

The arrangement for bleeding the brakes, showing the rubber tube attached to a front brake bleeder valve, with its free end submerged. It is essential that only genuine Lockheed Orange Brake Fluid is used in the system.

IT is not within the scope of this article to detail the operation of every single part of the braking system fitted to the Morris Oxford, but rather to give general information on maintenance and overhauling procedure, stressing the importance of certain precautions to be taken—many of which will be applicable to other Nuffield models fitted with similar braking equipment.

The principle of hydraulic operation will be known to most, that is, fluid pressure is employed to transmit the pedal effort to the brake-shoes, instead of using rods, cables and levers. When the brake pedal is operated a piston in what is called the master cylinder applies force to the fluid, causing pistons in two single-ended wheel cylinders in each front brake and in one double-ended wheel cylinder in each rear brake to apply a pair of brake-shoes to each drum. The whole system is connected with pipe lines consisting of metal tubes and rubber hoses.

Two leading shoes are incorporated in the front wheel brake assembly and they take the greater percentage of the braking force. The rear brakes are of the leading and trailing shoe type. All shoes have a floating anchorage. Upon applying the brakes, the hydraulic pressure throughout the closed circuit, being uniform, ensures an equal and undiminished force to the pistons in each wheel cylinder. Once the pedal is released, springs fitted to the brake-shoes force each wheel cylinder piston back into its respective cylinder and the fluid returns to the master cylinder for the next brake application.

The hand brake lever operates the rear brakes mechanically through a lever operating a piston in the rear wheel cylinder, which is fitted to an elongated slot in the back plate. The rear pistons are made in two halves; only the outer

half is actuated by the lever pivoted in the cylinder body. When operated by hydraulic application both halves of the piston are moved, thus applying the leading shoe, the trailing shoe being applied by the floating cylinder body, in each case.

Although the maintenance of the system is simple and requires little attention, it is nevertheless very important. First of all it is essential that the brake pedal push-rod clearance is set correctly, in order that the piston in the master cylinder can return to its stop, thus ensuring that the small by-pass hole between the fluid reservoir and piston bore is not blocked by the lip of the master cup that is pushed along in front of the piston every time the brake pedal is depressed. Blocking the small by-pass hole would prevent circulation of the fluid and pressure could thus build up in the system, causing all the shoes to drag against the brake-drums, although the pedal is released. There must, therefore, be $\frac{1}{2}$ in. free movement at the pedal pad before resistance is felt. This movement can be felt best by hand; should it not be apparent, check to make sure the pedal is not being held by a displaced carpet or floorboard before making any adjustment. In the normal course of events the free movement at the pedal pad should never need alteration as it is set during assembly of the car. The length of the push-rod extension can be reset after slackening its locknut.

Adjustment for Wear

Wear of the brake linings will increase the clearance between the brake linings and drums, and when the pedal can be pushed down to within 1 in. of the floorboards to apply the brakes fully, then all the brake-shoes should be adjusted. This can be done by turning the adjusters that are visible through holes in the brake-drums. Firstly the car should be raised, using the jack provided in the tool kit, the wheels remaining in contact with the ground being chocked up. On earlier models the road wheel must be removed, in addition to the hub disc of the particular wheel, in order to give access to adjusters. With later and current models only the hub disc and rubber plug sealing the adjusting hole is removed. Turn the wheel or drum until the slotted head of the adjuster is opposite the hole, then, using a screwdriver, turn the adjuster in a clockwise direction until the brake-shoe locks the drum, after which the adjuster should be turned back one notch only. The brake-drum should then be free to rotate without rubbing and the adjustment on that wheel is complete. A closer adjustment may be obtained by spinning the drum and applying the brakes hard, in order to set the position of the shoes, after which a further adjustment should be carried out. Both adjusters on the front wheels require the same operation. Repeat these operations for the adjuster on each rear wheel.

Examination of the reservoir of the master cylinder is a matter of routine maintenance every 1,000 miles. The fluid

level should never drop to less than half full or be higher than $\frac{1}{2}$ in. from the top of the filler neck.

Replacement of fluid is required only after extremely long intervals, but should the level drop considerably then an examination for leaks in the line and unions should be carried out immediately, whilst an assistant is applying firm pressure to the brake pedal.

Any risk of brake failure through leakage has been eliminated as far as possible by extreme care in manufacture and by the development of metal tubing and flexible hoses that have a safety margin far beyond the maximum limits of pressure reached in service.

The master cylinder filler is accessible for fluid inspection and topping up through a hinged cover-plate revealed when the carpet in front of the driver's seat is lifted. Before replacing the filler cap it is advisable to inspect the air vent in its side to ensure that it is not choked. Blockage at this point would cause the brakes to drag. The vent may be cleared by probing with a piece of thin wire.

