

Part 4

POWER TRANSMISSION,
REAR AXLE

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Illustration 4-A. Clutch and clutch controls

Illustration 4-B. Gearbox

Illustration 4-C. Overdrive

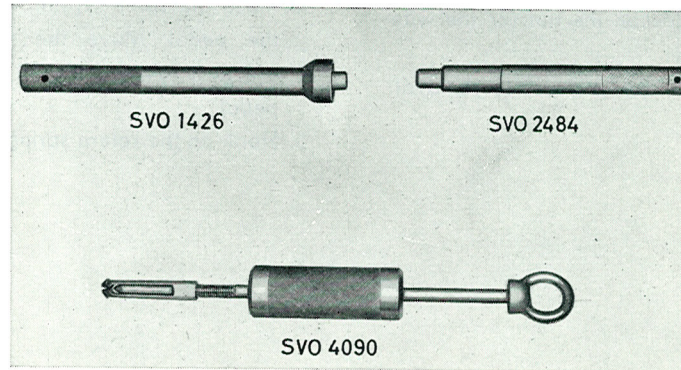
Illustration 4-D. Final Drive

GROUP 41

CLUTCH

TOOLS

The following tools are used for work on the clutch.



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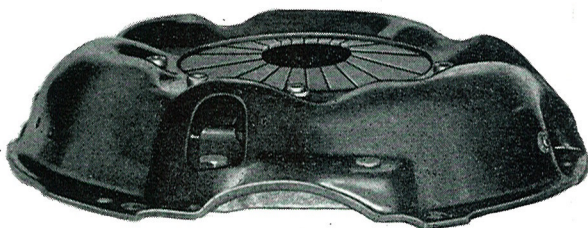
Fig. 4-1. Special tools

SVO 1426 Drift for pilot bearing in flywheel.
SVO 2484 Mandrel for centring clutch plate.
SVO 4090 Puller for ball bearing in flywheel.

DESCRIPTION

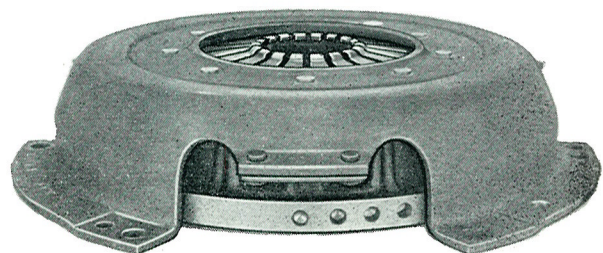
The clutch (Illustration 4-A) is of the diaphragm spring type. It is available in two different versions (Figs. 4-2 and 4-3), but both mainly consists of a pressure plate, a diaphragm spring and clutch casing. The diaphragm spring has a double function, that of the clutch lever when declutching and the pressure spring when engaging.

The clutch operation takes place by means of the clutch pedal, the movements of which are transferred to the clutch via a wire, a lever and a release bearing.



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Fig. 4-2. Clutch, type I



VOLVO
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Fig. 4-3. Clutch, type II

REPAIR INSTRUCTIONS

WORK WHICH CAN BE CARRIED OUT WITH THE CLUTCH INSTALLED

REPLACING THE CLUTCH WIRE

1. Unhook the return spring for the release fork. Slacken the rear nut and possibly the front nut a couple of turns. Disconnect the wire from the release fork.
2. Loosen the clamp holding the wire to the reinforcing member of the wheel housing.
3. Remove the panel under the dashboard. Take off the bearing bolt for the pedal. Disconnect the wire from the pedal. Slacken the nut for the wire sleeve. Remove the wire.
4. Fit the new wire in the reverse order to removal.

REPLACING THE CLUTCH PEDAL OR BUSHES

The description given below is applicable if it concerns either the replacement of the pedal or of the bushes.

1. Unhook the return spring for the pedal. Slacken the nut and remove the bolt. Disconnect the pedal from the wire and remove the pedal.
2. Take out the tubular shaft. Drive out the bushes with a suitable drift.
3. Fit the new bushes. Lubricate them with grease. Fit the tubular shaft.
4. Place the return spring on the bearing sleeve of the pedal. Move the pedal into position and attach it to the wire. Fit the bolt which holds the pedal.
5. Hook on the return spring.

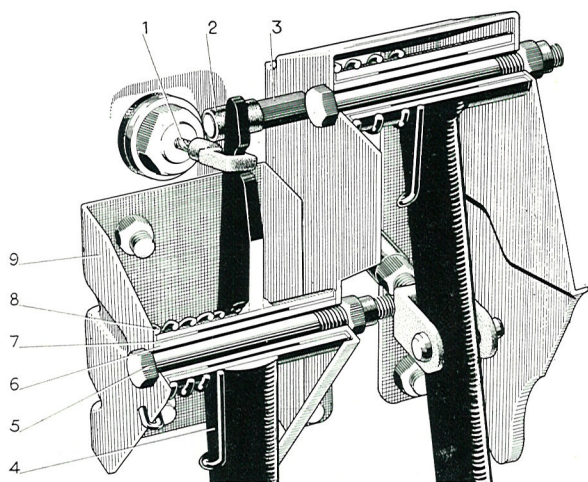


Fig. 4-4. Pedal carrier

- | | |
|------------------|------------------|
| 1. Clutch wire | 6. Shaft |
| 2. Rubber sleeve | 7. Bush |
| 3. Pedal stop | 8. Return spring |
| 4. Clutch pedal | 9. Bracket |
| 5. Bolt | |

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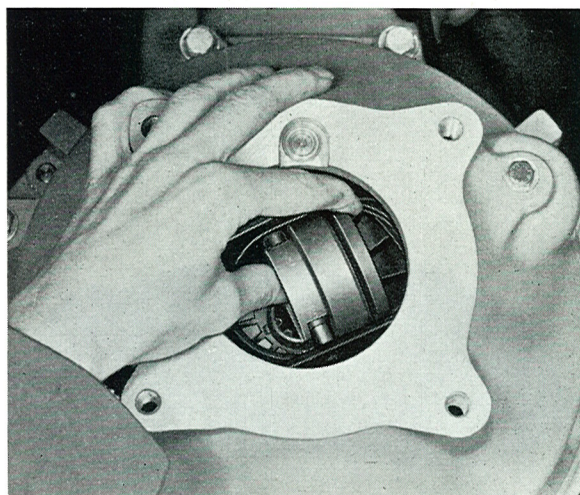


Fig. 4-5. Removing the release bearing

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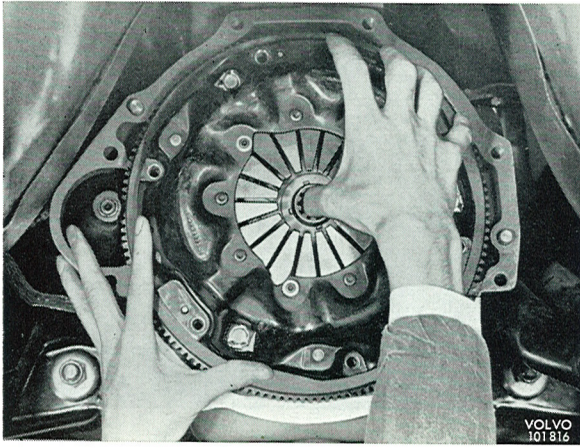


Fig. 4-6. Removing the clutch

REMOVING THE CLUTCH

1. Remove the gearbox according to the instructions given in Group 43.
2. Remove the upper bolt for the starter motor.
3. Remove the release bearing. Disconnect the wire from the release fork. Slacken the wire sleeve from the bracket.

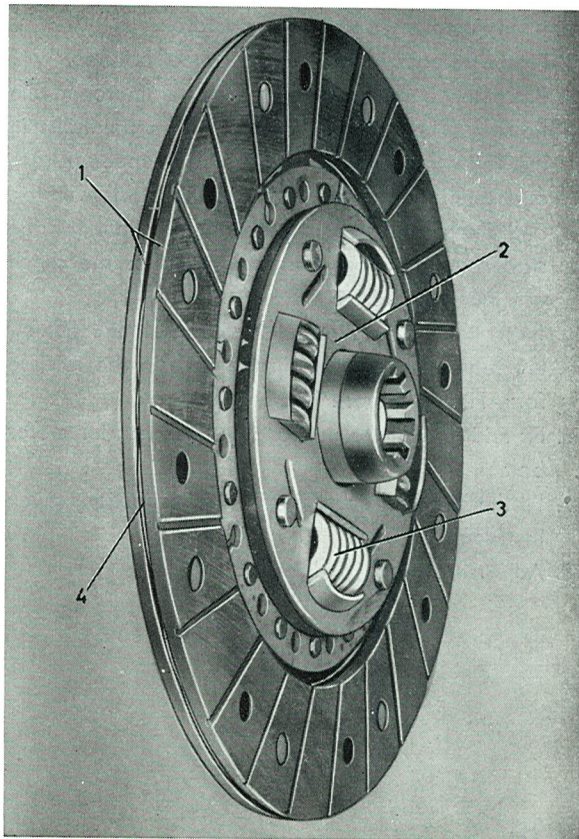


Fig. 4-7. Clutch disc

1. Facings 2. Hub 3. Spring 4. Disc

4. Slacken the bolts and remove the flywheel housing.
5. Slacken the bolt for the release fork ball joint. Remove the ball and the release fork.
6. Slacken the bolts holding the clutch to the flywheel by loosening them crosswise a couple of turns at a time to prevent warping. Remove the clutch and clutch plate.

REPLACING THE CLUTCH FACINGS

1. Drill out the old rivets with a drill having the same diameter as the rivets, 3.5 mm (0.14"), and remove the old facings.
2. Check the clutch plate. The indentations on the tongues should be even. The clutch plate must not be warped. The clutch springs and rivets in the hub should fit securely and not show any signs of looseness. Check to make sure that there are no cracks.
If the clutch plate has any of the above defects, it should be replaced with a new one.
3. Rivet on the new facings (preferably in a rivet press). N.B. The rivets should be inserted from the side on which the facing lies and riveted up from the opposite direction against the disc. Use every other hole in the facing. After riveting, the facings should be spaced from each other as determined by the indentations on the clutch disc. See Fig. 4-7. This is most important in order to achieve a smooth engagement when starting and driving.

The clutch facings must be absolutely free from oil. Oil on the facings can cause clutch grabbing.

INPUT SHAFT BEARING IN THE FLYWHEEL

1. The bearing is pulled out with puller SVO 4090, see Fig. 4-8. The bearing is cleaned in petrol

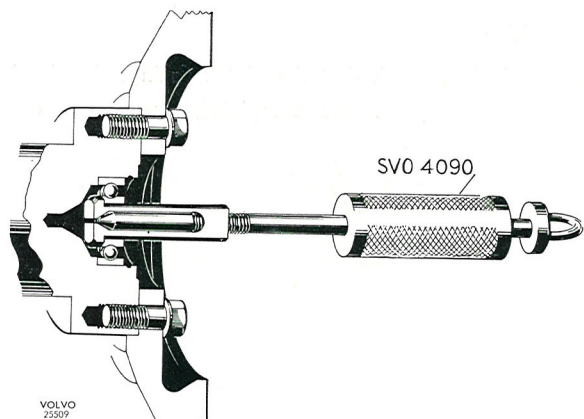


Fig. 4-8. Removing the pilot bearing

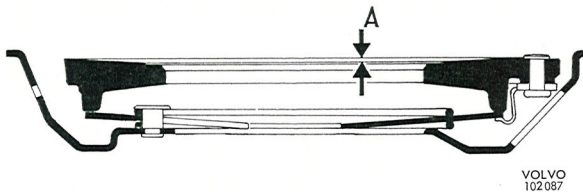


Fig. 4-9. Checking the curvature of the pressure plate

(gasoline). If the bearing, upon inspection, runs smoothly and evenly and has no noticeable play, it should be packed with ball bearing grease and refitted. N.B. Heat-resistant grease should be used.

