums, the handbrake control just slightly applied, and the cable slackness just removed, by means of adjusting the sleeve nut at the front end of the longitudinal cable.
Section M.2
MAINTENANCE
Replenishment of Hydraulic Fluid
Inspect the supply tank at regular intervals and maintain at the indicated level by the addition of Castrol Girling Brake Fluid Amber.
Exercise great care when adding brake fluid, to prevent dirt or foreign matter entering the system.
IMPORTANT.—Serious consequences may result from the use of incorrect fluids, and on no account should any other than Castrol Girling Brake Fluid Amber be used.

Bleeding the Hydraulic System
Bleeding is necessary when a portion of the hydraulic system has been disconnected, or if the level of the brake fluid has been allowed to fall so low that air has entered the master cylinder.
Pressure bleeding methods are not suitable for Girling systems and are not recommended.
To prepare the brakes for bleeding release the handbrake. Check that each rear wheel cylinder is free to slide and turn the adjuster clockwise until the drum is fully locked by the shoes. The wheel cylinder piston will then be pushed right into the bore, with a minimum of air to be expelled. Slacken off the adjusters of the front brakes to allow the shoe springs to push the pistons into the wheel cylinder bores, leaving a minimum amount of space for air or fluid. Fill the master cylinder with the recommended fluid 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 farthest from the master cylinder 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 about three-quarters of a turn.
Begin bleeding with a fairly full stroke of the pedal, allowing it to fly back freely. Lift the floor covering if this prevents free movement of the pedal. One or two slightly faster applications may now be made to advantage. Watch the flow of fluid into the glass jar, and when air bubbles cease to appear close the bleeder screw during the last (slow) pedal application.
If the bleeding of any cylinder continues without success for a considerable time it is possible that air is being drawn in past the bleeder screw threads. In such cases tighten the bleeder screw at the end of each downward stroke of the pedal and allow the pedal to return fully before re-opening it. Close the bleeder screw finally during the last pedal application.

Tighten the bleeder screws to a torque wrench reading of 5 to 7-5 lb. ft. (69 to 1-03 kg. m.);
Repeat the operation on each wheel, finishing with the wheel nearest the master cylinder.
After bleeding top up the master cylinder to its correct level. Adjust all brakes in the usual manner.
NOTE.—Clean fluid bled from the system must be allowed to stand for at least 24 hours until it is clear of air bubbles before it is used again. Dirty fluid should be discarded.

Adjusting the Brake Shoes
The brakes are adjusted for lining wear, only at the brakes themselves, and no alteration should be made to the handbrake cable for this purpose.
Front Brakes. A separate small cam adjuster is provided for each shoe. Jack up the car until the wheel to be adjusted is clear of the ground, then fully release both the hexagon head adjuster bolts on the outside of the backplate by turning them anti-clockwise.
Turn one of the adjuster bolts clockwise until the brake shoe touches the brake drum, then release the adjuster until the shoe is just free of the drum. Repeat the process for the second adjuster and shoe. Spin the wheel to ensure that the brake shoes are quite free of the drum. Repeat the procedure for the second front wheel.
Rear Brakes. One adjuster is provided for both shoes and the adjustment of both rear wheels is identical.
Release the handbrake and jack up the car. Turn the square end of the adjuster on the outside of each rear wheel clockwise until the brake shoe touches the brake drum, then release the adjuster until the shoe is just free of the drum. Repeat the process for the second adjuster and shoe. Spin the wheel to ensure that the brake shoes are quite free of the drum. Repeat the procedure for the other rear wheel for the second rear wheel.

austin-healey 100-6/3000. Issue 4. (70575) 253
brake backplate in a clockwise direction until a resistance is felt. Slacken two clicks and the drum should rotate freely.

Section M.3 FRONT BRAKES
Replacing Brake Shoes

NOTE.—Always fit Girling “Factory Lined” replacement shoes. These have the correct type of lining and are accurately ground to size. When fitting replacement shoes, fit a new set of shoe return springs.

1. Jack up the car and remove road wheels, hub extensions and brake drums.
2. Lift one shoe out of the abutment slot of one wheel cylinder, then release from the piston slot of the other. (It will be found quite simple to remove the shoe return springs). To prevent the wheel cylinder pistons from expanding it is advisable to place a rubber band round each cylinder. Repeat with the second shoe.
3. Clean down the backplate, check wheel cylinders for leaks and freedom of motion.
4. Check adjusters for easy working and turn back (anti-clockwise) to full “off” position. Lubricate where necessary with Girling (White) Brake Grease.
5. Smear the tips of the brake shoe supports on the backplate, and the operating and abutment ends of the new shoes with Girling (White) Brake Grease. The (white) brake grease must not be allowed to contact hydraulic cylinders, pistons or rubber parts. Keep all grease off the linings on new replacement shoes and do not handle more than necessary.
6. Fit new shoe return springs to the new shoes. Place the hooked end of the spring through the hole in the shoe web and the swan neck through the hole in the backplate near the abutment end of the same shoe. Each shoe can be replaced independently. Remove rubber bands from cylinder.
7. Make sure the drums are clean and free from grease, etc., then re-fit.
8. Adjust the brakes as described under “Running Maintenance”.
9. Re-fit the road wheels and lower the car to the ground.

