



CARS

PART 4 (43 b)

OVERDRIVE

TYPE J

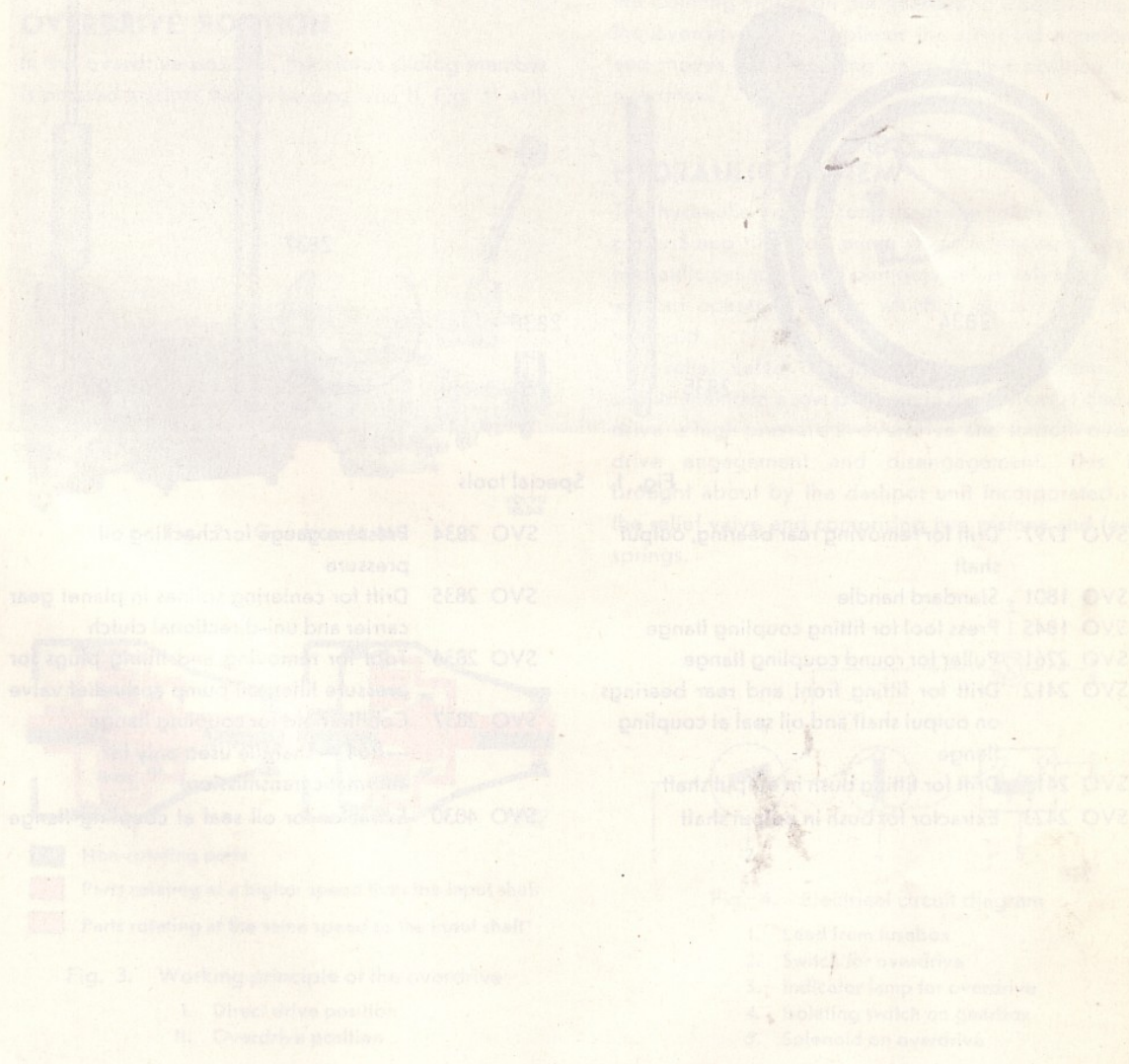
SERVICE MANUAL

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SPECIFICATIONS

Overdrive reduction ratio	0.797: 1
Oil pressure, direct drive	approx. 2.8 kg/cm ² (40 p.s.i.)
overdrive M 41	32—35 kg/cm ² (450—490 p.s.i.)
M 410	36—39 kg/cm ² (510—550 p.s.i.)
Tightening torques, nut for flange	11.0—14.0 kgm (80—100 lb.ft.)
plugs for pressure filter,	
pump non-return valve and relief valve ..	2.2 kgm (16 lb.ft.)
solenoid	4.2—5.5 kgm (30—40 lb.ft.)
Lubricant	Engine oil
viscosity all year round	SAE 30 or SAE 20 W-40
grade	Service ML or higher
Oil capacity, gearbox and overdrive M 41	approx. 1.6 litres (2.8 Imp. pints = 3.4 US pints)
M 410	approx 1.4 litres (2.5 Imp. pints = 3.0 US pints)



SPECIAL TOOLS

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

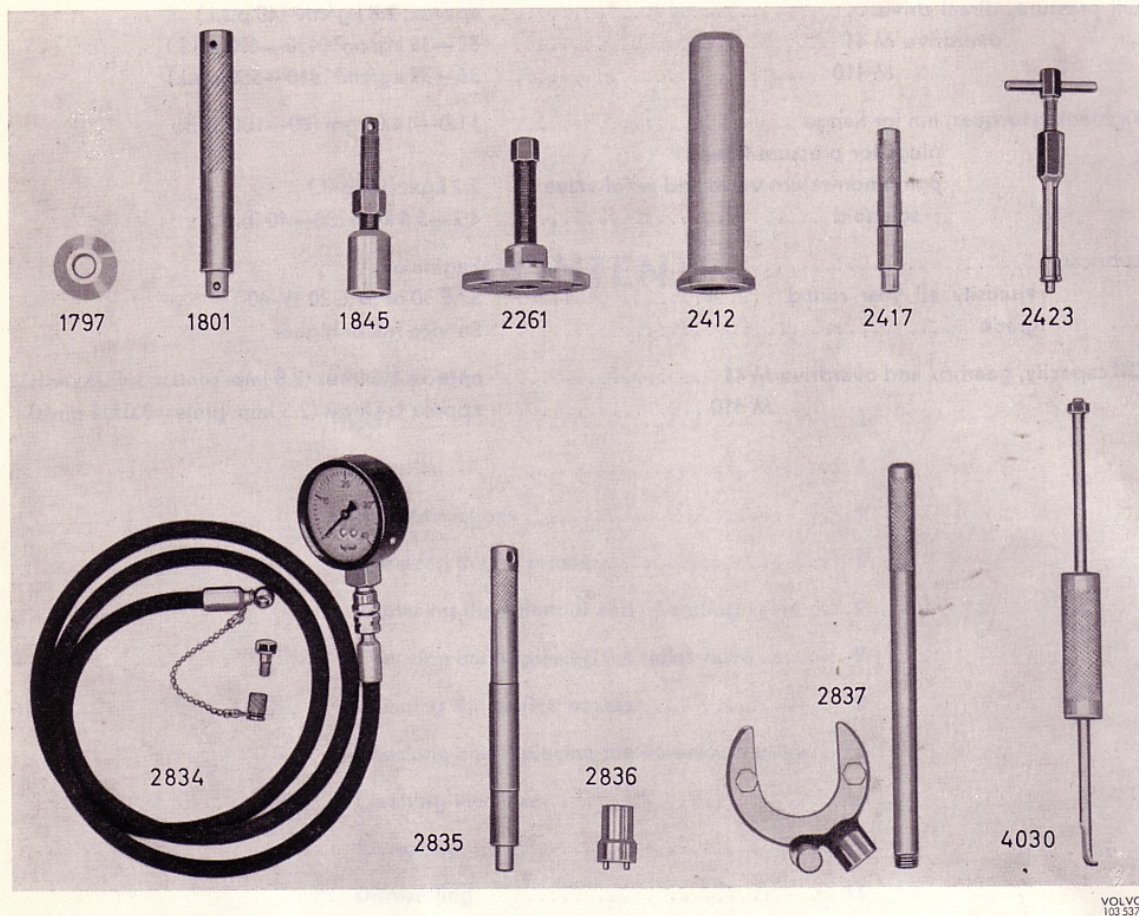


Fig. 1. Special tools

- | | | | |
|----------|---|----------|---|
| SVO 1797 | Drift for removing rear bearing, output shaft | SVO 2834 | Pressure gauge for checking oil pressure |
| SVO 1801 | Standard handle | SVO 2835 | Drift for centering splines in planet gear carrier and uni-directional clutch |
| SVO 1845 | Press tool for fitting coupling flange | SVO 2836 | Tool for removing and fitting plugs for pressure filter, oil pump and relief valve |
| SVO 2261 | Puller for round coupling flange | SVO 2837 | Counterhold for coupling flange — 164 — (handle used only for automatic transmission) |
| SVO 2412 | Drift for fitting front and rear bearings on output shaft and oil seal at coupling flange | SVO 4030 | Extractor for oil seal at coupling flange |
| SVO 2417 | Drift for fitting bush in output shaft | | |
| SVO 2423 | Extractor for bush in output shaft | | |

DESCRIPTION

The overdrive unit is of the epicyclic type and is attached to the rear end of the gearbox. The construction of the overdrive is shown in Figs. 2 and 16 as well as in Illustration A.

