

Section 4

TRANSMISSION, REAR AXLE

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GROUP 41

CLUTCH

TOOLS

The following are used for clutch work.

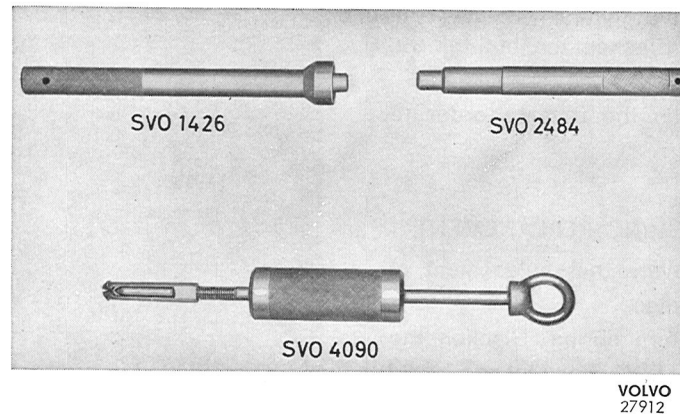


Fig. 4-1. Special tools

- 999 (SVO) 1426 Drift for pilot bearing in flywheel.
- 999 (SVO) 2484 Mandrel for centering clutch plate.
- 999 (SVO) 4090 Puller for ball bearing in flywheel.

GENERAL INFORMATION

The clutch (illustration 4-2) is of the diaphragm spring type. It is available in two different versions (Figs. 4-2 and 4-3), but both mainly consist of a pressure plate, a diaphragm spring and a clutch cover. The diaphragm spring has a double func-

tion: that of a clutch lever when declutching and a pressure spring when engaging.

The movements of the clutch pedal are transferred to the clutch via a wire, a lever and a release bearing.

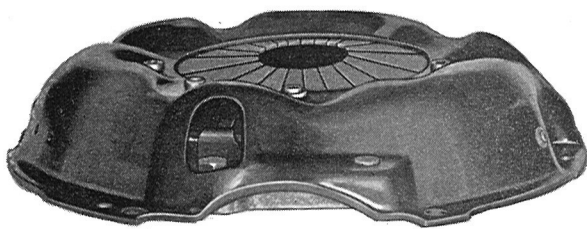


Fig. 4-2. Clutch, type I

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Fig. 4-3. Clutch, type II

VOLVO
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SERVICE PROCEDURES

CLUTCH WORK IN VEHICLE

CLUTCH WIRE REPLACEMENT

Volvo Standard Times Operation Number 41254.

1. Unhook the release fork return spring. 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. Remove the pedal bearing bolt. Disconnect the wire from the pedal. Slacken the nut for the wire sleeve. Remove the wire.
4. Install the new wire in the reverse order to removal.

CLUTCH PEDAL OR BUSHING REPLACEMENT

The discription below covers the replacement of the pedal and/or the bushings.

1. Unhook the pedal return spring. Slacken the nut and remove the bolt. Disconnect the pedal wire and remove the pedal.
2. Remove the tubular shaft. Drive out the bushings with a suitable drift.
3. Install the new bushings. Lubricate them with grease. Install the tubular shaft.
4. Position the return spring on the pedal bearing sleeve. Move the pedal into position and attach it to the wire. Install the bolt which holds the pedal.
5. Hook on the return spring.

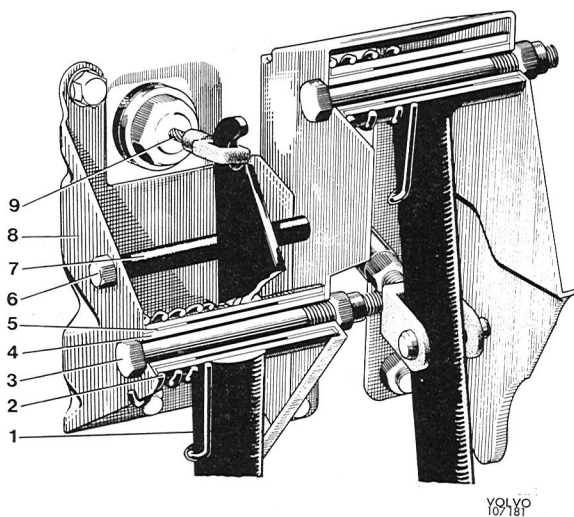


Fig. 4-4. Pedal carrier

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

CLUTCH REMOVAL

Volvo Standard Times: Replace clutch disc (clutch)

Op.No. 41112 includes transmission removal

Op.No. 41103 excludes transmission removal

1. Remove the transmission according to the instruction in Group 43.
2. Remove the upper bolt for the starter motor.
3. Remove the release bearing. See Fig. 4-5. Disconnect the wire from the release fork. Slacken the wire sleeve from the bracket.

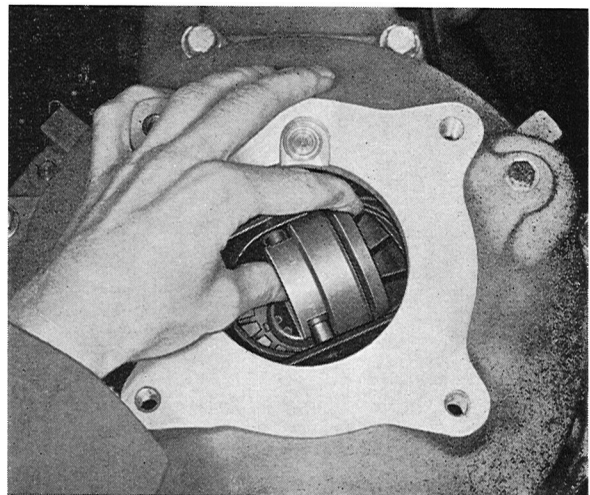


Fig. 4-5. Release bearing removed

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.

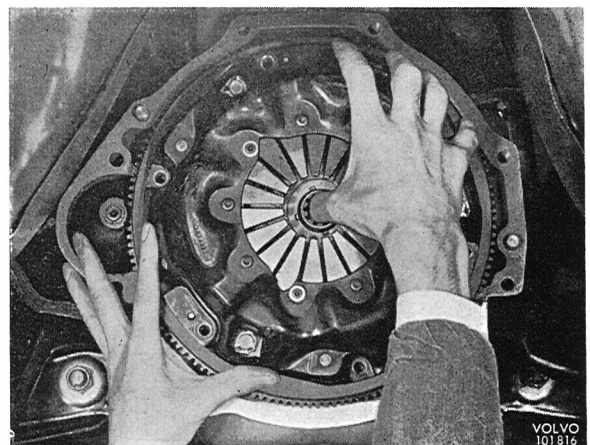


Fig. 4-6. Clutch removal

CLUTCH FACING REPLACEMENT

1. Drill out the old rivets with a drill having the same diameter as the rivets, 3.5 mm (9/64"), and remove the old facings.

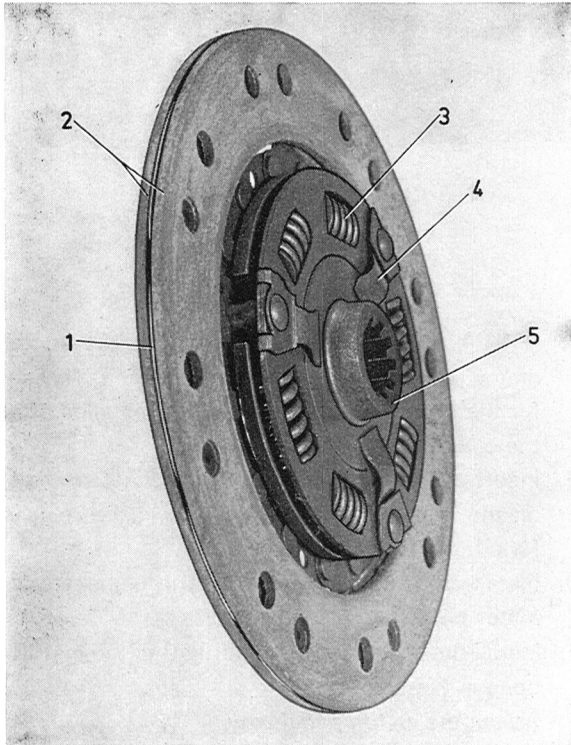


Fig. 4-7. Clutch disc

1. Disc 2. Facings 3. Spring 4. Damping spring 5. Hub

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 the new facings (preferably in a rivet press). NOTE: 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. 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.

SERVICING CLUTCH SHAFT PILOT BEARING

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

If the bearing, after light oiling, runs smoothly and evenly and has no noticeable play, it should be packed with ball bearing grease and re-installed. NOTE: heat-resistant grease should be used.

The bearing should be pressed by drift 1426.

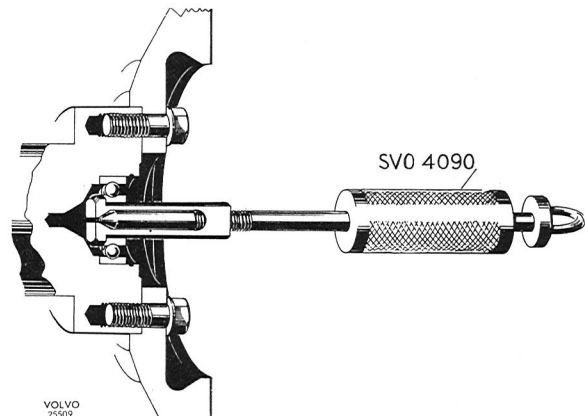


Fig. 4-8. Pilot bearing removal

CLUTCH CARRIER INSPECTION

As the clutch carrier cannot be disassembled, it must be replaced complete if defective. 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 (9 1/2") 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 of .03 mm (.00012", see Fig. 4-9).