Section M.4 REAR BRAKES
Replacing Brake Shoes

Proceed in stages as described for front brakes, paragraphs 1 to 9, substituting the details in the following paragraphs for those bearing the same number.
(5) Unscrew the nut securing the brake and clutch pedal shaft and withdraw the shaft to release the brake and clutch pedal levers together with their distance piece.

(6) Inspect the lever bushes for wear and renew if necessary.

**To Replace**

Replacement is the reverse of the procedure "To Remove".

**Section M.6 MASTER CYLINDER**

**Description**

The master cylinder consists of an alloy body with a polished finish bore, and reservoir with cap. The inner assembly is made up of the push rod, dished washer circlip, plunger, plunger seal, spring thimble, plunger return spring, valve spacer, spring washer, valve stem and valve seal. The open end of the cylinder is protected by a rubber dust cover.

**Dismantling the Brake Master Cylinder**

1. Release the master cylinder push rod from the brake pedal as described in Section M.5.
2. Disconnect the pressure pipe union from the cylinder and remove the securing bolts, then the master cylinder and fluid reservoir may be withdrawn complete from the car.

3. Remove the filler cap and drain out the fluid. Pull back the rubber dust cover and remove the circlip with a pair of long nosed pliers. The push rod and dished washer can then be removed.

4. When the push rod has been removed the plunger with seal attached will be exposed; remove the plunger assembly complete. The assembly can be separated by lifting the thimble leaf over the shouldered end of the plunger.

5. Depress the plunger return spring allowing the valve stem to slide through the elongated hole of the thimble thus releasing the tension on the spring.

6. Remove the thimble, spring and valve complete.

7. Detach the valve spacer, taking care not to lose the spacer spring washer which is located under the valve head. Remove the seal.

8. Examine all parts, especially the seals, for wear or distortion and replace with new parts where necessary.

**Assembling the Brake Master Cylinder**

1. Replace the valve seal so that the flat side is correctly seated on the valve head.
2. The spring washer should then be located with the dome side against the underside of the valve.
BRAKES

Fig. M.6. Further section of master cylinder.
1. Washer. 2. Valve stem. 3. Valve spacer.

head, and held in position by the valve spacer the legs of which face towards the valve seal.

(3) Replace the plunger return spring centrally on the spacer, insert the thimble into the spring and depress until the valve stem engages through the elongated hole of the thimble, making sure the stem is correctly located in the centre of the thimble. Check that the spring is still central on the spacer.

(4) Refit a new plunger seal with the flat of the seal seated against the face of the plunger. Insert the reduced end of the plunger into the thimble until the thimble leaf engages under the shoulder of the plunger. Press home the thimble leaf.

(5) Smear the assembly with the recommended brake fluid, and insert the assembly into the bore of the cylinder valve end first, easing the plunger seal lips into the bore.

(6) Replace the push rod with the dished side of the washer under the spherical head, into the cylinder followed by the circlip which engages into the groove machined in the cylinder body.

(7) Replace the rubber dust cover and refit the whole unit into its aperture in the scuttle, not forgetting to fit the packing washer first. Secure the unit by means of the two bolts on the flange and refit the pressure pipe union into the cylinder.

(8) Reconnect the push rod fork with its corresponding hole in the brake pedal lever, securing it with the circlip.

(9) Bleed the hydraulic system.
SECTION MM

BRAKES

SERIES BN6

NOTE

For details of the brakes fitted to BN6 cars refer to Section M.
SECTION MMM

BRAKES

Mk. I and II (SERIES BN7 and BT7)
AND Mk. II and Mk. III (SERIES BJ7 and BJ8)

Section No. MMM.1 General description
Section No. MMM.2 Maintenance
Section No. MMM.3 Front brakes
Section No. MMM.4 Removing a calliper unit
Section No. MMM.5 Dismantling a calliper unit
Section No. MMM.6 Assembling a calliper unit
Section No. MMM.7 Brake disc
Section No. MMM.8 Rear brakes
Section No. MMM.9 Dismantling a wheel cylinder
Section No. MMM.10 Assembling a wheel cylinder
Section No. MMM.11 Master cylinder
Section No. MMM.12 Fault diagnosis
Section No. MMM.13 Dust covers
Section No. MMM.14 Disc brake pad shims
Section No. MMM.15 Brake servo

NOTE
This section should be used in conjunction with Section M,
particular attention being given to Sections M.2 and M.5
Section MMM.1

GENERAL DESCRIPTION

The brakes on all four wheels are hydraulically operated by foot pedal application, the pedal being directly coupled to a master cylinder in which the hydraulic pressure of the brake operating fluid is originated.