The working principle of the overdrive is as follows:

DIRECT DRIVE POSITION

In direct drive, power is transmitted from the gearbox mainshaft through the uni-directional clutch to the output shaft. At the same time the clutch sliding member (position 1, Fig. 3) is pressed by four clutch return springs against the tapered part of the output shaft. The torque is then transmitted through the clutch sliding member, when reversing or when the engine acts as a brake.

OVERDRIVE POSITION

In the overdrive position, the clutch sliding member is pressed against the brake ring (see II, Fig. 3) with

the help of the pistons (27, Fig. 16) in the hydraulic cylinders, thereby locking the sunwheel. Since the planet gear carriers are splined to the mainshaft, the planet gears are forced to rotate around the sunwheel. This causes the output shaft to rotate at a higher speed than the mainshaft.

ELECTRICAL SYSTEM

The overdrive is engaged electro-hydraulically. Mounted on the gearbox cover is an isolating switch the contacts of which close when 4th gear is engaged. Shifting to overdrive can thus only take place when 4th gear is engaged. The overdrive is switched on by means of a switch placed underneath the steering wheel. This switch closes the circuit via the isolating switch on the gearbox to a solenoid on the overdrive. This displaces the solenoid armature and moves the operating valve to the position for overdrive.

HYDRAULIC SYSTEM

The hydraulic system consists of the following main parts: Sump filter, oil pump (Fig. 5), pressure filter, hydraulic cylinders and plungers, relief valve (Fig. 6) and an operating valve, which is actuated by the solenoid.

The relief valve has three different functions. It should maintain a low pressure in the system at direct drive, a high pressure in overdrive and smooth overdrive engagement and disengagement. This is brought about by the dashpot unit incorporated in the relief valve and comprising two pistons and four springs.

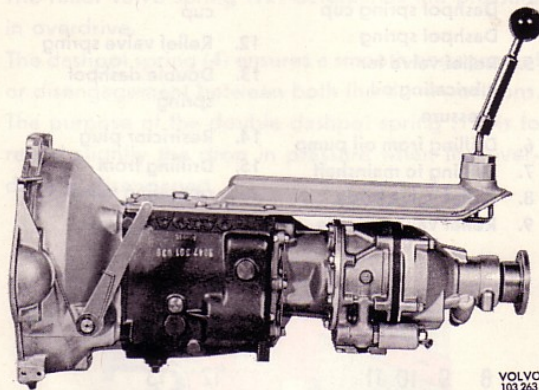


Fig. 2. Gearbox M 410

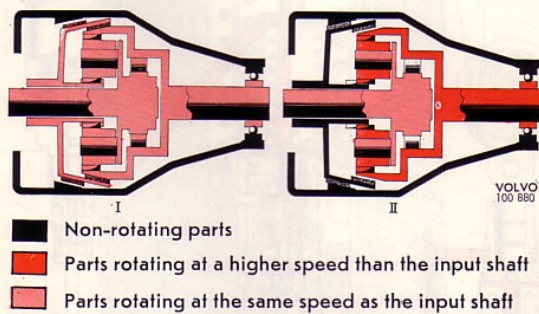


Fig. 3. Working principle of the overdrive

- I. Direct drive position
- II. Overdrive position

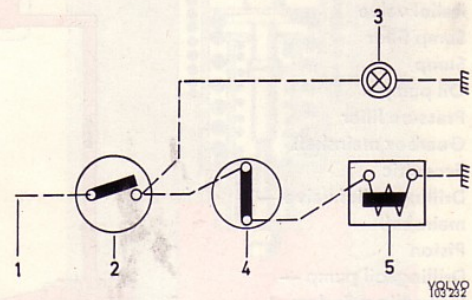


Fig. 4. Electrical circuit diagram

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

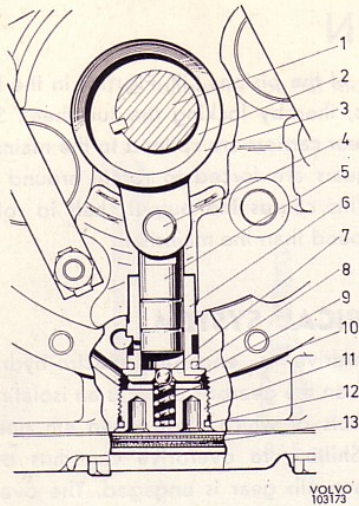


Fig. 5. Oil pump

- | | |
|--------------------------|-----------------------------|
| 1. Mainshaft | 8. O-ring |
| 2. Eccentric | 9. Non-return body |
| 3. Pump strap | 10. Non-return valve spring |
| 4. Pump pin | 11. Plug |
| 5. Plunger | 12. O-ring |
| 6. Body | 13. Sump filter |
| 7. Non-return steel ball | |

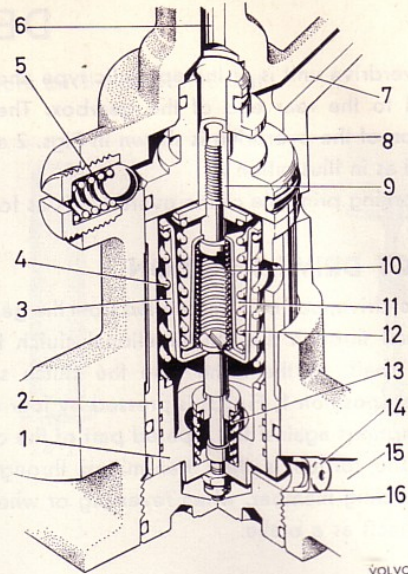


Fig. 6. Relief valve

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|--|-----------------------------------|
| 1. Dashpot piston | 10. Residual spring |
| 2. Dashpot sleeve | 11. Relief valve spring cup |
| 3. Dashpot spring cup | 12. Relief valve spring |
| 4. Dashpot spring | 13. Double dashpot spring |
| 5. Relief valve for lubricating oil pressure | 14. Restrictor plug |
| 6. Drilling from oil pump | 15. Drilling from operating valve |
| 7. Drilling to mainshaft | 16. Dashpot plug |
| 8. Relief valve body | |
| 9. Relief valve spindle | |

- | | |
|---|---|
| 1. Restrictor plug | 8. Gearbox mainshaft |
| 2. Drilling, operating valve — relief valve | 9. Eccentric |
| 3. Relief valve | 10. Drilling, relief valve — mainshaft |
| 4. Sump filter | 11. Piston |
| 5. Sump | 12. Drilling, oil pump — hydraulic cylinders — operating and relief valve |
| 6. Oil pump | 13. Operating valve and solenoid |
| 7. Pressure filter | |