The bearing should be pressed in by drift SVO 1426.

INSPECTING

As the clutch cannot be dismantled, it must be replaced completely if faulty. Check the clutch carefully. Check the pressure plate for damage by heat, cracks, scoring or other damage on the friction surface. Check the curvature of the pressure plate with a 240 mm (9½") long steel ruler, which is placed diagonally across the friction surface of the pressure plate. Then measure the distance between the straight edge of the ruler and the inner diameter of the pressure plate. This measurement must not exceed a maximum 0.03 (0.0012"), see Fig. 4-9. There must be no "crowning", i.e. clearance between the straight edge of the ruler and the outer diameter of the pressure plate. Carry out the check at several points. Check the pressure spring carefully; if it is cracked or damaged in any other way, the clutch should be replaced.

Check the release bearing by turning it round a few times under light pressure so that the balls rotate against the races. The bearing should turn easily without binding at any point. The release bearing should also slide easily on the guide sleeve from the gearbox.

FITTING

Before fitting, check that the clutch facings, flywheel and pressure plate are completely free from oil.

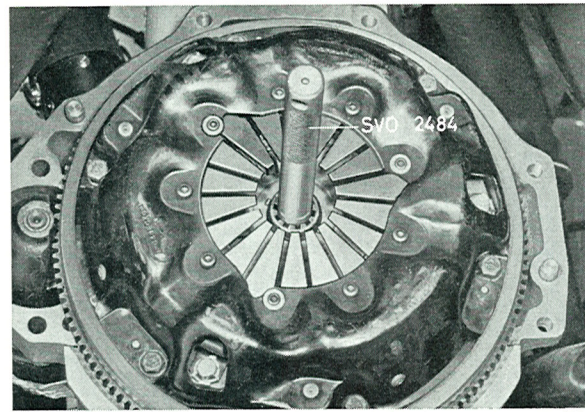


Fig. 4-10. Fitting the clutch

Wash them with clean petrol (gasoline) and wipe off well with a clean piece of cloth.

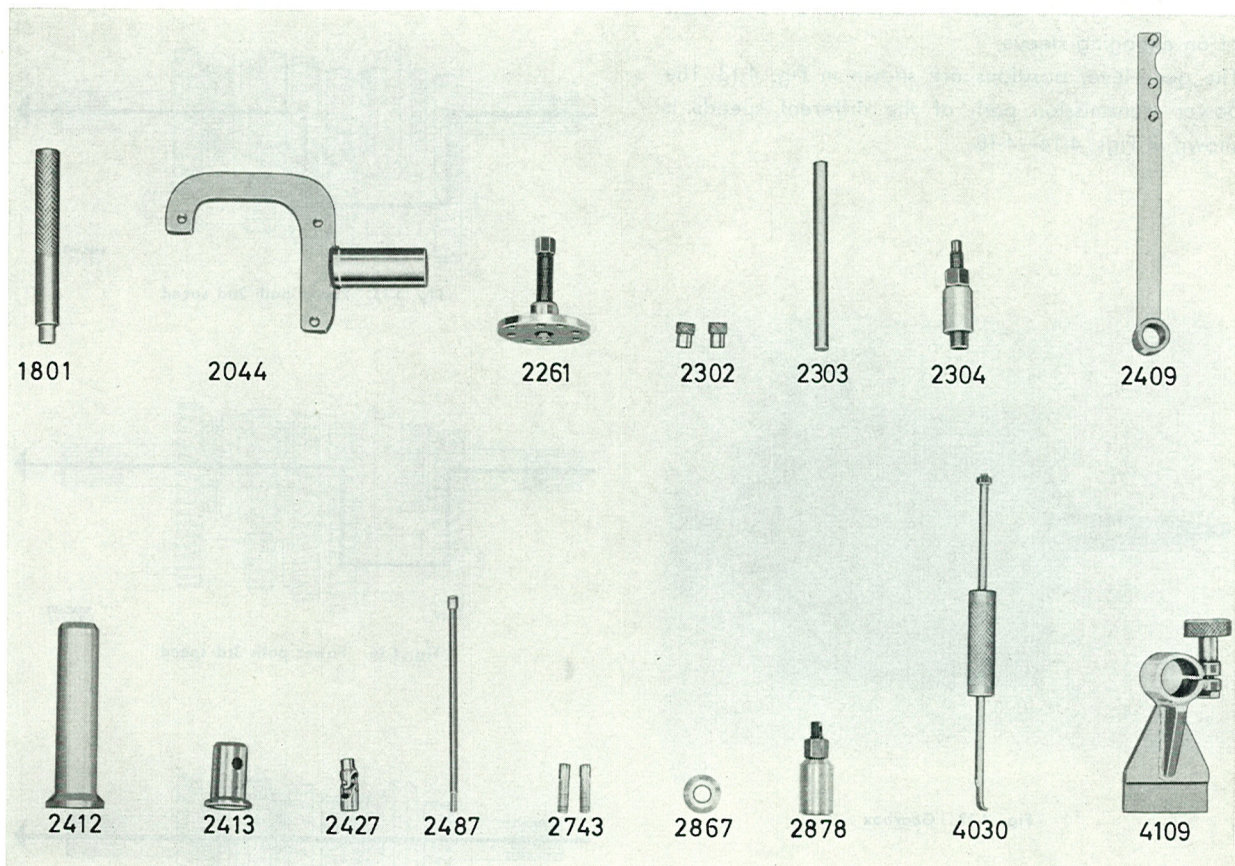
1. Set up the clutch plate (the longest side of the hub facing backwards) together with the clutch and insert the centering mandrel SVO 2484 so that the guide journal on this centres the pilot bearing in the flywheel, see Fig. 4-10.
2. Place in the six bolts which hold the clutch and tighten them crosswise a couple of turns at a time. Remove the centering mandrel.
3. Fit the release yoke in the flywheel housing.
4. Place the upper bolt for the starter motor in the housing. Then fit the housing. Fit on the bolts in the following order: First the four upper (7/16"), and then the lower bolts for the starter motor, and finally the two lower (3/8"). The nut for the starter motor upper bolt is fitted after the clutch wire has been fitted.
5. Insert the wire sleeve in the bracket and put on the rear nut. Securely fix the wire in the release fork. Fit the release bearing.
6. Fit and tighten the nut for the upper starter motor bolt.
7. Fit the gearbox according to the instructions given in Group 43.
8. Adjust the clutch pedal play.

GROUP 43 A

GEARBOX

TOOLS

The following special tools are required for carrying out gearbox repairs.



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Fig. 4-11. Special tools

- | | | | |
|----------|--|----------|--|
| SVO 1801 | Standard handle 18×200 mm. | SVO 2413 | Fitting drift for oil seal in rear cover. |
| SVO 2044 | Fixture for gearbox when dismantling and assembling.
(used together with SVO 4109). | SVO 2427 | Universal joint for SVO 2487. |
| SVO 2261 | Puller for flanges. | SVO 2487 | 3/8" hexagon socket spanner for upper gearbox bolts. |
| SVO 2302 | Guide plug for thrust washer, used (two) together with
SVO 2303 when fitting idler gear. | SVO 2743 | Dowels for gearbox. |
| SVO 2303 | Drift for fitting idler gear. | SVO 2867 | Fitting drift for oil seal in cover for input shaft. |
| SVO 2304 | Press tool for fitting yoke (flange). | SVO 2878 | Puller for removing reverse shaft. |
| SVO 2409 | Counterhold for yoke (flange). | SVO 4030 | Puller for oil seal on (flange) yoke. |
| SVO 2412 | Fitting drift for bearing on input shaft, for bearing in
rear cover output shaft and for fitting input shaft
in housing. | SVO 4109 | Stand for fixture SVO 2044. |

The following tool is also used for removing the gearbox:

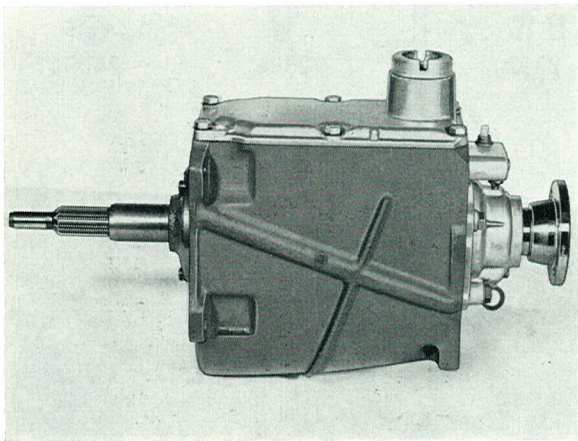
SVO 2727 Engine suspension device.

DESCRIPTION

(Concerning gearbox with overdrive [M 41], see also Group 43 B "Overdrive")

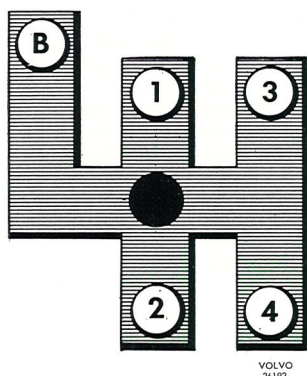
M 40 is a four-speed fully synchronized gearbox. The fact that the gearbox is fully synchronized means that there is synchronization on all the forward gears. The construction of the gearbox is shown in Fig. 4-12 and Illustration 4-B. All gears with the exception of reverse are in constant mesh with one other. In the neutral position the gears on the mainshaft rotate freely. For this reason they are provided with bronze bushes. When engaging a gear, the corresponding gear wheel is connected to the mainshaft by means of an engaging sleeve.

The gear lever positions are shown in Fig. 4-13. The power transmission path of the different speeds is shown in Figs. 4-14—4-18.



