



SERVICE MANUAL

VOLVO 164 1971

GROUP 43 B

OVERDRIVE

TOOLS

The following special tools are required for work on the overdrive unit

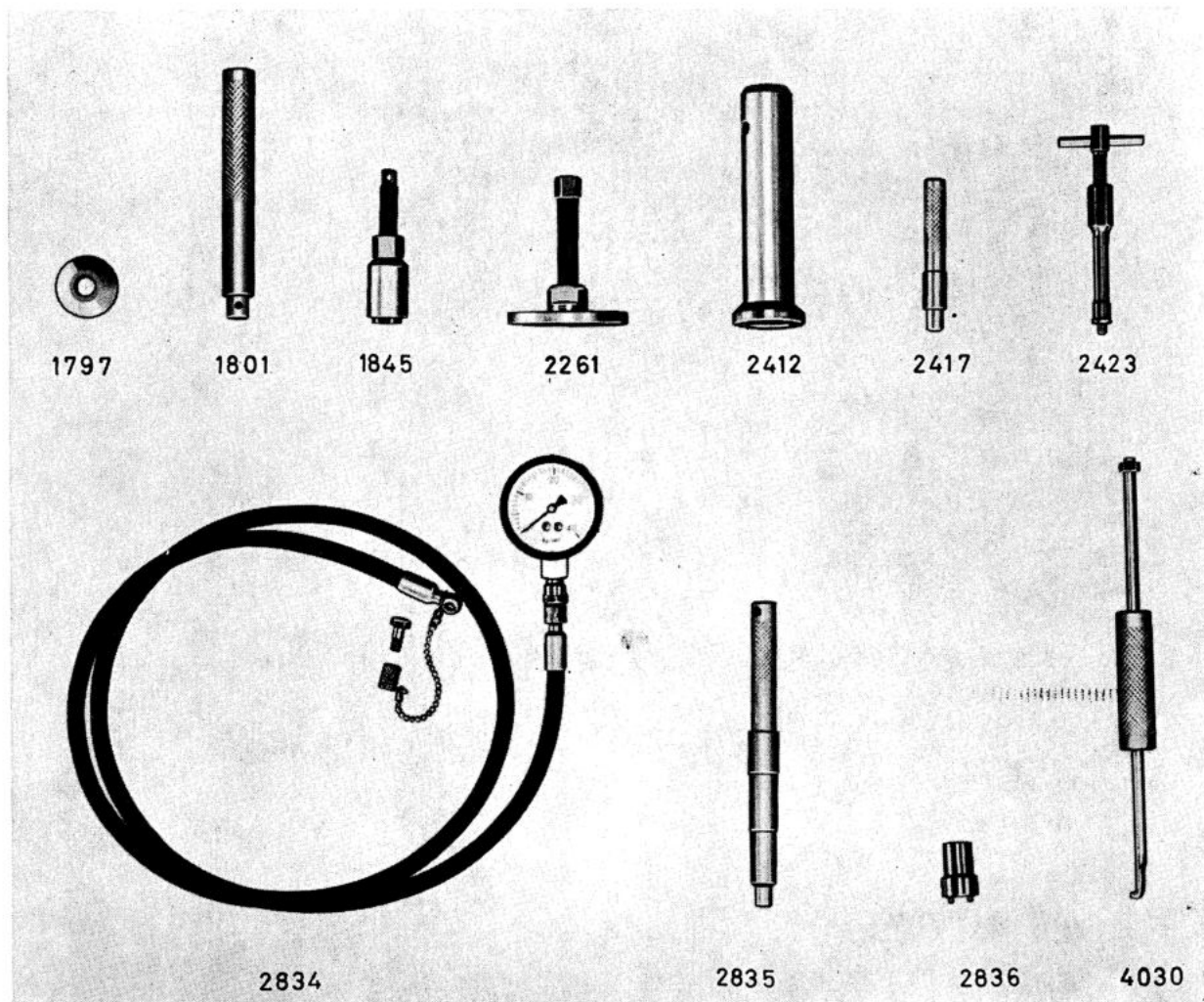


Fig. 4-32. Special tools

- SVO 1787 Drift for removing rear bearing, output shaft
- SVO 1801 Standard handle
- SVO 1845 Press tool for fitting flange
- SVO 2261 Puller for flange
- SVO 2412 Sleeve drift for fitting front and rear bearings on output shaft and oil seal at flange
- SVO 2417 Drift for fitting bush in output shaft
- SVO 2423 Puller for bush in output shaft
- SVO 2834 Pressure gauge for checking oil pressure
- SVO 2835 Centering mandrel for splines in planet carrier and unidirectional clutch
- SVO 2836 Socket for removing and fitting plugs for fine filter, oil pump and relief valve
- SVO 4030 Puller for oil seal at flange

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DESCRIPTION

The overdrive unit is of the epicyclic type and is attached to the rear end of the gearbox. Its design and construction are shown in Figs. 4-33, 4-41 and Illustration 4-C. The working principle of the overdrive is as follows:

DIRECT DRIVE POSITION

When travelling forwards the power is transmitted from the gearbox mainshaft through the uni-directional clutch to the output shaft of the overdrive. At the same time the clutch sliding member (position I, Fig. 4-34) is pressed by four springs against the tapered part of the output shaft. When reversing or when the engine acts as a brake, the torque is transmitted through the clutch sliding member.

OVERDRIVE POSITION

In the overdrive position the clutch sliding member is pressed against the brake ring (see II, Fig. 4-34) with

the help of the pistons (27, Fig. 4-41) in the hydraulic cylinders. This also locks the sunwheel. Since the planet gear retainers are linked to the mainshaft through the splines, the planet gears are forced to rotate around the sunwheel. As a result of this, the output shaft will rotate at a higher speed than the mainshaft.

ELECTRICAL SYSTEM

The overdrive is engaged by electro-hydraulic means. On the gearbox cover there is a contact which cuts in when 4th speed is engaged. Thus the overdrive can only be engaged when this speed is engaged. It is switched on by means of a switch placed underneath the steering wheel. This switch closes the circuit via the switch on the gearbox to a solenoid on the overdrive. The solenoid armature is thus moved and this operates the control valve to the position for overdrive.

