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## DESCRIPTION

The PV 444 is fitted with two independent brake systems. One of these, the footbrake, is controlled by means of a brake pedal and operates on all four wheels through a hydraulic system. The other brake system, the handbrake, is controlled by a brake lever and operates mechanically on both the rear wheels.

## Footbrake

The arrangement of the footbrake is shown in Fig. 1.

When the brake pedal (11) is depressed, it operates on the plunger in the master cylinder (9) by means of a link rod (10). The hydraulic pressure in the master cylinder rises and is trans-

mitted through the brake fluid in the pipeline (6) to the wheel unit cylinders (2). The plungers (5) in these are then pressed outwards and the brake is applied.

When pressure on the pedal is released, the hydraulic pressure decreases and the return springs (4) cause the brake shoes to return to their rest position. The valve (15) maintains a low residual pressure in the system which is necessary for correct functioning.

Since the brake shoes are flexibly attached to the brake backing plate and because of the shape of the lower support (Fig. 2), the brake shoes are self-centring. In addition, the front brake shoes, the linings of which are as a rule subjected to most wear, are self-adjusting.

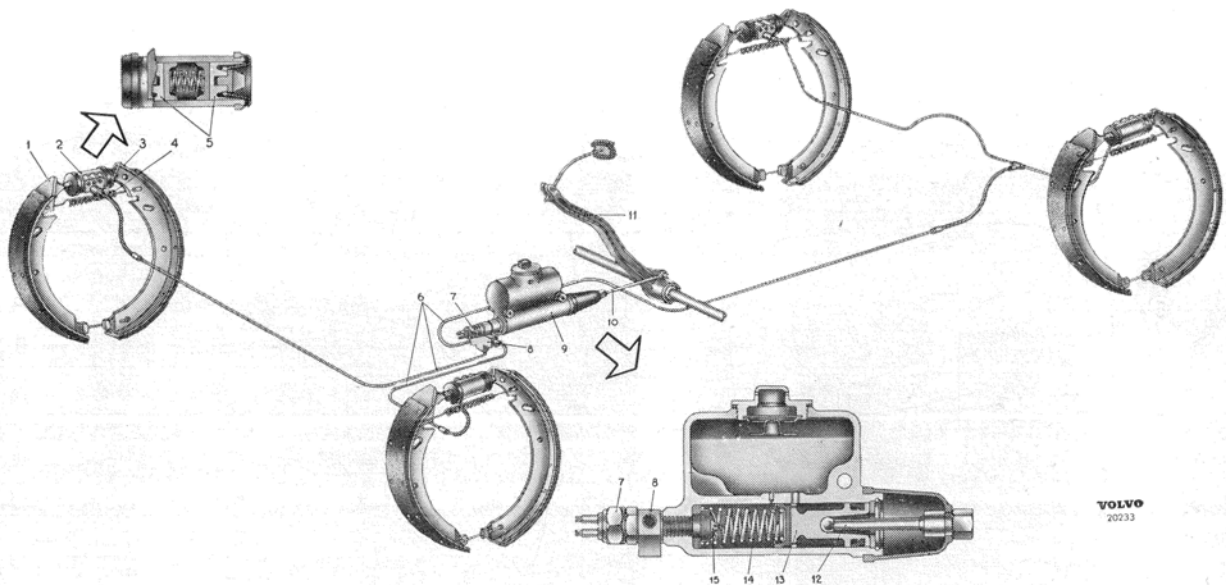


Fig. 1. Footbrake system.

- |                        |                    |
|------------------------|--------------------|
| 1. Brake shoe, front   | 9. Master cylinder |
| 2. Wheel unit cylinder | 10. Link rod       |
| 3. Brake shoe, rear    | 11. Brake pedal    |
| 4. Return spring       | 12. Thrust rod     |
| 5. Plunger             | 13. Plunger        |
| 6. Brake pipelines     | 14. Return spring  |
| 7. Brake contact       | 15. Valve          |
| 8. Three-way union     |                    |

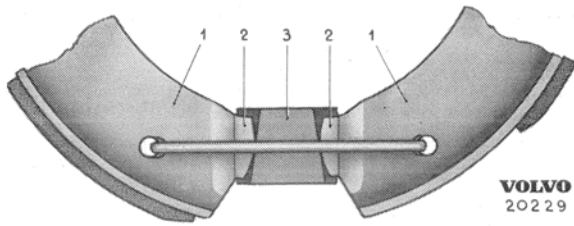


Fig. 2. Lower support.

1. Brake shoe 2. Lip 3. Support

The self-adjusting device (Fig. 3) functions in the following way.

A contact plug (4) is fitted in a hole in the brake shoe. The outer end of this plug is in contact with the brake drum and is held against this by a spring (2). As the brake lining wears down, the contact plug is moved inwards causing the lever (7) to press against the eccentric (6) by means of a stud (3). In this way the distance between the guide lip (8) on the brake shoe and the toothed lip (9) on the lever (7) is widened. The toothed key (11) which is influenced by a spring

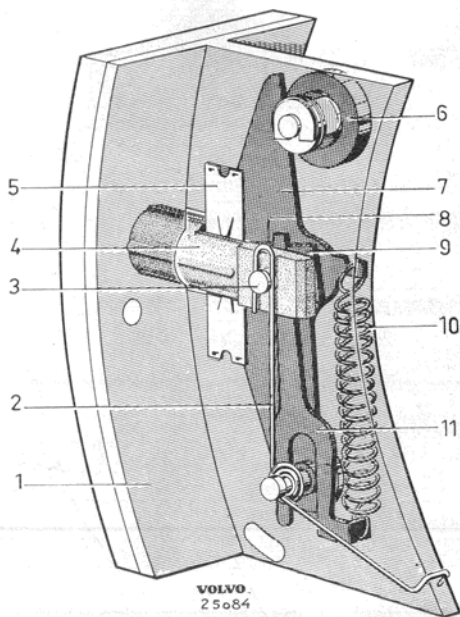


Fig. 3. Self-adjusting device.

- |                   |              |
|-------------------|--------------|
| 1. Brake shoe     | 7. Lever     |
| 2. Spring         | 8. Guide lip |
| 3. Stud           | 9. Lip       |
| 4. Contact plug   | 10. Spring   |
| 5. Damping spring | 11. Key      |
| 6. Eccentric      |              |

(10), is then pulled in between the above lips (8 and 9 respectively). The return movement of the brake shoe is thereby limited so that the clearance between the brake lining and drum remains constant regardless of the degree of wear on the brake lining.

When the brake linings have worn down so that the contact plug reaches the web of the brake shoe, self-adjusting ceases. With further lining wear the clearance between the lining and drum increases. If the pedal stroke increases, i.e. it can be pressed down nearer to the floor, this often means that the brake linings are worn out and require replacing.

In order to prevent the contact plug from vibrating, a damping spring (5) is fitted between the brake shoe and contact plug.

On early production self-adjusting devices there is a coil spring inside the contact plug and locking springs on the stud instead of the spring (2).

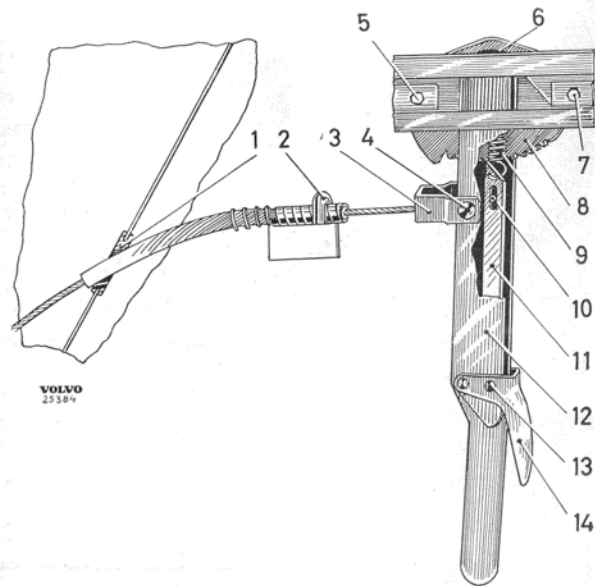


Fig. 4. Handbrake control, PV 444 chassis numbers 1-12504.

- |                   |                    |
|-------------------|--------------------|
| 1. Rubber bushing | 8. Ratchet segment |
| 2. Clamp          | 9. Spring          |
| 3. Shackle        | 10. Bolt           |
| 4. Bolt           | 11. Ratchet rod    |
| 5. Bolt           | 12. Brake lever    |
| 6. Pivot pin      | 13. Rivet          |
| 7. Bolt           | 14. Release grip   |

## Handbrake

The control device for the handbrake is placed under the instrument panel to the left of the driver. On chassis numbers 1—12504 the handbrake is controlled by an arrangement as shown in Fig. 4. From chassis numbers 12505 onwards the handbrake is controlled by means of a pull rod (see Fig. 5).

The movement of the control device is transmitted through the front brake cable (21, Fig. 6) to the intermediate lever (2). From there the movement continues via the equalizing link (3) and rear brake cable (5) to the rear wheel brake unit levers (2, Fig. 32). The upper end of the lever is attached to the rear brake shoe. When the lever is pulled forward the shoes are forced outwards with the help of the link (1) thereby applying the brakes.