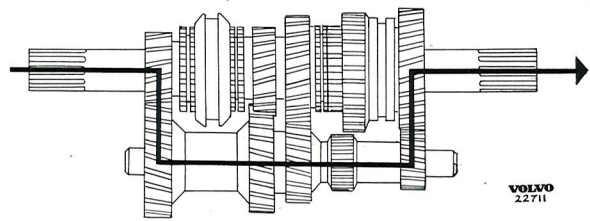
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Fig. 4-12. Gearbox



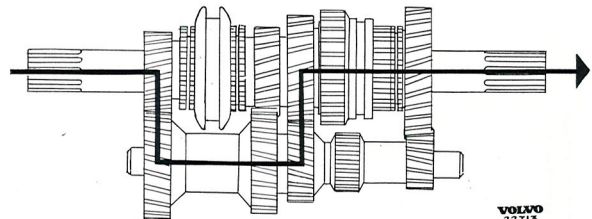
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Fig. 4-13. Gear lever positions



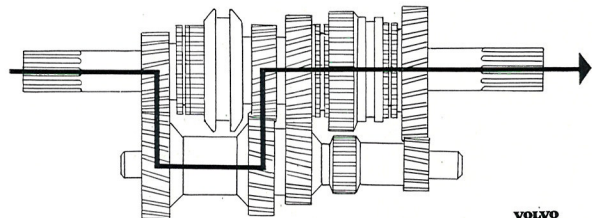
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Fig. 4-14. Power path 1st speed



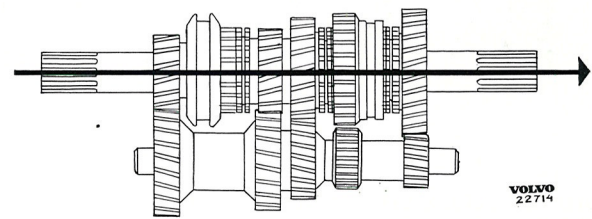
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Fig. 4-15. Power path 2nd speed



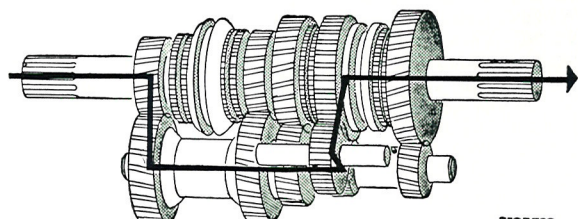
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Fig. 4-16. Power path 3rd speed



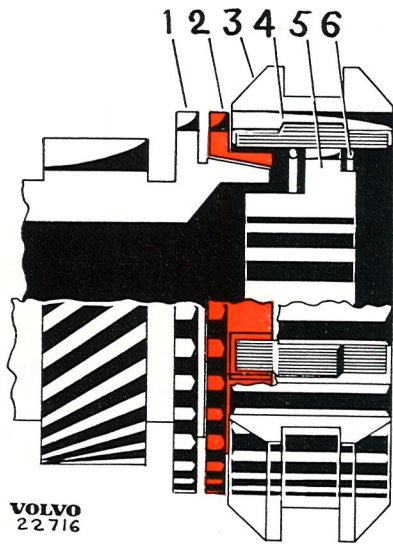
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Fig. 4-17. Power path 4th speed



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Fig. 4-18. Power path reverse gear

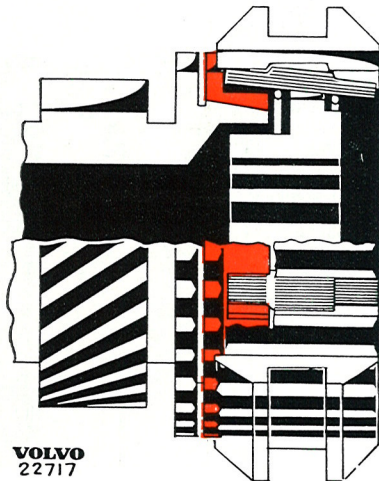


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Fig. 4-19. Neutral position

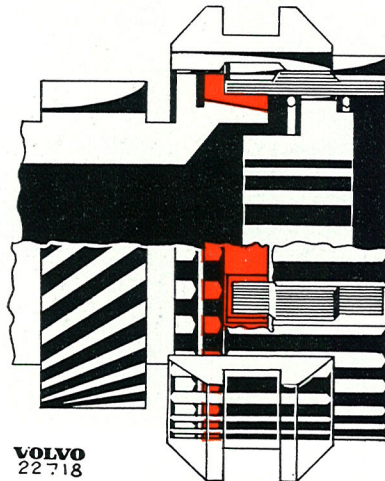
- | | |
|-----------------------|----------------------|
| 1. Ring gear | 4. Engaging spring |
| 2. Synchronizing cone | 5. Synchronizing hub |
| 3. Engaging sleeve | 6. Spring |

The design and function of the synchronizing mechanism is shown in Figs. 4-19—4-21. When a gear is engaged, the gear selector fork presses the engaging sleeve (3, Fig. 4-19) towards the corresponding gear wheel. The engaging springs (4) then press the synchronizing cone (2) against the cone on the gear wheel (1). If the synchronizer and gear wheels are rotating at different speeds, the synchronizing cone will turn in relation to the engaging sleeve. However, the synchronizing cone is prevented from turning more than half a tooth-width by the engaging springs, see Fig. 4-20. The teeth on the synchronizing cone then have half their width in contact with the teeth on the engaging sleeve and in this way prevent it from engaging. Due to friction between the synchronizing cone and the gear wheel, the gear wheel attains the same rotational speed as the synchronizer. When they are both rotating at the same speed, the engaging sleeve is able to turn back the synchronizing cone and the gear engages, see Fig. 4-21.



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Fig. 4-20. Synchronizing



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Fig. 4-21. Gear engaged

REPAIR INSTRUCTIONS

WORK WHICH CAN BE CARRIED OUT WITH THE GEARBOX INSTALLED IN THE VEHICLE

REPLACING THE OIL SEAL

1. Carry out operations 1—5 under the heading "Removing" as far as is necessary.
2. Slacken the yoke (flange) nut. USE SVO 2409 as a counterhold, see Fig. 4-22. Pull off the yoke (flange). Use puller SVO 2261, see Fig. 4-23.
3. Pull out the old oil seal with puller SVO 4030, see Fig. 4-24. Fit the new seal with the help of sleeve SVO 2413, see Fig. 4-25.

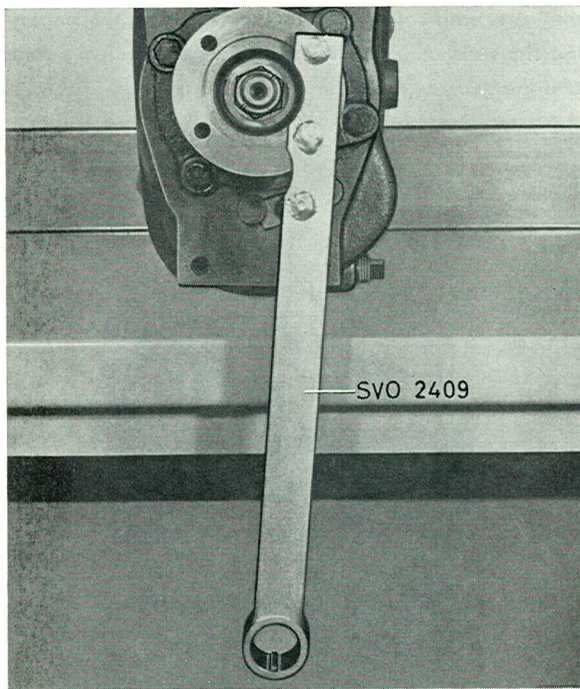


Fig. 4-22. Counterhold for yoke (flange)

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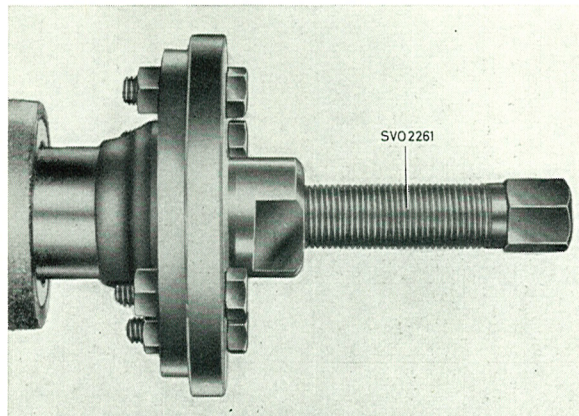


Fig. 4-23. Removing the yoke (flange)

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4. Press on the yoke (flange) with tool SVO 2304, see Fig. 4-26. Fit the remaining parts.

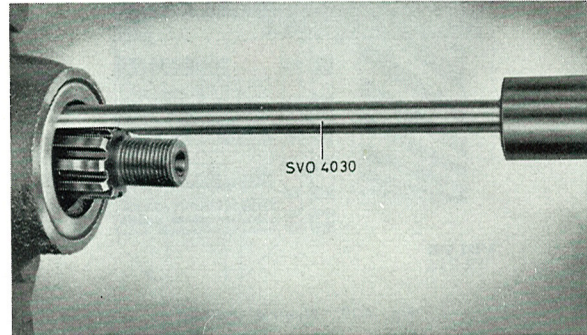


Fig. 4-24. Removing the oil seal

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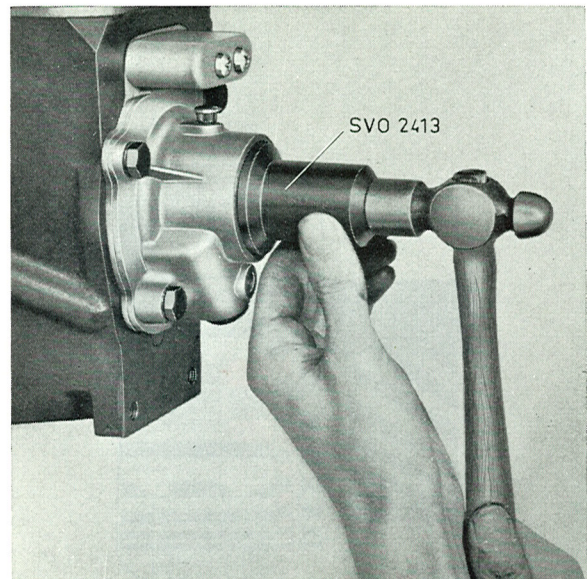


Fig. 4-25. Fitting the oil seal

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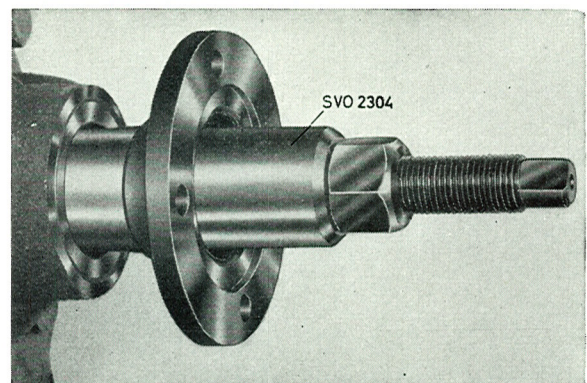
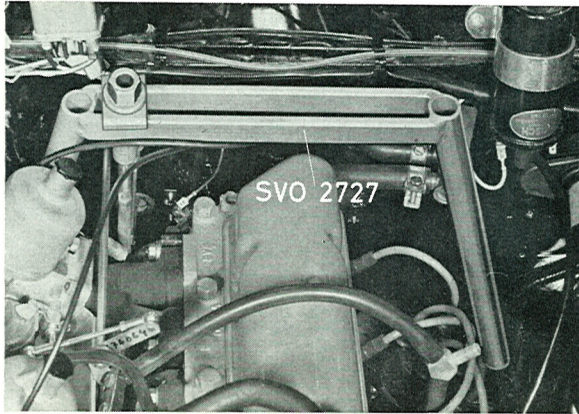


Fig. 4-26. Fitting the yoke (flange)

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Fig. 4-27. Suspending the engine

REMOVING

1. Fix tool SVO 2727 on the engine, see Fig. 4-27. Place the lifting hook round the exhaust pipe.
2. Remove the rubber protector and gear lever.
3. Jack up the vehicle and place blocks underneath. Begin with the rear end. Drain the oil from the gearbox.
4. Loosen and remove the supporting member under the gearbox. Disconnect the front universal joint from the gearbox yoke (flange). Disconnect the speedometer cable. Disconnect the rear engine mounting and the bracket for the exhaust pipe.
5. Lower the rear end of the engine about 2 cm (0.8") and then slacken the lines for the reversing lights and overdrive, if fitted.
6. Slacken the right upper and left lower gearbox bolts with spanner SVO 2487, swivelling joint SVO 2427, extension piece with 3/8" square end and ratchet handle, see Fig. 4-28. Fit two guide pins SVO 2743, see Fig. 4-43. Slacken the other two bolts. Pull out the gearbox backwards and lower it.