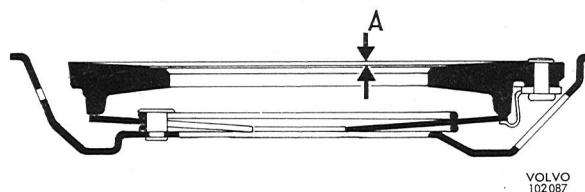


Fig. 4-9. Checking curvature of pressure plate

There must be no "crowning", i.e. clearance between the straight edge of the ruler and the outer diameter of the pressure plate. Check at several

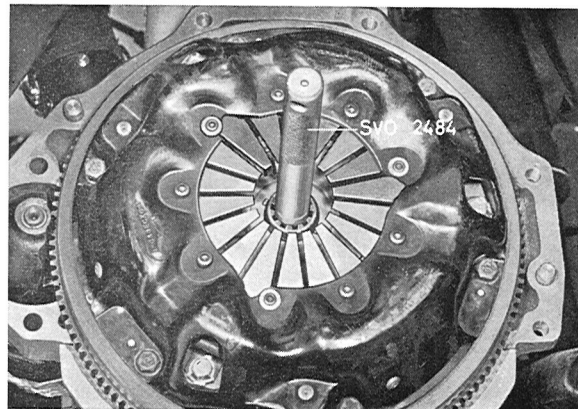
points. Check the pressure spring carefully, if it is cracked or damaged in any other way, the clutch should be replaced.

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 transmission.

CLUTCH INSTALLATION

Before installation, check that the clutch facings, flywheel and pressure plate are completely free from oil. Wash them with gasoline and wipe off 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 2484 so that the guide journal in this centers the pilot bearing in the flywheel, see Fig. 4-10.
2. Install the six bolts which hold the clutch and tighten them crosswise a couple of turns at a time. Remove the centering mandrel.
3. Install the release yoke in the flywheel housing.
4. Install the upper bolt for the starter motor in the housing and install the housing. Install the bolts in the following order: First the four upper



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Fig. 4-10. Clutch installation

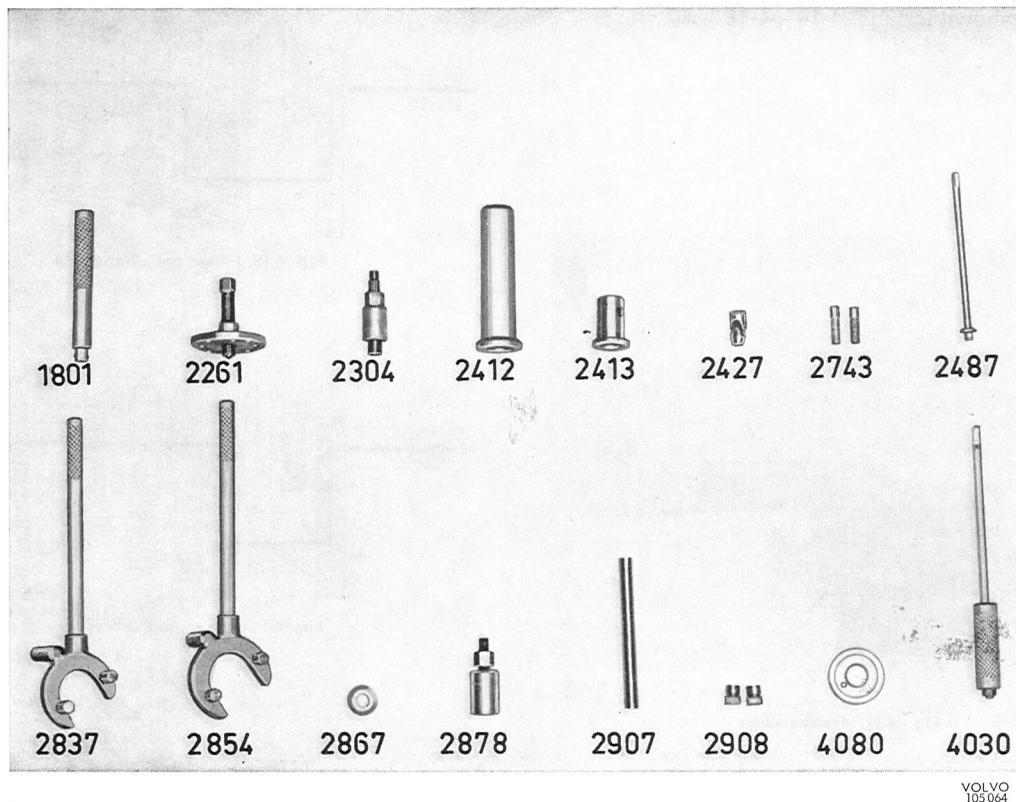
- (7/16"), and then the lower bolts for the starter motor, and finally the two lower (3/8"). The nut for the starter motor upper bolt is installed after the clutch wire has been fitted.
5. Insert the wire sleeve in the bracket and put on the rear nut. Secure the wire in the release fork. Install the release bearing.
6. Install and tighten the nut for the upper starter motor bolt.
7. Install the transmission according to the instructions in Group 43.
8. Adjust the clutch pedal play.

GROUP 43 A

TRANSMISSION

TOOLS

The following special tools are required for transmission repairs.



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Fig. 4-11. Special tools

999
(SVO)

- 1801 Standard handle 18×200 mm
- 2261 Flange puller
- 2304 Press tool for flange installation
- 2412 Drift for installation of bearing on input shaft and for installation of input shaft in housing
- 2413 Drift for installation of oil seal in rear cover
- 2427 Universal joint for 2487
- 2487 3/8" drive extension for upper transmission bolts
- 2743 Guide pins for transmission
- 2837 Flange counterhold (cars with B20 E)

- 2854 Flange counterhold (cars with B20 A, B and F)
 - 2867 Drift for installation of oil seal in input shaft cover
 - 2878 Reverse shaft puller
 - 2907 Mandrel for idler gear installation
 - 2908 Centering plug for thrust washer, used (two) together with 2907 when installing idler gear
 - 4030 Puller for rear cover oil seal
 - 4080 Drift for installation of rear cover bearing
- The following tools are also used:
- 2520 Stand for fixture 2922
 - 2922 Fixture for transmission disassembly and assembly (used together with 2520, see Fig. 4-27)

GENERAL INFORMATION

(Transmission M 41 with overdrive, see also Group 43 B "Overdrive")

M 40 is a four-speed fully synchronized gearbox with all gears except reverse in constant mesh. The transmission is shown in Fig. 4-12 and illustration 4-B. The gears on the mainshaft rotate freely in the neutral position. For this reason they are provided with bronze bushings. Shifting into a gear means that the corresponding gear is connected to the mainshaft by 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.

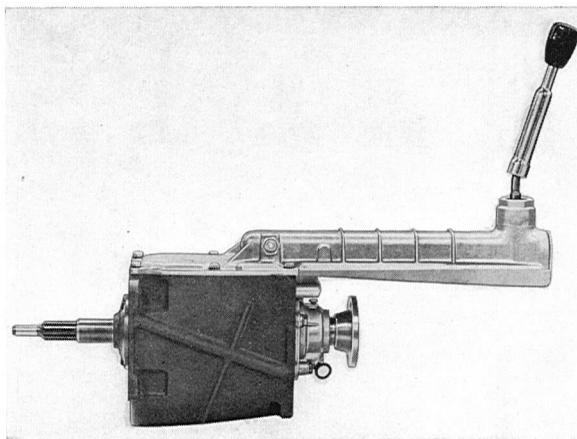


Fig. 4-12. Transmission

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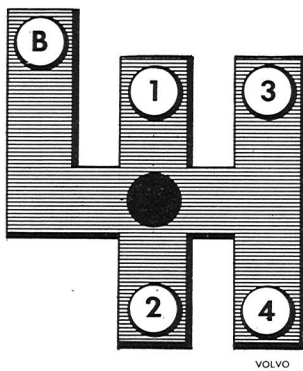


Fig. 4-13. Gear positions

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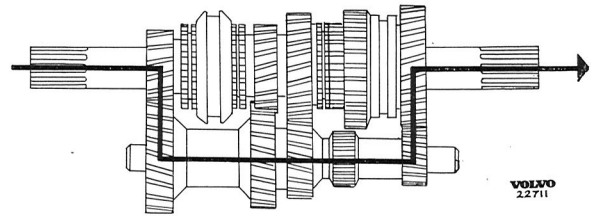


Fig. 4-14. Power path 1st speed

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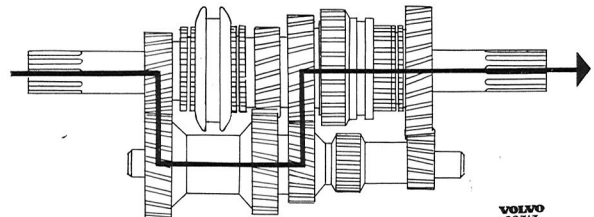


Fig. 4-15. Power path 2nd speed

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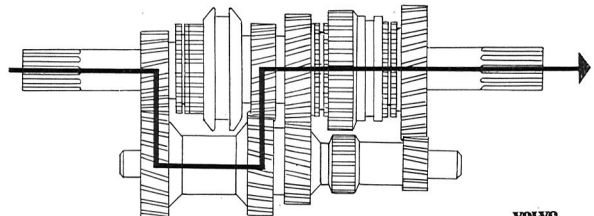


Fig. 4-16. Power path 3rd speed

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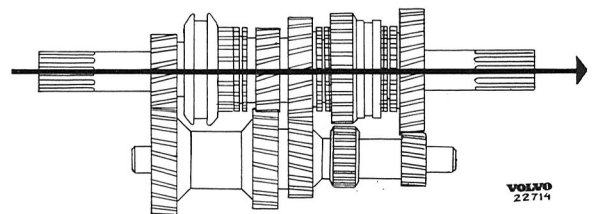


Fig. 4-17. Power path 4th speed

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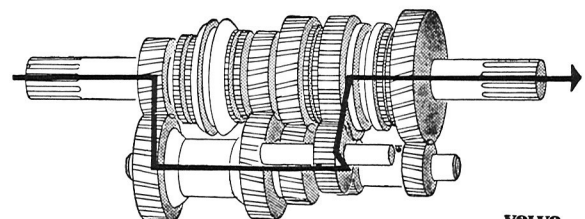


Fig. 4-18. Power path reverse

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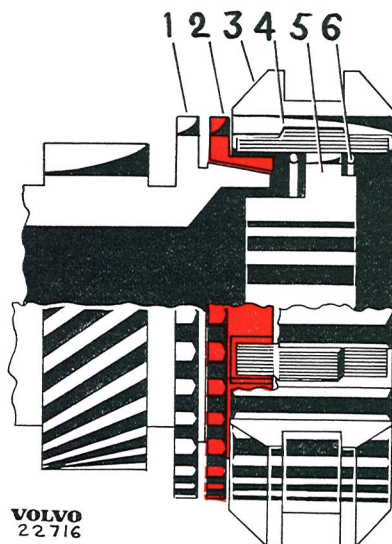


Fig. 4-19. Neutral position

The design and function for the synchronizing mechanism are 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.