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 operates the rear brake shoes only by mechanical expanders attached to the brake cylinder bodies.

Girling calliper type disc brakes are fitted to the front wheel hubs. Each brake consists of two carriers to which friction pads are bonded. The system is self adjusting in operation.

The rear brakes are of the single leading shoe type with sliding shoes which ensure automatic centralisation in operation. Manual adjustment is provided by means of a wedge type adjuster.

Fig. MMM.1. Front disc brake and hub assembly.

Front Brakes

The front brake unit consists of a hub mounted disc rotating with the wheel, and a braking unit rigidly attached to the swivel axle at the rear. The brake unit is a calliper which straddles the disc and houses two horizontally opposed blind cylinders and the friction pads. Within each cylinder is a rubber sealing ring positioned by a groove in the cylinder body, and a piston protected by a dust cover. A segmental friction pad bonded to a steel backplate is inserted between each piston and the disc. The pads and backplates are secured by retaining pins and spring clips. The pads are self adjusting in operation and should need no attention between replacements.

If any part of the hydraulic system is disconnected the brake lines must be bled, the bleed screw is fitted at the top of the caliper housing on the inside.

NOTE:—The bridge bolts joining the two halves of the caliper together should not be removed.

Rear Brakes

(Refer to fig. M.2.)

The brake shoes are allowed to slide and centralise during the actual braking operation which distributes the braking force equally over the lining area ensuring high efficiency and even lining wear. They are hydraulically operated by a single acting wheel cylinder incorporating the handbrake mechanism. At the cylinder end the leading shoe is located in a slot in the piston while the trailing shoe rests in a slot formed in the cylinder body. At the adjuster end the shoes rest in slots in the adjuster links. Both shoes are supported on the backplate and are held in position by the two return springs fitted from shoe to shoe with the shorter spring nearer the adjuster.

The whole cylinder consists of a light alloy die casting with a highly finished bore in which moves the piston and seal. A slot is machined in the other end of the cylinder body to carry the trailing shoe and at right angles projecting through the backplate is pivoted the handbrake lever. The cylinder is attached to the backplate by a spring clip allowing it to slide laterally.

A bleed screw is incorporated in the cylinder housing with a rubber dust cap cover over the nipple.

Adjustment for lining wear is made by the brake shoe adjuster. This has a steel housing which is spigotted and bolted firmly to the inside of the backplate. The housing carries two opposed steel links, the outer end slotted to carry the shoes, and the inclined inner faces bearing on inclined faces of the hardened steel wedge.

The wedge has a threaded spindle with a square end which projects on the outside of the backplate, enabling a spanner to be used for adjustment purposes, by rotating the wedge in a clockwise direction, the links are forced apart and the fulcrum of the brake shoes expanded.

When the brake is applied, the piston under the influence of the hydraulic pressure, moves the leading shoe and the body reacts by sliding on the backplate to operate the trailing shoe.

The handbrake lever is pivoted in the cylinder body, and when operated the lever tip expands the leading shoe, and the pivot moves the cylinder body which in turn moves the trailing shoe against the brake drum.

Handbrake

The handbrake operates on the rear wheels only.
and is applied by the lever alongside the gearbox cover. The cable from the control is attached to the compensator mounted on the rear axle. From the compensator to the brake levers are transverse rods which are non-adjustable.

The handbrake linkage is set when leaving the works and should not require any attention. Only when a complete overhaul is necessary should the handbrake linkage require re-setting.

When this is correct the rear shoes should be locked to the drums, the handbrake control just slightly applied, and the cable slackness just removed, by adjusting the sleeve nut at the front end of the cable.

Section MMM.2

MAINTENANCE

This section should be used in conjunction with Section M.2 particular attention being given to— "Replenishment of Hydraulic Fluid" and "Bleeding the Hydraulic System."

Front brake adjustment

Wear on the front disc brake friction pads is automatically compensated during braking operations, manual adjustment is therefore not required. In order to maintain peak braking efficiency and at the same time obtain the maximum life from the friction pads, they should be examined at the recommended mileage and if the wear on one pad is greater than the other their operating positions should be changed over.