HYDRAULIC SYSTEM

The hydraulic system consists of the following main parts: Pre-filter, plunger pump, fine filter, hydraulic cylinders and plungers, relief valve and a control valve which is operated by the solenoid.

The relief valve has a special construction with a hydraulic piston and four different springs. It has three different functions: It must maintain a low pressure in the system with direct drive, a high pressure with overdrive, and also provide smooth changing when shifting from overdrive to direct drive and vice versa. Its function is described in more detail below.

The oil flow with direct drive is shown in Fig. 4-38.

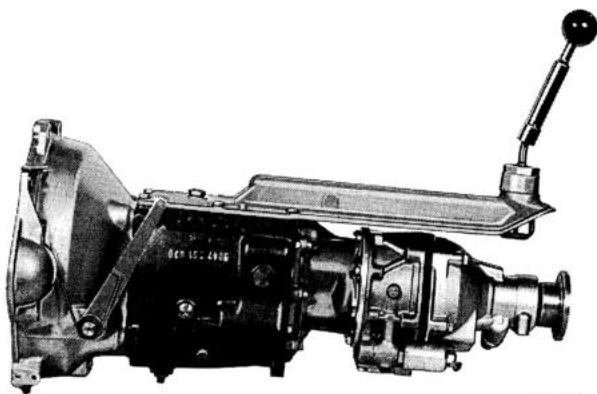
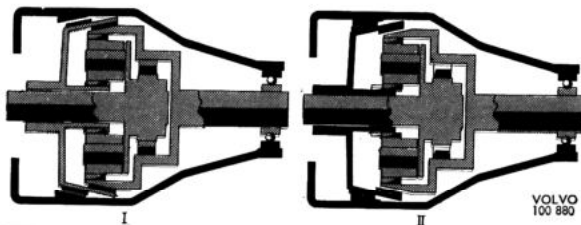


Fig. 4-33. Gearbox M 410

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- Non-rotating parts
- Parts rotating at a higher speed than the input shaft
- Parts rotating at the same speed as the input shaft

Fig. 4-34. Working principle of the overdrive

- I. Direct drive position
- II. Overdrive position

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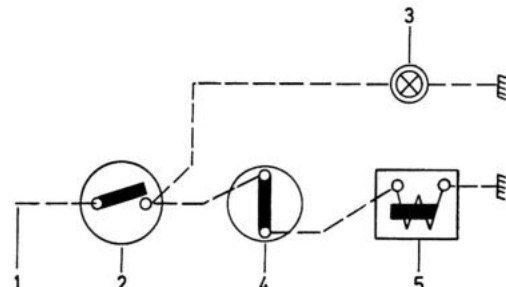


Fig. 4-35. Electrical circuit diagram

- 1. Lead from fusebox
- 2. Switch for overdrive
- 3. Indicator lamp for overdrive
- 4. Switch on gearbox
- 5. Solenoid on overdrive

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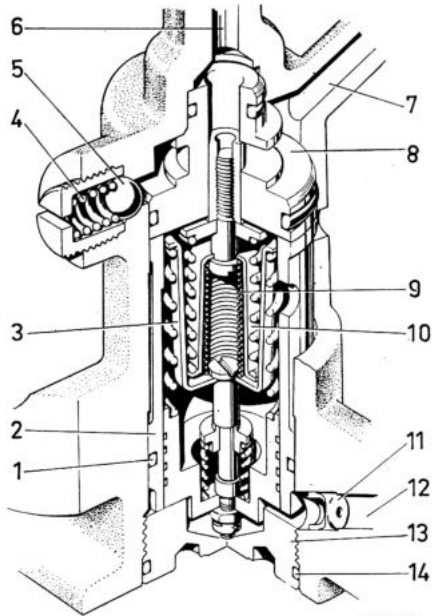


Fig. 4-36. Relief valve

- | | |
|-------------------------|--------------------------------|
| 1. O-ring | 9. Spring |
| 2. Cylinder | 10. Small piston unit |
| 3. Large piston unit | 11. Nozzle |
| 4. Spring | 12. Channel from control valve |
| 5. Valve ball | 13. Plug |
| 6. Channel for oil pump | 14. O-ring |
| 7. Channel to mainshaft | |
| 8. End piece | |

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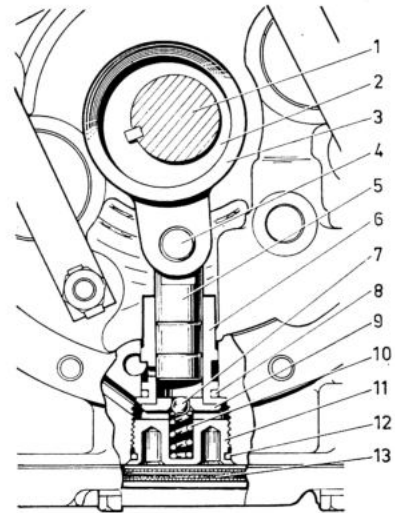


Fig. 4-37. Oil pump

- | | |
|-------------------|----------------|
| 1. Mainshaft | 8. O-ring |
| 2. Eccentric | 9. Valve seat |
| 3. Connecting rod | 10. Spring |
| 4. Gudgeon pin | 11. Plug |
| 5. Piston | 12. O-ring |
| 6. Cylinder | 13. Pre-filter |
| 7. Ball | |

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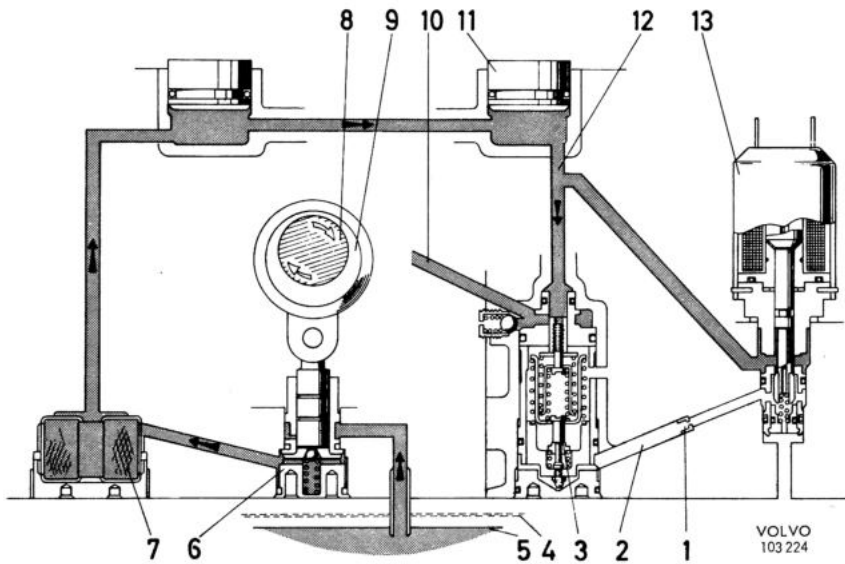