The inserts (4) then press the synchronizing cone (2) against the cone on the gear (1). If the hub and gear are rotating at different speeds, the synchronizer will turn in relation to the engaging sleeve. The synchronizer is, however, prevented from turning more than half a tooth-width by the engaging springs, see Fig. 4-20.

The teeth and the synchronizer 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 synchronizer and the gear, the gear attains the same speed as the synchronizer. When they are both rotating at the same speed, the engaging sleeve is able to turn back the synchronizer and the gear engages, see Fig. 4-21.

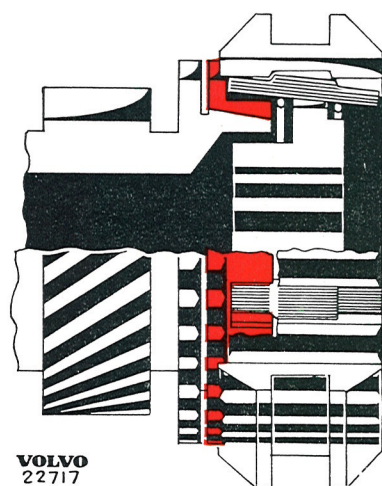


Fig. 4-20. Synchronizing

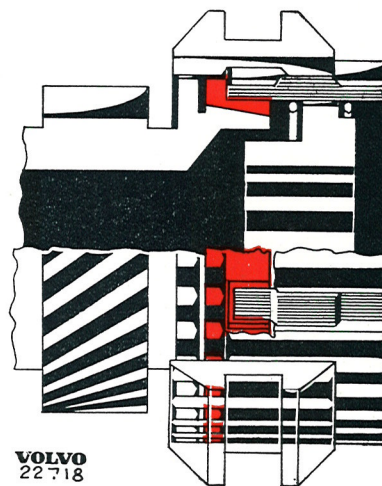


Fig. 4-21. Gear engaged

SERVICE PROCEDURES

WORK ON TRANSMISSION IN VEHICLE

REAR TRANSMISSION COVER SEAL REPLACEMENT

Volvo Standard Times Op. No. 43130

1. Carry out operations 1-4 under the heading "Removal" to extent necessary.
2. Slacken the flange nut. Use 2854 as a counterhold for cars with B20 A, B and F and 2837 for cars with B 20 E engines, see Fig. 4-22.

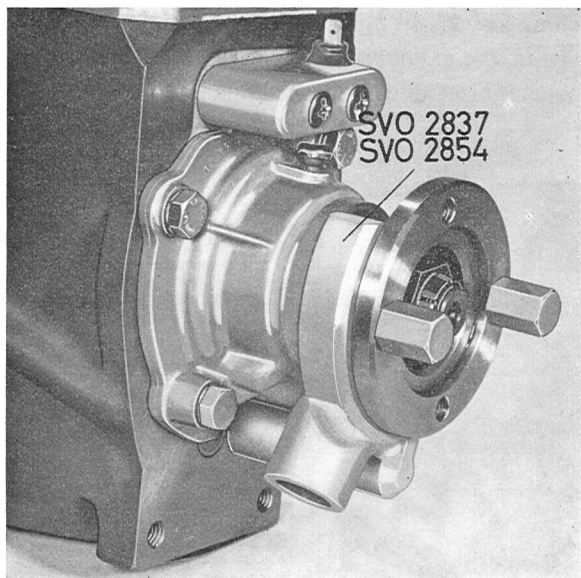


Fig. 4-22. Flange counterhold

Pull off the flange. Use puller 2261, see Fig. 4-23.

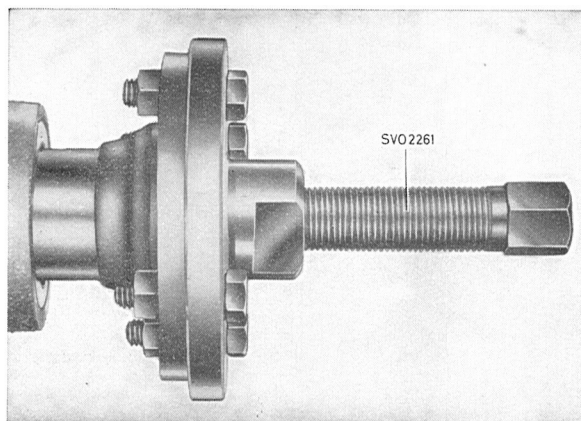


Fig. 4-23. Flange removal

3. Pull out the old oil seal with puller 4030. Install the new seal with sleeve 2413 see Fig. 4-24.

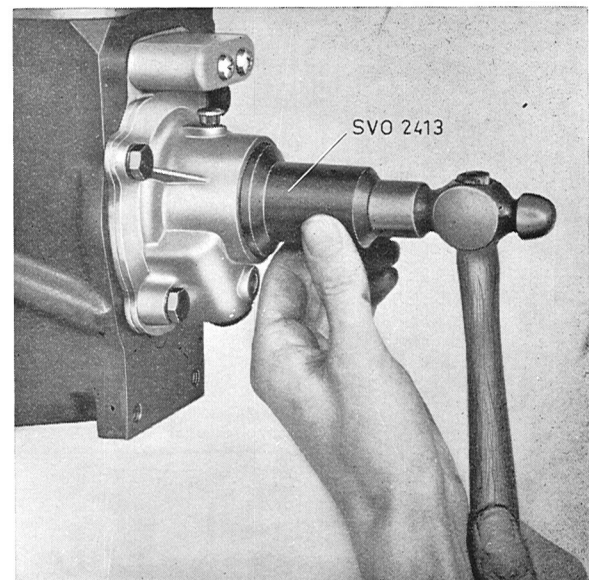


Fig. 4-24. Oil seal installation

4. Press on the flange with tool 2304, see Fig. 4-25. Re-store.

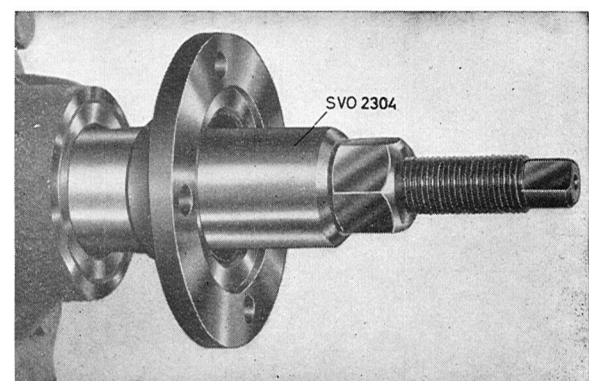


Fig. 4-25. Flange installation

TRANSMISSION REMOVAL

Replace transmission=Volvo Standard Times Op. No. 43104

1. Remove the gearshift lever.
2. Begin with the rear end, jack up the vehicle and put it on stands. Drain the transmission oil.
3. Use a jack to support under the transmission. Loosen and remove the supporting member under the transmission. Disconnect the front universal joint from the transmission flange. Disconnect the speedometer cable. Disconnect the rear motor mount and the exhaust pipe bracket.
4. Install a piece of wood between the engine and the firewall and lower the jack until the engine is aligned against the wooden piece. Disconnect the wires at the transmission.
5. Slacken the right upper and left lower transmission bolt with spanner 2487, flexible joint 2427, the extension with 3/8" drive and ratchet handle, see Fig. 4-26.

Install two guide pins 2743, see Fig. 4-41.

Slacken the other two bolts. Pull out the transmission backwards and lower it.

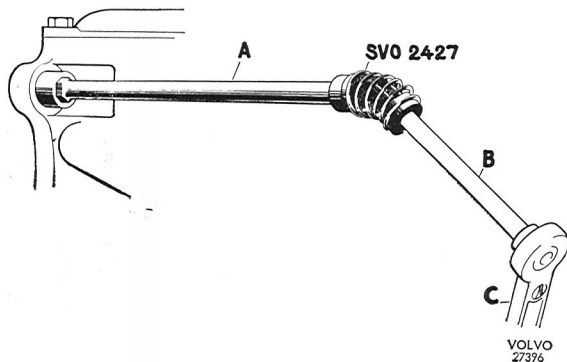


Fig. 4-26. Removal of transmission hose

A=2487

B=3/8" drive extension

C=Ratchet handle

TRANSMISSION DISASSEMBLY

Volvo Standard Times: Re-build transmission

Transmission removal and installation is included in Op. No. 43102 but excluded in Op. No. 43171.

The following description applies to transmissions without overdrive. If the transmission is equipped with an overdrive, remove the rear end bolts and remove the overdrive. Proceed with the operations described below as far as necessary.