Rear Brakes are adjusted for wear only at the brakes themselves and on no account should any alteration be made to the handbrake cable for this purpose.

One common adjuster is provided for both shoes and the adjustment for both wheels is identical.

Release the handbrake and jack up the car. Turn the end of the adjuster on the outside of each brake backplate in a clockwise direction until a resistance is felt. Slacken two notches when the drum should rotate freely.

Section MMM.3

FRONT BRAKES

Replacing Friction Pads

When wear has reduced the thickness of the pads to approximately 1/16 in. (3·2mm.) they must be renewed. Under no circumstances should a pad be allowed to wear below 3/32 in. (1·6mm.).

1. Jack up the car and remove the road wheels.
2. Remove the spring clips locking the retaining pins in position and draw them back. Pull out the friction pad assemblies.
3. Clean down the callipers and inspect for fluid leaks.
4. Push in the pistons to the bottom of the cylinder bores with a suitable lever.
5. Slip in the new pads and locate them in position with the retaining pins and secure with the spring clips.
6. Press the brake pedal hard once or twice in order to settle the hydraulic system.

Section MMM.4

REMOVING A CALLIPER UNIT

To Remove

1. Unscrew the brake pipe union nut in front of its support bracket, disconnect and blank off the pipe.

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1. Wire clip.
2. Retaining pin.
3. Linning pad and steel backplate.

Fig. MMM.2. Front calliper exploded.

4. Dust cover.
5. Sealing ring.
6. Piston.
7. Bleed nipple dust cover.
8. Bleed nipple.
9. Calliper body.
(2) Remove the two nuts securing the brake hose support bracket and remove the bracket.
(3) Unscrew the two caliper retaining bolts and remove the caliper assembly complete.

To Replace
Replacement is the reverse of the procedure “To Remove”.

NOTE.—Tighten the retaining bolts to a torque reading of between 45 and 50 lb. ft. (6.22 and 6.91 kg.m.).

Section MMM.5
Dismantling a Calliper Unit
(1) Remove the caliper from the vehicle as described in Section MMM.4.
(2) Withdraw the brake pads as described in Section MMM.3 but do not push the pistons to the bottom of their bores.
(3) It is recommended that the unit is thoroughly cleaned before proceeding with dismantling.
(4) Force the pistons out of their bores by connecting the flexible hose to a fluid supply and applying pressure to reject the pistons. Alternatively, push back the dust seal and insert two suitable levers into the seal groove and pull the piston out with an even pressure. Taking care not to damage the groove and piston surfaces.
(5) Disengage the dust cover and remove the internal seal, by inserting a blunt blade along its side and easing it out. Renew the dust cover and internal seal if they show signs of wear.
Clean internally with methylated spirits only and allow to dry. Use brake fluid to clean rubber parts.

NOTE.—No attempt should be made to remove the bridge bolts joining the two halves of the caliper.

Section MMM.6
Assembling a Calliper Unit
(1) Fit the internal seal into the groove in the cylinder bore with the scraping edge (smaller diameterrinnermost.
(2) Locate the lip of the dust cover in the outer groove.
(3) Smear the piston with brake fluid and push it into the bore, closed end first.
(4) Push the piston right home and then engage the outer edge of the cover with the groove in the piston body.
(5) Refit the pad assemblies and lock in position with the retaining pins. (Section MMM.3).
(6) Refit the caliper unit taking care that the disc passes between the two pads. (Section MMM.4).

(7) Connect the brake hose and bleed the system (Section M.2). Check for leaks with the brake fully applied.

Section MMM.7
The Brake Disc
A check should be made to ascertain that the disc is running true. As maximum efficiency can only be attained when the disc run-out is at a minimum.
It must be remembered that run-out at the disc may also be due to the hub bearings being out of adjustment, this item should be checked carefully before condemning a disc (see Section LLL.1).

To Check for Run-out
Clamp the dial indicator to a suitable fixed point on the vehicle with the needle pad bearing on the disc face. Run-out must not exceed 0.004 in. (0.1mm) total, as excessive run-out will cause knocking back of the pistons which may create judder and increased pedal travel. If there is doubt concerning this condition the disc should be renewed.

To Remove
(1) Remove the caliper unit as described in Section MMM.4 but do not disconnect the hydraulic supply hose. A spacer should be placed between the pads in order to hold the pistons in position.
(2) Dismantle the hub assembly as described in Section LLL.1.
(3) The disc is held to the hub by five nuts and spring washers, after removing these the two components may be separated.

To Replace
(1) Assembling the brake disc to the hub is a reversal of the instructions “To Remove”.
(2) Replace the hub on the swivel axle (See Section LLL.1).
(3) Check for run-out as detailed above.
(4) Replace the caliper assembly as described in Section MMM.4
(5) Refit the wheel.