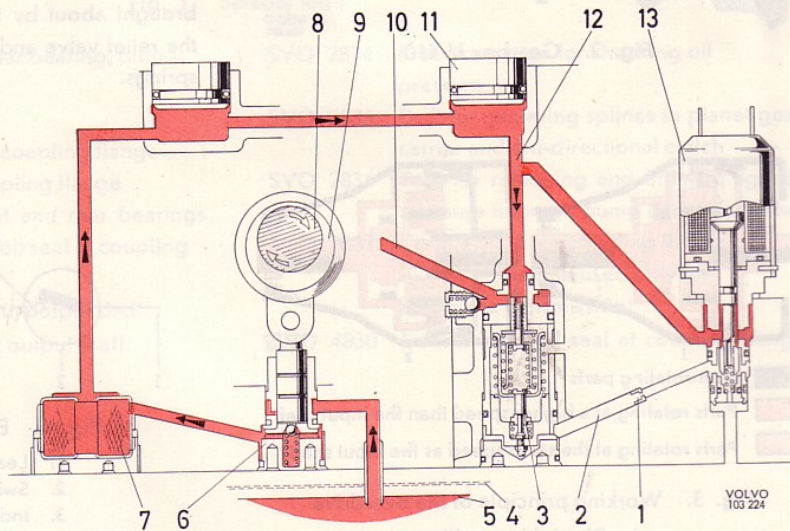
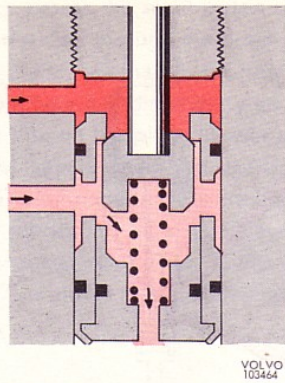


Fig. 7. Function with direct drive

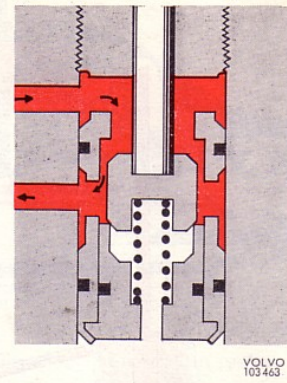


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Fig. 8. Operating valve with direct drive

Figs. 8—11. Colour marking

- Pressure above 25 kg/cm² (355 p.s.i.)
- Pressure about 2.8 kg/cm² (40 p.s.i.)
- Pressureless



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Fig. 10. Operating valve with overdrive

These have the following function:

The small piston (9, Fig. 6) is the actual relief valve.

The purpose of the large piston (1) is to alter the spring force on the small piston.

The residual spring (10) determines the pressure in direct drive.

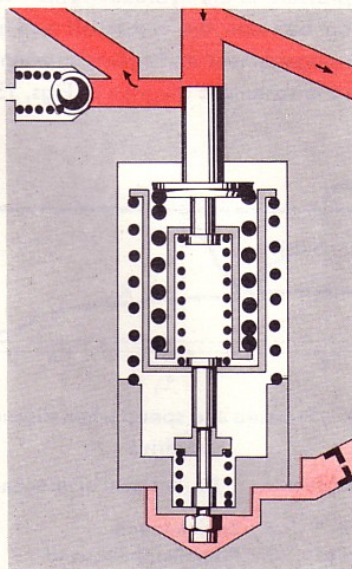
The relief valve spring (12) determines the pressure in overdrive.

The dashpot spring (4) ensures a smooth engagement or disengagement between both the drive positions.

The purpose of the double dashpot spring (13) is to retard slightly the drop in pressure when the overdrive is disengaged.

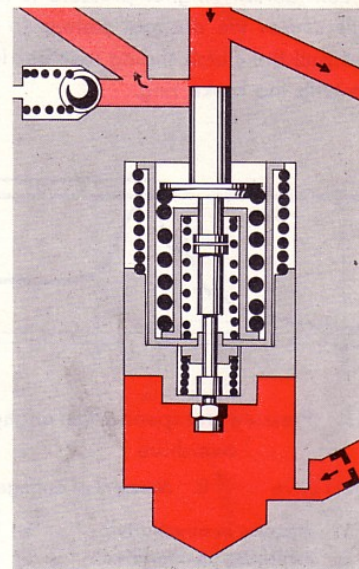
The function of the hydraulic system is as follows:

In direct drive (see Fig. 7), oil is drawn up through the sump filter by the oil pump and is forced through the pressure filter. From there it flows on through the hydraulic cylinders to the relief and operating valves. The operating valve is closed (Fig. 8) and the large piston of the relief valve is in its lower position (Fig. 9). The residual spring (10, Fig. 6) is off-loaded, so that only a low pressure is required to press down the small piston of the relief valve. Oil then flows past this piston out into the drilling (7) for the main-shaft.



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Fig. 9. Relief valve with direct drive



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Fig. 11. Relief valve with overdrive

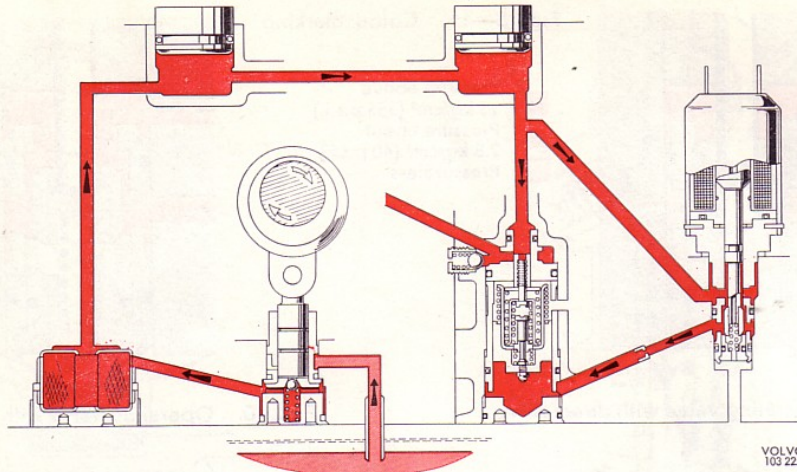


Fig. 12. Function — direct drive

On engaging overdrive, the solenoid is energized and its valve opens to the position shown in Fig. 10. Oil is directed to the bottom of the relief valve and causes the dashpot piston to rise and compress the springs (Fig. 11). The springs are prevented from being compressed further than their working length by means of the relief valve and dashpot spring cups. The only spring which can operate in this position is the relief valve spring 12, Fig. 6, which thus determines the pressure during overdrive engagement. Spring 12 is considerably stronger than spring 10, so that a considerably higher pressure is now obtained. This causes the dashpot pistons to be displaced and pull the clutch sliding member forwards to engage with the brake ring.

Returning to direct drive de-energizes the solenoid and its valve is closed by a spring, cutting off the oil supply between passages 12 and 2, Fig. 7. The connection between passage 2 and the sump is opened instead. Oil can then flow out into the sump under the large piston unit of the relief valve so that pressure in the system progressively drops and direct drive is engaged. By means of the restrictor plug (14, Fig. 6) and the spring (13), the engaging time is so balanced that smooth engagement is obtained without slipping.

How the pressure in the hydraulic system varies and the relation between the crankshaft and propeller shaft with engagement and disengagement can be seen from the schematic diagram in Figs. 13 and 14.

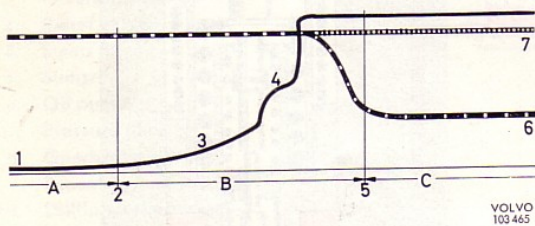


Fig. 13. Pressure and speed when engaging overdrive

A. Direct drive B. Moment of engagement

- | | |
|-----------------------------|---|
| 1. Pressure in direct drive | 4. Temporary stop in pressure increase with displacement of pistons |
| 2. Switching on overdrive | 5. Overdrive engaged |
| 3. Pressure increase | |

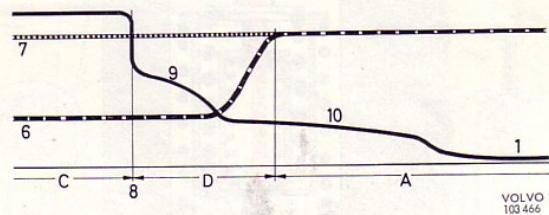
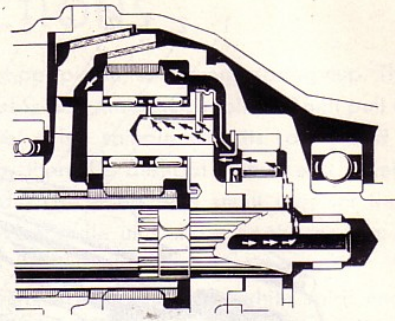


Fig. 14. Pressure and speed when disengaging overdrive

C. Overdrive D. Moment of disengagement

- | |
|-------------------------------------|
| 6. Engine speed |
| 7. Propeller shaft speed |
| 8. Switching off overdrive |
| 9. Pressure drop with disengagement |
| 10. Continued pressure drop |

Oil, which passes the small piston unit of the relief valve, is directed through the drilling (7, Fig. 6) and a drilling in the mainshaft to the free wheel and shaft bush. From here it is directed by an oil thrower into a catcher disc on the planet carrier and then led via the planet gear back to the gearbox housing, see Fig. 15. The oil pump has such a large capacity that sufficient lubricating oil always flows past the relief valve. A special relief valve (5, Fig. 6) is installed in drilling (7) in order to maintain even lubricating oil pressure.