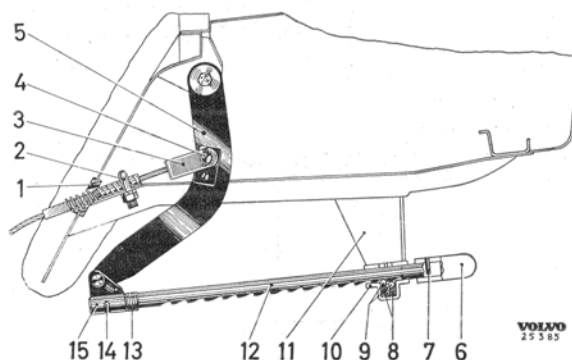


Fig. 5. Handbrake control PV 444 chassis numbers 12505 onwards.

- |                             |                     |
|-----------------------------|---------------------|
| 1. Rubber bushing           | 8. Springs          |
| 2. Clamp                    | 9. Interlock balls  |
| 3. Shackle                  | 10. Ratchet housing |
| 4. Bolt                     | 11. Bracket         |
| 5. Front intermediate lever | 12. Pull rod        |
| 6. Handle                   | 13. Return spring   |
| 7. Locking pin              | 14. Stop pin        |
|                             | 15. Link            |

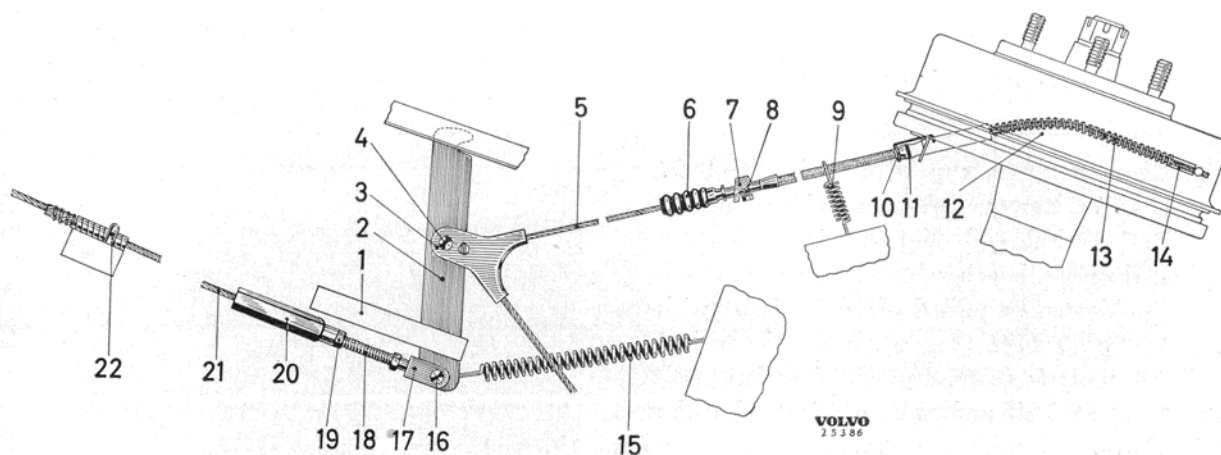


Fig. 6. Part of handbrake system.

- |                                   |                       |
|-----------------------------------|-----------------------|
| 1. Support for intermediate lever | 12. Brake drum        |
| 2. Intermediate lever             | 13. Return spring     |
| 3. Equalizing link                | 14. Lever             |
| 4. Stud                           | 15. Return spring     |
| 5. Rear brake cable               | 16. Stud              |
| 6. Rubber casing                  | 17. Shackle           |
| 7. Bracket                        | 18. Adjusting screw   |
| 8. Clamp                          | 19. Lock nut          |
| 9. Support spring                 | 20. Turnbuckle        |
| 10. Locking spring                | 21. Front brake cable |
| 11. Sealing ring                  | 22. Clamp             |

## REPAIR INSTRUCTIONS

### Footbrake

#### Wheel brake units

##### Disassembling front wheel brake units

1. Remove hub cap and slacken wheel nuts slightly. Lift up car and place block under lower control arm. Remove wheel.

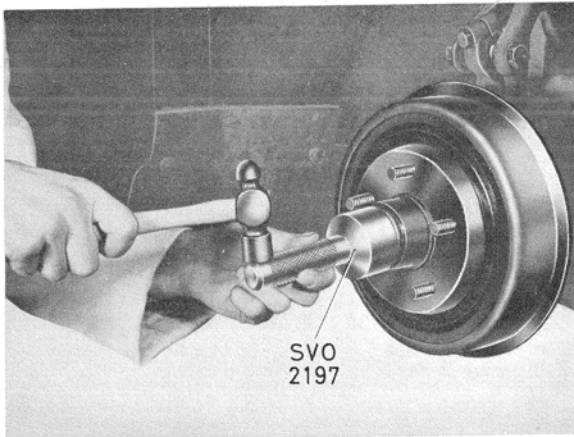


Fig. 7. Removing grease cap.

2. Remove grease cap with tool SVO 2197 (Fig. 7). Remove split pin and castle nuts. Pull off hub with tool SVO 1791 (Fig. 8). If the inner bearing does not come out with it, this can be pulled off the spindle with tool SVO 1794 (Fig. 9). For hubs with 4 wheel studs (earlier production), use pullers SVO 1446 and SVO 4016 instead of the above.

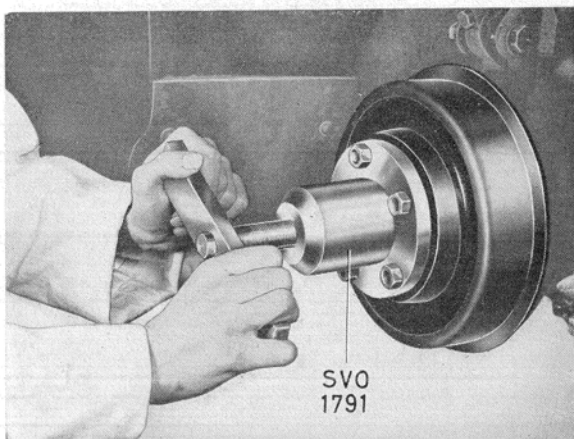


Fig. 8. Removing hub.

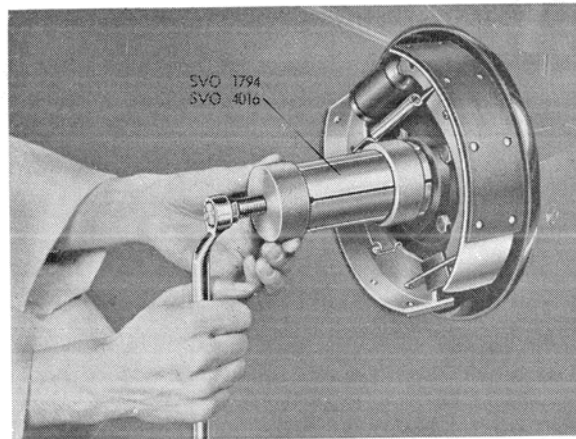


Fig. 9. Removing inner bearing.

3. Place clamp SVO 4074 on wheel unit cylinder so that the plungers cannot be pressed outwards. Remove lower spring with help of brake pliers SVO 1221 (see Fig. 11). Unhook return spring with help of pliers or key (Fig. 10). Remove locking washer and other washers from adjusting cam pivot pin. Lift off the shoes.

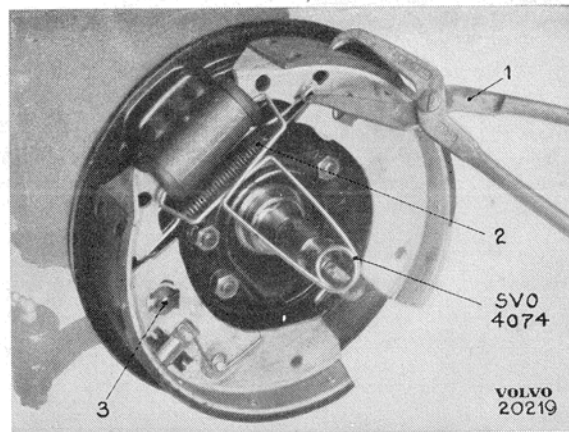


Fig. 10. Removing return spring.

##### Disassembling rear wheel brake unit

1. Apply the handbrake. Remove hub caps. Remove split pin and slacken the castle nut and wheel nuts slightly. Lift up the car and place blocks under rear axle. Remove wheel.

2. Release handbrake. Pull off hub with tool SVO 1791, see Fig. 8. If the hub has 4 wheel studs (chassis numbers 1—20004) use SVO 1446.
3. Place clamp SVO 4074 on wheel unit cylinder so that the plungers cannot be pressed outwards. Remove the lower spring with the help of brake pliers SVO 1221 (see Fig. 11). Remove locking washer and other washers from front shoe. Then turn the shoe outwards so that the handbrake link can be removed. Remove brake shoe and return spring. Disconnect handbrake cable and remove rear shoe.