1. Install fixture 2922 in stand 2520. Place the transmission in the fixture, see Fig. 4-27.
2. Remove the transmission cover bolts. Lift off the cover. Remove the spring and interlock bolts for the selector rails.
3. Remove the cover over the selector rails. Remove the selector fork bolts.
4. Slide the selector fork backwards to 1st speed position. Drive out the pin slightly (it must not

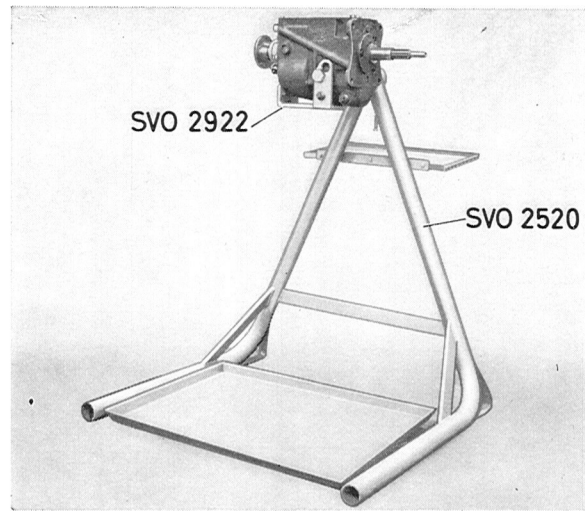


Fig. 4-27. Transmission fixture

foul the 1st speed gear). Then move the selector fork forwards sufficiently to allow the pin to pass in front of the gear. 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. Remove the rear cover bolts. Turn the cover so that it does not lock the shaft for the idler and reverse gears. Drive out the idler gear shaft.

NOTE: The shaft must be driven out backwards.

Let the idler gear fall to the bottom of the transmission.

7. Pull out the mainshaft.
8. Remove the bolts and the cover over the input shaft. Lever out the oil seal from the cover with a screwdriver or similar tool.
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 reverse gear shaft with puller 2878, see Fig. 4-28. Take out the reverse gear and other parts.

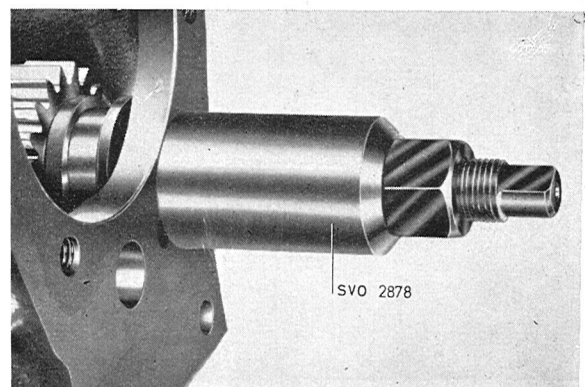


Fig. 4-28. Reverse gear removal

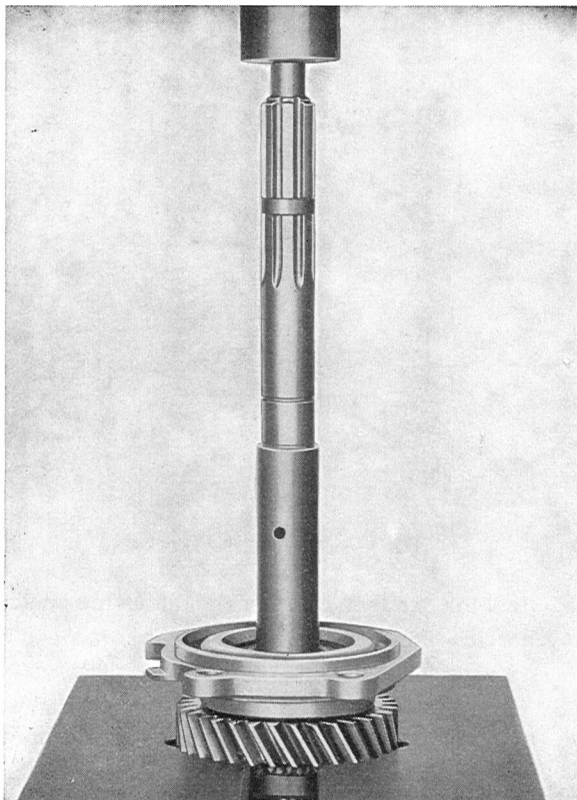


Fig. 4-29. Main shaft disassembly, M 41

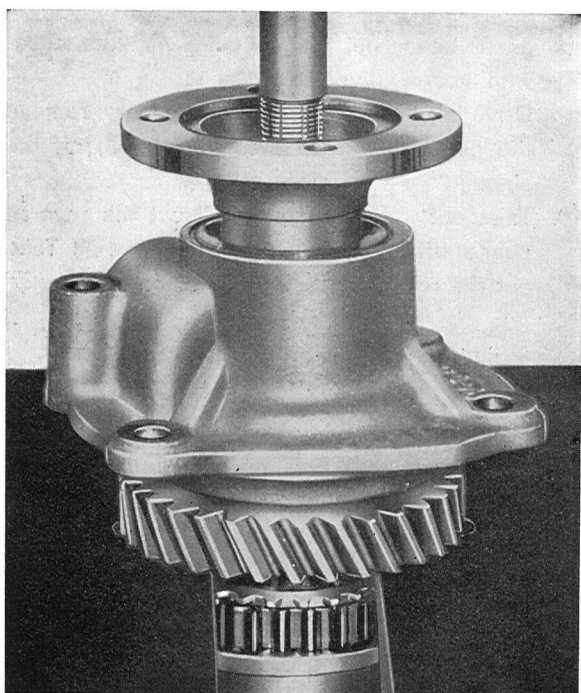


Fig. 4-30. Main shaft disassembly, M 40

MAIN SHAFT DISASSEMBLY

(Part of Volvo Standard Times 43102 and 43171)

- 1a. Transmission with overdrive (M 41):
Remove the circlip and press off the rotor for the overdrive oil pump. Remove the circlip for the 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. Press out the shaft as shown in Fig. 4-29.
- 1b. Transmission without overdrive:
Remove the flange nut. Use 2837 resp. 2854 as a flange counterhold. 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. Press out the shaft with a drift, see Fig. 4-30.
2. Remove the synchronizer, thrust washer, engaging sleeves, inserts and springs from the shaft.
3. Remove the snap ring on the front end of the shaft. Pull off the synchronizing hub and 3rd speed gear with a puller, see Fig. 4-31. Remove the thrust washer.

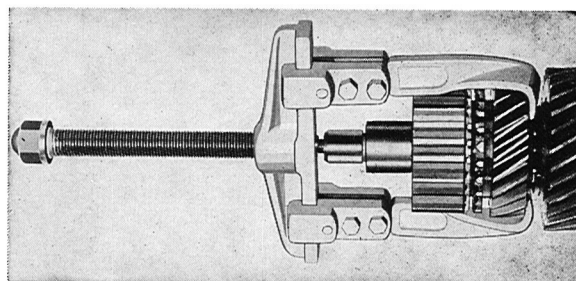


Fig. 4-31. Front synchronizer removal

4. Remove the snap ring and then the thrust washer, 2nd speed gear, synchronizing ring and spring.
5. Remove the oil seal from the rear cover and take out the speedometer gear. If necessary, remove the snap rings and press out the ball bearing.

INSPECTION

(Part of Volvo Standard Times 43102 and 43171)

Check the gears, 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.

ASSEMBLY

MAIN SHAFT ASSEMBLY

(Part of Volvo Standard Times 43102 and 43171)

1. Press the ball bearing into the rear cover, see Fig. 4-32, and install the snap ring. There are different thicknesses of snap rings, so select one which fits snugly into the groove.

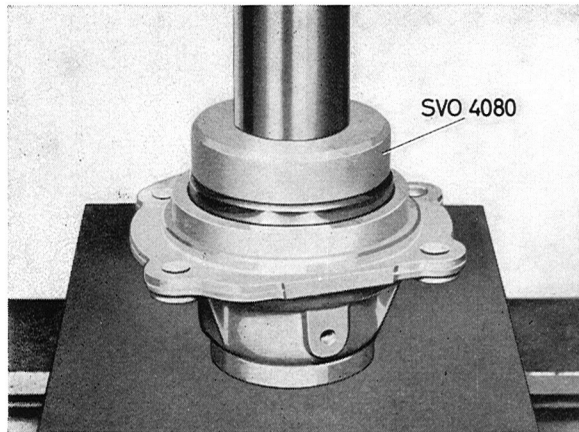


Fig. 4-32. Installation of ball bearing in rear cover

2. Transmission without overdrive:
Place the speedometer gear on the bearing in the rear cover. Press in the oil seal with drift 2413, see Fig. 4-33.

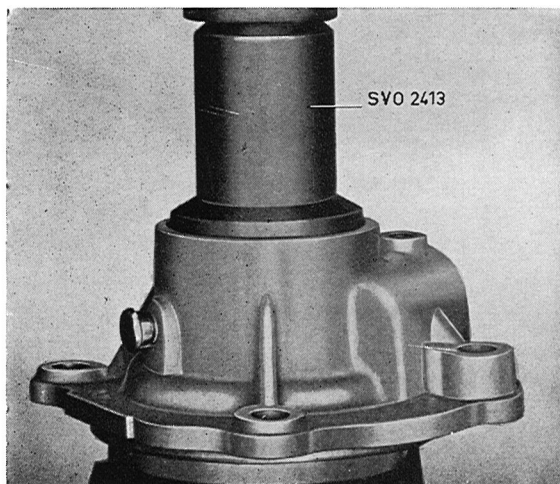


Fig. 4-33. Installation of oil seal in rear cover

3. Install parts for the 1st and 2nd synchronizer on the mainshaft. Install the springs correctly, see Fig. 4-34.

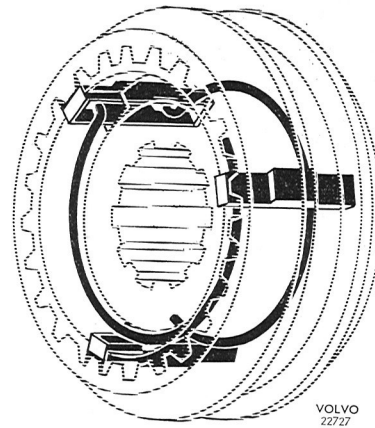


Fig. 4-34. Synchronizer assembly

- 4a. Transmission without overdrive:
Install the synchronizing ring, 1st speed gear and thrust washer. Place the rear cover on the shaft. Ensure that the speedometer gear is positioned correctly. Install the flange. Use a sleeve which fits into the recess in the flange, press on the cover and flange, see Fig. 4-35. Install the washer and nut for the flange. Use 2854 resp. 2837 as a counterhold on the flange and tighten the nut.