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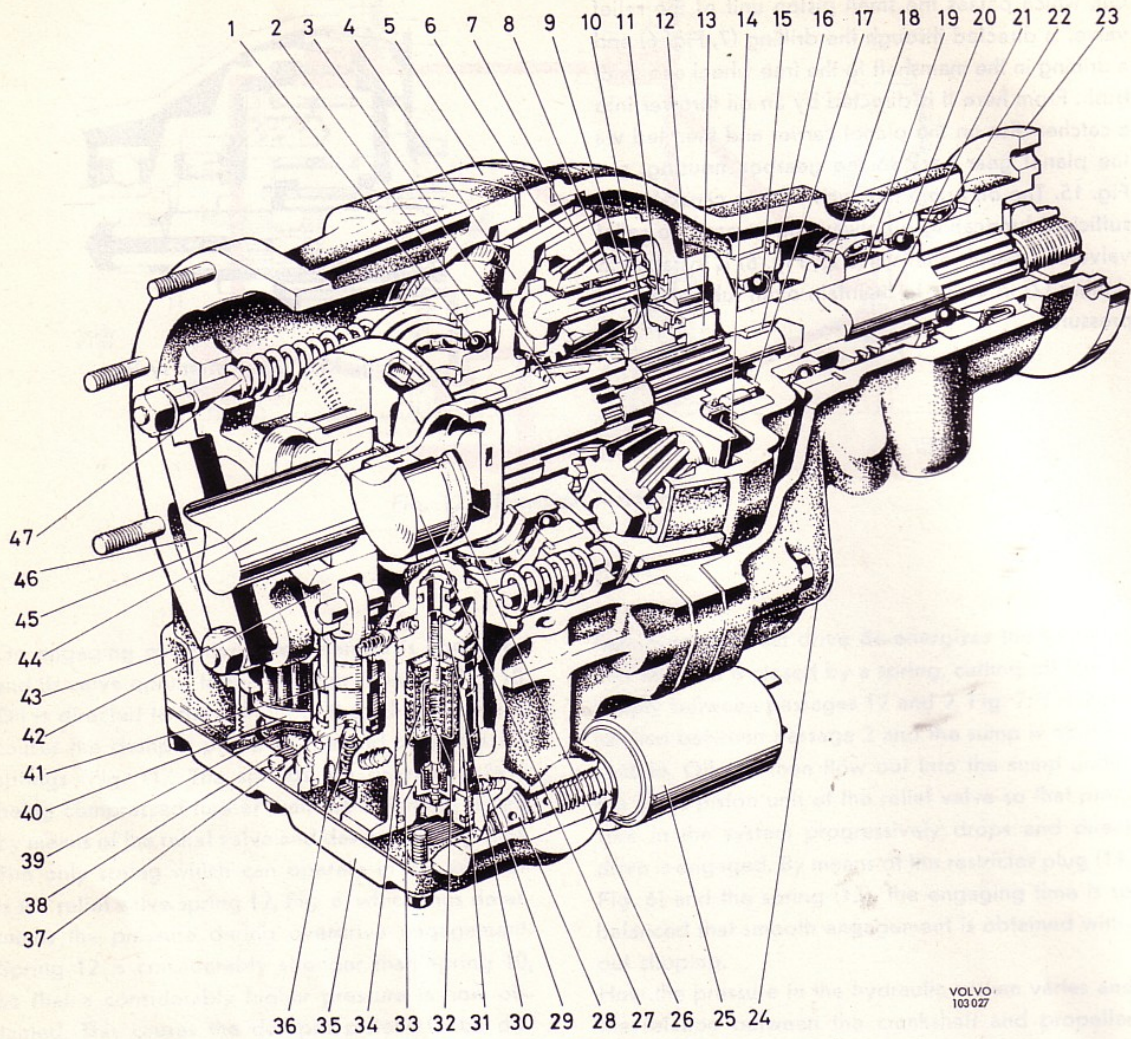
Fig. 15. Lubrication system

REPLACING THE OIL PUMP AND RELIEF VALVE

The oil pump and relief valve are mounted on the mainshaft and are replaced as a unit. The relief valve is replaced with a 25 mm (1") bore steel ball with a 25 mm (1") diameter hole. The ball should be 42-43 mm (1.65-1.70") long.

CHECKING AND REPLACING THE OIL PUMP AND RELIEF VALVE

- 1. Oil pump
- 2. Relief valve
- 3. Oil thrower
- 4. Catcher disc
- 5. Planet gear
- 6. Planet carrier
- 7. Mainshaft
- 8. Free wheel
- 9. Shaft bush
- 10. Gearbox housing
- 11. Oil pump
- 12. Relief valve
- 13. Oil thrower
- 14. Catcher disc
- 15. Planet gear
- 16. Planet carrier
- 17. Mainshaft
- 18. Free wheel
- 19. Shaft bush
- 20. Gearbox housing



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Fig. 16. Overdrive

- | | | |
|------------------------------------|------------------------------|-------------------------------------|
| 1. Ball bearing | 17. Thrust washer | 33. Large piston unit |
| 2. Thrust bearing ring | 18. Speedometer driving gear | 34. Small piston unit |
| 3. Sunwheel | 19. Spacer | 35. Sump |
| 4. Clutch sliding member | 20. Annulus ball bearings | 36. Non-return valve for oil pump |
| 5. Brake ring | 21. Output shaft | 37. Pump body |
| 6. Clutch sliding member lining | 22. Oil seal | 38. Magnet |
| 7. Planet gear | 23. Coupling flange | 39. Sump filter |
| 8. Needle bearings | 24. Rear casing | 40. Pressure filter |
| 9. Stud | 25. Solenoid | 41. Pump plunger |
| 10. Planet gear carrier | 26. Piston seal | 42. Connecting rod |
| 11. Oil thrower | 27. Piston | 43. Front casing |
| 12. Uni-directional clutch rollers | 28. Operating valve | 44. Input shaft (gearbox mainshaft) |
| 13. Uni-directional clutch | 29. Restrictor plug | 45. Eccentric |
| 14. Oil catcher | 30. End piece | 46. Bridge piece |
| 15. Annulus ball bearings | 31. Cylinder | 47. Spring |
| 16. Bush | 32. Spring | |

REPAIR INSTRUCTIONS

WORK WHICH CAN BE CARRIED OUT WITH THE OVERDRIVE INSTALLED

CHECKING THE OIL PRESSURE

The oil pressure can be checked by driving on test rollers or on the highway. It can also be checked with the car jacked up, but this should be avoided for reasons of safety.

1. Remove the plug under the operating valve and connect the oil pressure gauge SVO 2834, see Fig. 17.
2. Read off the pressure when driving in direct drive at about 40 km.p.h. (25 m.p.h.). The pressure should then be about 2.8 kg/cm² (40 p.s.i.).
3. Engage the overdrive and check that the pressure rises to 36—39 kg/cm² (510—550 p.s.i.) for the 164 model and 32—35 kg/cm² (450—490 p.s.i.) for the other models.
4. Disengage the overdrive and check the time taken for the pressure to drop to 2.8 kg/cm² (40 p.s.i.). The time may 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 removal and fitting use a 25 mm (1") box wrench. Use a new seal and O-rings when fitting. The tightening torque should be 4.2—5.5 kgm (30—40 lb.ft.).