Scoring of brake discs is not detrimental, provided that the scoring is concentric, even, and not excessive. If the discs are heavily or unevenly scored, however, the braking efficiency will be impaired and pad wear increased. In this case the discs may be reground, but this work must be carried out with extreme accuracy and should only be considered if new discs are unobtainable. The ground surface must be quite flat and parallel with the mounting face, and must have a fine finish.
Avoid sharp corners at the inner circumference of the ground area. Either or both sides may be ground, but no more than 0.040 in. (1.02 mm.) should be removed from each side, i.e. after grinding the thickness must not be less than 0.335 in. (8.51 mm.).

When fitted to the hub disc must run centrally between the caliper cylinders. To check this remove the friction pads from the caliper and insert feeler gauges between the pad abutments on the caliper body and the faces of the disc. It is permissible for the gap on opposite sides of the disc to differ by 0.015 in. (0.38 mm.) but there must be no difference between the gaps at the two abutments on the same side of the caliper. This ensures that the caliper is in correct alignment with the disc and that the pads and pistons are square with the disc. Shims must be used at the caliper mounting to correct any discrepancy.

Section MMM.8

REAR BRAKES

Replacing Brake Shoes

NOTE.—Always fit Girling "Factory Lined" replacement shoes. These have the correct type of lining and are accurately ground to size. When fitting replacement shoes, fit a new set of shoe return springs.

(1) Jack up the car and remove the road wheels, hub extensions and brake drums.

(2) Lift one of the shoes out of the slots in the adjuster link and wheel cylinder piston. Both shoes can then be removed complete with springs. Place a rubber band round the wheel cylinder to keep the adjusters in place.

(3) Clean down the backplate, check the wheel cylinders for leaks and freedom of motion.

(4) Check the adjusters for easy working and turn back (anti-clockwise) to full "off" position. Lubricate where necessary with Girling (White) Brake Grease.

(5) Smear the tips of the brake shoe supports on the backplate, and the operating and abutment ends of the new shoes with Girling (White) Brake Grease. The (white) brake grease must not be allowed to contact hydraulic cylinders, pistons or rubber parts. Keep all grease off the linings of new replacement shoes and do not handle more than necessary.

(6) Fit the two new shoe return springs to the new shoes (with the shorter spring at adjuster end) from shoe to shoe and between shoe web and backplate. Locate one shoe in the adjuster link and wheel cylinder piston slots, then raise over the opposite shoe into its relative position. Remove rubber band.

(7) Make sure the drums are clean and free from grease, etc., then re-fit.

(8) Adjust the brakes as described in Section MMM.2.

(9) Re-fit the road wheels and lower the car to the ground.

NOTE.—The first shoe has the lining positioned towards the heel of the shoe and on the second shoe towards the toe or operating end in both left-hand and right-hand brake assemblies. Several hard applications of the brake pedal should be made to ensure all the parts are working satisfactorily and the shoes bedding to the drums, then the brakes should be adjusted as described.

Immediately after fitting replacement shoes it is advisable to slacken one further notch on the brake adjuster to allow for possible lining expansion, reverting to normal adjustment afterwards.

Section MMM.9

DISMANTLING A WHEEL CYLINDER

(Refer to Fig. M.2)

(1) Jack up the car and remove the road wheel, hub extension and brake drum.

(2) Disconnect the rod from the handbrake lever, remove the brake shoes, disconnect the pressure pipe union from the cylinder, and remove the rubber dust cover from rear of the backplate.

(3) Prise the retaining plate and spring plate apart and tap the retaining plate from beneath the backplate.

(4) Withdraw the handbrake lever from between the backplate and wheel cylinder.

(5) Remove the spring plate and distance piece, and finally the wheel cylinder from the backplate.

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

Section MMM.10

ASSEMBLING A WHEEL CYLINDER

(1) Locate the neck of the wheel cylinder in the larger slot and replace the distance piece with cranked lips away from the backplate.

(2) Insert the spring plate between the distance piece and the backplate with cranked lips outwards.

(3) Replace the handbrake lever and tap the retaining plate into position between the distance piece and the spring plate, until located by the spring plate.

(4) Fit the rubber dust cover, connect the pressure hose union and refit the brake rod.

(5) Replace the shoes and brake drum, and bleed the system. Finally refit the road wheel.