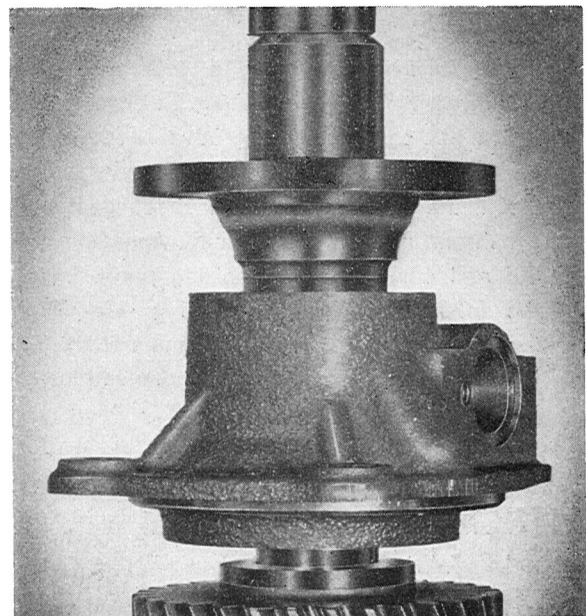


Fig. 4-35. Installation of rear cover, M 40

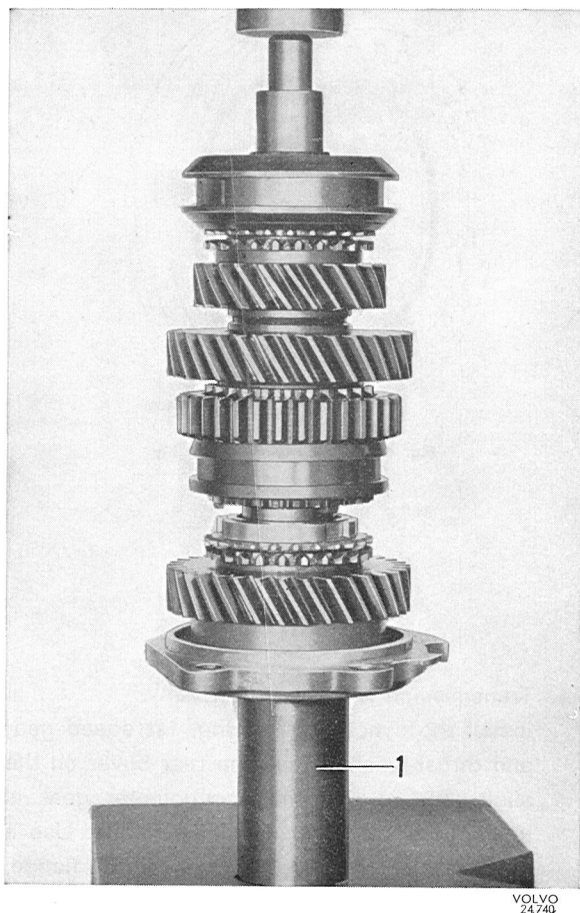


Fig. 4-36. Installation of rear cover, M 41

4b. Transmission with overdrive (M41):

Place the rear cover and ball bearing on a cushioning ring or sleeve as shown in Fig. 4-36. Install the thrust washer, 1st speed gear and synchronizing ring. Press in the shaft. Select a snap ring of suitable thickness and install it. Install the key, the rotor for the oil pump and snap ring.

5. Install the synchronizing ring, 2nd speed gear and thrust washer on the shaft. Select a circlip which fits snugly in the groove on the shaft and install it.
6. Install the thrust washer, 3rd speed gear and synchronizing ring on the shaft. Assemble the 3rd and 4th gear synchronizing parts. Install the snap rings correctly, see Fig. 4-34. Then install the synchronizer on the main shaft. Select a lock ring of correct thickness and install it.

TRANSMISSION ASSEMBLY

(Part of VST 43102 and 43171)

1. Install the striker lever and striker. Install the reverse gear and reverse shaft. The reverse

shaft is fitted so that it extends 7.0—7.6 mm (9/32") outside the transmission housing, see Fig. 4-37.

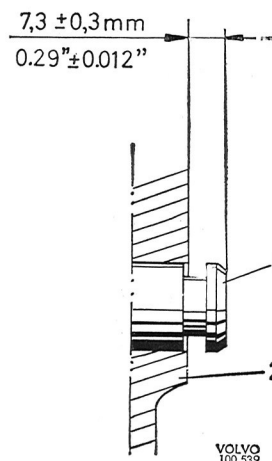


Fig. 4-37. Installation reverse gear shaft

2. Place mandrel 2907 in the idler gear. Install the spacer 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 into position, with the centering plugs 2908, see Fig. 4-38. Lay the idler gear in the bottom of the housing.

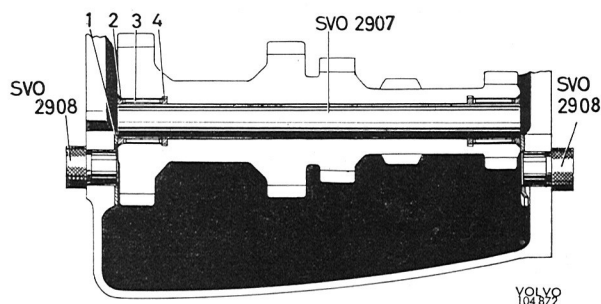


Fig. 4-38. Installation idler gear

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

4. Press the bearing onto the input shaft, using drift 2412, see Fig. 4-39. Select a snap ring of suitable thickness and install it. Place the 14 bearing rollers for the main shaft 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 2867. Then install the cover over the input shaft. Do not forget the O-rings for the bolts.
5. Place the main shaft in the housing. Turn the rear cover so that the countershaft can be installed.

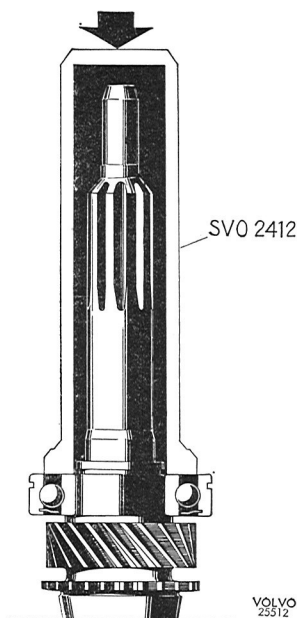


Fig. 4-39. Installation ball bearing on input shaft

6. Turn the transmission upside down. Install the countershaft from the rear. Hold against 2907 with the hand. Ensure that the thrust washers do not loosen and fall down.
- 7a. Transmission without overdrive:
Install the rear cover bolts.
- 7b. Transmission with overdrive:
Install the overdrive. Use new locking for the intermediate flange.
8. Install the selector rails and forks. Move the selector fork over the rear position when installing the pin. Use a new pin. Install the cover over the selector rails.
Place the interlock balls and springs in position, see Fig. 4-40. Install the gearbox cover. Check that all the gears engage and disengage freely.

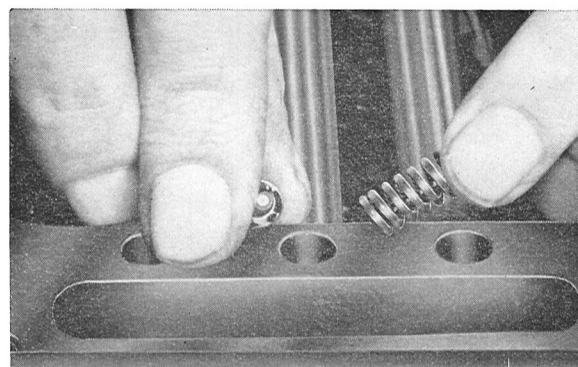


Fig. 4-40. Installation of lock balls and springs

TRANSMISSION INSTALLATION

Part of Volvo Standard Times Op. No. 43102 and 43172

Make sure that guide pins 2743 are installed according to Fig. 4-41. Installation is done in the reverse order to removal. Fill the transmission with oil.