CHECKING AND REPLACING THE RELIEF VALVE

1. Remove the oil sump and the sump filter. The oil can be collected in a vessel. Warning: If the car has been recently run, the oil may be hot so there is danger of scalding if contact is made with the skin.
2. Release the dashpot plug under the relief valve with tool SVO 2836, see Fig. 18. Pull out the

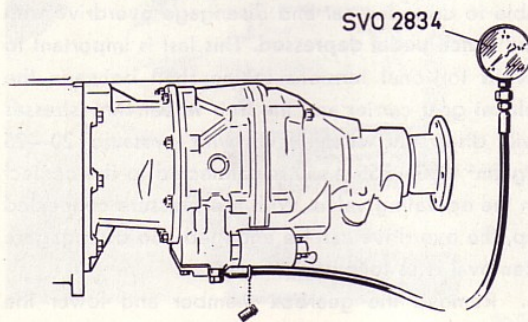
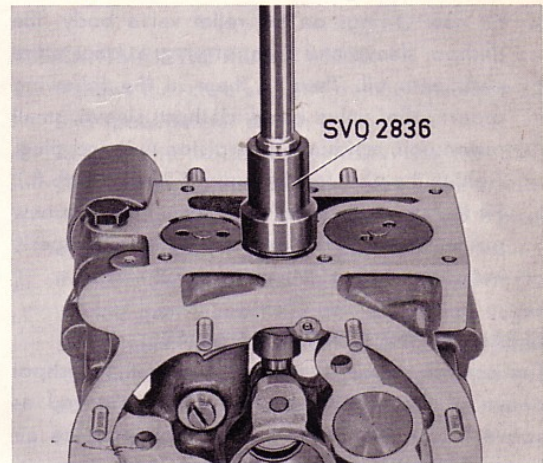


Fig. 17. Checking the oil pressure

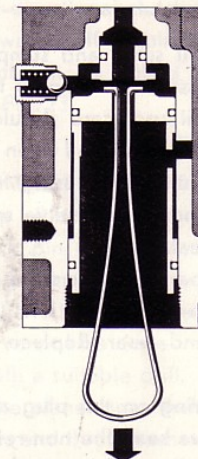
dashpot piston, spring and spring cup. The residual spring should also follow. Then pull out the relief valve spindle with its spring and spring cup, then the dashpot sleeve and relief valve body. Use pliers with small jaws for the relief valve spindle unit and a hook, see Fig. 19, for the dashpot sleeve and packing.

3. Clean all the parts in white spirit and blow them dry with compressed air. Check them carefully for wear and damage. Both the dashpot piston and relief valve spindle should run easily in their sleeves. Replace any parts that are faulty. N.B. The following parts are available as spares: relief valve body, packing, dashpot sleeve, the relief valve spindle unit, the residual spring, the dashpot piston unit, dashpot plug and the O-rings.



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Fig. 18. Removing the dashpot plug



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Fig. 19. Removing the relief valve

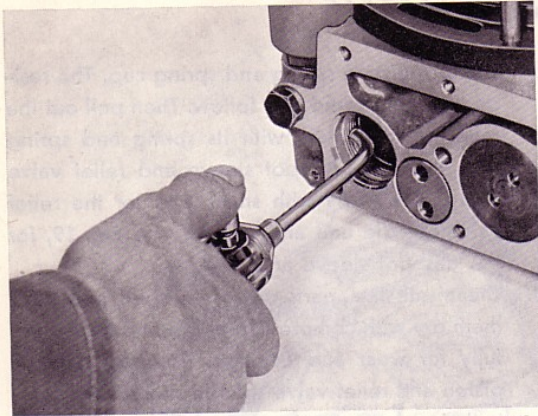
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Fig. 20. Cleaning the control orifice

4. Before fitting the relief valve components, blow the control orifice clean with a high-pressure air line, see Fig. 20.
5. Fit new O-rings on the relief valve body, the dashpot sleeve and dashpot plug. Lubricate the parts with oil. Then fit them in the following order: relief valve body, dashpot sleeve, small piston unit, residual, large piston unit and plug. Tighten the plug to a torque of 2.2 kgm (16 lb.ft.).
6. Fit the sump filter and the oil sump with a new gasket. Make sure that the magnet is properly in position on the bottom plate. Fill with oil.

CLEANING THE CONTROL ORIFICE

The control orifice is accessible after the dashpot sleeve of the relief valve has been removed as above. Clean the orifice with a high pressure air line, see Fig. 20.

CHECKING AND REPLACING THE NON-RETURN VALVE

1. Remove the oil sump and sump filter. Collect the oil in a vessel. Warning: If the vehicle has been in recent use, care should be taken to avoid burns from the hot oil when released.
2. Remove the pump plug using tool SVO 2836. Take out the non-return valve spring, ball and pump valve seat.
3. Clean all the parts in white spirit and blow them dry with a high-pressure air line. Check the parts for damage and wear. Replace those that are faulty.
4. Fit a new O-ring on the plug and then install the pump valve seat, the non-return valve ball, spring and finally the plug. Tighten the plug to a torque of 2.2 kgm (16 lb.ft.).

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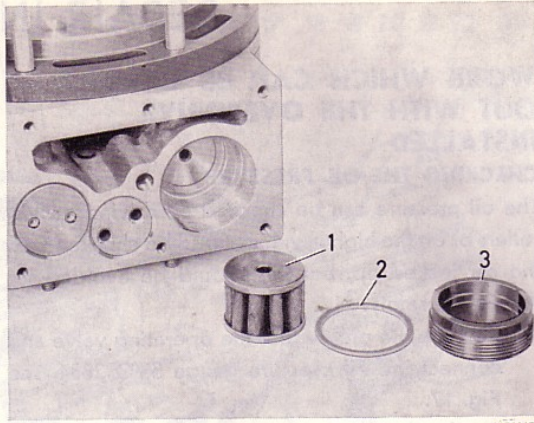
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Fig. 21. Pressure filter

1. Filter 2. Packing 3. Plug

5. Re-fit the sump filter and the oil sump with a new gasket. Do not forget the magnet in the oil sump. Fill with oil.

CLEANING THE PRESSURE FILTER

1. Remove the oil sump and sump filter. Collect the oil in a vessel. Warning: If the vehicle has been in recent use, care should be taken to avoid burns from the hot oil when released.
2. Release the plug and take out the packing and pressure filter, see Fig. 21.
3. Clean all the parts in white spirit. Then blow them dry with a high-pressure air line.
4. Re-fit the pressure filter, a new gasket and the plug. Tighten the plug to a torque of 2.2 kgm (16 lb.ft.).
5. Re-fit the sump filter and oil sump with a new gasket. Make sure that the magnet is properly in position in the oil sump. Fill with oil.

REMOVING THE OVERDRIVE

Before commencing overdrive removal, it is advisable to drive the car and disengage overdrive **with the clutch pedal depressed**. This last is important to avoid torsional tensions in the shaft between the planet gear carrier and the free wheel. Any stresses will disappear even if oil with pressure 20—25 kg/cm² (285—355 p.s.i.) is connected to the contact in the operating valve. With this pressure connected up, the overdrive can be engaged and disengaged. Removal is as follows:

1. Remove the gearbox member and lower the gearbox according to the instructions given under "Removing" in Part 4 (43) "Gearbox".

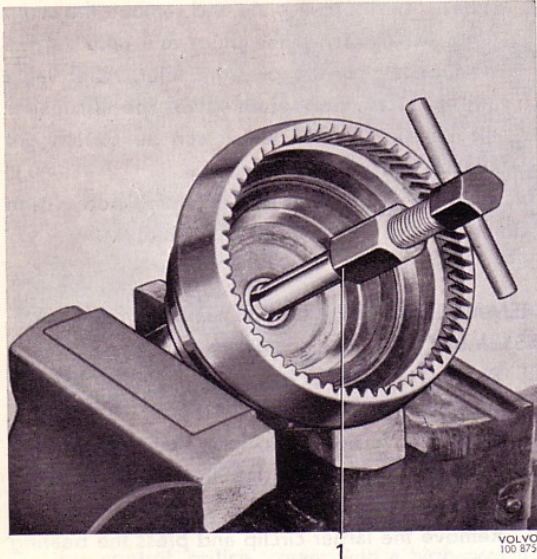


Fig. 23. Removing the bush, output shaft
1. Extractor SVO 2423

INSPECTING THE OVERDRIVE

Before inspecting wash all the parts clean in white spirit and then blow them dry with a high-pressure air line. Particular care should be paid to the cleaning of the filters and all the oil drillings. Check that the control orifice in the drilling between the relief and operating valves is clean. If cleaning is not fully effective with an air line, the orifice should be cleaned with a pointed piece of wood or similar. Hard objects may not be used for this since the calibration may be altered in the process. Check also that the groove inside the ring gear on the output shaft is properly clean. Because of centrifugal force, dirt easily collects there. After cleaning, check all the parts thoroughly for wear, cracks or other damage. Carefully observe the following:

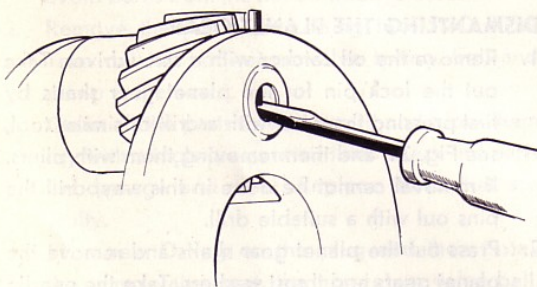


Fig. 24. Removing the lock pin

The solenoid should be checked with the help of a 12 volt battery and an ammeter. Current consumption should be about 2 amps. Check the operation for the valve when engaging and disengaging. Check to make sure that the filters are not damaged. Examine the hydraulic system plungers for wear and proper function. Check the valves for wear. All the springs should be undamaged. Check all gears and bearings for cracks and wear. The bush on the sun-wheel must not be worn. If any replacement has to be done here, the sunwheel should be replaced complete with bush. The bush must be concentric with the gear, and this is difficult to achieve if the wheel or bush is treated separately. If one planet gear has to be replaced, the other one must also be replaced at the same time. Otherwise there is risk of noise occurring in the planet gear assembly. For the same reason, both needle bearings in a planet gear should be replaced simultaneously. Check the brake ring for scoring, cracks or wear. Check that the linings on the clutch sliding member are not burnt or worn.

ASSEMBLING THE OVERDRIVE UNIT

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

ASSEMBLING THE REAR CASING

1. Press the bush on to the output shaft with drift SVO 2417, see Fig. 25. Press the front bearing on to the output shaft with drift SVO 2412.

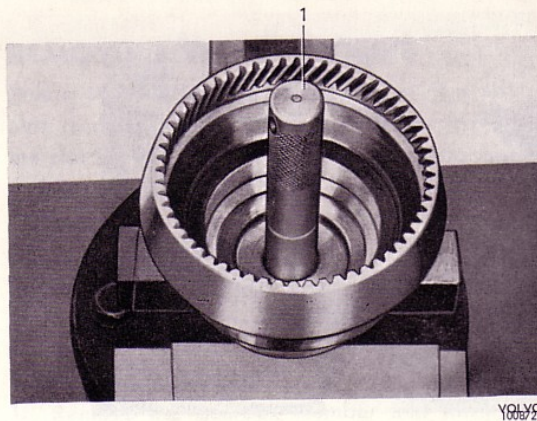


Fig. 25. Fitting the bush, output shaft
1. Drift SVO 2417

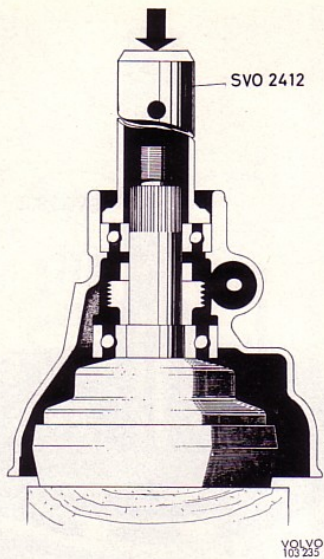


Fig. 26. Fitting the output shaft

2. Press the support bearing on to the rear casing with drift SVO 2412.
3. Support under the output shaft with a block of wood. Fit on the speedometer driving gear and spacer. Press on the rear casing with drift SVO 2412, see Fig. 26.
4. Press in the oil seal with drift SVO 2412. Fit the coupling flange, washer and nut. Tighten the nut to a torque of 11—14 kgm (80—100 lb.ft.).
5. Assemble the uni-directional clutch, spring and roller cage, see Fig. 27. Turn the roller cage

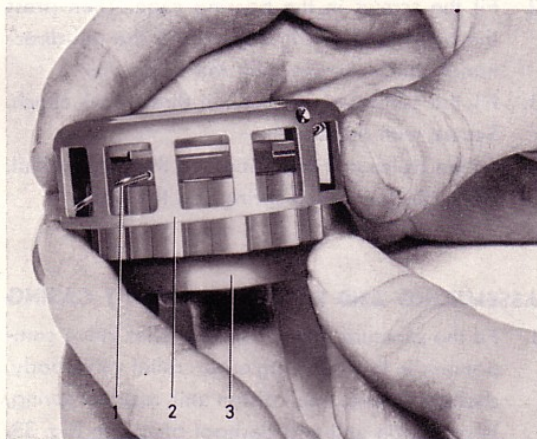


Fig. 27. Assembling the uni-directional clutch, I

1. Spring 2. Cage 3. Uni-directional clutch

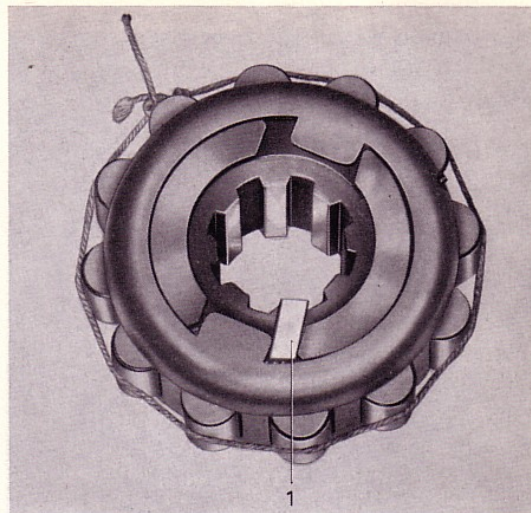


Fig. 28. Assembling the uni-directional clutch, II

1. Key

- clockwise as far as it will go and lock it in this position with a key as shown in Fig. 28. Place in the rollers. Tie a piece of string or rubber band round the rollers.
6. Fit the thrust washer and then the uni-directional clutch in position on the output shaft, see Fig. 29. Fit the oil thrower and secure it with the circlip, see Fig. 30.
7. Install the speedometer driven gear and the bush. Fit the cage and bolt.

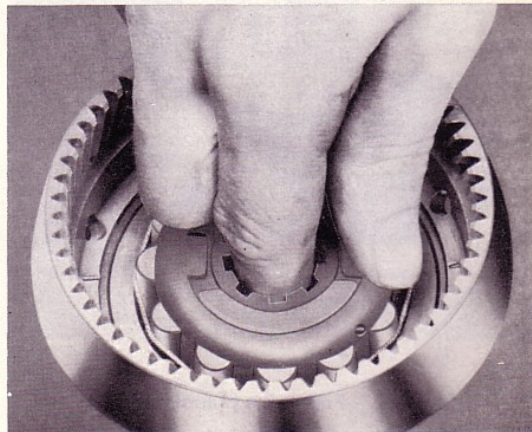


Fig. 29. Fitting the uni-directional clutch

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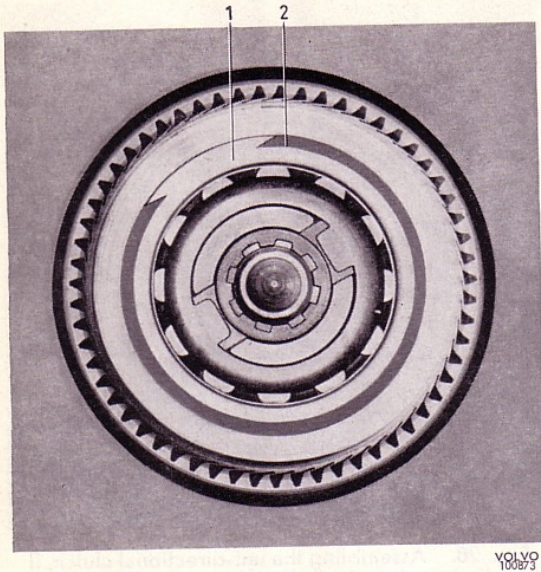