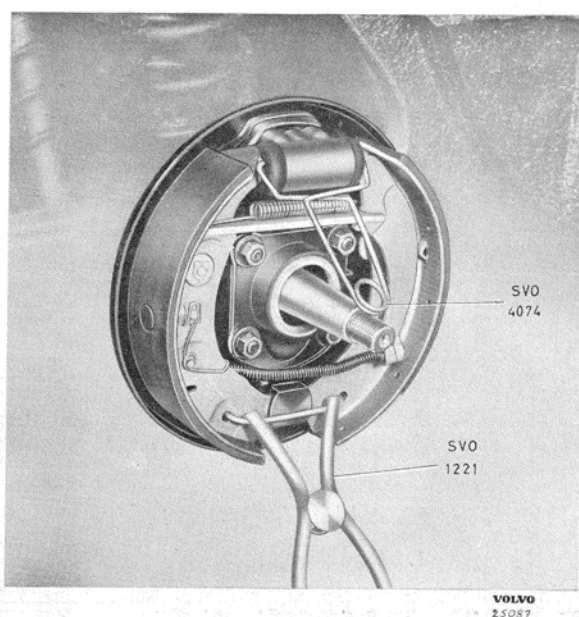


Fig. 11. Removing lower spring.

### Replacing brake linings

Late production PV 444 cars are fitted with bonded brake linings. These can also be fitted on earlier production cars but must be done in pairs so that each axle has the same type of brake lining on both sides, otherwise uneven braking effect will result.

Brake linings should be replaced as follows.

#### Early production (riveted)

Remove the old linings by pressing out the rivets in a rivet press. Then wash the brake shoes and self-adjusting parts and blow them dry with compressed air.

When fitting new linings, ensure that the correct sizes are used. The hole in the longer

lining should be 19 mm ( $\frac{3}{4}$ "). For further details see "Specifications".

Begin riveting at the centre of the lining and see that the lining beds properly on the shoe through its entire length. Use a rivet press and rivet punches suitable for the sizes of the rivets. The rear lining (shorter one) should be fitted on the upper part of the shoe (see Fig. 32).

#### Late production (bonded)

The old linings should preferably be removed in a band grinding machine. They can also be chiseled off after which the brake shoe should be polished with emery cloth. Use care in both cases to ensure that the shoe is not damaged.

After polishing, wash the shoe in clean petrol or similar and then allow it to dry. After this the contact surface for the lining must not be touched or allowed to become dirty.

The sizes of the new linings are given in the "Specifications". When fitting, see that the lining does not come obliquely on the shoe and that the hole in the front lining comes opposite the contact plug. The rear lining is fitted on the upper part of the shoe.

Use only bonding compound which is specially made to withstand the high temperatures arising during prolonged periods of braking. Volvo original linings are ready-treated with suitable quantities of such bonding compound. The procedure for bonding varies with different makes of oven so that no general description can be given. Therefore follow the manufacturer's recommendations carefully.

### Self-adjusting device

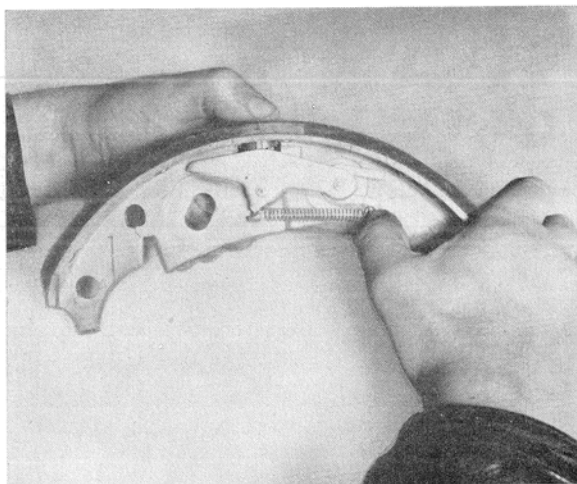
#### Disassembling

1. Press in the contact plug (4, Fig. 3) and check that the key (11) is in its inner position.
2. Disconnect the spring (10) for key and spring (2) for contact plug.
3. Remove lever (7), key (11), contact plug (4), damping spring (5) and guide lip (8).

#### Assembling

1. Fit the guide lip (8, Fig. 3). Replace the contact plug and fit the new one in position in the brake shoe. Place key (11) in position with the smooth side facing the guide lip.

2. Press in the contact plug far enough so that the hole in this comes opposite the hole in the brake shoe and fit lever (7) and spring (2) for contact plug.
3. Connect on spring (10) for key and fit damping spring.

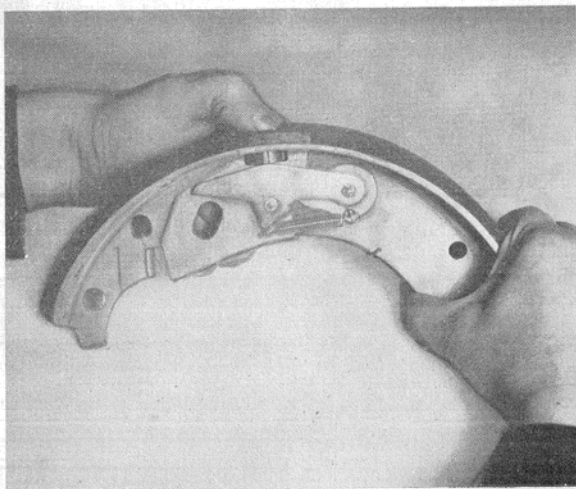


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Fig. 12. Testing self-adjusting device.

### Testing

Testing is carried out in such a way that while the contact plug is held pressed in, the key is moved to its outer position, see Fig. 12, after which pressure is released and the key removed. When the contact plug is pressed again the spring should be able to pull the key inwards, see Fig. 13. With pressure still being maintained, the key should move back to its outer position and the brake shoe is now ready for the contact plug to be adjusted.



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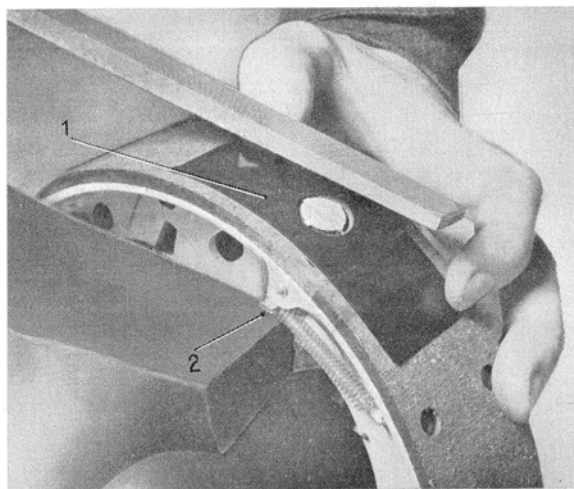
Fig. 13. Testing self-adjusting device.

### Adjusting contact plug

The contact plug is adjusted with the help of a file and adjusting jig (part number 210030).

With the contact plug in the outer position, hold the brake shoe in a vice. The lip of the lever (2, Fig. 14) should rest against one of the jaws so that the plug cannot be pushed in during adjustment, causing faulty adjustment to be made.

Place the adjusting jig (1) over the contact plug and file this flush with the adjusting jig (see Fig. 14). This will cause the plug to come 0.1 mm (0.004") above the surface of the brake lining.



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Fig. 14. Adjusting contact plug.

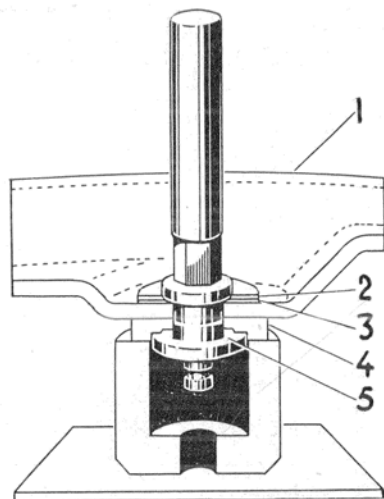
1. Adjusting jig
2. Lip

### Replacing stud for adjusting cam

The stud (5, Fig. 15) for the adjusting cam (4) which is fitted in the brake backing plate can be replaced by pressing out the old stud and fitting in a new stud with the compressing tool SVO 2119 provided for this purpose.

The stud is replaced as follows.

1. Remove the brake backing plate. Place the backing sleeve of the compressing tool in a press as shown in Fig. 15 and press out the stud (5) with the help of a drift.
2. Turn the backing sleeve and place a new stud above this. Place adjusting cam (4), brake backing plate (1), spacing washer (3) and the spring washer with internal teeth (2) on the stud. Press down the washers with the help of the compressing tool, see Fig. 16.



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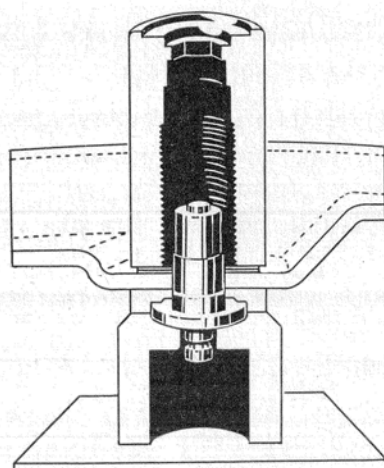
Fig. 15. Removing stud.

- |                        |                  |
|------------------------|------------------|
| 1. Brake backing plate | 4. Adjusting cam |
| 2. Washer              | 5. Stud          |
| 3. Washer              |                  |

- Turn the tool and centre it on the stud. See that it comes in a straight line with the stud. Press down the tool, see Fig. 17. Cease pressing at a maximum pressure of 8 tons. Turn the tool and check that the stud does not move too easily. If so, press further slightly.
- Place in the bolt and pull the tool off the stud, see Fig. 18.