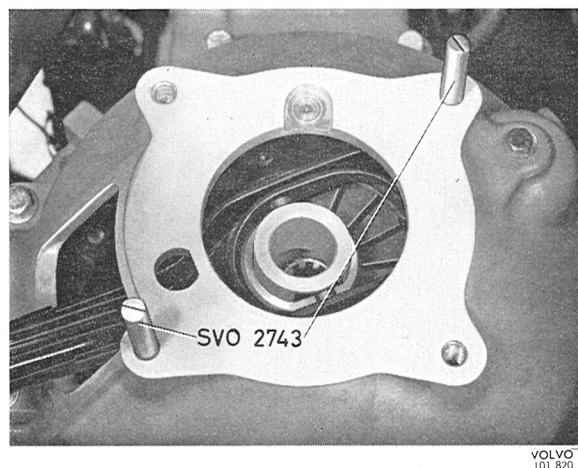


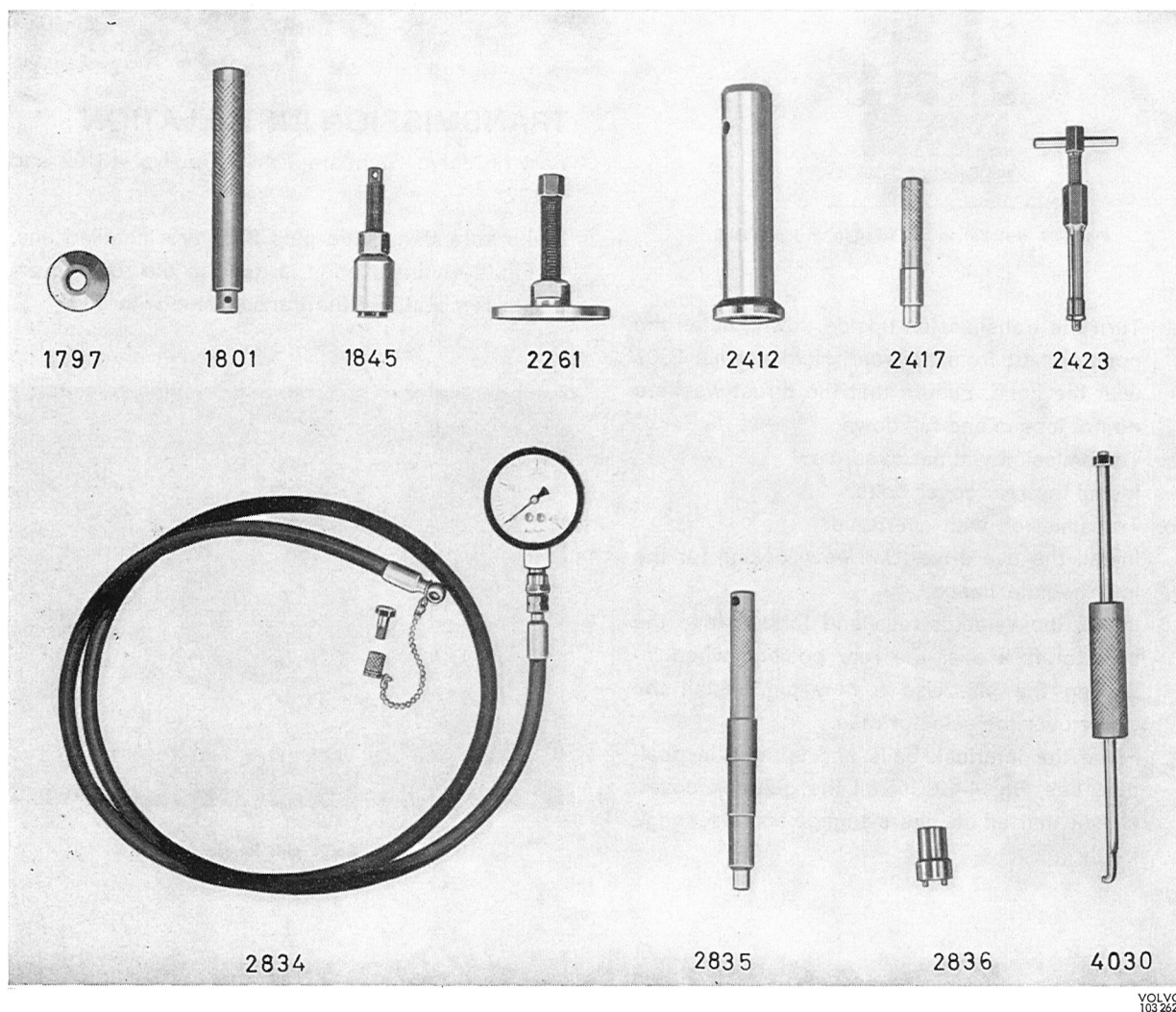
Fig. 4-41. Guide pins for transmission

GROUP 43 B

OVERDRIVE

TOOLS

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



VOLVO
103262

Fig. 4-42. Special tools

- | | |
|---|--|
| <p>999
(SVO)</p> <p>1797 Drift for removal rear bearing, output shaft</p> <p>1801 Standard handle</p> <p>1845 Press tool for flange installation</p> <p>2261 Puller for flange</p> <p>2412 Sleeve drift for installation of front rear bearing on output shaft and oil seal at flange</p> | <p>2417 Drift for installation of bushing in output shaft</p> <p>2423 Puller for bushing in output shaft</p> <p>2834 Oil pressure gauge</p> <p>2835 Centering mandrel for splines in planet carrier and one-way clutch</p> <p>2836 Socket for removal and installation of plugs for fine filter, oil pump and relief valve</p> <p>4030 Oil seal puller</p> |
|---|--|

GENERAL INFORMATION

The overdrive unit is of the epicyclic type and is attached to the rear end of the transmission. 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, power is transmitted from the gearbox main shaft through the one-way clutch to the output shaft of the overdrive. At the same time, the clutch sliding member (position 1, Fig. 4-43), is pressed by four springs against the tapered part of the output shaft. When reversing or when the engine acts as a brake, torque is transmitted through the clutch sliding member.

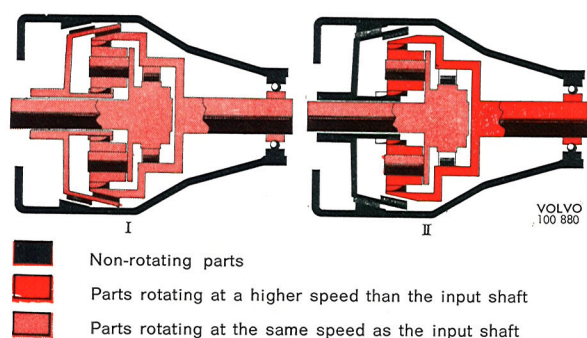


Fig. 4-43.

- I. Direct drive position
- II. Overdrive position

OVERDRIVE POSITION

In the overdrive position, the clutch sliding member is pressed against the brake ring (see 2, Fig. 4-43) with the help of the pistons (27, Fig. 4-50) in the hydraulic cylinders. This also locks the sun wheel. Since the planet gear retainers are linked to the main shaft through the splines, the planet gears are forced to rotate around the sun wheel. As a result of this, the output shaft will rotate at a higher speed than the main shaft.

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.

A manually operated switch placed underneath the steering wheel closes the circuit via the switch on the transmission to a solenoid on the overdrive. The solenoid moves a control valve to the position for overdrive.

HYDRAULIC SYSTEM

The hydraulic system consists of the following main parts: Pre-filter, plunger pump, fine filter, hydraulic cylinders and plungers, relief valve and a control valve which is operated by the solenoid. The relief valve has a special construction with a hydraulic piston and three different springs. It has three different functions:

- it must maintain a low pressure in the system with direct drive
- a high pressure with overdrive
- provide smooth changing when shifting from overdrive to direct drive and vice versa

The relief valve function is described in more detail below. The oil flow with direct drive is shown in Fig. 4-47.

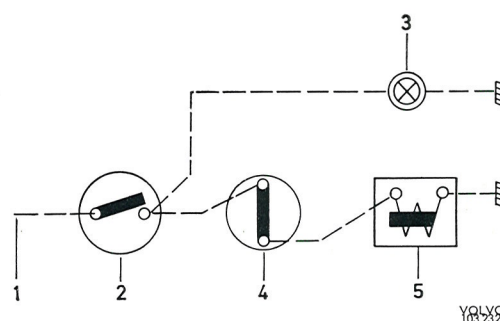


Fig. 4-44. Electrical circuit diagram

- 1. Lead from fuse box
- 2. Manual switch for overdrive
- 3. Overdrive warning lamp
- 4. Transmission switch
- 5. Solenoid on overdrive