Fig. 4-38. Function with direct drive

- | | |
|--|--|
| 1. Nozzle | 9. Eccentric |
| 2. Channel, control valve-relief valve | 10. Channel, relief valve — mainshaft |
| 3. Relief valve | 11. Piston |
| 4. Pre-filter | 12. Channel, oil pump — hydraulic cylinder — control and relief valves |
| 5. Oil sump | 13. Control valve and solenoid |
| 6. Oil pump | |
| 7. Fine filter | |
| 8. Gearbox mainshaft | |

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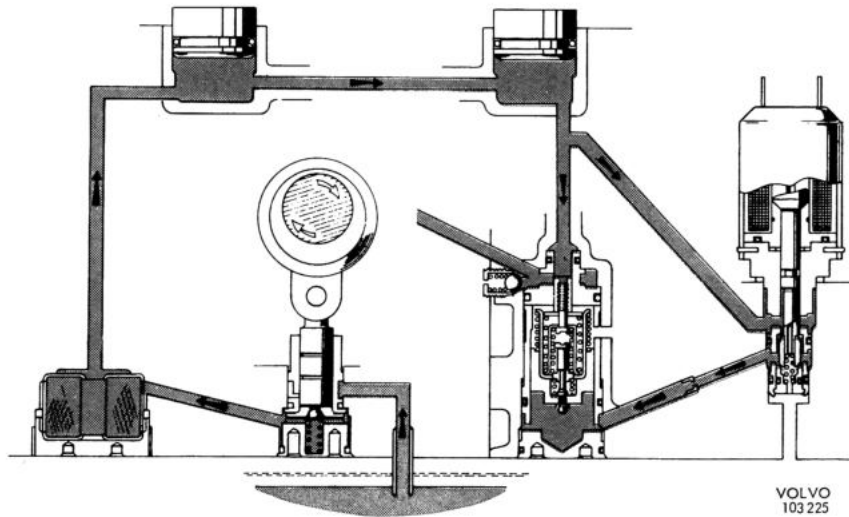


Fig. 4-39. Overdrive in function

The oil is drawn through the pre-filter by the plunger pump and is conveyed under pressure through the fine filter. From here the oil flows further through the hydraulic cylinders to the relief and control valves. The control valve is closed and the large piston of the relief valve is in its lower position. This off-loads the springs so that only a low pressure is required to press down the small piston of the relief valve. Oil then flows past the small piston out into the channel to the mainshaft.

When the overdrive is engaged, the control valve is displaced and oil flows through the oilway and operates the large piston of the relief valve. This is then moved upwards and causes the springs to tension. The more the springs tension the greater the force is required to press down the small piston, this causing the hydraulic pressure to rise. The pistons are thereby displaced in the hydraulic cylinders, the clutch sliding member is pulled forwards and contact made with the brake ring.

With disengagement of the overdrive, the connection between channels 12 and 2 is closed. Instead, the connection between channel 2 and the sump is opened. This permits oil under the large piston of the relief valve to flow out into the sump, the pressure in the system drops and direct drive is engaged. Because of the orifice nozzle in the channel and owing to a suitable balancing of the spring force, a certain time passes for the piston of the relief valve to move from

one outer position to the other. This time is so adapted that a smooth engagement occurs without any slipping of gears.

Oil passing the small piston of the relief valve is conveyed through the channel and a drilling in the mainshaft to the uni-directional clutch and the needle bearing shaft. Thereafter the oil is caught up by a plate and lead via the planet gear back to the gear-box housing, see Fig. 4-40.