Fig. 30. Fitting the oil thrower
1. Oil thrower 2. Circlip

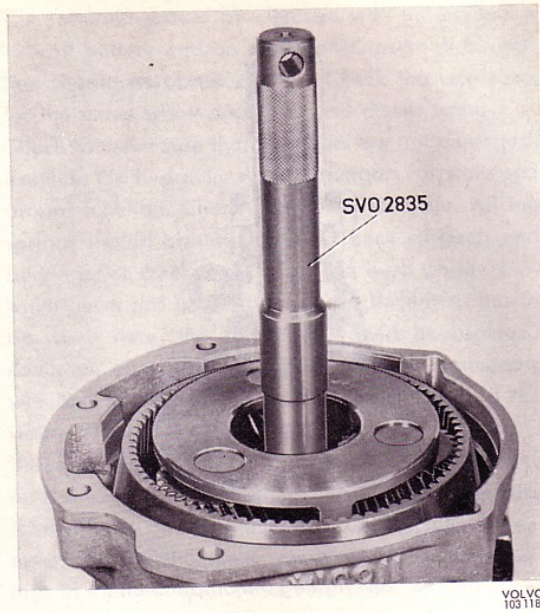


Fig. 32. Fitting the planet gear, II

ASSEMBLING THE PLANET GEAR UNIT

1. Fit the needle bearings to be followed by the spacers. Assemble the planet gear carrier, shafts, washers and planet gears, see Fig. 31. Fit the new lock pin.
2. Fit a **new** oil catcher on the planet gear assembly. Secure it with a suitably blunt chisel. N.B. The oil

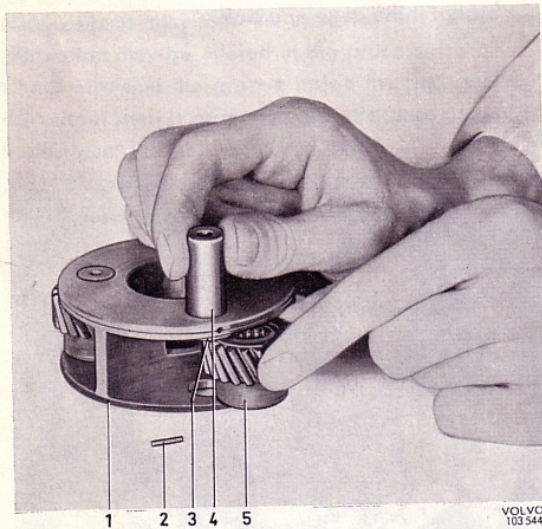


Fig. 31. Fitting the planet gears, I
1. Planet carrier 4. Shaft
2. Lock pin 5. Planet gear
3. Thrust washer

3. Place the planet gear carrier complete with planet gears in position on the output shaft. Guide the splines into the planet gear carrier and the uni-directional clutch with drift SVO 2835, see Fig. 32.

ASSEMBLING THE CLUTCH UNIT

1. Press the ball bearing into the carrier and secure with a circlip.
2. Fit the screws in the bearing cage. Then press the ball bearing with cage on to the uni-directional clutch. Secure with the circlip.
3. Fit the sunwheel on the uni-directional clutch. Secure with the circlip.
4. Fit the clutch unit in position on the output shaft. Place the four thrust springs on the bolts.

ASSEMBLING AND FITTING THE FRONT CASING

1. Fit the pressure filter. Also the relief valve components in the following order: relief valve body, dashpot sleeve, small piston unit, residual spring, large piston unit and dashpot plug, see Fig. 33.
2. Place the spindle and pump plunger in position in the casing. Then push in the cylinder, there after the valve seat, ball spring and plug.

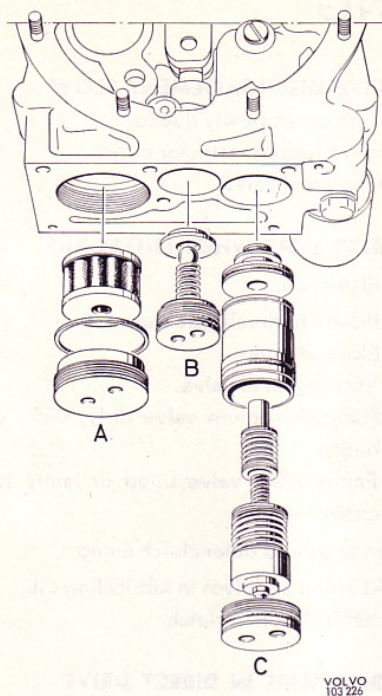


Fig. 33. Fitting the pressure filter (A), the oil pump non-return valve (B) and relief valve (C)

3. Tighten the plugs for the pressure filter, relief valve and the oil pump non-return valve with a torque wrench and tool SVO 2836. The tightening torque is 2.2 kgm (16 lb.ft.). Fit the sump filter, magnet, gasket and oil sump.
4. Fit the operating plungers in their cylinders.
5. Install the brake ring in the front casing. Fit the front casing to the rear one. Install washers and

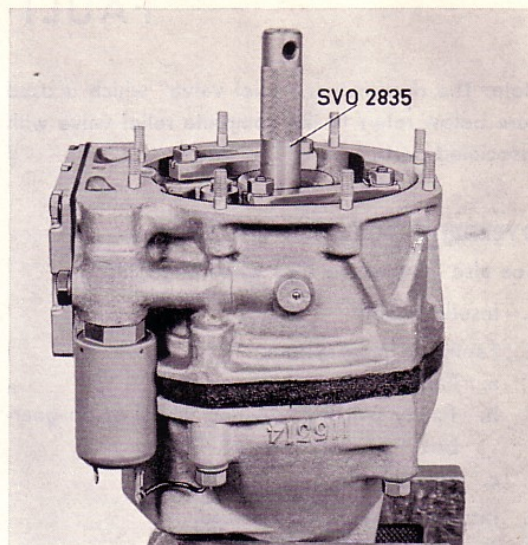


Fig. 34. Fitting the front casing

nuts, see Fig. 34. Note that both the copper washers should be fitted on the upper bolts. The threads should also be coated with sealing fluid. Tighten the nuts a little at a time until they have been tightened evenly all round.

6. Fit both the thrust washers. Tighten and lock the nuts. Fit the operating valve and solenoid.

FITTING THE OVERDRIVE UNIT

Fitting of the overdrive unit is in reverse order to removal. Fill with oil. Check oil level in the main gearbox after having driven the car 10—15 km (7—10 miles).

FAULT TRACING

Note: The designation "relief valve" which is used here below refers to the complete relief valve with associated parts.

OVERDRIVE DOES NOT ENGAGE

(see also "Overdrive slips when engaging")

1. Insufficient oil.
2. Faulty electrical system.
 - a. Faulty solenoid.
 - b. Faulty switch at steering wheel or on gear-box.
 - c. Faulty cable.
3. Insufficient hydraulic pressure.
 - a. Blocked filters.
 - b. Faulty operating valve.
 - c. Dirty check pump non-return valve.
 - d. Sticking relief valve.
4. Faulty inner components which involve the dismantling of the overdrive.

OVERDRIVE DOES NOT DISENGAGE

N.B. This calls for immediate attention. The vehicle must **not** be reversed with the overdrive engaged as this can damage the overdrive.

1. Faulty electrical system.
 - a. Faulty solenoid.
 - b. Faulty switches.
 - c. Faulty cables.
2. Hydraulic pressure remains.
 - a. Faulty relief valve.
 - b. Blocked control orifice.
3. Sticking clutch.
4. Faulty internal components which require dismantling of the overdrive unit.

OVERDRIVE DISENGAGEMENT SLOW

The pressure drops slowly due to:

- a. Partially blocked restrictor orifice.
- b. Sticking relief valve.

OVERDRIVE SLIPS WHEN ENGAGING

1. Insufficient oil.
2. Insufficient hydraulic pressure.
 - a. Blocked filters.
 - b. Sticking relief valve.
 - c. Pump non-return valve dirty, sticks or seals badly.
 - d. Faulty relief valve fitted or faulty solenoid control valve.
3. Worn or glazed outer clutch lining.
4. Anti-friction additives in lubricating oil.
5. Mechanical fault in clutch.

OVERDRIVE SLIPS IN DIRECT DRIVE

1. The direct drive pressure is too high due to:
 - a. Restrictor orifice partially blocked.
 - b. Solenoid control valve faulty.
 - c. Spring in relief valve too rigid.
2. Worn or glazed internal clutch lining.
3. Clutch springs too weak.
4. Broken or wrongly fitted sunwheel circlip.