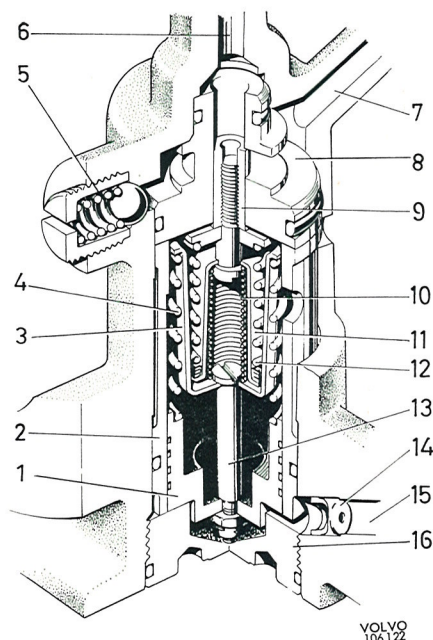


Fig. 4-45. Relief valve

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

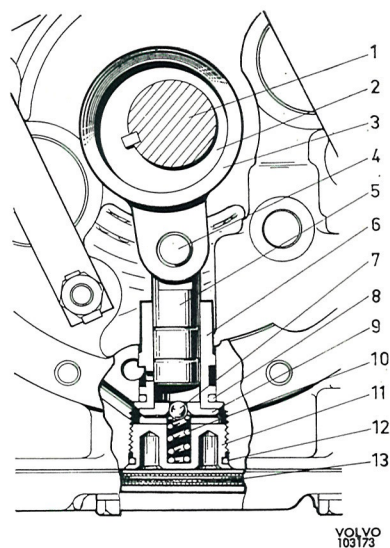


Fig. 4-46. Oil pump

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

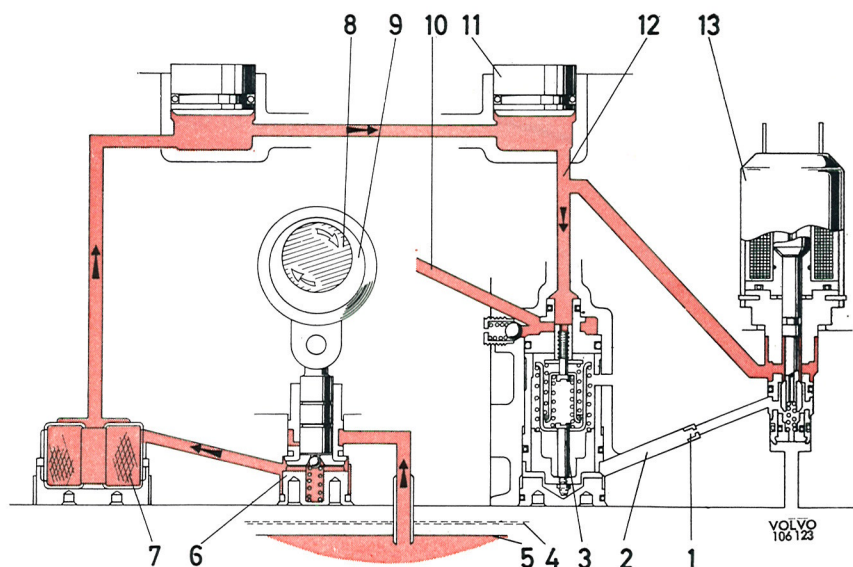


Fig. 4-47. Function with direct drive

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

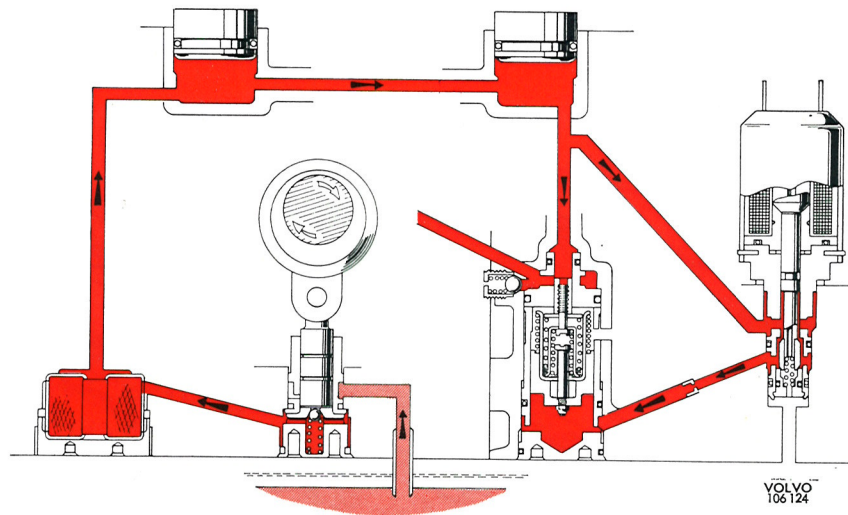


Fig. 4-48. Overdrive in function

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 closes and the large piston of the relief valve is in its lower position. This offloads 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 main shaft. When the overdrive is engaged, see Fig. 4-48, 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 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 closes. The connection between channel 2 and the sump then opens. 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 interval 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 main shaft to the one-way clutch and the needle bearing shaft. Thereafter the oil is caught by a plate and led via the planet gear back to the transmission housing, see Fig. 4-49.

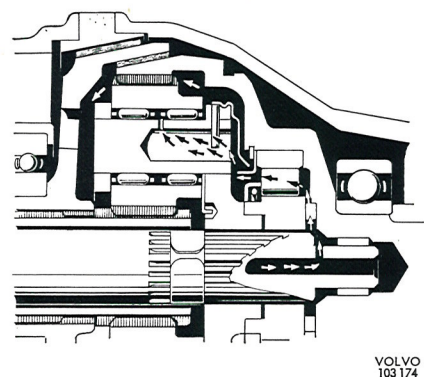


Fig. 4-49. Lubricating system

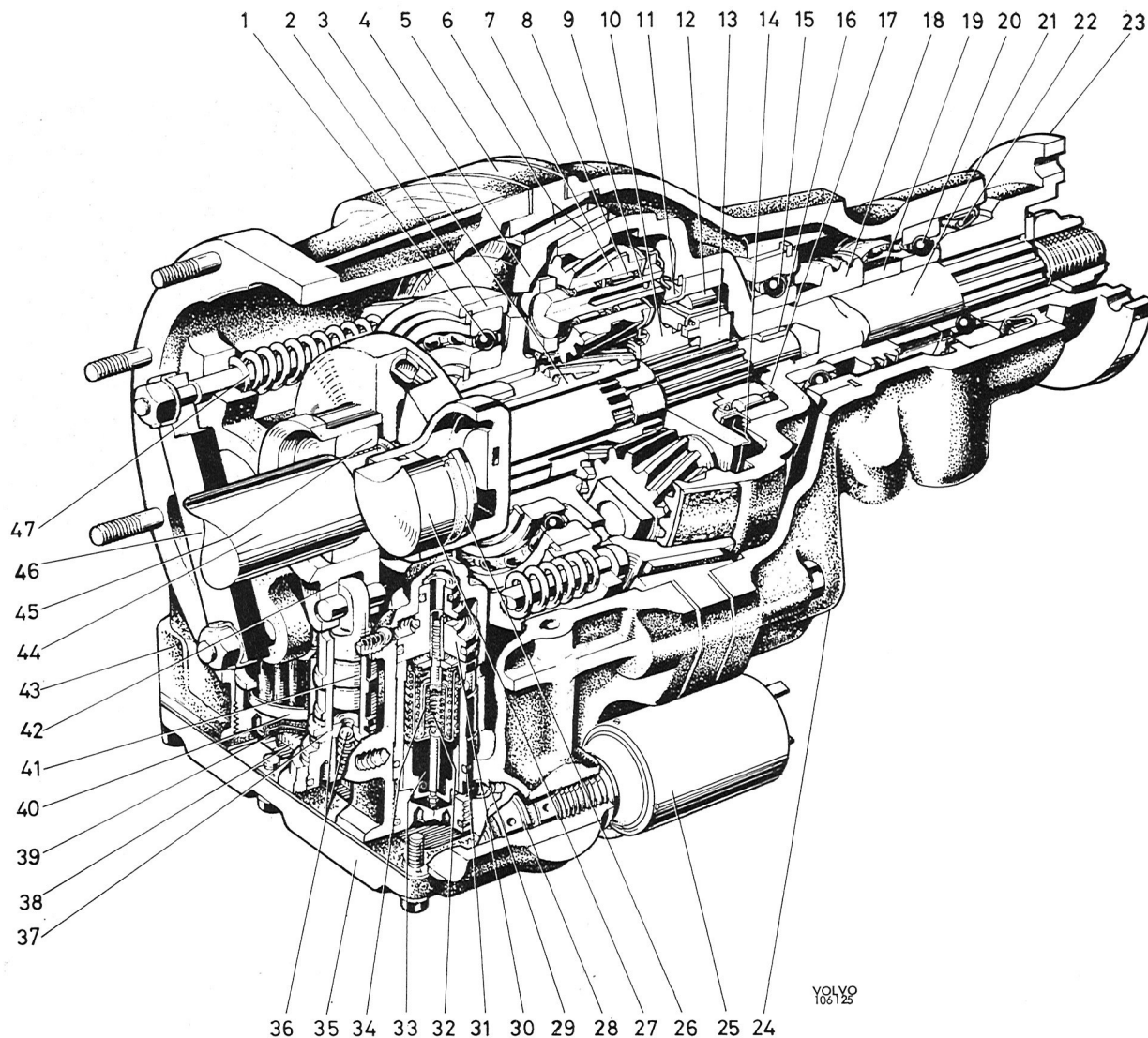


Fig. 4-50. Overdrive

1. Thrust bearing
2. Thrust bearing retainer
3. Sun wheel
4. Clutch sliding member
5. Brake ring
6. Clutch member linings
7. Planet gear
8. Needle bearing
9. Shaft
10. Planet carrier
11. Oil thrower
12. One-way clutch rollers
13. One-way clutch
14. Oil trap
15. Ball bearing
16. Bushing

17. Thrust washer
18. Speedometer driving gear
19. Spacer
20. Ball bearing
21. Output shaft
22. Oil seal
23. Coupling flange
24. Rear casing
25. Solenoid
26. Piston seal
27. Piston
28. Operating valve
29. Orifice nozzle
31. Cylinder
32. Spring
33. Large piston

34. Small piston
35. Base plate
36. Check valve for oil pump
37. Pump cylinder
38. Magnet
39. Pre-filter
40. Fine filter
41. Pump plunger
42. Connecting rod
43. Front casing
44. Input shaft
(transmission main shaft)
45. Eccentric
46. Bridge piece
47. Spring

SERVICE PROCEDURES

WORK ON OVERDRIVE IN VEHICLE CHECKING OIL PRESSURE

Volvo Standard Times Op. No. 43318

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

Check as follows:

1. Remove the plug under the operating valve and connect the pressure gauge 2834, see Fig. 4-51.

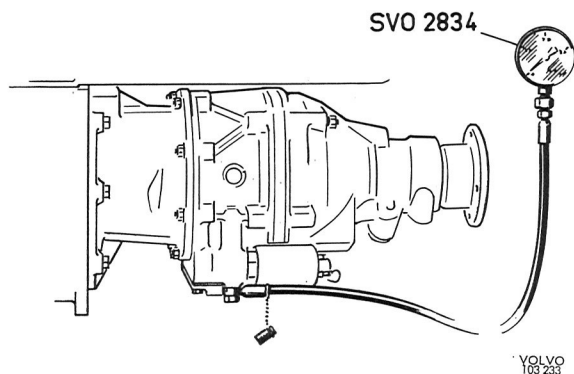


Fig. 4-51. Oil pressure check

2. Read the pressure when driving on direct drive at about 40 km/h (25 mph). The pressure should then be approx. 1.5 kp/cm² (21 psi).
3. Engage the overdrive and check that the pressure rises to 27—30 kp/cm² (380—425 psi).
4. Disengage the overdrive and check the time for the pressure to drop to 1.5 kp/cm² (21 psi). The time must not exceed 3 seconds.

SOLENOID AND OPERATING VALVE REPLACEMENT

The solenoid and operating valve are built together and replaced as a unit. For removal and installation, use a 25 mm (1") wrench. Use new seals and O-rings when needed. Tightening torque 42—55 Nm = 4.2—5.5 kgm = 30—40 lb.ft.

RELIEF VALVE CHECK AND REPLACEMENT

1. Remove the base plate and the pre-filter. Collect the oil in a container. Warning: If the vehicle has been driven recently, the oil may be hot and scald if it comes into contact with your skin.
2. Remove the plug under the relief valve with tool 2836, see Fig. 4-52.

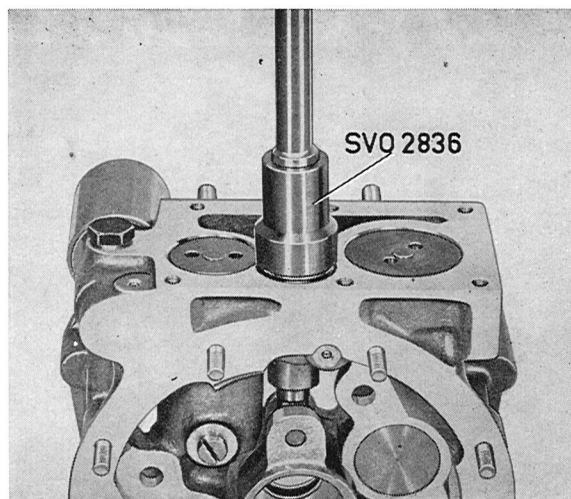


Fig. 4-52. Plug removal

Pull out the large piston of the relief valve, then spring and spring retainer. 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 units and a loop. see Fig. 4-53, for the cylinder and washer.