264
Section MMM.11

MASTER CYLINDER

Description
The master cylinder consists of an alloy body with a polished bore, into which is connected the fluid inlet and outlet ports. The fluid reservoir is connected to the inlet port at the end of the cylinder by a length of steel pipe. Connected to the outlet port in the top of the cylinder body is the pressure pipe for the braking system. The inner assembly is made up of the push rod, dished washer, circlip, plunger, plunger seal, end seal, spring thimble, plunger return spring, valve spacer, spring washer, valve stem and valve seal. The open end of the cylinder is protected by a rubber dust cover.

Dismantling the Brake Master Cylinder

1. Release the master cylinder push rod from the brake pedal as described in Section M.5.
2. Disconnect the inlet and pressure pipe unions from the cylinder and remove the securing bolts, then withdraw the master cylinder.
3. Drain off the fluid from inside the cylinder. Pull back the rubber dust cover and remove the circlip with a pair of long nosed pliers. The push rod and dished washer can then be removed.
4. When the push rod has been removed the plunger with seal attached will be exposed. Remove the plunger assembly complete. The assembly can be separated by lifting the thimble leaf over the shouldered end of the plunger (ref. Fig. M.4).
5. Depress the plunger return spring allowing the valve stem to slide through the elongated hole of the thimble thus releasing the tension on the spring.
6. Remove the thimble, spring and valve complete.
7. Detach the valve spacer, taking care not to lose the spacer spring washer which is located under the valve head. Remove the seal.
8. Examine all parts, especially the seals, for wear or distortion and replace with new parts where necessary.

Assembling the Brake Master Cylinder

1. Replace the valve seal so that the flat side is correctly seated on the valve head.
2. The spring washer should then be located with the dome side against the underside of the valve head, and held in position by the valve spacer, the legs of which face towards the valve seal. (Ref. Fig. M.7).
3. Replace the plunger return spring centrally on the spacer, insert the thimble into the spring and depress...
until the valve stem engages through the elongated hole of the thimble, making sure the stem is correctly located in the centre of the thimble. Check that the spring is still central on the spacer.

(4) Refit a new plunger seal with the flat of the seal seated against the face of the plunger. Insert the reduced end of the plunger into the thimble until the thimble leaf engages under the shoulder of the plunger. Press home the thimble leaf.

(5) Smear the assembly with Girling red rubber grease or with the recommended hydraulic fluid. Insert the assembly into the bore of the cylinder, valve end first, easing the plunger seal lips into the bore.

(6) Replace the push rod with the dished side of the washer under the spherical head, into the cylinder followed by the circlip which engages into the groove machined in the cylinder body.

(7) Replace the rubber dust cover and refit the whole unit into its aperture in the scuttle, not forgetting to fit the packing washer first. Secure the unit by means of the two bolts on the flange and refit the pressure pipe and inlet pipe unions to the cylinder.

(8) Reconnect the push rod fork with its corresponding hole in the brake pedal lever, securing it with the circlip.

(9) Bleed the system.

Section MMM.12

FAULT DIAGNOSIS

This Section should be used in conjunction with Section M.7.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>No.</th>
<th>Possible fault</th>
</tr>
</thead>
<tbody>
<tr>
<td>(c) Brakes Grab or Pull to Side</td>
<td>1</td>
<td>Disc out of true</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Calliper loose</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Pad loose in calliper</td>
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<tr>
<td>(d) Dragging Brakes</td>
<td>1</td>
<td>Excessive pad wear</td>
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<tr>
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<td>2</td>
<td>Pressure build up in fluid supply</td>
</tr>
<tr>
<td>(f) Brakes Inefficient</td>
<td>1</td>
<td>Disc out of true</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Incorrect grade of lining pad.</td>
</tr>
</tbody>
</table>

Section MMM.13

DUST COVERS

To prevent excessive wear of the front brake pads, due to the entry of water and road grit, dust covers have been fitted in production to the front brakes of later cars. This change took place at the following car numbers: BT7, (Disc wheels) 9088; (Wire wheels) 9090, BN7, (Disc wheels) 9450; (Wire wheels) 9453. This modification can also be carried out on earlier cars.

Section MMM.14

DISC BRAKE PAD SHIMS

Should the front disc brakes develop a high pitched squeal after several applications of the brakes, this can be remedied by fitting four anti-squeal shims (Part No. BHA4195). They must be positioned between each brake pad and piston with the indicating arrow on each shim pointing towards the caliper bleeder screw, i.e. in the direction of the forward rotation of the wheel.
Section MMM.15

**BRAKE SERVO**

*(Optional on 3000 Mk. II cars)*

A vacuum servo of Girling manufacture for the braking system was offered as an optional extra from Car Number 15104 on 3000 Mk. II cars, but standard equipment on 3000 Mk. III cars. When this is fitted the following different parts are also embodied in the braking system: a master cylinder with a larger bore (½ in.), new front brake calliper units (incorporating new calliper body assemblies, pistons, friction pads, and the anti-squeal shims mentioned in Section MMM.14), and new rear brake shoes.