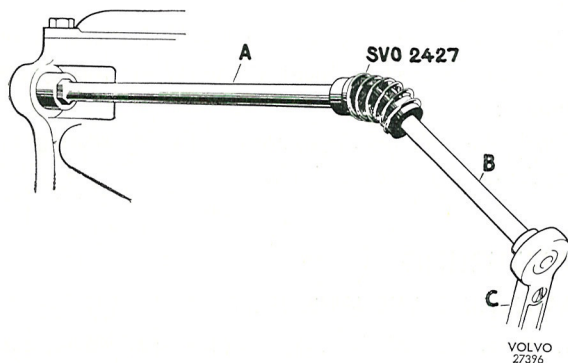


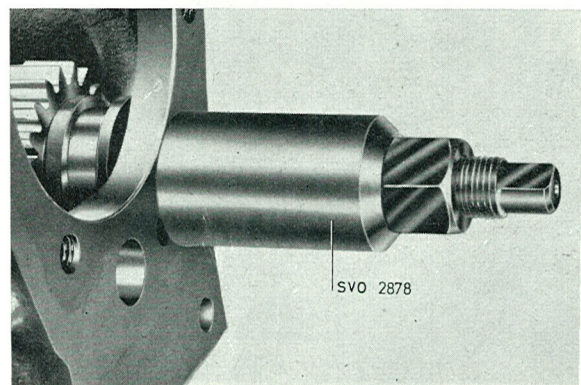
Fig. 4-28. Removing the gearbox bolts

- A = SVO 2487
 B = Extension with 3/8" square
 C = Ratchet handle

DISMANTLING

The following description applies to gearboxes without overdrive. If the gearbox is fitted with an overdrive, unscrew the bolts in the rear end and remove the overdrive. Then carry out the operations described below as far as necessary.

1. Secure stand SVO 4109 and fixture SVO 2044 in a vice. Place the gearbox in the fixture.
2. Unscrew the bolts for the gearbox cover. Lift off the cover. Remove the springs and interlock balls for the selector rails.
3. Remove the cover over the selector rails. Unscrew the selector fork bolts.
4. Slide the selector fork backwards to 1st speed position. Drive out the pin slightly (it must not foul the 1st speed gear wheel). Then move the selector fork forwards sufficiently to allow the pin to pass in front of the gear wheel. Drive out the pin.
5. Slide out the selector rails. When doing this, hold the selector forks so that they do not come askew and jam on the rails. Remove the selector forks.
6. Unscrew the bolts for the rear cover. Turn the cover so that it does not lock the shaft for the idler and reverse gears. Drive out the shaft for the idler gear. **N. B. The shaft must be driven out backwards.** Let the idler gear fall into the bottom of the gearbox.
7. Pull out the mainshaft.
8. Unscrew the bolts and remove the cover over the input shaft. Prise out the oil seal from the cover with a screwdriver or similar.
9. Drive out the input shaft. If necessary, remove the circlip and press the ball bearing off the shaft.
10. Take out the idler gear. Pull out the shaft for the reverse gear with puller SVO 2878, see Fig. 4-29. Take out the reverse gear and other parts.



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Fig. 4-29. Removing the reverse gear

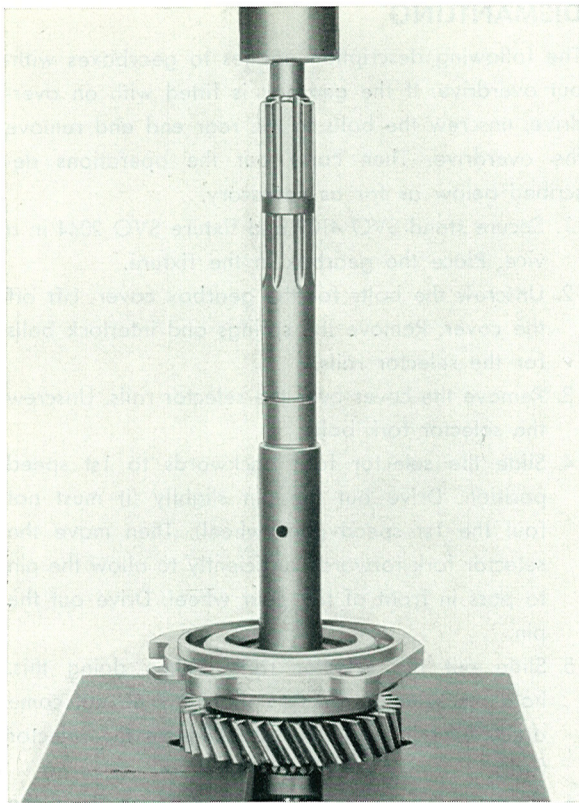


Fig. 4-30. Dismantling the mainshaft, M 41

DISMANTLING THE MAINSHAFT

1a. Gearbox with overdrive (M41):

Remove the circlip and press off the rotor for the overdrive oil pump. Remove the circlip for the

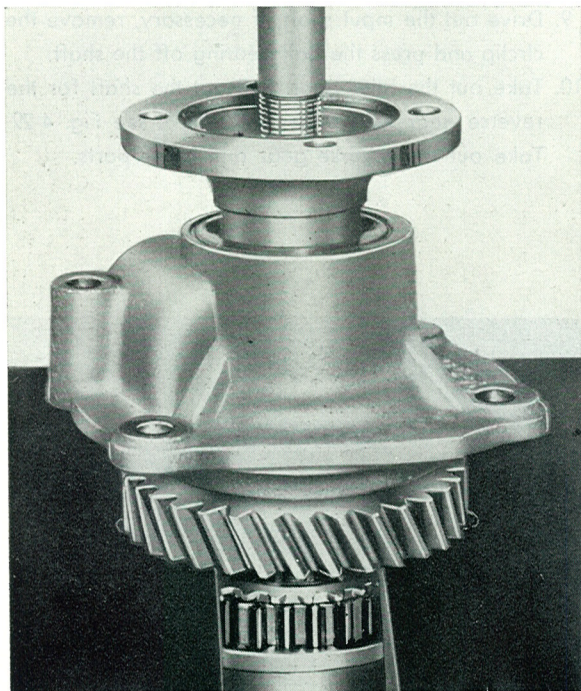


Fig. 4-31. Dismantling the mainshaft, M 40

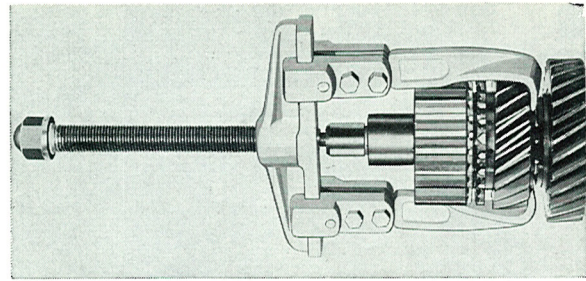


Fig. 4-32. Removing the front synchronizer

mainshaft rear bearing. Slide the engaging sleeve for 1st speed and 2nd speed forwards. Place the shaft in a press and a support under the 1st speed gear wheel. Press out the shaft as shown in Fig. 4-30.

1b. Gearbox without overdrive:

Unscrew the yoke (flange) nut. Use SVO 2409 as a counterhold on the yoke (flange). Slide the engaging sleeve for 1st speed and 2nd speed forwards. Place the shaft in a press and a support under the 1st speed gear wheel. Press out the shaft with a drift, see Fig. 4-31.

2. Remove the synchronizing cone, thrust washer, engaging sleeves, engaging springs, and snap springs from the shaft.
3. Remove the circlip on the front end of the shaft. Pull off the synchronizing hub and 3rd speed gear wheel with a puller, see Fig. 4-32. Remove the thrust washer.
4. Remove the circlip and then the thrust washer, 2nd speed gear wheel, synchronizing cone and spring.
5. Remove the oil seal from the rear cover and take out the speedometer gear. If necessary, remove the circlips and press out the ball bearing.

INSPECTING

Check the gear wheels, particularly for cracks or chips on the tooth surfaces. Damaged or worn gears must be replaced.

Check the ball bearings, particularly for scoring or cracks on the races or balls.

ASSEMBLING

ASSEMBLING THE MAINSHAFT

1. Press the ball bearing into the rear cover, see Fig. 4-33, and fit the circlip. There are different thicknesses of circlips, so select one which fits snugly into the groove.

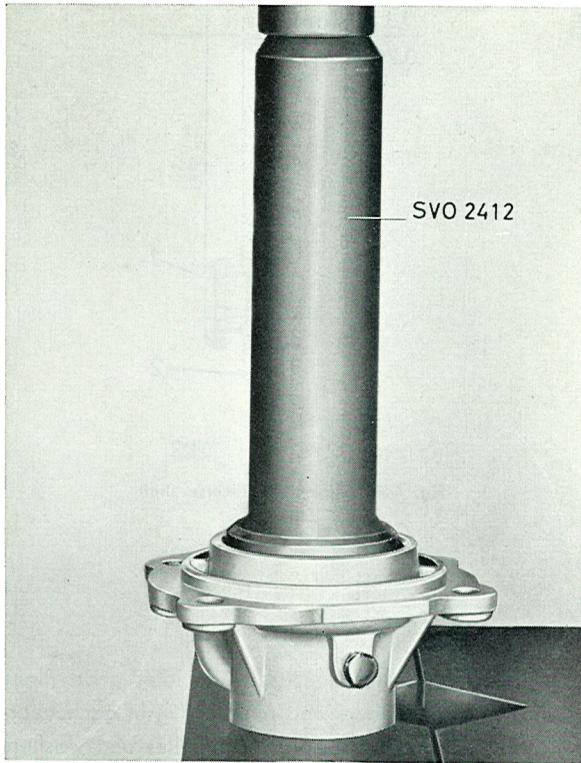


Fig. 4-33. Fitting the ball bearing in rear cover

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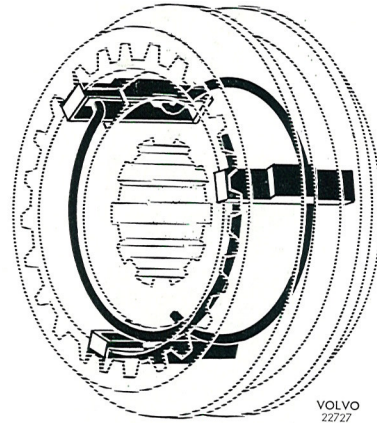


Fig. 4-35. Assembling the synchronizer

2. Gearbox without overdrive:
Place the speedometer gear on the bearing in the oil seal with drift SVO 2413, see Fig. 4-34.
3. Fit the parts for the 1st and 2nd synchronizer on the mainshaft. Fit the snap rings correctly, see Fig. 4-35.