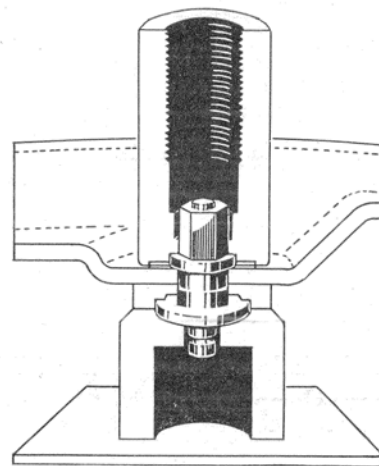
### Brake drum

The friction surface and radial throw of the brake drum should be checked. The radial throw



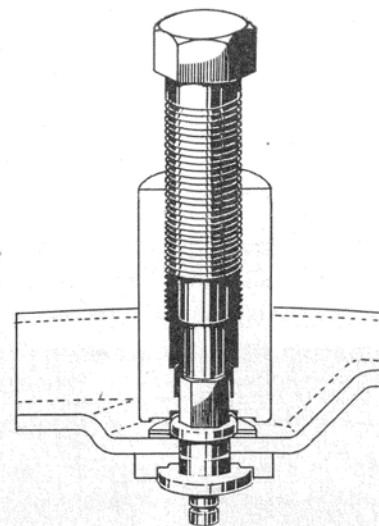
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Fig. 16. Fitting washers.



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Fig. 17. Compressing.



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Fig. 18. Removing tool.

must not exceed 0.15 mm (0.006"). If the friction surface is concave, scratched or cracked, the brake drum must be replaced. Rust spots and small scratches can be polished or ground off in a machine.

### Assembling front wheel brake unit

- Check that the key in the self-adjusting device is in the outer position and that the eccentrics on the brake backing plate are turned to their lowest positions. The self-adjusting device must not be lubricated as this results in dirt adhering which will impair the functioning of the device.



2. Place the rear shoe in position. Fit flat washer, spring washer, flat washer and locking washer on adjusting cam stud. Squeeze up the locking washer slightly after fitting.
3. Hook the return spring onto the shoes, place the front shoe in position on the wheel cylinder, turn the shoe outwards and fit it in position. Fit the locking arrangement. Place the lower spring in position with the help of brake pliers SVO 1221. Remove clamp SVO 4074.
4. Check that the return springs and locking washers are properly in position and that the linings are free from burr, grease and dirt.
5. If the front wheel bearing has been removed, this is placed in position in the hub. Lubricate if necessary with ball bearing grease. Press in the sealing ring with help of drift SVO 1798 (for chassis numbers 1—20004, SVO 4001) and standard handle SVO 1801, see Fig. 19.
6. Fit hub and brake drum on the spindle. Fit on outer bearing, washer, and castle nut.



Fig. 19. Fitting sealing ring.

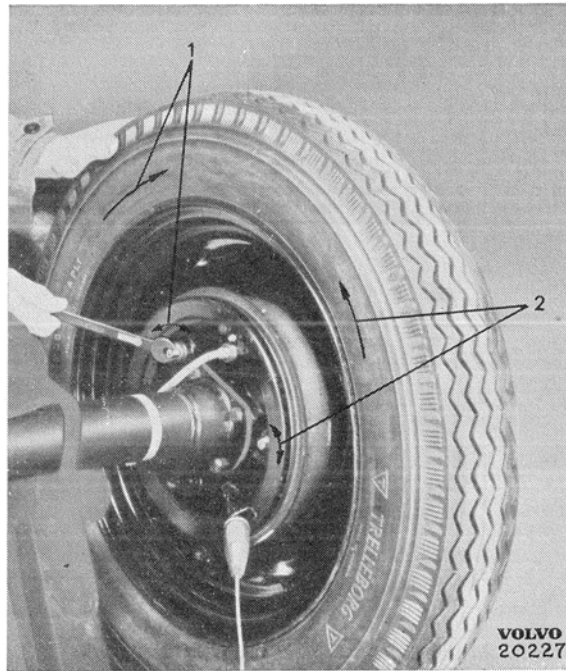


Fig. 20. Adjusting wheel brake unit.

Adjust the bearings by first tightening the nut to a torque of 6.9 kgm (50 lb.ft.). Then slacken the nut 1/3rd of a turn and lock it. Fill the grease cap with grease and fit same with drift SVO 2197.

7. Fit the wheel and adjust the brakes, see under "Adjusting wheel brake units". Lower the car. Tighten the wheel nuts to a torque of 10—14 kgm (70—100 lb.ft.). Fit on the hub cap.

#### Assembling rear wheel brake units

1. Proceed according to points 1 and 2 under "Assembling front wheel brake units".
2. Hook the return spring onto the shoes, place the front shoe in position on the wheel unit cylinder, turn the shoe outwards, fit the handbrake link and then place the shoe in position. Fit the locking arrangement.
3. Fit the lower spring with the help of brake pliers SVO 1221. Hook on the handbrake cable. Remove clamp SVO 4074. See Fig. 32.
4. Check that springs and locking washers are properly in position and that the linings are free from burr, grease and dirt.

5. Fit the hub, brake drum washer and castle nut. Fit the wheel. Adjust the brakes, see under "Adjusting wheel brake units".

Lower the car. Tighten the castle nut properly and lock it with split pin. Tighten the wheel nuts to a torque of 10—14 kgm (70—100 lb.ft.). Fit on hub cap.

### Adjusting wheel brake units

Check that the handbrake is not applied. Rotate the wheel backwards and turn the eccentric for the front brake shoe away from the wheel unit cylinder (anti-clockwise on right wheel, clockwise on left wheel) until the wheel is locked by the brake shoe. Then slacken the eccentric sufficiently to enable the wheel to rotate freely (see 2, Fig. 20). Adjust the rear brake shoe by rotating the wheel forwards and applying the eccentric in the opposite direction to the front one (see 1, Fig. 20).

### Hydraulic system

Observe the utmost cleanliness in all work connected with the hydraulic system. Wash the hands with soap and water before cleaning the internal parts. These should be washed in clean spirit. Petrol, paraffin, etc. must not be used.

Use only high-quality brake fluid which fulfills the requirements of SAE 70 R 1 (HD quality). Do not spill any brake fluid onto the paintwork as this can cause damage.

### Master cylinder

#### Removing

The master cylinder is removed from underneath. Remove the cover plate and disconnect the brake pipeline connections at the cylinder and the leads for the brake contact. Disconnect the link rod from the brake pedal. Unscrew the two bolts which hold the master cylinder to the body and lift off the cylinder. Avoid spilling any brake fluid.

#### Disassembling

1. Blow the master cylinder clean externally. Remove the filling plug and empty out the brake fluid.

2. Pull the rubber cover (5, Fig. 21) off the master cylinder and remove thrust-rod (4) with rubber cover.
3. Remove plunger (8), seal (9), return spring (10) with valve (11) and seal (12).
4. Remove the three-way union (1) with brake contact.

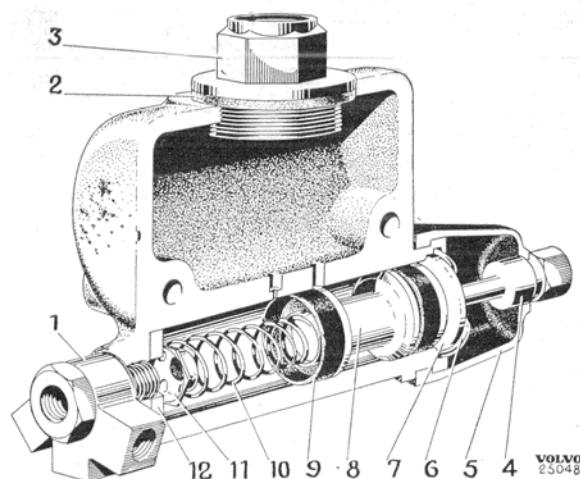


Fig. 21. Master cylinder.

- |                    |                   |
|--------------------|-------------------|
| 1. Three-way union | 7. Stop washer    |
| 2. Washer          | 8. Plunger        |
| 3. Plug            | 9. Seal           |
| 4. Thrust-rod      | 10. Return spring |
| 5. Rubber cover    | 11. Valve         |
| 6. Locking ring    | 12. Seal          |

#### Inspecting

Before inspecting, all parts of the master cylinder should be washed in clean spirit.

Inspect the cylinder carefully internally. There must be no grooves, scratches or rust spots on the polished surface. Such damage can as a rule be eliminated by honing the cylinder. The procedure for this varies with different tools so that no general description can be given. Therefore follow the manufacturer's instructions carefully. Clean the cylinder carefully after honing and check that the equalizing hole is free.

The clearance between plunger and cylinder should be 0.025—0.127 mm (0.001—0.005") and is measured as shown in Fig. 22. If the clearance exceeds 0.127 mm (0.005"), test with a new plunger. If this does not help, the master cylinder must be replaced.

The free length of the return spring should be 75 mm (2<sup>15</sup>/<sub>16</sub>").

Check seals and other parts for wear and damage. Damaged or worn parts must be replaced.