**General Description**

The brake servo unit is installed in the hydraulic system between the master cylinder and the wheel cylinders, with the outlet pipe from the master cylinder connected to the servo hydraulic inlet and the servo hydraulic outlet connected to the wheel cylinders. The force required to augment the driver’s effort is obtained by admitting atmospheric pressure to a vacuum cylinder containing a piston. The pressure difference thus obtained across the vacuum piston produces a thrust which is used to increase the hydraulic pressure available at the wheel cylinders.

The piston in the vacuum cylinder is normally subjected to the vacuum on both sides. This provides a more rapid response than the direct vacuum type of cylinder, in which the piston is normally subjected to atmospheric pressure on both sides and the vacuum is introduced to one side when a pressure difference is required.

When atmospheric pressure is admitted to the vacuum cylinder by the control valve, the piston drives the piston rod down the hydraulic cylinder, providing a considerable increase in the pressure of fluid at the wheel cylinders. The control valve, operated by the fluid from the master cylinder, exercises control over the pressure increase and the brakes are operated in proportion to the effort applied to the pedal.

Fig. MMM.4 shows the unit at rest with no pressure in the hydraulic system. The valve is open to the engine inlet manifold and the vacuum on both sides of the piston is equal.

When the brake pedal is applied hydraulic pressure is exerted throughout the whole system and equally on both ends of the valve control piston. As one end of the piston is larger than the other, an equal pressure on both ends causes a proportionally greater thrust to be exerted on the large end. The piston therefore moves to the left (see Fig. MMM.5) and the “T” shaped rocking lever opens the valve to the atmosphere. The atmospheric pressure admitted to the right-hand end of the vacuum cylinder drives the piston into the cylinder. The piston rod first seals the central hole in the output piston and, continuing the movement into the hydraulic cylinder,
applies pressure on the fluid proceeding to the wheel cylinders and to the small end of the valve control piston (see Fig. MMM.5).

Movement of the output piston into its bore continues until the thrust on the small end of the valve control piston by the fluid at high pressure overcomes the thrust of the fluid at low pressure at the large end. The valve control piston is thus moved back, closing the air valve. At this point both valves are closed and the brakes are being held on (see Fig. MMM.6). If the brake pedal is released the fluid pressure is reduced at the large end of the control piston. The control piston moves to the right opening the vacuum valve, and consequently air is drawn out of the vacuum cylinder. As a result the vacuum piston moves towards the end cover and with it the hydraulic output piston, relieving the fluid pressure to the wheel cylinders (see Fig. MMM.7). The piston rod is withdrawn from the output piston seal allowing fluid to flow between the wheel cylinders and supply tank.

If the force on the pedal is increased after arriving at the position shown in Fig. MMM.6, the valve gear operates to give additional assistance from the vacuum piston until the thrust on each end of the control piston balances, or until the limit of available vacuum is reached. Conversely, if the brake pedal force is reduced, the valve gear operates to reduce the pressure at the wheel cylinders until a state of balance at the control piston is reached. In this way the pressure in the wheel cylinders varies in proportion to the effort at the pedal and full control of the braking effort is maintained.

A non-return valve is fitted in the pipeline between the engine inlet manifold and the servo to prevent the entry of air or petrol vapour into the servo in conditions of limited or non-existent manifold depression. The valve, which is serviced as an assembly, is screwed into the body of the servo unit and seated on a gasket.

Dismantling

Absolute cleanliness is essential when dismantling the servo unit.

Hold the unit in a vice by the mounting lugs on the body.

Remove the seven screws and nuts from the vacuum cylinder flange, supporting the cylinder cover against the pressure of the piston return spring. Carefully allow the piston return spring to extend and remove the end cover, gasket, piston and seal assembly, and the return spring. If the piston rod shows signs of scoring, the complete servo unit must be replaced.

Unscrew the three set bolts from inside the closed end of the vacuum cylinder. The body of the servo will now be released from the cylinder. Remove the three set bolts, copper washers, and the clamp plate from inside the cylinder. Pull the body away from the cylinder, easing the vacuum pipe from the grommet in the cylinder flange.
Push the air filter cover spring clip aside and remove the cover. The air filter element is now accessible. Remove the four screws retaining the valve chest cover and take off the cover with the vacuum pipe and gasket. Remove the two screws from inside the valve chest and lift out the valve retaining plate and the valves with their rocking lever. The valve plates are attached to the rocking lever by two separate clips.