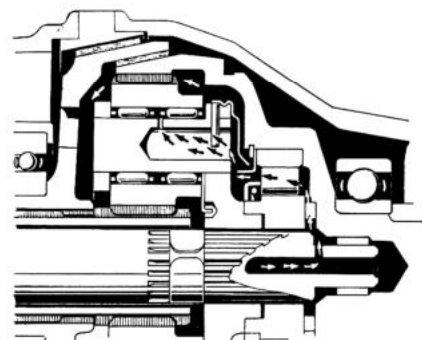
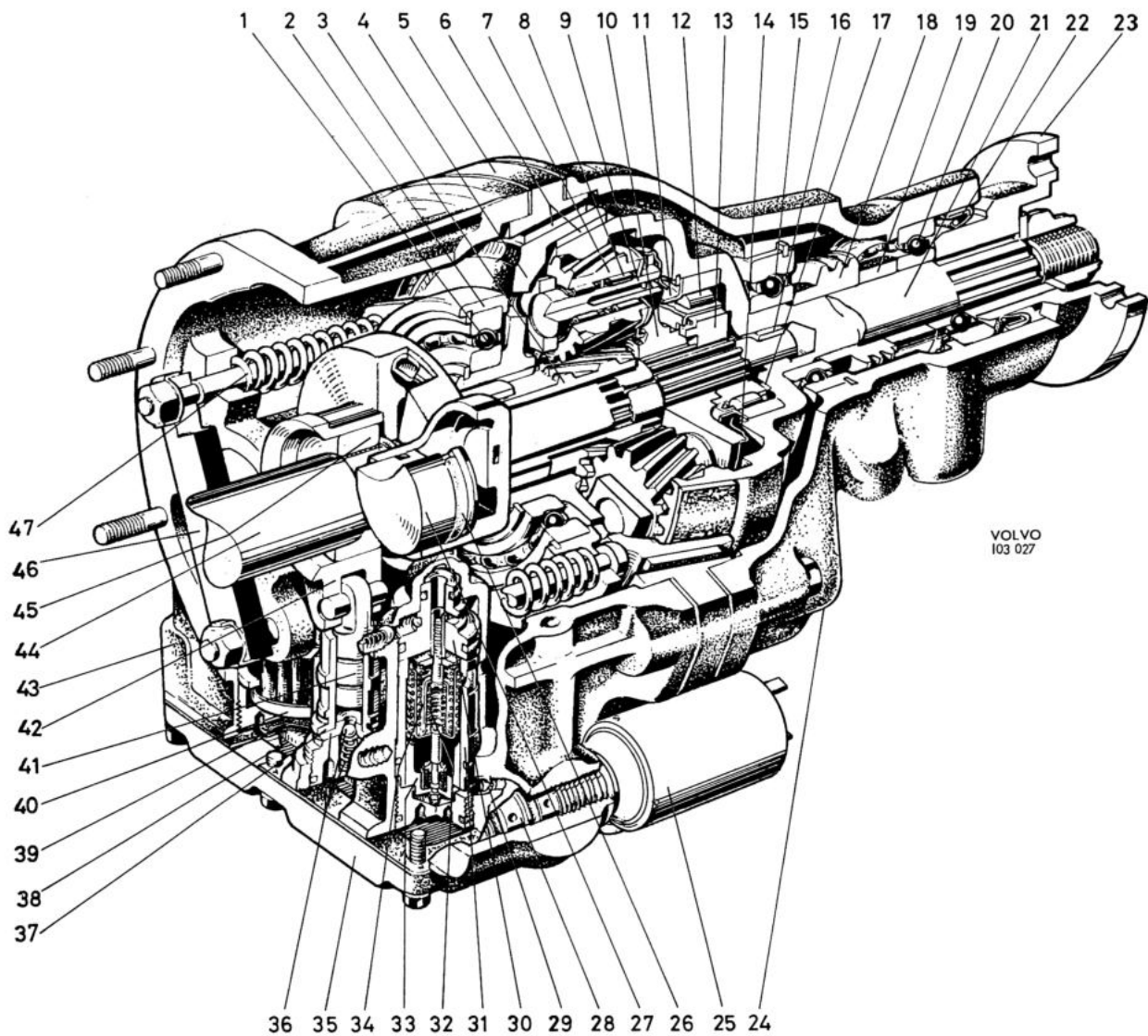


Fig. 4-40. Lubricating system



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Fig. 4-41. Overdrive

- | | | |
|------------------------------------|------------------------------|------------------------------|
| 1. Output shaft support bearing | 17. Thrust washer | 34. Small piston |
| 2. Thrust bearing retainer | 18. Speedometer driving gear | 35. Base plate |
| 3. Sunwheel | 19. Spacer | 36. Check valve for oil pump |
| 4. Clutch sliding member | 20. Ball bearing | 37. Pump cylinder |
| 5. Brake ring | 21. Output shaft | 38. Magnet |
| 6. Clutch member outer lining | 22. Oil seal | 39. Pre-filter |
| 7. Planet gear | 23. Coupling flange | 40. Fine filter |
| 8. Needle bearing | 24. Rear casing | 41. Pump plunger |
| 9. Shaft | 25. Solenoid | 42. Connecting rod |
| 10. Planet carrier | 26. Piston seal | 43. Front casing |
| 11. Oil thrower | 27. Piston | 44. Input shaft |
| 12. Uni-directional clutch rollers | 28. Operating valve | (gearbox mainshaft) |
| 13. Uni-directional clutch | 29. Orifice nozzle | 45. Eccentric |
| 14. Oil trap | 30. Cylinder top | 46. Bridge piece |
| 15. Ball bearing | 31. Cylinder | 47. Spring |
| 16. Bush | 32. Spring | |
| | 33. Large piston | |

REPAIR INSTRUCTIONS

WORK WHICH CAN BE CARRIED OUT WITH THE OVERDRIVE INSTALLED

CHECKING THE OIL PRESSURE

The oil pressure can be suitably checked when driving on test rollers or on a motorway. The check can also be made with the vehicle jacked up but this should be avoided for reasons of safety.

Checking is as follows:

1. Remove the plug under the operation valve and connect the pressure gauge SVO 2834, see Fig. 4-42.
2. Read off the pressure when driving on direct drive at about 40 km.p.h. (25 m.p.h.). The pressure should then be about 1.5 kp/mm² (21 p.s.i.).
3. Engage the overdrive and check that the pressure rises to 36—39 kp/mm² (510—550 p.s.i.).
4. Disengage the overdrive and check the time for the pressure to drop to 1.5 kp/cm² (21 p.s.i.). The time must not exceed 3 seconds.

REPLACING THE SOLENOID AND OPERATING VALVE

The solenoid and operating valve are integrally built as one unit, which is replaced complete. For removing and fitting, use a 25 mm (1") fixed spanner. Use a new seal and O-rings when fitting. The tightening torque should be 4.2—5.5 kpm (30—40 lb.ft.).

CHECKING AND REPLACING THE RELIEF VALVE

1. Remove the base plate and the pre-filter. Collect the oil in an oil container. Warning. If the vehicle has been driven recently, the oil may be hot and scald if it comes into contact with your skin.
2. Remove the plug under the relief valve with tool SVO 2836, see Fig. 4-43. Pull out the large piston

of the relief valve, then the spring and spring retainer. Even the low-pressure spring will also be included in the removal. Then pull out the small piston with its spring and spring retainer, also the cylinder and end washer. Use a pair of pliers with narrow jaws for the piston unit and a loop, see Fig. 4-44, for the cylinder and washer.

3. Wash all the parts in white spirit and blow them dry with compressed air. Check them carefully for wear and damage. The pistons should run easily in their cylinders. Faulty parts must be replaced. N.B. The following units are available as spare parts: End washer, cylinder, the small piston, adjuster washer, low-pressure spring, large piston, plug and the O-rings.