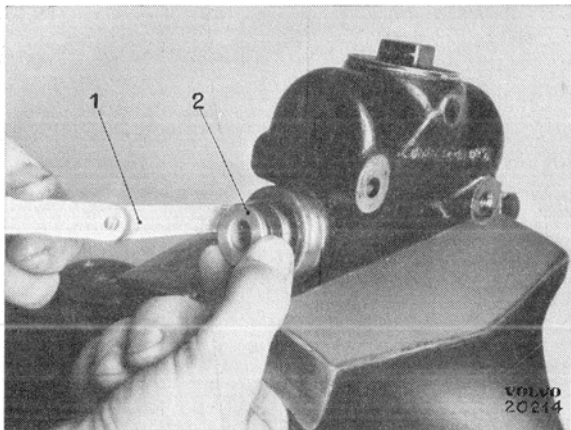


Fig. 22. Checking clearance.

1. Feeler gauge    2. Plunger

### Assembling

Before assembling, check that the two holes between the cylinder and brake fluid container and the overflow holes in the plunger are open.

1. Place the seal (12, Fig. 21) and valve and return spring (10) in the cylinder.
2. Fit the rear seal on plunger (8). Dip plunger and seal (9) in brake fluid and press them into the cylinder. Fit the stop washer (7) in position and fit lock ring (6).

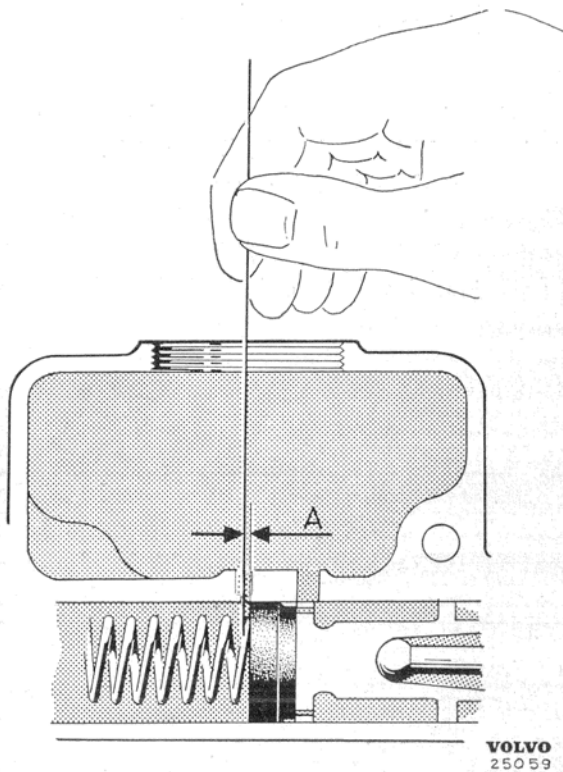


Fig. 23. Checking equalizing hole.

3. Place the thrust-rod (4) in plunger (8) and pull rubber cover (5) over the shoulder on master cylinder. Fit the three-way union (1) with brake contact.
4. Check that the equalizing hole is clear by pushing down a 0.5 mm (0.02") wire through the hole (Fig. 23). It should then be possible to press the plunger in about 0.5 mm (0.02") (A, Fig. 23) before the wire is gripped. Be careful to see that the seal is not damaged. If the equalizing hole is not clear, this usually means that the master cylinder has been assembled wrongly.

### Fitting

The master cylinder is fitted in the reverse sequence to removing.

Fill up with brake fluid and bleed according to the instructions under "Bleeding the brake system".

Check and if necessary adjust the brake pedal free travel. This should be 7—12 mm ( $\frac{9}{32}$ — $\frac{15}{32}$ ") and is adjusted according to instructions under "Adjusting free travel".

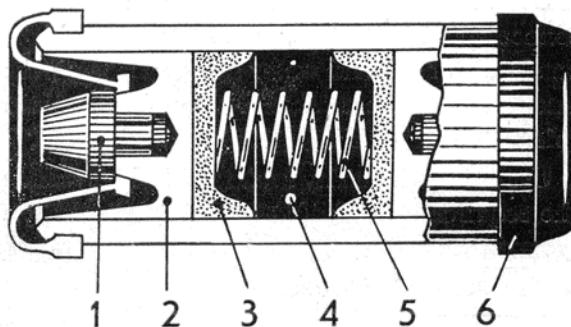


Fig. 24. Wheel unit cylinder.

- |               |                                  |
|---------------|----------------------------------|
| 1. Thrust pin | 4. Connection for brake pipeline |
| 2. Plunger    | 5. Spring                        |
| 3. Seal       | 6. Rubber cover                  |

### Wheel unit cylinders

#### Removing

1. Remove hub and brake shoes, see under "Disassembling wheel brake units".
2. Remove brake pipelines and wheel unit cylinder attaching bolts. Lift out the wheel unit cylinder but see that no brake fluid gets onto the linings.

## Overhauling

Remove clamp, pull off the rubber cover (6, Fig. 24) and remove plunger (2), seal (3) and spring (5). Wash all parts in clean spirit.

Examine the cylinder carefully internally. There must be no scoring, scratches or rust spots on the polished surface. Such damage can be removed by honing the cylinder. Since the procedure for this varies with different types of tool, follow the respective manufacturer's instructions. Clean the cylinder carefully after honing when the bleeding nipple should be removed.

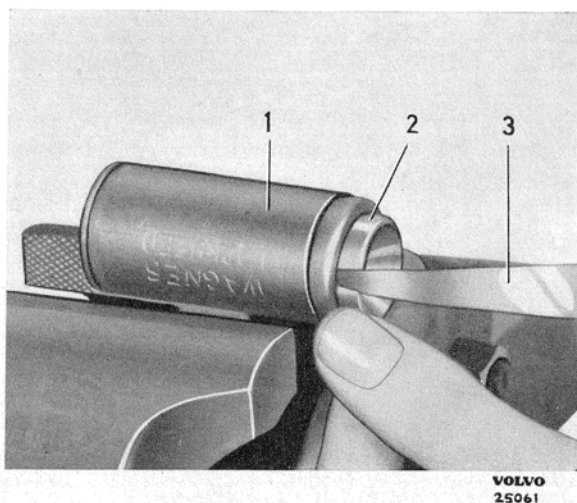


Fig. 25. Checking clearance.

1. Wheel unit cylinder 2. Plunger 3. Feeler gauge

The clearance between plunger and cylinder should be 0.025—0.127 mm (0.001—0.005") and is measured as shown in Fig. 25. If the clearance exceeds 0.127 mm (0.005"), test with a new plunger. If this does not help, the wheel unit cylinder must be replaced.

Examine the seals and other parts for wear and damage. Damaged or worn parts must be replaced.

Assemble the parts in the reverse sequence to disassembling. Dip plungers and seals in brake fluid.

## Fitting

Fitting is done in the reverse sequence to removing. When working on both front and rear wheel unit cylinders, remember that the front wheel unit cylinder should be 1" in diameter

and rear wheel unit cylinder  $\frac{7}{8}$ " diameter. Bleed the wheel unit cylinder.

## Brake pipelines

The brake pipelines should be flushed in connection with complete overhaul of the hydraulic system.

The pipelines should be disconnected one by one from the wheel unit cylinders and flushed with clean spirit. This is preferably done by filling the master cylinder with spirit and then carrying out repeated braking movements with the pedal. When the master cylinder has been overhauled, this is filled with brake fluid after which the pipelines are flushed free from spirit. All spirit must be carefully removed from the pipelines as otherwise bubbles may occur in the system giving rise to a "spongy" pedal.

If any leakage occurs or if the pipelines have been subjected to any external damage whereby leakage can be suspected, replace the damaged pipelines. This should be done as follows.

1. Remove the damaged pipeline.
2. If the replacement involves a pipe which is not available ready made, a new pipe should be cut off to the length required (see "Specifications"). The pipe should be cut off at right-angles and all burr removed.
3. If the pipe is of copper, this is flanged in the usual way. If it is a steel pipe, it should be double-flanged which is done with tool SVO 2049. Place the tool in a vice, insert the pipe far enough so that its end comes flush with the jaw as shown in Fig. 26. Tighten the nuts.

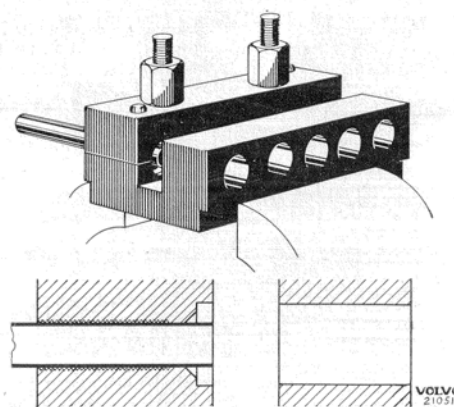


Fig. 26. Flanging brake pipe.

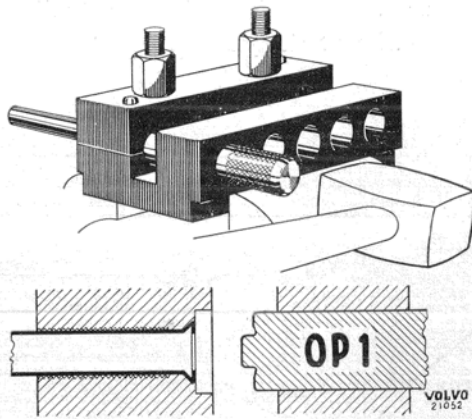


Fig. 27. Flanging brake pipe.