VERY HARD ENGAGEMENT

Excessive hydraulic pressure.

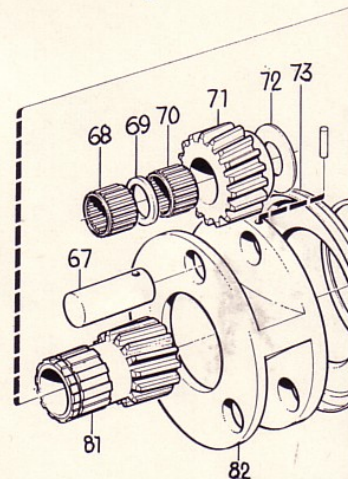
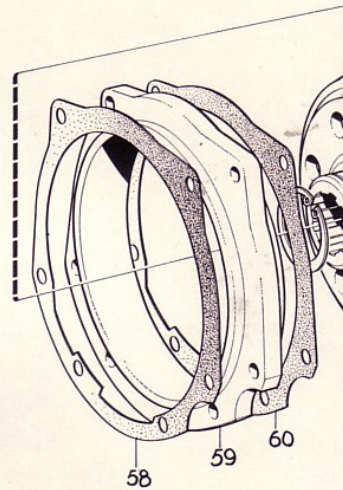
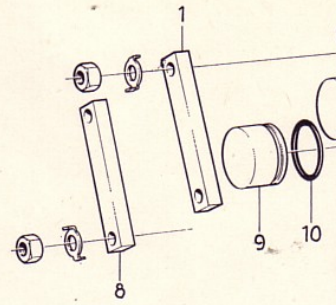
- a. Sticking relief valve.

EXTREMELY HARD DISENGAGEMENT

The control pressure for the relief valve drops too rapidly.

- a. Faulty check pump non-return valve.

- | | |
|-------------------------------------|---|
| 1. Bridge piece | 47. Dashpot spring |
| 2. Operating piston | 48. Dashpot piston |
| 3. O-ring | 49. Dashpot piston locknut |
| 4. Main case | 50. Dashpot plug |
| 5. Clutch return spring | 51. O-ring |
| 6. Thrust ball race | 52. Washer |
| 7. Thrust ring | 53. Pressure tapping plug |
| 8. Bridge piece | 54. Sump filter |
| 9. Operating piston | 55. Sump gasket |
| 10. O-ring | 56. Sump |
| 11. Pump pin | 57. Sump magnet |
| 12. Pump strap | 58. Rear case gasket |
| 13. Lubrication relief valve plug | 59. Rear case |
| 14. Lubrication relief valve spring | 60. Rear case gasket |
| 15. Steel ball | 61. Clutch sliding member |
| 16. O-ring | 62. Retainer |
| 17. Washer | 63. Oil seal |
| 18. Solenoid | 64. Speedometer bearing |
| 19. Pressure filter | 65. O-ring |
| 20. Pressure filter washer | 66. Speedometer driven gear |
| 21. Pressure filter plug | 67. Stud |
| 22. Pump plunger | 68. Needle bearing |
| 23. O-ring | 69. Washer |
| 24. Pump cylinder | 70. Needle bearing |
| 25. Non-return valve seat | 71. Planet gear |
| 26. Steel ball | 72. Washer |
| 27. Non-return valve spring | 73. Oil catcher |
| 28. Plug | 74. Oil thrower |
| 29. O-ring | 75. Free wheel carrier |
| 30. Restrictor plug | 76. Uni-directional clutch rollers |
| 31. O-ring | 77. Annulus front ball race |
| 32. Relief valve body | 78. Speedometer driving gear |
| 33. O-ring | 79. Spacer |
| 34. Dashpot sleeve | 80. Rear case |
| 35. O-ring | 81. Sunwheel |
| 36. Relief valve spindle | 82. Planet gear carrier |
| 37. Relief valve spindle plate | 83. Spring |
| 38. Relief valve spring | 84. Uni-directional clutch |
| 39. Relief valve spring cup | 85. Thrust washer |
| 40. Adjuster washer | 86. Annulus, integral with output shaft |
| 41. Residual spring | 87. Annulus ball race |
| 42. Relief valve spindle | 88. Oil seal |
| 43. Dashpot spindle | 89. Coupling flange |
| 44. Dashpot spring cup | |
| 45. Dashpot packing | |
| 46. Double dashpot spring | |



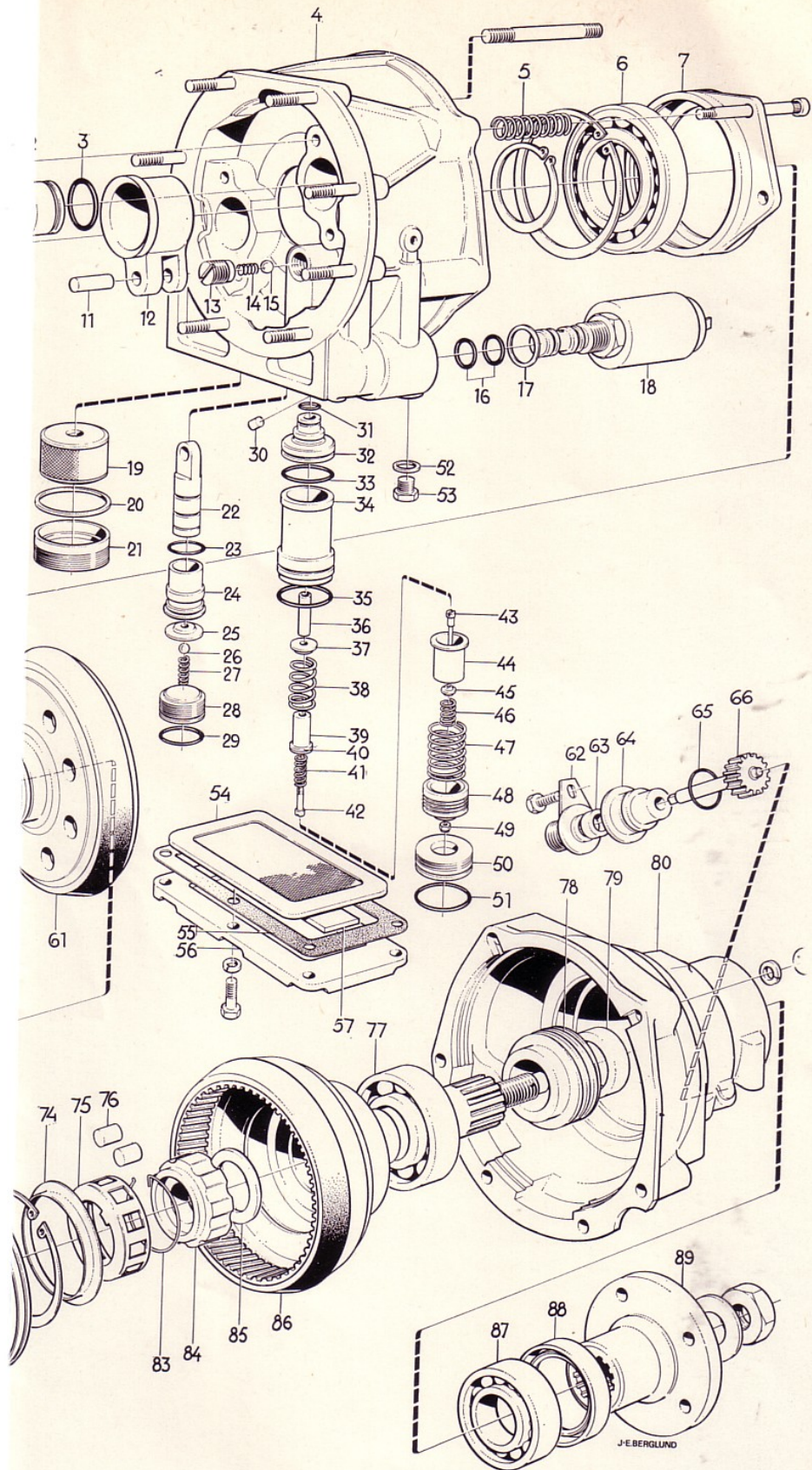


Illustration A. Overdrive

REFERENCES TO WORKSHOP BULLETINS

A series of horizontal dotted lines for writing references.

Handelstryckeriet, Göteborg