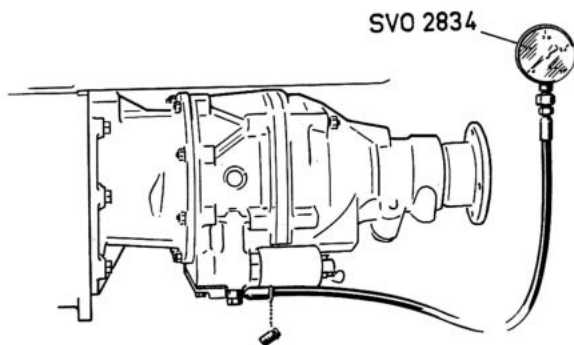


Fig. 4-42. Checking the oil pressure

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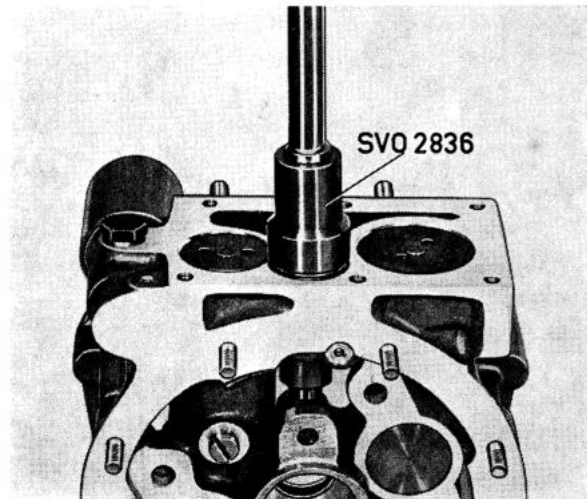


Fig. 4-43. Removing the plug

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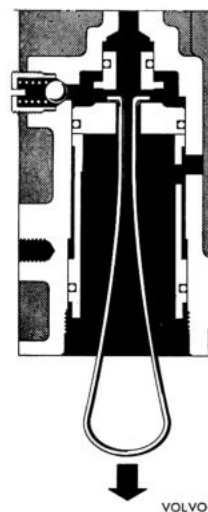
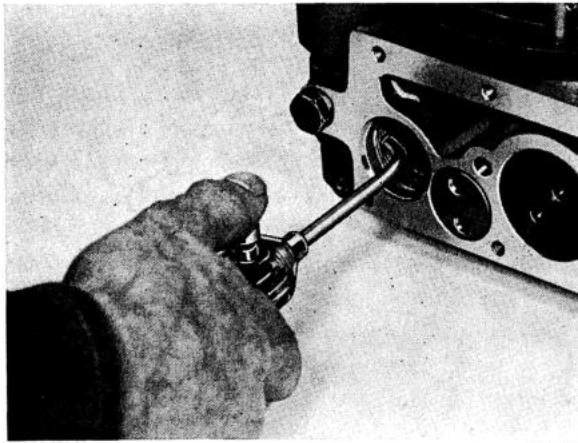


Fig. 4-44. Removing the relief valve

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Fig. 4-45. Blowing the orifice nozzle clean

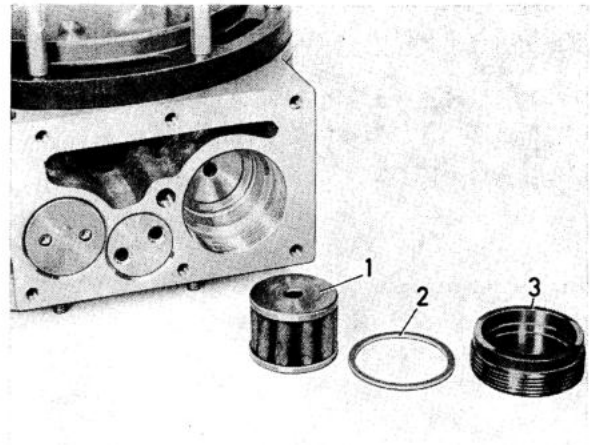
4. Before fitting the parts of the relief valve, it may be suitable to blow the orifice nozzle clean with compressed air, see Fig. 4-45.
5. Fit the new O-rings on the end washer, cylinder and plug. Lubricate the parts with oil. Then install them in the following order: End washer, cylinder, small piston, low-pressure spring, large piston and plug. Tighten the plug to a torque of 2.2 kpm (16 lb.ft.).
6. Fit the pre-filter and base plate with a new gasket. Make sure that the magnet is in position on the base plate. Fill with oil.

CLEANING THE ORIFICE NOZZLE

The orifice nozzle is accessible after the cylinder of the relief valve has been removed according to above. Blow the orifice nozzle clean with compressed air, see Fig. 4-45.

CHECKING AND REPLACING THE CHECK VALVE

1. Remove the base plate and pre-filter. Collect the oil in an oil container. Warning. If the vehicle has been recently driven, the oil may be hot and scald if contact is made with your skin.
2. Remove the plug with tool SVO 2836. Take out the non-return valve spring, non-return ball and non-return body.
3. Clean all the parts in white spirit and blow them dry with compressed air. Check the parts for damage and wear. Replace faulty parts.
4. Fit a new O-ring on to the plug and then re-fit the non-return body, ball, spring and plug. Tighten the plug to a torque of 2.2 kpm (16 lb.ft.).



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Fig. 4-46. Fine filter

1. Filter 2. Seal 3. Plug

5. Re-fit the pre-filter and base plate together with a new gasket. Do not forget the magnet on the bottom plate. Fill with oil.

CLEANING THE FILTER

1. Remove the base plate and the pre-filter. Collect the oil in an oil container. Warning. If the vehicle has been recently driven, the oil may be hot and cause damage if contact is made with your skin.
2. Remove the plug and take out the seal and fine filter, see Fig. 4-46.
3. Clean all the parts in white spirit. Then blow them dry with compressed air.
4. Fit the fine filter, a new seal and the plug. Tighten the plug to a torque of 2.2 kpm (16 lb.ft.).
5. Re-fit the pre-filter and the base plate with a new gasket. Make sure that the magnet is in position on the base plate. Fill with oil.

REMOVING THE OVERDRIVE

To facilitate removal, the vehicle should first be driven with the overdrive engaged and then with it disengaged **with the clutch pedal depressed**. The last-mentioned is important in order to avoid torsional tensions in the shaft between the planet carrier and uni-directional clutch. Any stresses will disappear even if oil with pressure of 20—25 kp/cm² (284—335 p.s.i.) is connected to the output at the operating valve. The overdrive is engaged and disengaged with this pressure.