4. Place drift OP 1 in the tool. Knock drift with a copper mallet until it bottoms. The edge of the pipe is then flanged as shown in Fig. 27.
5. Replace the drift with OP 2 (Fig. 28) and knock this in until it bottoms.
6. Fit on the union nuts and repeat operations 3—5 at the other end of the pipe.
7. Bend the brake pipeline thus made using the old one as a pattern. Bending should be done round an object having the same radius as the bend required.
8. Blow the pipe clean internally and fit it. Ensure that the pipe comes in such a position that it cannot be chafed during driving. Particularly important points to watch are where the pipe passes over the support arm clamps on the rear axle, where it must not be nearer to the clamps than 10 mm ( $\frac{3}{8}$ " ) and where it passes the rear springs.
9. Bleed the hydraulic system.

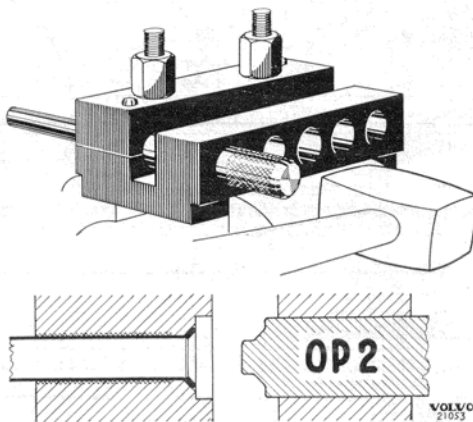


Fig. 28. Flanging brake pipe.

### Bleeding the hydraulic system

Symptoms that there is air in the hydraulic system are that the brake pedal can be depressed without any noticeable resistance or if it feels "spongy".

Bleeding must be done whenever any part of the system has been removed. Air can also enter the system if there is insufficient brake fluid in the container. If, for example, only one wheel unit cylinder has been removed, it is usually sufficient to bleed this only. If, on the other hand, the master cylinder or pipelines from same have been removed, then the whole system should be bled.

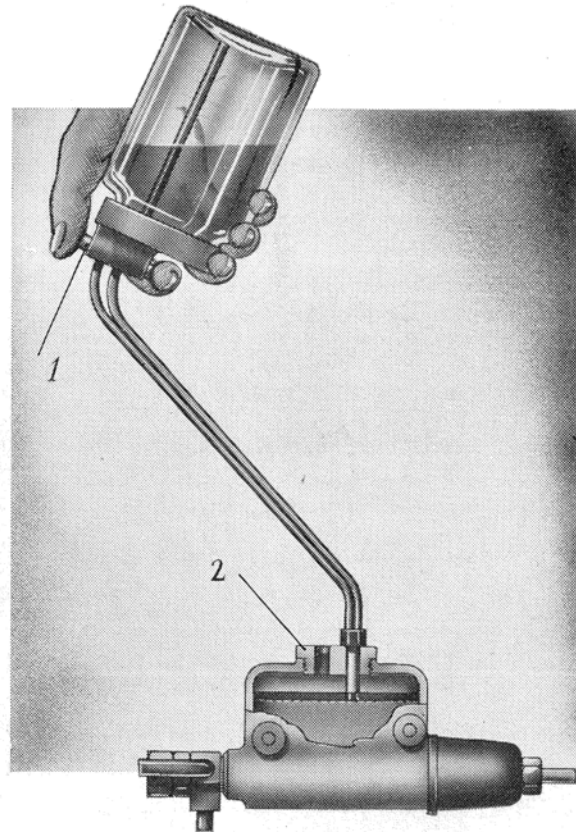


Fig. 29. Filling brake fluid.  
1. Tap 2. Plug

Bleeding of the whole brake system is carried out as follows.

1. Clean around the filling cover and bleeding nipples.
2. Remove the master cylinder cover. Use wrench SVO 1457 on chassis numbers 1—20004 and wrench SVO 2384 on chassis numbers 20005 onwards. Fill up with brake fluid if necessary.

It is best to use a special filling flask as shown in Fig. 29. Screw the plug (2) into the place of the cover. Insert the pipe through one of the holes in the plug and open the tap (1). The flask will then maintain the fluid level constant and at the correct level during bleeding.

3. Fit wrench SVO 1431 with hose on bleeding nipple and let the other end of the hose hang down in the fluid in a suitable collecting vessel, see Fig. 30.

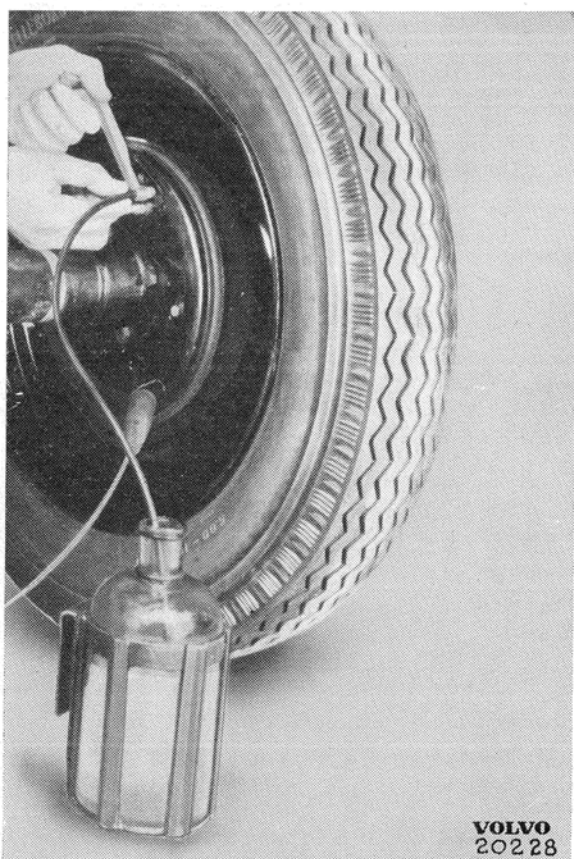


Fig. 30. Bleeding.

4. Open the nipple and have someone slowly depress and release the brake pedal a few times. Keep the nipple open as long as there are air bubbles in the fluid which flows out. Then close the nipple while the brake pedal is held fully depressed.
5. Bleed the other wheels in the same manner. Then close the tap on the filling flask and remove it. Check the gasket and screw in the cover.

When bleeding, a special bleeding device can be used which maintains the hydraulic system under a certain positive pressure. In this case the brake pedal does not need to be depressed so that bleeding can be carried out by one person.

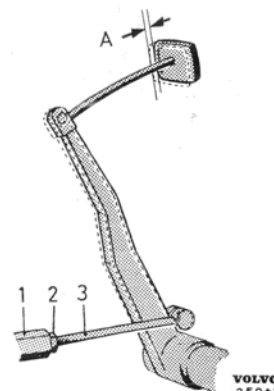


Fig. 31. Adjusting free travel.

1. Thrust-rod
2. Lock nut
3. Link-rod

## Brake pedal

### Adjusting free travel

It is important that the brake pedal has correct free travel. If this is insufficient, the equalizing hole between the cylinder and fluid container can be obstructed by the plunger seal with the result that the brake shoes are prevented from returning to their rest positions. If the free travel is too great, the effective stroke can be insufficient so that "pumping" must be carried out to obtain sufficient braking effect.

The brake pedal free travel is set by adjusting the length of the link-rod (3, Fig. 31). Slacken the lock nut (2) and turn the thrust-rod (1) until the pedal has a free travel of 7—12 mm ( $\frac{9}{32}$ — $\frac{15}{32}$ " (measurement A). Tighten the lock nut.

### Replacing bushing and shaft

This is done in connection with overhauling the clutch pedal, see Service Manual, Part 2 under heading "Overhauling pedal shaft".

## Handbrake

### Replacing rear brake cable

#### Removing

1. Apply the handbrake. Remove the rear wheel hub caps. Remove split pins and slacken the castle nuts and wheel nuts slightly. Lift up the car and place blocks

under the rear axle. Remove the rear wheels.

2. Release the handbrake. Pull off hubs with tool SVO 1791, see Fig. 8. If the hub has four wheel studs, use SVO 1446.
3. Remove the stud (4, Fig. 6) and equalizing link (3). If the return spring (15) is attached to the bolt (early production), the spring must first be unhooked. For cables with outer casings, the clamps and springs must also be removed.
4. Unhook the cable (3, Fig. 32) from the lever (2) on the rear brake shoe. The cable with outer casing can then be pulled forwards after the locking spring has been unhooked. For cables without outer casings, the rubber cover is first pulled off the pipe after which the cable is pulled to the rear so that the locking washer can be removed. If the guide sleeve does not come off with the cable, it can be knocked to the rear with a narrow drift.

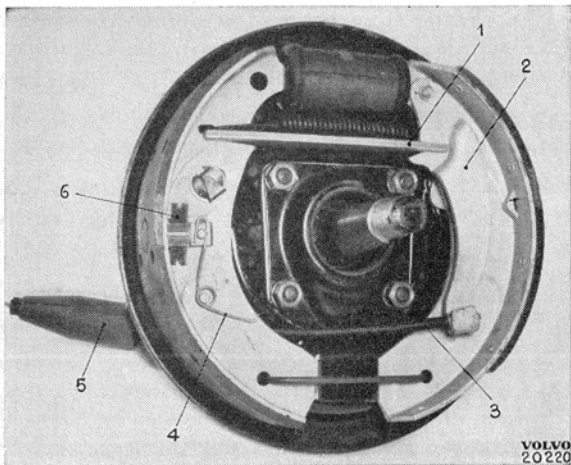


Fig. 32. Rear wheel brake unit.