Pull the gasket off the face of the body and, by tapping the face on a wooden surface, remove the plug sealing the valve control piston bore (upper bore). The control piston assembly will now be pushed out by its spring. Lift out the complete assembly. To dismantle this assembly, remove the circlip from the large diameter end to release the washer and spring. Lift off the square-section spring abutment washer and remove the two tapered seals.

To remove the components from the output cylinder (lower bore), pull out the end guide bush. Ease up the gland seal with a thin bladed screwdriver and lift out the nylon spacers. Using a pair of long-nosed circlip pliers, remove the circlip from its groove in the bore. The output piston with its stop washer will now be ejected from the bore by the piston return spring. The piston assembly will be found to have two seals: a tapered seal is located in an annular groove in the outside of the piston, and a second washer-like seal is held in place by a metal cup pressed into the end of the piston. The latter, which serves to seal the end of the piston rod when the brakes are applied, cannot be serviced on its own: a new output piston assembly must be fitted.

Assembling

With the servo unit dismantled examine the metal components for signs of corrosion, pitting, or scoring. The piston rod, pistons and bores must be free from scoring or steps. All cleaning must be done with methylated spirit or brake fluid. Never allow oil, grease, paraffin, or trichloroethylene to be used on any hydraulic parts. Lubricate hydraulic parts, pistons, seals and bores with Castrol Girling Brake Fluid Amber, before assembly. Always exercise extreme cleanliness.

Fit a new taper seal to a new output piston assembly with the taper facing the smaller end of the piston. Assemble the return spring, piston and washer to the output cylinder (lower bore). Press these components down into the bore against the tension of the spring and, using suitable circlip pliers, insert the circlip into its groove in the bore. Drop in the seal spacer (large end first), ease in the gland seal with the taper towards the output piston, and push in the guide bush with its flange level with the face of the body.

Fit new seals to the valve control piston, positioning the large tapered seal with the taper facing the spring and the small tapered seal with its taper facing away from the spring. Place the abutment washer, spring and retaining washer in position on the piston. Press the spring down and insert the circlip into its groove. Place the piston assembly into the bore aligning the hole in the piston with the hole in the side of the bore. Fit the valve plates to the valve rocking lever and place the assembly into the valve chest engaging the ball end of the lever in the valve control piston. Position the valve retainer over the valve assembly and secure with the two screws and washers. Check the operation of the valve gear by depressing and releasing the valve operating piston. The valves must move freely, and in the normal position, the valve nearest the body flange should be open, and the other valve closed. Fit a new seal into the groove in the valve control bore plug. Insert the plug into the bore until about 1/2 in. (16 mm.) of the plug stands proud of the body face.

Fit the valve chest cover and vacuum pipe, securing the cover with the four screws. The vacuum cylinder can now be assembled to the body. Place the retaining plate on the vacuum pipe. Insert the gasket between the body and the cylinder and place the cylinder in position, easing the vacuum pipe into the grommet in the cylinder flange. Position the clamp plate inside the cylinder and tighten home the three set bolts with their copper washers to a torque wrench reading of 10 to 12 lb. ft. (1:38 to 1:66 kg. m.).

No lubrication is needed for the piston seal as the seal and cylinder are specially treated during manufacture, but the seal sponge rubber backing ring and the end cover gasket must be renewed. Insert the return spring, piston, and piston seal assembly into the cylinder, taking care not to damage the rod or the central bearing guide bush. Press the piston home, fit the end cover with a new gasket, and secure the cover and vacuum pipe retaining plate with the seven screws and nuts.

Fit the moulded cellular air filter element. This should be renewed each time replacement brake shoes are fitted. Place the cover over the element and press the spring retaining clip into position.

Removing

The servo unit is mounted under the right-hand front wing behind the road wheel. When removing it from the car proceed as follows:

From underneath the bonnet, disconnect the top end of the rubber vacuum hose from the vacuum pipe adjacent to the master cylinders.

Unscrew the servo hydraulic inlet pipe union from the three-way connector situated next to the windscreen horn on the wing valance.
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<tr>
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<th>Description</th>
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<th>Description</th>
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<td>3-way connection to servo unit pipe</td>
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<tr>
<td>50</td>
<td>Dust cover</td>
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</tbody>
</table>
With the front of the car jacked up and working underneath the front wing, unscrew the hydraulic outlet pipe union from the body of the servo unit.

Seal the open ends of the pipes to prevent dirt entering and to avoid unnecessary loss of fluid.

Remove the three set bolts holding the servo unit to the mounting bracket under the front wing. The servo with the hydraulic inlet pipe and vacuum hose attached may now be pulled downwards and removed from the car.

Replacing

Replacement is a reversal of the above instructions. The braking system must then be bled as described in Section M.2.