Air in the system would, due to its compressibility, prevent efficient braking and should, therefore, be expelled. Normally this would only be necessary if some portion of the hydraulic equipment has been disconnected or the fluid has been drained off.

To bleed the system, fill the master cylinder with fluid and keep it at least half full throughout the operation. Attach a piece of rubber tubing to the bleed valve in one of the wheel cylinders, behind the back plate, and allow the other end of the tube to be submerged in a little fluid in a clean glass jar, then open the bleed screw one full turn. Next push the pedal down firmly and allow it to return without assistance. Repeat this operation several times until the flow into the glass jar is free from air bubbles. Once the air bubbles cease to appear, screw up the bleeder screw securely, whilst an assistant holds the pedal hard down. Repeat this procedure for all four wheels. Fluid bled from the system should be allowed to stand for several hours before using it again, because of its aerated condition. Contaminated fluid should be discarded.

Scrupulous Cleanliness

If the system has become contaminated by the use of incorrect fluid or mineral oil, then it is essential that all parts should be dismantled for cleaning, rubber parts, including flexible hoses, being renewed.

Dismantling of the brake system must be carried out under conditions of scrupulous cleanliness, it being most important that all mud and dirt is cleaned off before removing any part from the car. Hands must be clean before touching any internal parts. The general grime of garage work would soon damage the rubber parts, necessitating their renewal. It is always advisable to replace any rubber parts should any doubt as to their serviceability exist.

KING SYSTEM

Designed by GUY HOWITT

A sheet of clean paper, upon which to lay the parts, should be laid on the bench before dismantling and a tray of clean fluid is necessary in which to wash the parts. Once the parts are clean and have been dried carefully, they should be laid out on the sheet of paper in their order of assembly. All internal parts must be assembled wet with fluid.

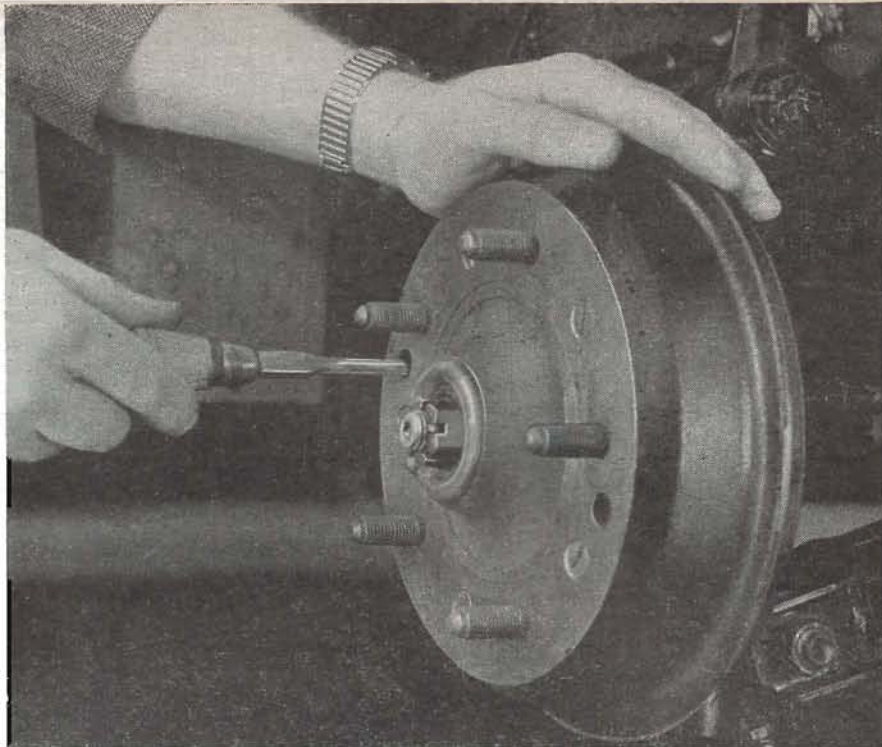
In order to disconnect the master cylinder from the frame member, remove the front carpets and extract the $\frac{3}{8}$ in. bolts and flat washers retaining the floor panel over the gearbox, and release the dip switch, which is secured by two recessed-headed screws. Disconnect the $\frac{3}{8}$ in. union nuts from the three-way connection above the master cylinder, disconnecting the front feed pipe first.

The Master Cylinder

Remove from the frame channel the clutch pedal stop bolt with distance tube, as fitted to later and current models. Unscrew the nuts and remove the two bolts holding the master cylinder and hand brake cable abutment bracket to the frame member, taking care not to lose the two spring washers. Disconnect the clutch and brake pedal return springs from the frame, and from the rear of the clutch operating rod remove the split pin and washer. Remove the nut and flat washer from the clutch pedal cotter pin and drive the pin from the pedal. Now the brake pedal complete with push-rod, rubber boot and return spring can be lifted clear of the frame member. The master cylinder complete with main supply pipe is removed by a forward and upward movement.