- |                |                            |
|----------------|----------------------------|
| 1. Link        | 4. Spring for contact plug |
| 2. Lever       | 5. Rubber cover            |
| 3. Brake cable | 6. Damping spring          |

### Fitting brake cables without outer casings

1. Screw back the screw (18, Fig. 6) in the turnbuckle. Place the cable in the equalizing link (3) and fit this to the intermediate lever (2). Hook on the return spring if this has been removed.

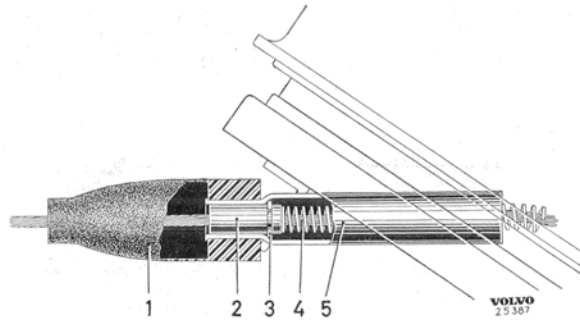


Fig. 33. Cable guide.

- |                   |                                |
|-------------------|--------------------------------|
| 1. Rubber casing  | 4. Cable                       |
| 2. Sleeve         | 5. Tube in brake backing plate |
| 3. Locking washer |                                |

2. Insert the cable and guide sleeve through the support in the body and then through the tube in the brake backing plate and fit locking washer (3, Fig. 33) and then place the guide sleeve in position. Fit the cable to the lever. Pull on the rubber casing.
3. Fit hub with brake drum, washer and castle nut. Fit wheel. Adjust the handbrake after both wheel brake units have been fitted. Lower the car. Tighten the castle nut properly and lock with split pin. Tighten the wheel nuts to a torque of 10—14 kgm (70—100 lb. ft.). Fit on hub cap.

### Fitting cables with outer casings

1. If the car was previously equipped with cables without outer casings, first weld the retainers supplied in set no. 276354 onto the body floor as shown in Fig. 34.
2. Place the cable in equalizing link (3, Fig. 6) and fit this to the lever (2). Hook on return spring if this has been removed.

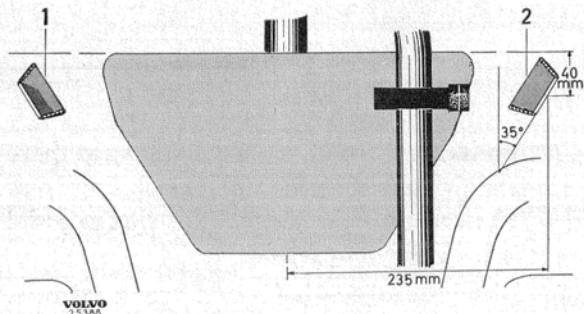


Fig. 34. Location of brackets.

- |                 |                  |
|-----------------|------------------|
| 1. Left bracket | 2. Right bracket |
|-----------------|------------------|

3. Fit the sealing ring (11) over the spring and insert the cable through the tube in the brake backing plate. Hook the cable onto the lever. Fit the locking spring (10). Repeat the procedure on the other wheel.
4. Attach the cable sleeves to the welded retainers by means of clamp (8), spring washer and nut. See that the clamp enters the groove on sleeve. If necessary slacken the adjusting screw (18) on the front cable turnbuckle. Pull on the rubber casing (6).
5. Fit springs (9). If these were not fitted previously, first drill a 4 mm ( $\frac{5}{32}$ " hole in the centre of each support arm about 300 mm ( $11\frac{13}{16}$ " from the front joint.
6. See point 3 under "Fitting brake cables without outer casings".

### Replacing rubber casing

If the handbrake cable rubber casing has been damaged for any reason, it must be replaced. If not, water and dirt can penetrate and cause it to rust up. A special rubber casing with sealing plug (part numbers 86850 and 86851 respectively) are available for this replacement.

The hub on the side where the rubber casing is to be replaced should be removed, see points 1 and 2 under "Replacing rear brake cable". Then unhook the cable from the brake shoe lever. If the replacement concerns a cable without outer casing, the damaged casing is pulled off, the locking washer removed and the cable pulled out. For cables with outer casing, the clamp and springs are removed.

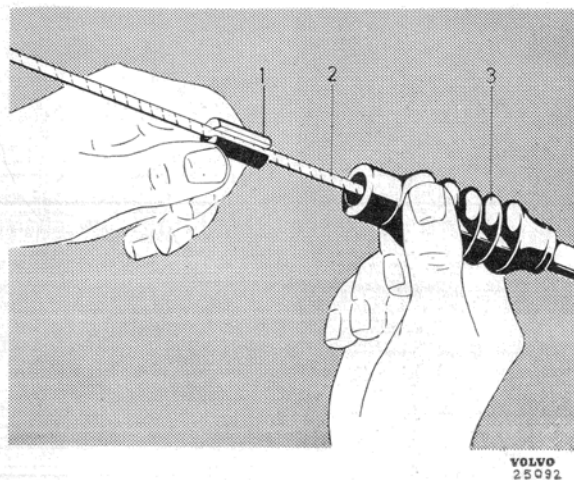


Fig. 35. Fitting rubber casing.

1. Sealing plug    2. Cable    3. Rubber casing

The new casing is placed in position on the cable over the spring and outer casing respectively and the parts are put together. The slotted sealing plug (1, Fig. 35) is fitted on the cable (2) and pressed into the rubber casing (3). Fit the hub and wheel, see point 3 under "Fitting brake cables without outer casings".

### Replacing front brake cable

1. Unhook return spring (15, Fig. 6) and remove stud (16). Remove clamp (22) and any clips.
2. Remove clamp (2, Figs. 4 and 5 respectively), bolt (4), rubber bushing (1) and clip. Pull the cable forwards and screw off shackle and adjusting screw (18, Fig. 6).
3. Fit the shackle to the turnbuckle in the new brake cable. Place the cable in position and fit bolts, rubber bushing, clamps and clips.
4. Adjust the handbrake.

### Replacing ratchet rod and segment (handbrake lever type)

#### Removing

1. Remove the left-hand glove compartment.
2. Remove the bolt (4, Fig. 4) which attaches the shackle (3) to the handbrake lever.
3. Remove the two bolts (5 and 7 respectively) which retain the ratchet segment (8) and lift out the lever and segment.
4. Remove the pivot pin (6) which holds the lever and segment together. Disconnect the spring (9).
5. Grind off the head of the rivet (13) which attaches the ratchet rod (11) to the release grip (14). Drive out the rivet. Remove the ratchet rod bolt (10).

#### Fitting

1. Insert the ratchet rod into the brake lever, place in rivet and rivet same ensuring that it is not riveted so tightly as to prevent the grip from being fully moveable in all positions. Fit in the bolt at the other end of the ratchet rod.
2. Fit the lever to the segment and connect on the spring.



3. Bolt the segment to its attachment. Connect the brake cable shackle to the handbrake lever.

### Replacing brake lever and ratchet housing (pull-rod type)

1. Disconnect the return spring (13, Fig. 5) for the pull-rod (12) and drive out the stop pin (14) at the link (15) for the intermediate lever.
2. Remove the ratchet housing (10) from the bracket (11) and take out the pull-rod and ratchet housing.
3. Remove the return spring and ratchet housing from the pull-rod. Drive in the pin (7) for the pull-rod and pull off the handle.
4. Push the handle on to the new pull-rod and knock in the pin flush with the handle.
5. Fit springs and interlock balls in ratchet housing and push this onto the pull-rod together with return spring.

6. Insert the pull-rod into the intermediate lever link and drive in the stop pin. Fit on return spring.
7. Bolt the ratchet housing to the bracket.

### Adjusting the handbrake

There are two possibilities for adjusting the handbrake. In the first place the front brake cable is stretched by turning the adjusting screw (18, Fig. 6) until the handbrake gives full braking effect at the 6th—8th notch. If the adjusting screw is fully screwed into the turn-buckle, there is further possibility of adjustment by moving the equalizing link (3) forwards. First screw the adjusting screw back after which the stud (4) can be fitted into the rear hole in the equalizing link. Carry out final adjustment with the adjusting screw as above.

Do not forget to lock the stud (4) or to tighten the lock nut (19).

## FAULT TRACING

REASON	REMEDY
--------	--------

### No or only weak braking effect

Pedal free travel excessive.  
Insufficient brake fluid in the system.

Air in the hydraulic system.  
Leakage in hydraulic system.  
Defective master cylinder.  
Incorrectly adjusted brakes.  
Unsuitable brake linings.  
Grease or oil on brake linings.

Adjust free travel.  
Top up with brake fluid. Check for leakage.  
Bleed.  
Bleed the system.  
Check and repair leakage. Bleed.  
Overhaul master cylinder.  
Adjust the brakes.  
Replace with original brake linings.  
Replace brake linings. Check sealing ring.