4a. Gearbox without overdrive:

Fit the synchronizing cone, 1st speed gear wheel and thrust washer. Place the rear cover on the shaft. Ensure that the speedometer gear is positioned correctly. Fit on the yoke (flange). Use a sleeve which fits into the recess in the yoke (flange), press on the cover and yoke (flange), see Fig. 4-36. Place on the washer and nut for the (flange) yoke. Use SVO 2409 as a counterhold on the yoke (flange) and tighten the nut.

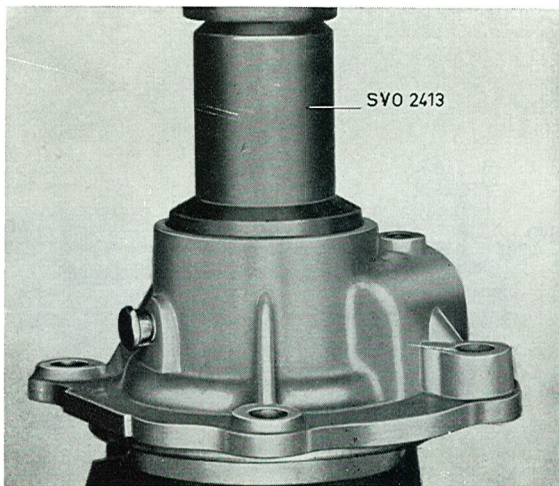


Fig. 4-34. Fitting the oil seal in rear cover

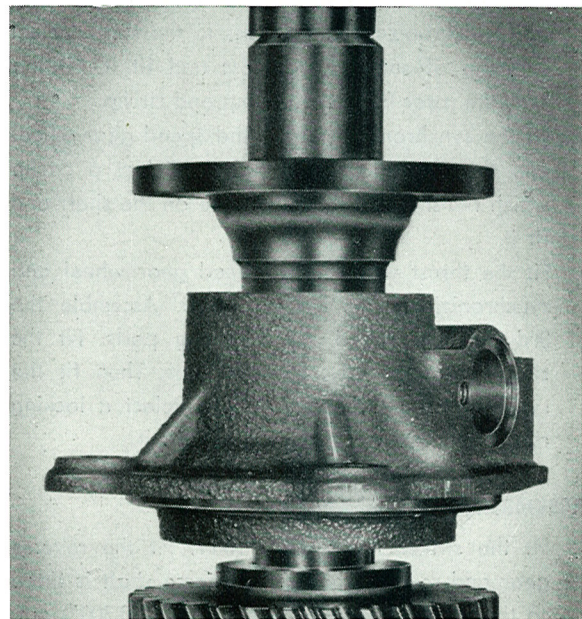


Fig. 4-36. Fitting the rear cover M 40

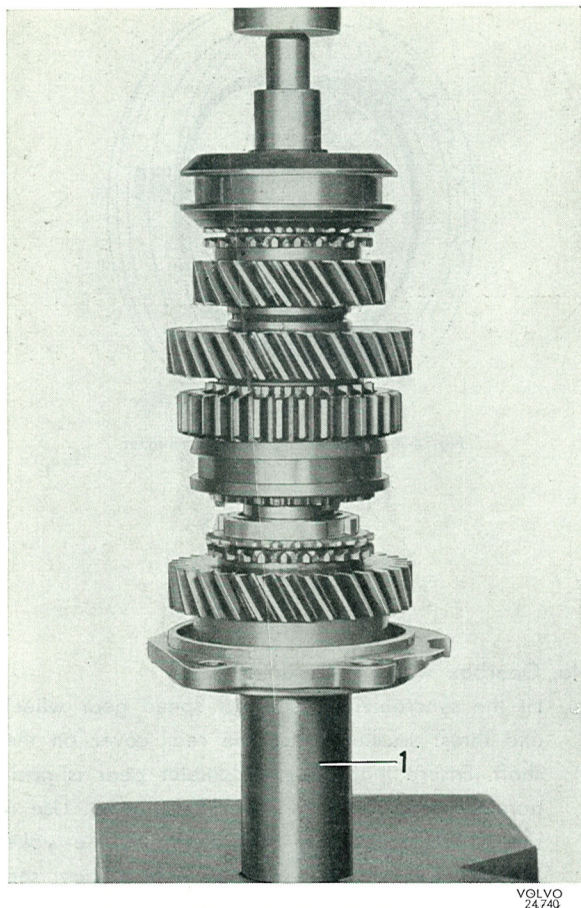


Fig. 4-37. Fitting the rear cover, M 41
1. Sleeve

4b. Gearbox with overdrive (M 41):

Place the rear cover and ball bearing on a cushioning ring or sleeve as shown in Fig. 4-37. Place on the thrust washer, 1st speed gear wheel and synchronizing cone. Press in the shaft. Select a circlip of suitable thickness and fit it. Fit the key, the rotor for the oil pump and circlip.

5. Fit the synchronizing cone, 2nd speed gear wheel and thrust washer on the shaft. Select a circlip which fits snugly into the groove on the shaft and fit it.

6. Fit the thrust washer, 3rd speed gear wheel and synchronizing cone on the shaft. Assemble the 3rd and 4th speed synchronizing parts. Fit the snap rings correctly, see Fig. 4-35. Then fit the synchronizer on the main shaft. Select a locking ring of the correct thickness and fit it.

ASSEMBLING THE GEARBOX

1. Fit the striker lever and striker. Fit the reverse gear and reverse shaft. The reverse shaft is fitted so that it projects 7.0—7.6 mm (0.276—0.300") outside the gearbox housing, see Fig. 4-38.

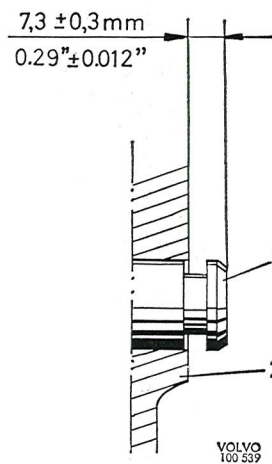


Fig. 4-38. Fitting the reverse shaft

2. Place mandrel SVO 2303 in the idler gear. Place in spacing washers and needles (24 in each bearing). Use grease to hold the needles and washers in position.

3. Fix the washers to the housing with grease and guide them up into position with the centering plugs SVO 2302, see Fig. 4-39. Lay the idler gear in the bottom of the housing.

4. Press the bearing onto the input shaft with the help of drift SVO 2412, see Fig. 4-40. Select a circlip of suitable thickness and fit it. Place the 14 bearing rollers for the mainshaft in position in the input shaft. Use grease to hold the rollers in place. Press the input shaft into position in the housing. Press the oil seal into the cover with drift SVO 2867.

Then fit the cover over the input shaft. Do not forget the O-rings for the bolts (late production).

5. Place the mainshaft in the housing. Turn the rear cover so that the countershaft can be fitted.

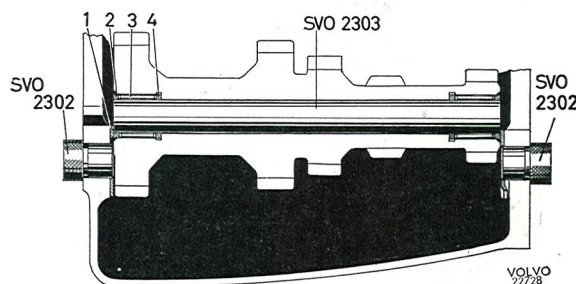


Fig. 4-39. Fitting idler gear

- | | |
|-------------------|-------------------|
| 1. Thrust washer | 3. Needle bearing |
| 2. Spacing washer | 4. Spacing washer |

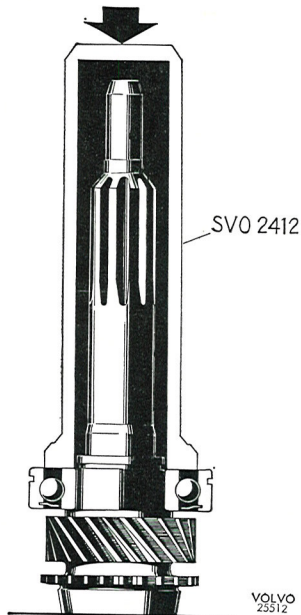


Fig. 4-40. Fitting ball bearing on input shaft

6. Turn the gearbox upside down. Fit the countershaft from the rear. Hold against SVO 2303 with the hand. Ensure that the thrust washers do not loosen and fall down.
- 7a. Gearboxes without overdrive:
Fit the bolts for the rear cover.
- 7b. Gearboxes with overdrive:
Fit the overdrive. Use new locking for the intermediate flange.

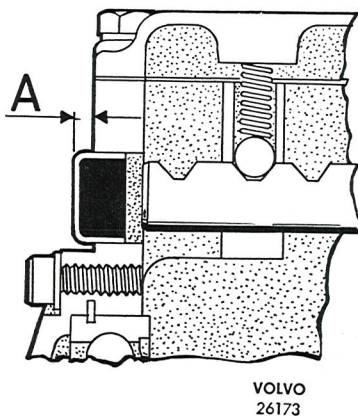


Fig. 4-41. Fitting end cap over selector rail

A = approx. 4 mm (0.16")

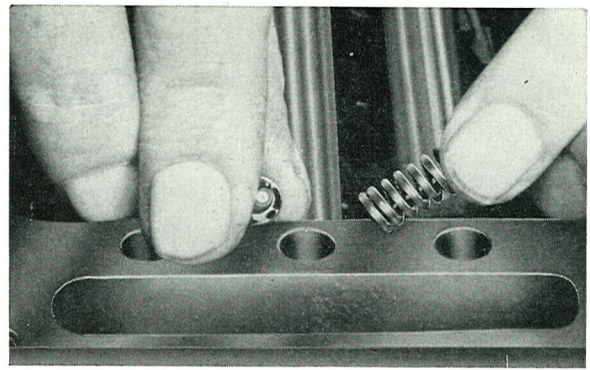


Fig. 4-42. Fitting interlock balls and springs

8. Fit the selector rails and forks. Move over the selector fork to the rear position when fitting the pin. Use a new pin. Fit the cover over the selector rails.
N. B. If the end caps at the front end of the housing have been removed, these should be fitted in the same way as previously, i.e. the centre end cap should project about 4 mm (0.16") outside the face of the housing, see Fig. 4-41.
9. Place the interlock balls and springs in position, see Fig. 4-42. Fit on the gearbox cover. Check that all the gears engage and disengage freely.

FITTING

Make sure that guide pins SVO 2743 are fitted acc. to Fig. 4-43. Fitting is done in the reverse order to removing. Fill up the gearbox with oil.