Removal is as follows:

1. Carry out operations 1—5 under "Removing" in Group 53 a.
2. Disconnect the cables to the solenoid.

3. Unscrew the bolts holding the overdrive unit to the intermediate flange. Pull the overdrive straight out backwards until it goes free from the gear-box mainshaft.

DISMANTLING THE OVERDRIVE

Maximum cleanliness must be observed when working with the overdrive unit. Before the dismantling, clean the outside of the unit thoroughly. Then first dismantle the main parts as follows:

1. Place the overdrive vertically in a vice provided with copper jaws. Remove the solenoid and operating valve.
2. Bend down the locking tab, unscrew and remove the nuts for the piston bridge pieces. Remove the bridge pieces.
3. Unscrew the nuts holding the brake ring, front and rear casing. Loosen the nuts successively all round in order to avoid any distortion from the springs. Lift off the front casing and brake ring, see Fig. 4-47.
4. Tap loose the brake ring from the front casing with the help of a copper drift and hammer.
5. Remove the springs for the clutch sliding member. Lift out the clutch sliding member complete with thrust bearing and sunwheel.
6. Lift out the planet gear carrier complete.

REMOVING THE FRONT CASING

1. Place the casing with the front side downwards on a bench. Connect compressed air to the hole for the operating valve and blow out the pistons.
2. Disconnect the base plate and remove the pre-filter. Then remove the plugs and take out the parts for the respective fine filter, relief valve and pump check valve. See also under the heading "Work which can be carried out with the overdrive installed".

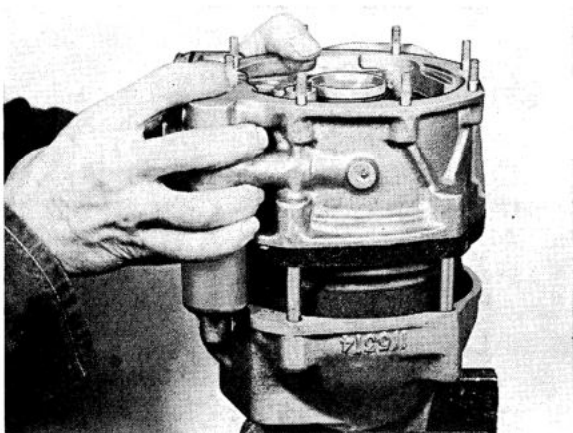


Fig. 4-47. Dismantling the overdrive

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3. Press down and pull out the pump cylinder. Then take out the connecting rod and pump plunger.

DISMANTLING THE CLUTCH UNIT

1. Remove the circlip for the sunwheel. Pull out the sunwheel backwards.
2. Remove the inner circlip for the bearing. Hold the bearing body and tap loose the clutch sliding member with a rubber mallet.
3. Remove the outer circlip and press the bearing out of the bearing housing.

DISMANTLING THE REAR CASING

1. Remove the bolt and pull out the retainer, the bush and the speedometer pinion.
2. Remove the nut and pull off the flange with puller SVO 2261. Place the housing in a press and press out the output shaft.
3. Remove the spacer, the speedometer driving gear. Pull out the bearing on the output shaft, suitably with a so-called knife extractor. The rear bearing and oil seal are pressed out of the housing with drift SVO 1797 and handle SVO 1801.
4. Remove the circlip and the oil thrower, which hold the uni-directional clutch on the output shaft. Lift out the uni-directional clutch components. Remove the thrust washer. If necessary pull the bush on the output shaft out with puller SVO 2423, see Fig. 4-48.

INSPECTING THE OVERDRIVE

Before inspecting, clean all the parts in white spirit and then blow them dry with compressed air. Pay particular attention to the cleaning of the filters and

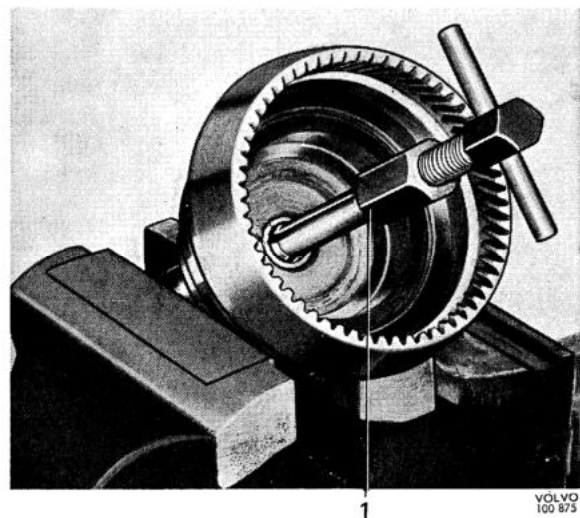


Fig. 4-48. Removing the bush, output shaft

1. Puller SVO 2423

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all the oilways. Check that the orifice nozzle in the channel between the relief and operating valves is clean. If it is not possible to blow the nozzle clean, it can be cleaned with a pointed wooden stick or suchlike. Hard objects must not be used since these can alter the graduation.

Check also that the groove inside the ring gear on the output shaft is properly cleaned. Dirt collects here due to the centrifugal force. After cleaning, check all the parts carefully for wear, cracks or other damage. Pay particular attention to the following:

Check the solenoid with the help of a 12 volt battery and an ammeter. Current consumption should be about 2 ampères. Check the movement of the valve during engagement and disengagement.

Check to make sure that the filters are not damaged. Also check the pistons of the hydraulic system for abrasion and wear. Check the valves for wear. Make sure that all the springs are not damaged. Check all the gears and ball bearings for cracks and wear. Make sure that the bush on the sunwheel is not worn. With replacement, change the sunwheel complete with bush. The bush must be concentric with the gear wheel, and this is difficult to bring about outside a workshop.

Check the brake ring for abrasion, cracks or wear. Check to make sure that the linings on the clutch sliding member are not burnt or worn.