### Car pulls to one side when braking

Grease or oil on one of the brake linings.  
Unevenly adjusted brakes.  
Out-of-round or uneven brake drums.  
Defective wheel unit cylinder.  
Excessive play in wheel bearings or incorrect front wheel alignment.  
Uneven tyre pressure.  
Unevenly worn tyres.

Replace the lining. Check the sealing ring.  
Adjust the brakes.  
Replace or grind brake drum.  
Overhaul wheel unit cylinder.  
Adjust front end.  
  
Adjust tyre pressure.  
See Part 8.

### Brakes grab

Badly adjusted brakes.  
Moisture on brake linings.  
  
Excessive play in the wheel bearings.  
Worn out brake linings.  
Carbonized brake linings.  
Damaged or loose brake linings.  
Loose brake backing plate.  
Out-of-round brake drum.  
Broken return spring.

Adjust brakes.  
Carry out repeated brakings until the fault disappears.  
Adjust the bearings.  
Replace the linings.  
Replace linings and repair leakage.  
Replace linings.  
Tighten brake backing plate.  
Replace or grind brake drum.  
Replace spring.

## Brakes bind on all wheels

Brakes incorrectly adjusted.  
Pedal has too little free travel, obstructs equalizing hole.  
Equalizing hole blocked up with dirt.  
During extremely cold weather: poor quality brake fluid.

Adjust the brakes.  
Adjust pedal free travel.  
  
Overhaul master cylinder.  
Replace brake fluid.

## Brakes bind on one of the wheels

Brakes incorrectly adjusted.  
Broken return spring.  
Handbrake cable chafes.  
Brake pipeline to wheel blocked up or damaged.  
Excessive play in wheel bearings.

Adjust the brakes.  
Replace spring.  
Lubricate or replace cable.  
Pipeline to be cleaned or replaced respectively.  
  
Adjust the bearings.

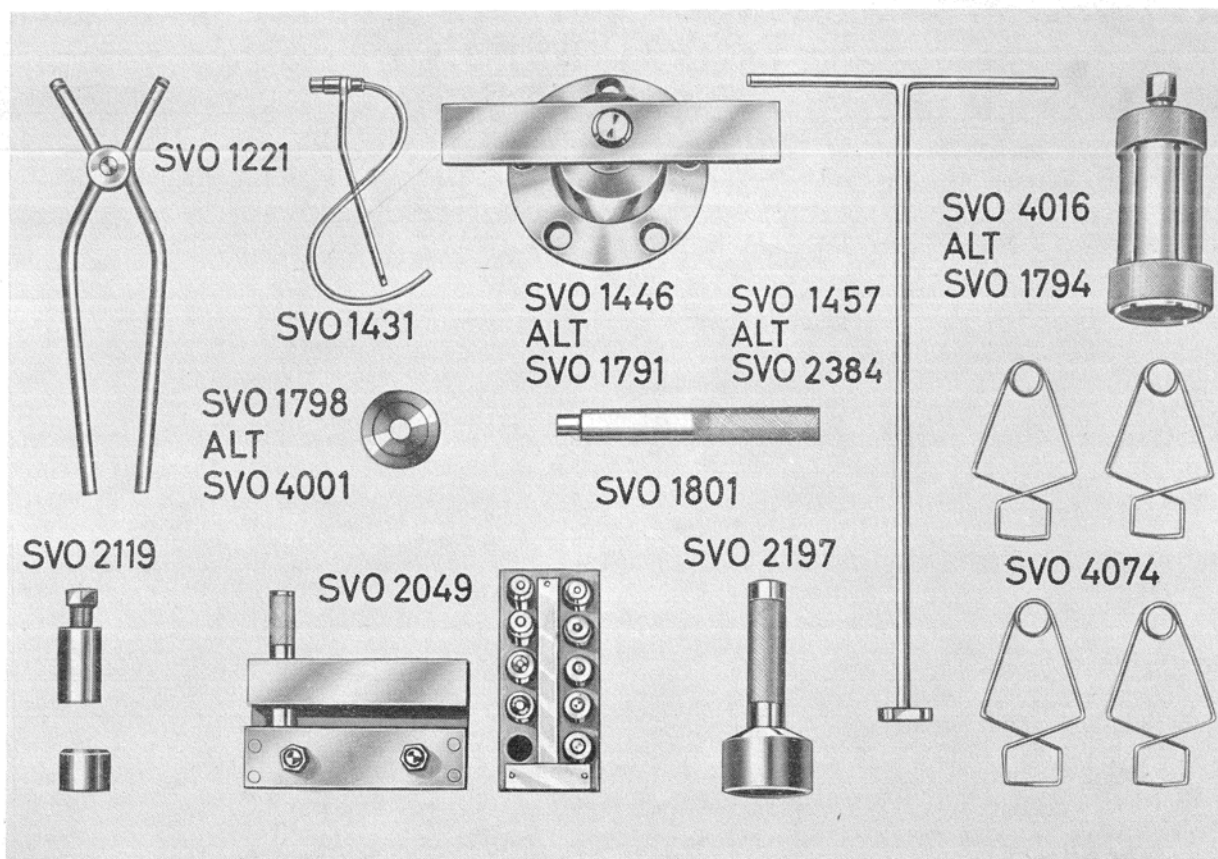
## Brake squeal

Brake linings worn out.  
Dirt in brake drums.  
Unsuitable brake linings.

Replace linings.  
Clean drums and linings.  
Replace with original linings.

## TOOLS

The following special tools are required when repairing the brake system.



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- |          |   |          |  |
|----------|---|----------|--|
| SVO 1221 | Pliers for removing and fitting lower brake spring.   | SVO 1801 | Standard handle.   |
| SVO 1431 | Spanner for bleeding screw.   | SVO 2119 | Compressing tool for adjusting cam stud.   |
| SVO 1446 | Puller for hub with brake drum on front and rear wheels (PV 444 chassis numbers 1—20004).                   | SVO 2049 | Flanging tool for brake pipeline.  |
| SVO 1457 | Key for master cylinder filling plug (PV 444 chassis numbers 1—20004).                                      | SVO 2197 | Drift for removing and fitting grease cap for front wheel hub.                               |
| SVO 1791 | Puller for hub brake drum on front and rear wheels (with effect from PV. 444 chassis number 20005 onwards). | SVO 2384 | Key for master cylinder filling plug (PV 444 with effect from chassis number 20005 onwards). |
| SVO 1794 | Puller for inner bearing on front wheel spindle (with effect from PV 444 chassis number 20005 onwards).     | SVO 4001 | Drift for removing sealing ring in front wheel hub (PV 444 chassis numbers 1—20004).         |
| SVO 1798 | Drift for fitting sealing ring in front wheel hub (PV 444 with effect from chassis number 20005 onwards).   | SVO 4016 | Puller for inner bearing on front wheel spindle (PV 444 chassis numbers 1—20004).            |
|          |   | SVO 4074 | Spring clamp for wheel unit cylinder.  |

## SPECIFICATIONS

## Master cylinder:

Bore .....	25.4 mm (1")
Clearance between plunger and cylinder .....	0.025—0.127 mm (0.001—0.005")
Return spring free length .....	75 mm (2 <sup>15</sup> / <sub>16</sub> ")

## Wheel unit cylinder:

Bore, front wheels .....	25.4 mm (1")
rear wheels .....	22.2 mm (7/8")
Clearance between plunger and cylinder .....	0.025—0.127 mm (0.001—0.005")

## Brake pipelines:

External diameter .....	<sup>3</sup> / <sub>16</sub> "
Length (late production) left, front .....	485 mm (19 <sup>3</sup> / <sub>32</sub> ")
right, front .....	935 mm (36 <sup>13</sup> / <sub>16</sub> ")
left, rear .....	485 mm (19 <sup>3</sup> / <sub>32</sub> ")
right, rear .....	940 mm (37")
master cylinder—rear axle .....	2150 mm (84 <sup>5</sup> / <sub>8</sub> ")

## Brake drum:

Diameter .....	228.6 mm (9")
Radial throw, maximum .....	0.15 mm (0.006")

## Brake linings:

Width .....	50.8 mm (2")
Thickness .....	4.8 mm ( <sup>3</sup> / <sub>16</sub> ")
Length, front shoe .....	260 mm (10 <sup>1</sup> / <sub>4</sub> ")
rear shoe .....	200 mm (7 <sup>7</sup> / <sub>8</sub> ")
Hole diameter for contact plug .....	19 mm ( <sup>3</sup> / <sub>4</sub> ")
Effective area, early production (riveted linings) .....	850 cm <sup>2</sup> (133 sq. in.)
late production (bonded linings) .....	930 cm <sup>2</sup> (145 sq. in.)

## Brake lining rivets:

Number, front shoe .....	10
rear shoe .....	8
Size .....	3.5×8 mm ( <sup>9</sup> / <sub>64</sub> × <sup>5</sup> / <sub>16</sub> ")
Length of return spring for brake shoe at a loading of 15.5—20.5 kg (34—45 lb.) .....	154 mm (6 <sup>1</sup> / <sub>16</sub> ")
Clearance between brake shoe and drum .....	0.10 mm (0.004")
Pedal free travel .....	7—12 mm ( <sup>9</sup> / <sub>32</sub> — <sup>15</sup> / <sub>32</sub> ")