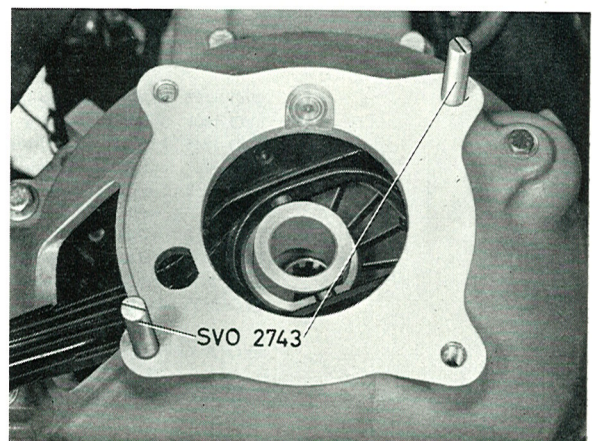


Fig. 4-43. Guide pins for gearbox

GROUP 43 B

OVERDRIVE

TOOLS

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

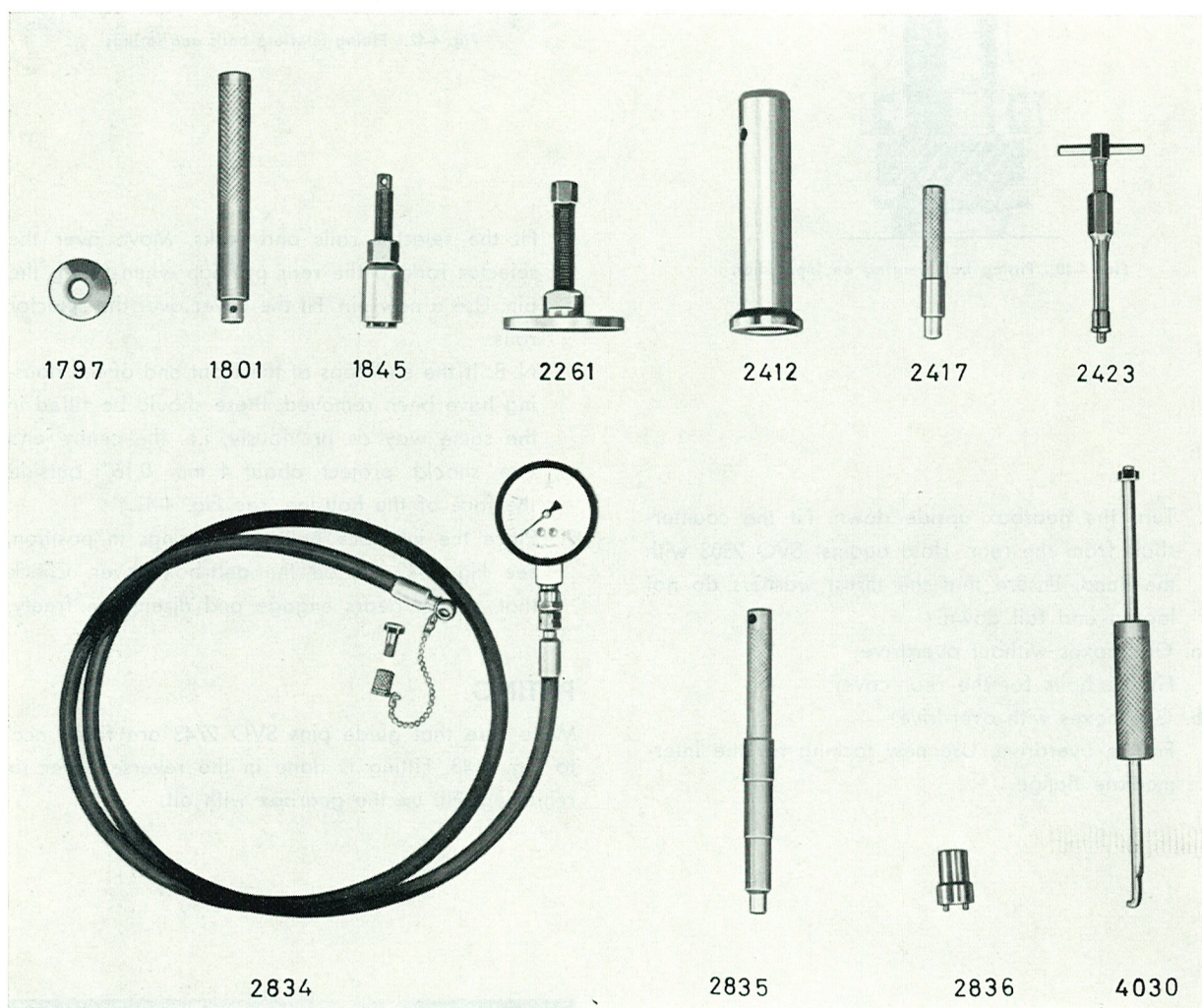


Fig. 4-44. Special tools

- SVO 1797 Drift for removing rear bearing shaft
- SVO 1801 Standard handle
- SVO 1845 Press tool for fitting flange
- SVO 2261 Puller for flange
- SVO 2412 Sleeve drift for fitting front rear bearing 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 undirection 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 Fig 4-52 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. 4-45, 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. 4-45) with the help of the pistons (27, Fig. 4-52) 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 an 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. 4-49.

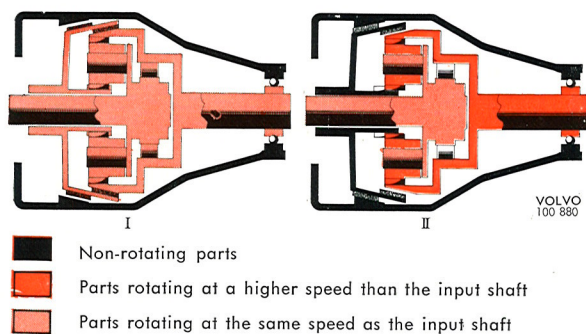


Fig. 4-45. Working principle of the overdrive

- I. Direct drive position
- II. Overdrive position

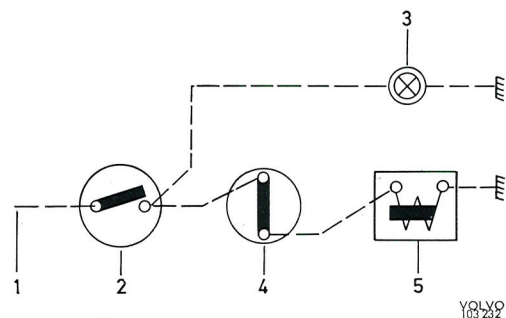


Fig. 4-46. Electrical circuit diagram

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

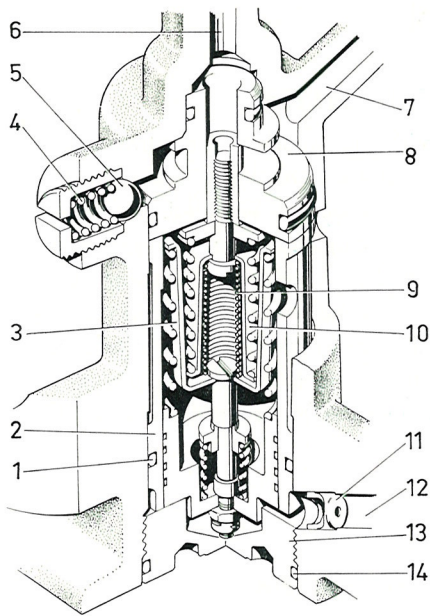


Fig. 4-47. Relief valve

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

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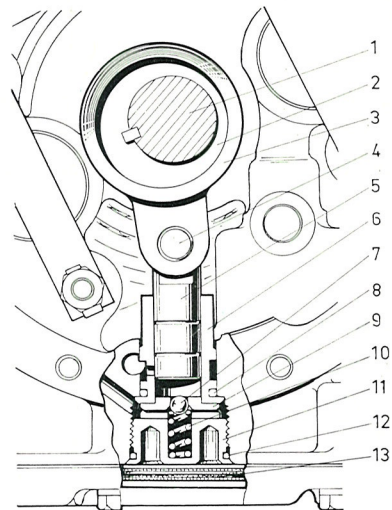


Fig. 4-48. Oil pump

- | | |
|-------------------|----------------|
| 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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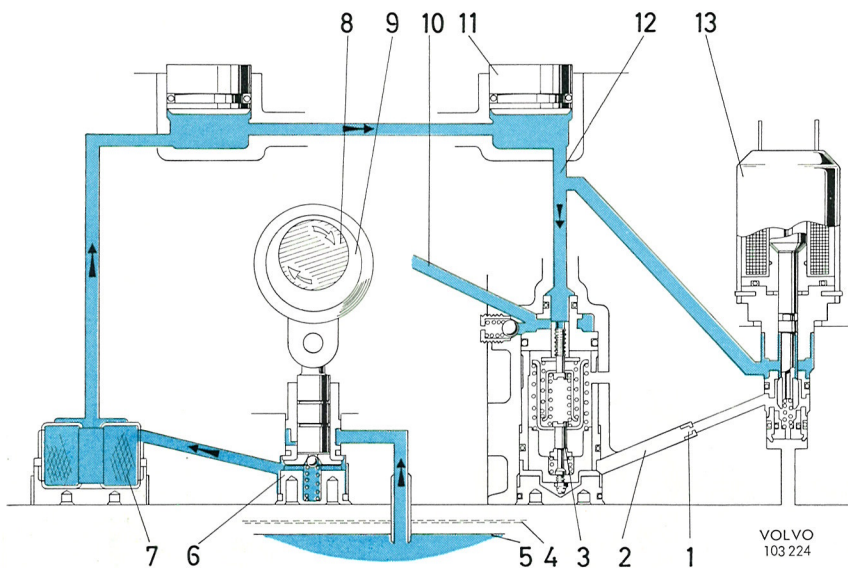


Fig. 4-49. Function with direct drive

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

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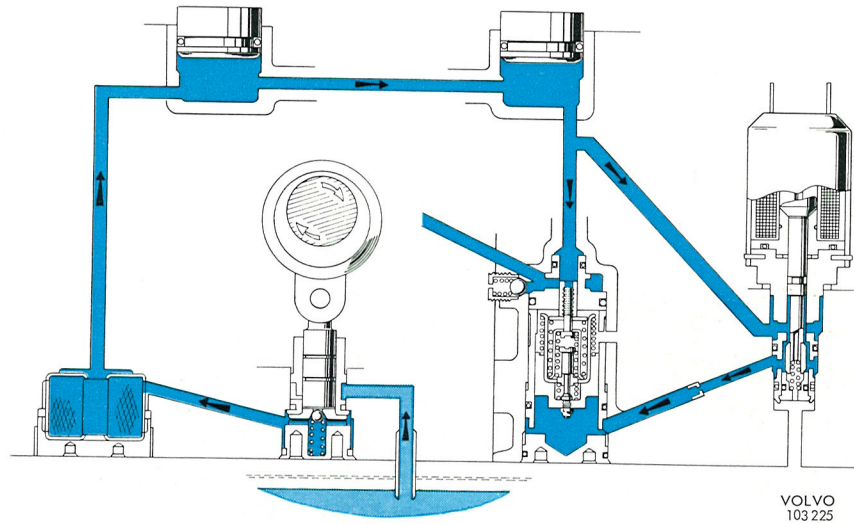


Fig. 4-50. Overdrive in function

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 led via the planet gear back to the gear-box housing, see Fig. 4-51.