ASSEMBLING THE OVERDRIVE

Use new gaskets, O-rings, lock washer and seals when assembling. Observe maximum cleanliness since the hydraulic system is sensitive to impurities.

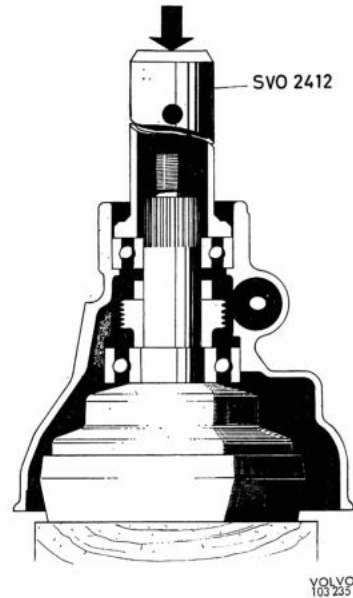


Fig. 4-50. Fitting the output shaft

ASSEMBLING THE REAR CASING

1. Push the bush on to the output shaft with drift SVO 2417, see Fig. 4-49. Press the front bearing to the output shaft with drift SVO 2412.
2. Press the rear bearing on to the rear casing section with drift SVO 2412.
3. Place a wooden block under the output as support. Fit the speedometer driving gear and spacer. Press on the rear casing with drift SVO 2412, see Fig. 4-50.
4. Press in the oil seal with drift SVO 2412. Fit the coupling flange, the washer and nut. Tighten the nut to a torque of 11—14 kpm (80—100 lb.ft.).

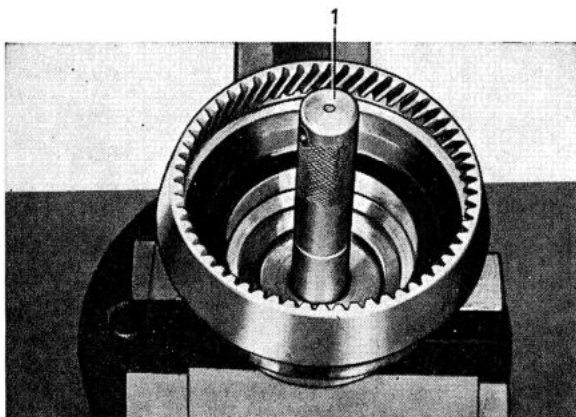


Fig. 4-49. Fitting the bush, output shaft
1. Drift SVO 2417

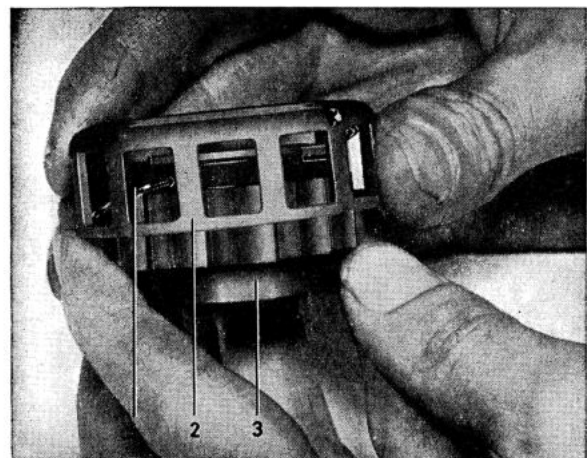
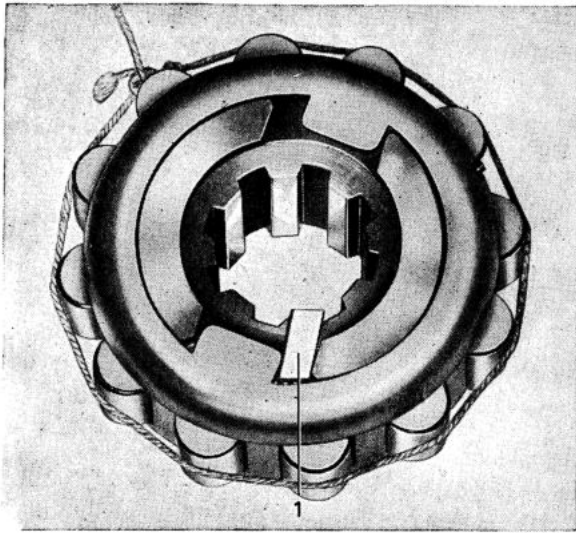
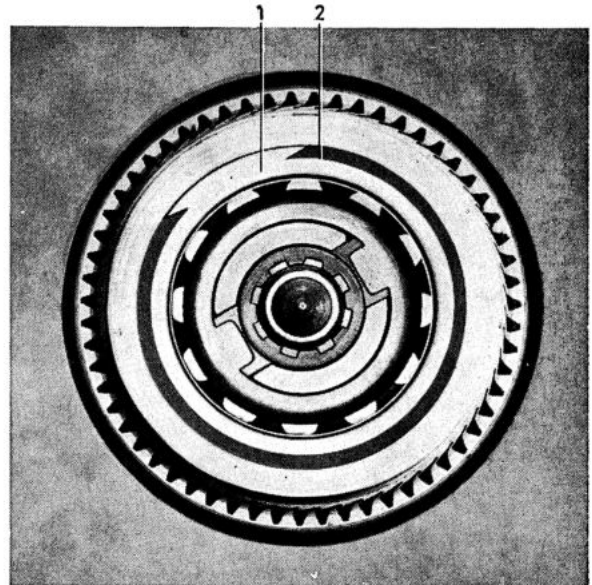


Fig. 4-51. Assembling the uni-directional clutch, I
1. Spring 2. Cage 3. Uni-directional clutch hub



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Fig. 4-52. Assembling the uni-directional clutch, II
1. Key



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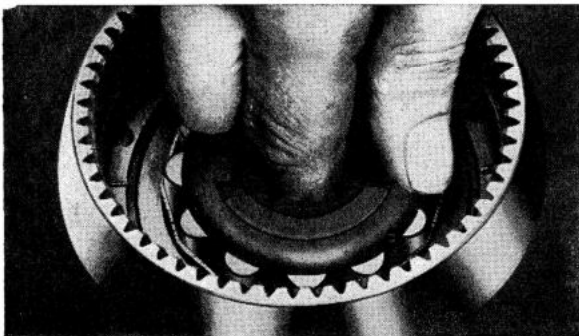
Fig. 4-54. Fitting the oil thrower
1. Oil thrower plate 2. Circlip

5. Assemble the uni-directional clutch, spring and roller cage, see Fig. 4-51. Turn the roller cage clockwise as far as it will go and lock it in this position with a key as shown in Fig. 4-52. Place in the rollers. Tie a piece of rubber band or string round the rollers.
6. Fit the thrust washer and then the uni-directional clutch in position on the output shaft, see Fig. 4-53. Fit the oil thrower and install the circlip, see Fig. 4-54.
7. Fit the speedometer pinion and bush. Fit the retainer and bolt.
8. Place the planet carrier complete with planet gear in position on the output shaft. Guide up the splines into the planet carrier and uni-directional clutch with drift SVO 2835, Fig. 4-55.