To dismantle the master cylinder, remove the filler cap and drain off the fluid. Remove the main feed pipe, union and washers. Push the piston a little way down the bore of the cylinder to release the pressure on the piston stop and remove the retaining circlip. Withdraw the piston and internal parts, namely the master cup, return spring, valve assembly and seating washer. The secondary cup can be removed by gently stretching it over the flange of the piston.

Assembly of the master cylinder is the reverse of the dismantling procedure, care being taken to observe absolute cleanliness. It will be noted that the secondary cup can be refitted correctly to the piston after cleaning by gently working the fingers round the cup and flange of the piston to ensure it is properly seated. The lip of the cup must face the opposite end of the piston. Place the valve seating washer in position in the bottom of the piston and fit the valve cup and body on to the return spring, inserting the spring, valve first, into the cylinder, with the little metal spring seat on the other end of the spring. Insert the master cup into the cylinder, lip foremost, taking care not to damage or turn back the lip of the cup. Press the piston into the cylinder gently, taking care not to damage or turn back the lip on the secondary cup. Finally, insert the piston stop and fit the circlip, ensuring that it beds evenly in its groove. Test the master cylinder by filling up the reservoir and



Adjustment of the brake-shoes is made by turning the adjuster cams with a screwdriver. There is a separate adjuster for each front brake-shoe, and one for each pair of rear shoes (six in all).

pushing the piston inwards, allowing it to return unassisted; fluid should flow from the outlet after one or two such applications.

Replacement of the master cylinder to the frame is the reverse of the removal procedure, it being advisable to make sure the main feed pipe is tight and in its correct position before fitting it to the frame member.

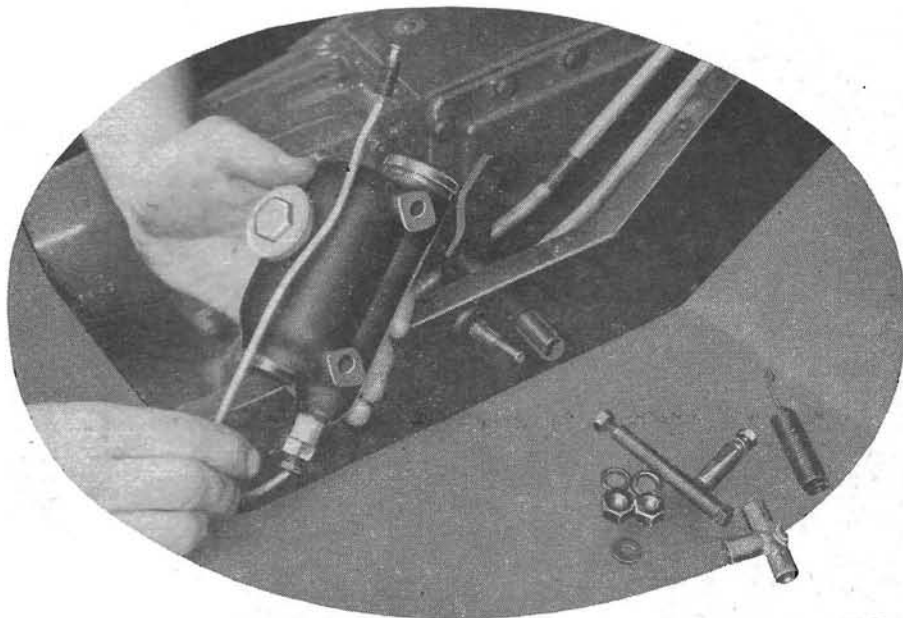
The brake-drum, together with the hub assembly, must be removed before access to the brake assembly can be gained. On early Morris Oxfords the brake-drums are attached to the wheel hub by countersunk-headed screws, the inner ends of which are riveted over. Later models have the hubs and brake-drum made in one piece. The hub extractor (Special Tool, Part No. 68822) is necessary for removal of the hub and brake-drum assembly. This work would normally be entrusted to a Morris Distri-

butor or Dealer who has the necessary tool.

Should it be necessary to remove a flexible hose from the front brakes or from the rear bracket, care should be taken not to unscrew the ends of the hose. The correct method is to disconnect the union nut on the tube, then remove the nut which holds the union to the frame and unscrew the hose from the wheel cylinder, or if the rear hose, the three-way connector.

Another point concerns brake-shoes and brake relining; when new shoes or relined shoes are being fitted, remember the wheel adjusting nuts must be returned to the full anti-clockwise position before attempting to refit the brake-drums. The hand brake must also be in the fully released position.

Finally, the brake linings must be of the same make and type throughout, otherwise uneven braking will result, despite every other part of the equipment being in order.



Removal of the master cylinder assembly from the frame. Note the pipe still attached to the unit.