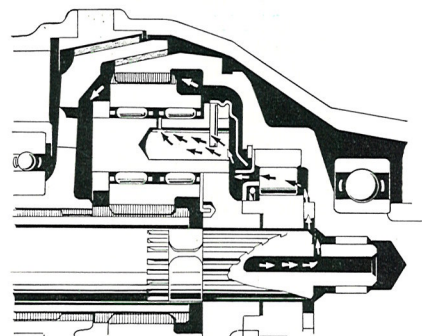
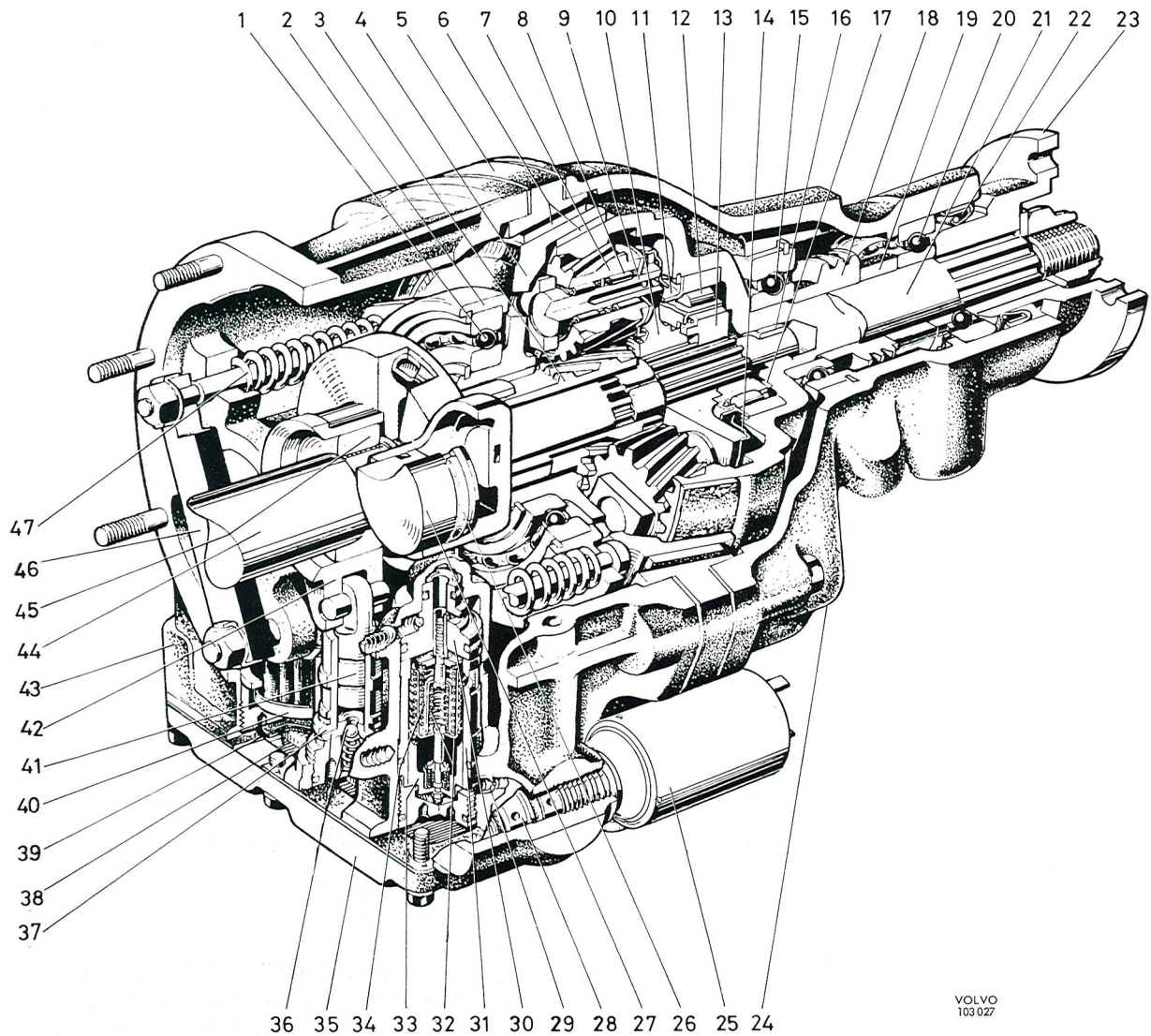


Fig. 4-51. Lubricating system



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Fig. 4-52. Overdrive

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

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 operating valve and connect the pressure gauge SVO 2834, see Fig. 4-53.
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 kg/cm² (21 lb./sq.in.).
3. Engage the overdrive and check that the pressure rises to 32—35 kg/cm² (455—498 lb./sq.in.).
4. Disengage the overdrive and check the time for the pressure to drop to 1.5 kg/cm² (21 lb./sq.in.). 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 kgm (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 cause damage if it comes into contact with your skin.
2. Remove the plug under the relief valve with tool SVO 2836, see Fig. 4-54. 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. 4-55, 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.

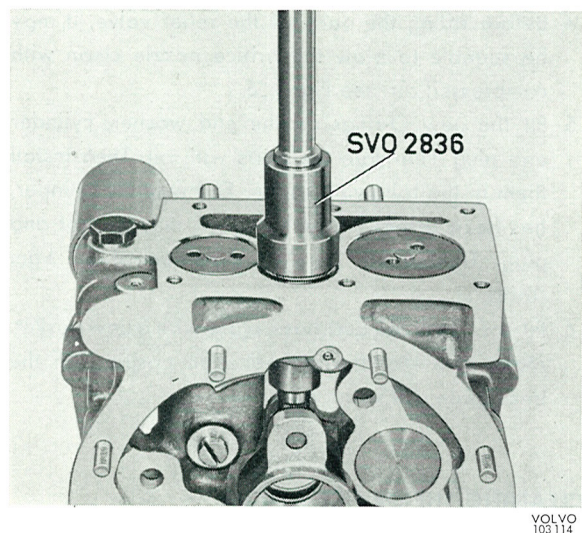


Fig. 4-54. Removing the plug

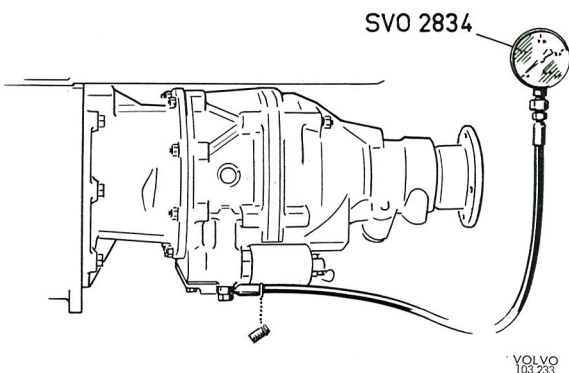


Fig. 4-53. Checking the oil pressure

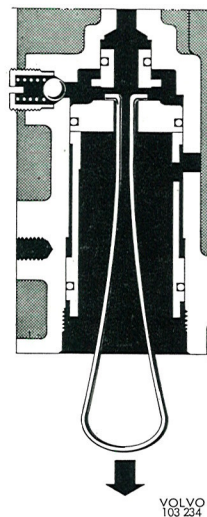
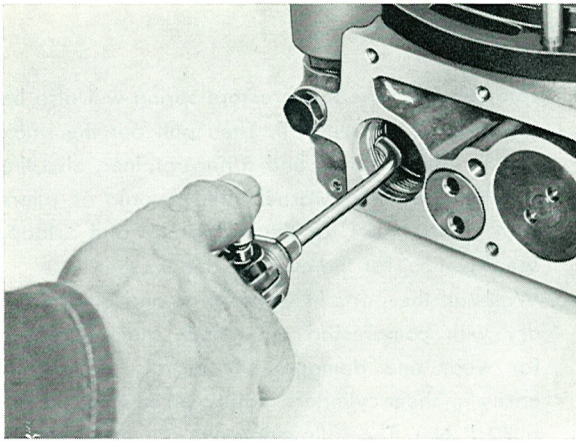


Fig. 4-55. Removing the relief valve



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Fig. 4-56. Blowing the orifice nozzle clean

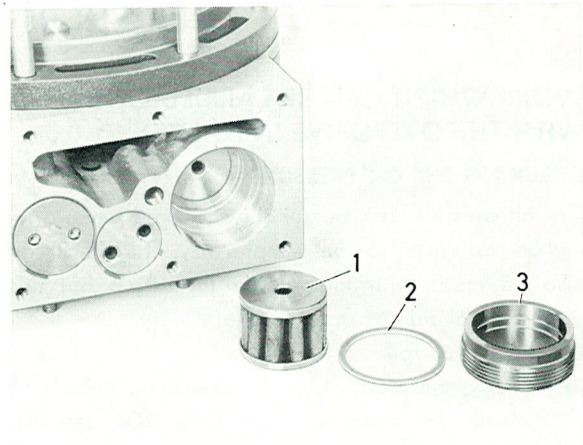
4. Before fitting the parts of the relief valve, it may be suitable to blow the orifice nozzle clean with compressed air, see Fig. 4-56.
5. Fit the new O-rings on the end washer, cylinder and plug. Lubricate the parts with oil. Then install them in the following order: End washer, cylinder, has been recently driven, the oil may be hot and plug. Tighten the plug to a torque of 2.2 kgm (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. 4-56.

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 cause damage 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 kgm (16 lb.ft.).



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4-57. 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. 4-57.
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 kgm (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 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 kg/cm² (284—335 lb./sq.in.) 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 53a.
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 gearbox 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 gradually all round in order to avoid any distortion from the springs. Lift off the front casing and brake ring, see Fig. 4-58.
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".

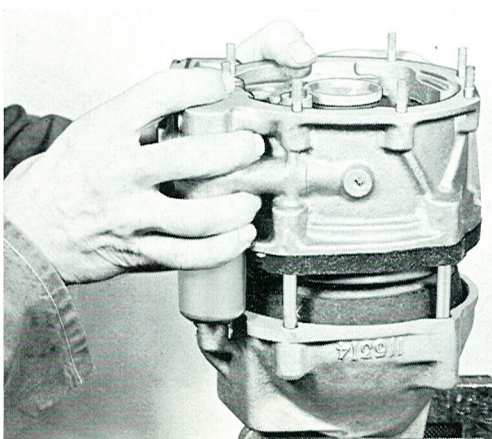


Fig. 4-58. Dismantling the overdrive

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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. 4-59.