2. Fit the bolts on the bearing retainer. Then press the bearing with retainer on to the clutch sliding member. Fit the circlip.
3. Fit the sunwheel on to the clutch sliding member. Fit the circlip.
4. Install the clutch unit in position on the output shaft. Fit the four thrust springs on to the bolts.

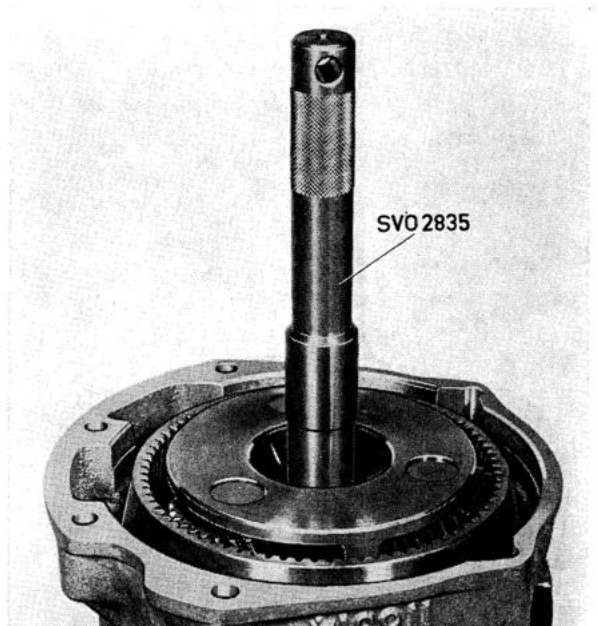
ASSEMBLING THE CLUTCH UNIT

1. Press the ball bearing into the retainer and fit the circlip.



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Fig. 4-53. Fitting the uni-directional clutch



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Fig. 4-55. Fitting the planet gear

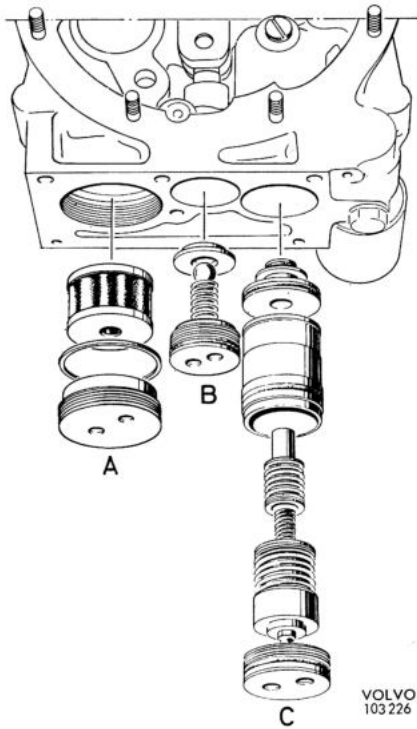


Fig. 4-56. Fitting the fine filter, oil pump check valve and relief valve

ASSEMBLING AND FITTING FRONT CASING

1. Fit the fine filter. Also fit the relief valve parts in the following order: End washer, cylinder, small piston, low-pressure spring, large piston and plug, see 4-56.
2. Place the connecting rod and pump plunger in position in the casing. Then push in the cylinder. After that fit the non-return body, non-return ball, spring and plug.
3. Tighten the plugs for the fine filter, relief valve and pump check valve with torque wrench and tool SVO 2836. The tightening torque is 2.2 kpm (16 lb.ft.). Fit the pre-filter, magnet, gasket and base plate.

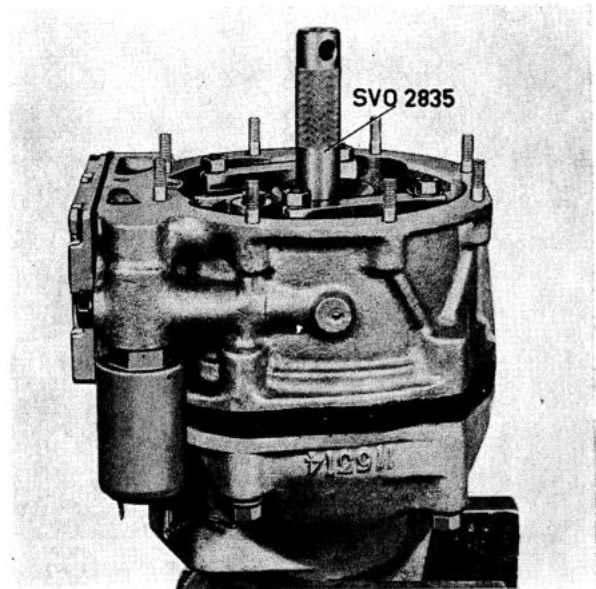


Fig. 4-57. Fitting the front casing

4. Fit the operating pistons in their cylinders.
5. Install the brake ring on the front casing. Place the front casing on the rear one. Fit washers and nuts, see Fig. 4-57. Note that both the copper washers should be fitted on the upper bolts. Tighten the bolts a little at a time until they are tightened evenly all around.
6. Fit both the thrust washers. Tighten and lock the nuts. Fit the operating valve and solenoid.

FITTING THE OVERDRIVE

Fitting the overdrive is in reverse order to removal. Fill with oil. Check the oil in the gearbox after the vehicle has been driven 10—15 km (6—9 miles).