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

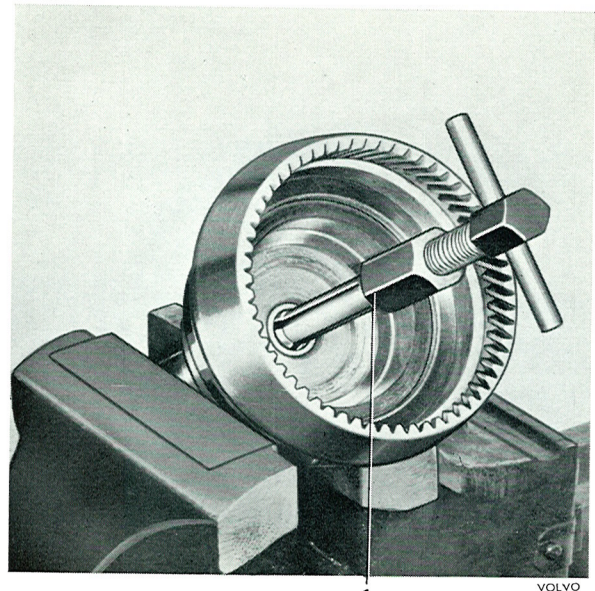


Fig. 4-59. Removing the bush, output shaft
1. Puller SVO 2423

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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 this 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.

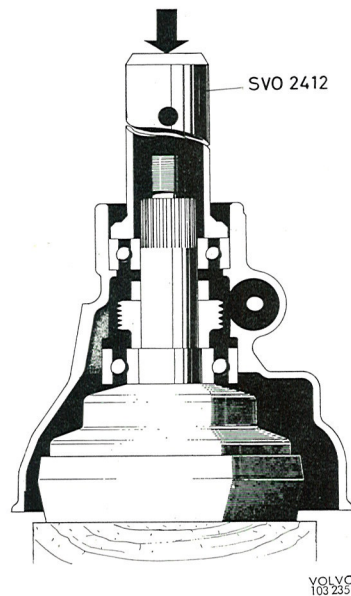


Fig. 4-61. Fitting the output shaft

ASSEMBLING THE REAR CASING

1. Push the bush on to the output shaft with drift SVO 2417, see Fig. 4-60. 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. 4-61.
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 kgm (80—100 lb.ft.).

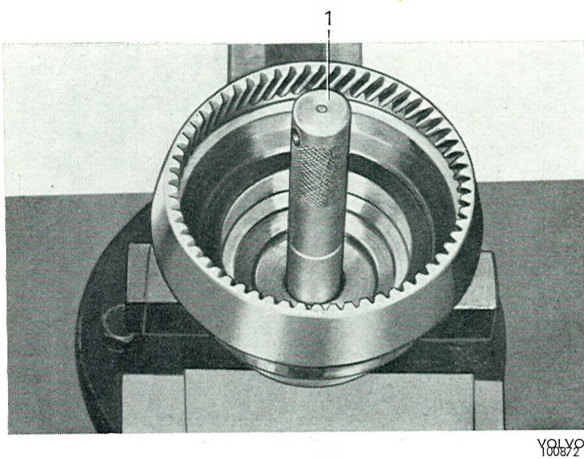


Fig. 4-60. Fitting the bush, output shaft
1. Drift SVO 2417

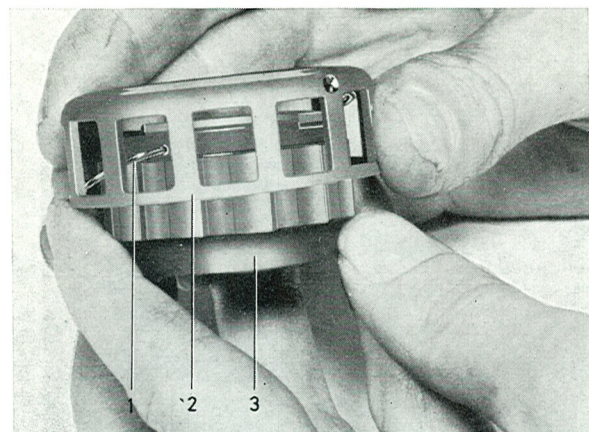


Fig. 4-62. Assembling the uni-directional clutch, I
1. Spring 2. Cage 3. Uni-directional clutch hub

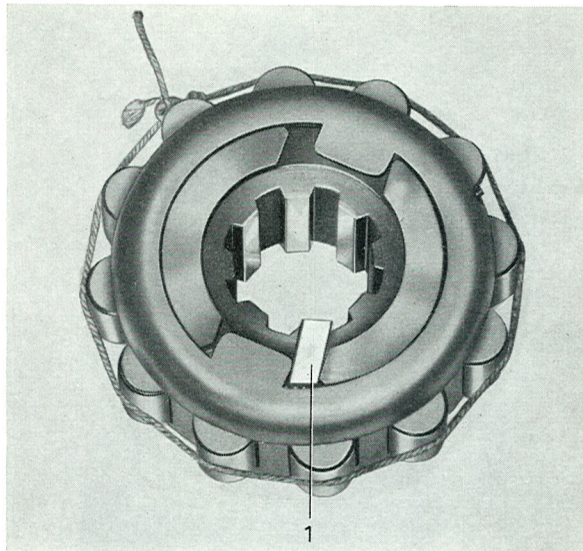


Fig. 4-63. Assembling the uni-directional clutch, II
1. Key

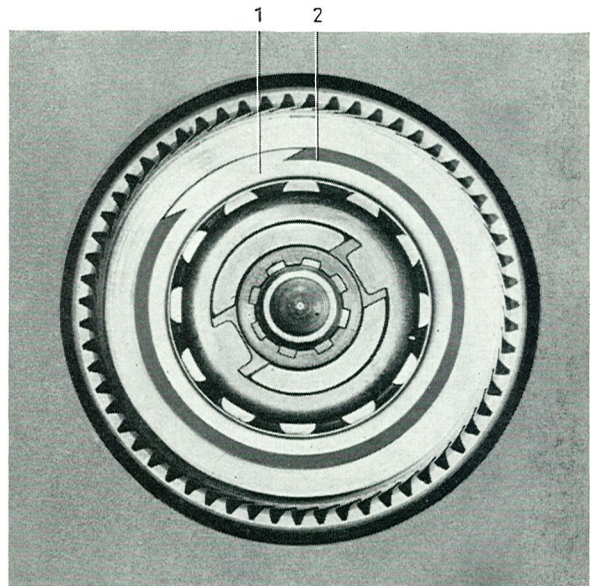


Fig. 4-65. Fitting the oil thrower
1. Oil thrower plate 2. Circlip

5. Assemble the uni-direction clutch, spring and roller cage, see Fig. 4-62. Turn the roller cage clockwise as far as it will go and lock it in this position with a key as shown in Fig. 4-63. 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. 4-64. Fit the oil thrower and install the circlip, see Fig. 4-65.
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. 4-66.

ASSEMBLING THE CLUTCH UNIT

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

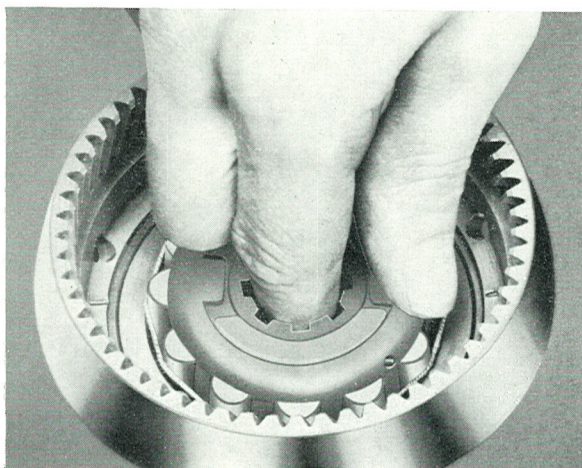


Fig. 4-64. Fitting the uni-directional clutch

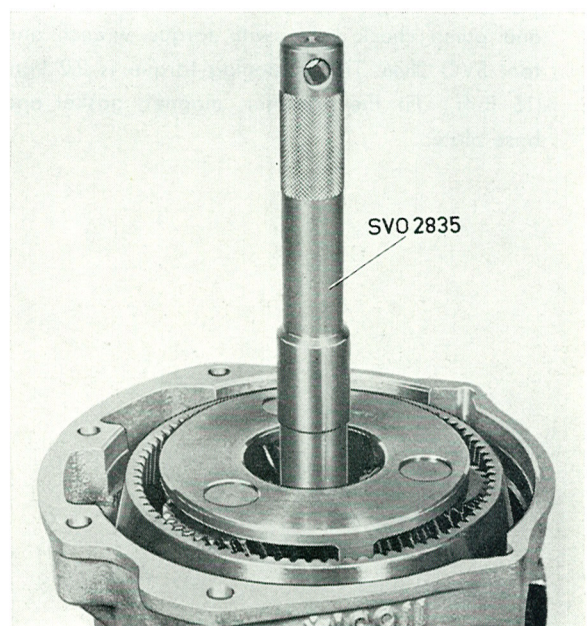


Fig. 4-66. Fitting the planet gear

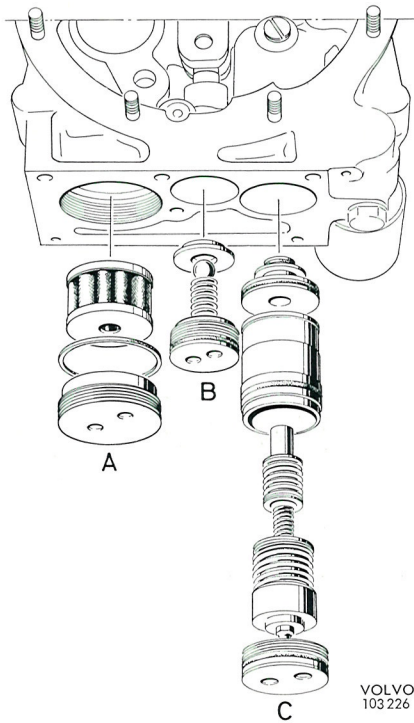


Fig. 4-67. Fitting the fine filter, oil pump check valve and relief valve

ASSEMBLING AND FITTING THE 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 Fig. 4-67.
2. Place the connecting rod and pump plunger in position in the casing. Then push in the cylinder. After that 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 kgm (16 lb.ft.). Fit the pre-filter, magnet, gasket and base plate.

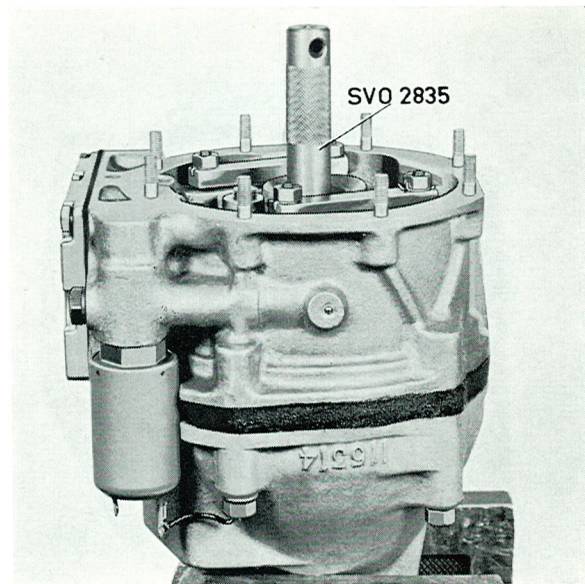


Fig. 4-68. Fitting the front casing

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. 4-68. 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 round.
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).