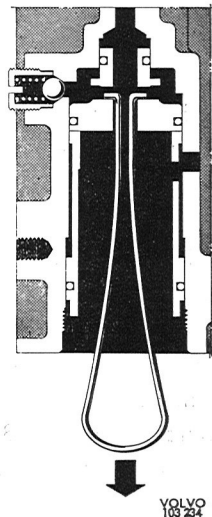


Fig. 4-53. Relief valve removal

3. Wash all the parts in alcohol or solvent and blow them dry with compressed air. Check them carefully for wear and damage. The pistons run easily in their cylinders. Replace defective parts.

NOTE: The following units are available as spare parts: End washer, cylinder, small piston, adjustment washer, low-pressure spring, large piston, plug and O-rings.

4. Before installation of the relief valve parts, blow the orifice nozzle clean with compressed air, see Fig. 4-54.

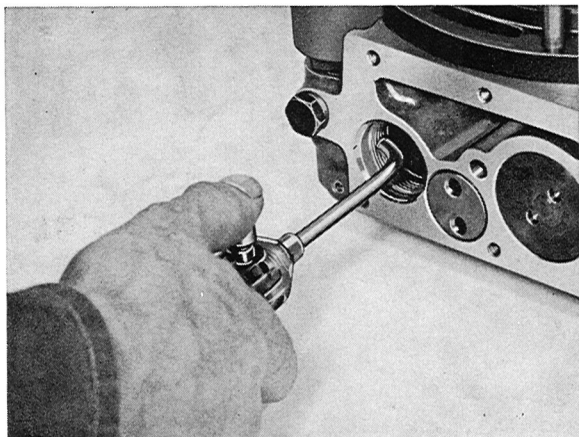


Fig. 4-54. Blowing orifice nozzle clean

5. Install the new O-rings on the end washer, cylinder and plug. Lubricate the parts with oil. Then install them in the following order: End washer, cylinder, small piston, low-pressure spring, large piston and plug. Tighten the plug to a torque of $22 \text{ Nm} = 2.2 \text{ kgm} = 16 \text{ lb.ft.}$
6. Install the pre-filter and base plate complete with a new gasket. Make sure that the magnet is in position on the base plate. Fill oil.

CLEANING 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. 4-54.

CHECK VALVE TEST AND REPLACEMENT

1. Remove the base plate and pre-filter. Collect the oil in a container. Warning: If the vehicle has been recently driven, the oil may be hot and scald if contact is made with your skin.
2. Remove the plug with tool 2836. Take out the non-return valve spring, non-return ball and non-return body.
3. Clean all the parts in alcohol or solvent and blow them dry with compressed air. Check the parts for damage and wear. Replace defective parts.
4. Install a new O-ring on the plug and then re-install the non-return body, ball spring and plug. Tighten the plug to a torque of $22 \text{ Nm} = 2.2 \text{ kgm} = 16 \text{ lb.ft.}$
5. Re-install the pre-filter and base plate together with a new gasket. Do not forget the magnet on the bottom plate. Fill oil.

FILTER CLEANING

1. Remove the base plate and the pre-filter. Collect the oil in a container. Warning: If the vehicle has been driven recently, the oil may be hot and scald if contact is made with your skin.
2. Remove the plug and the seal and the fine filter, see Fig. 4-55.

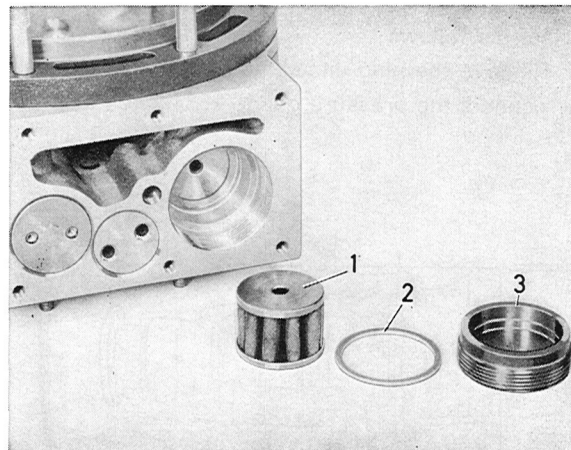


Fig. 4-55. Fine filter

3. Clean all the parts in alcohol or solvent. Then blow them dry with compressed air.
4. Install the fine filter, a new seal and the plug. Tighten the plug to a torque of $22 \text{ Nm} = 2.2 \text{ kgm} = 16 \text{ lb.ft.}$
5. Re-install the pre-filter and the base plate with a new gasket. Make sure that the magnet is in position on the base plate. Fill oil.

OVERDRIVE REMOVAL

Volvo Standard Times Op. No. 43313 (=replace overdrive).

To facilitate removal, the vehicle should first be driven with the overdrive engaged and then disengaged **with the clutch pedal depressed**. This is important in order to avoid torsional tensions in the shaft between the planet carrier and one-way clutch. Stresses will also disappear if oil with a pressure of $20\text{--}25 \text{ kp/cm}^2$ ($285\text{--}355 \text{ psi}$) is connected to the output at the operating valve. The overdrive is engaged and disengaged with this pressure.

Removal:

1. Carry out operations 1—5 under "Removal" in Group 43a.
2. Disconnect the solenoid wires.

3. Remove the bolts holding the overdrive unit to the intermediate flange. Pull the overdrive straight out backwards, until it is free from the transmission main shaft.

OVERDRIVE DISASSEMBLY

Volvo Standard Times

Op. No.

Rebuild overdrive, separated from transmission

43301

Rebuild overdrive, incl. remove and install transmission assembly

43312

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

1. Place the overdrive vertically in a vise provided with copper jaws. Remove the solenoid and operating valve.
2. Bend down the locking tab, remove the nuts for the piston bridge pieces. Remove the bridge pieces.
3. Remove the nuts holding the brake ring, front and rear casing. Loosen the nuts gradually all round in order to avoid any distorted tension from the springs. Lift off the front casing and brake ring, see Fig. 4-56.

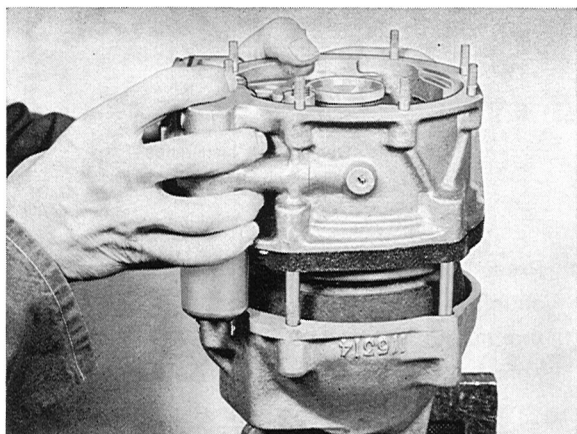


Fig. 4-56. Overdrive disassembly

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 sun wheel.
6. Lift out the planet carrier complete.

FRONT CASING REMOVAL

1. Place the casing on a bench with the front side downwards. 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 fine filter, relief valve and pump

check valve. See also under the heading "Work on overdrive in vehicle".

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

CLUTCH UNIT DISASSEMBLY

1. Remove the circlip for the sun wheel. Pull off the sun wheel 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.

REAR CASING DISASSEMBLY

1. Remove the bolt and pull out the retainer, the bushing and the speedometer pinion.
2. Remove the nut and pull off the flange with puller 2261. Place the housing in a press and press out the output shaft.
3. Remove the spacer and the speedometer drive gear. Pull out the bearing on the output shaft using a so-called knife extractor. The rear bearing and oil seal are pressed out of the housing with drift 1797 and handle 1801.
4. Remove the circlip and the oil thrower, which hold the one-way clutch on the output shaft. Lift out the one-way clutch components. Remove the thrust washer. If necessary pull the bushing on the output shaft with puller 2423, see Fig. 4-57.

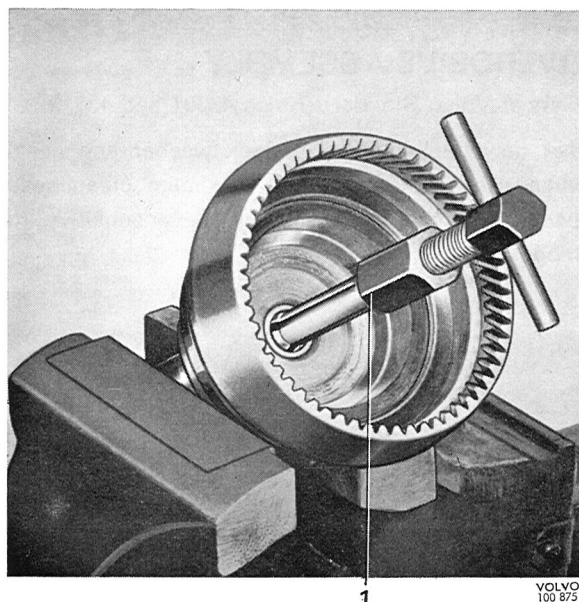


Fig. 4-57. Output shaft bushing removal

1. Puller 2423

OVERDRIVE INSPECTION

(Part of Volvo Standard Times 43301 and 43312)

Before inspecting, clean all the parts in alcohol or

solvent and then blow them dry with compressed air. Pay particular attention to the cleaning of the filters and 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 similar. 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 easily 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 amp-meter. Current draw should be approx. 2 amps. 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 bushing on the sun wheel is not worn. With replacement, change the sun wheel complete with bushing. The bushing must be concentric with the gear wheel, and this is difficult to achieve outside a special 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.

OVERDRIVE ASSEMBLY

(Part of Volvo Standard Times 43301 and 43312)

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

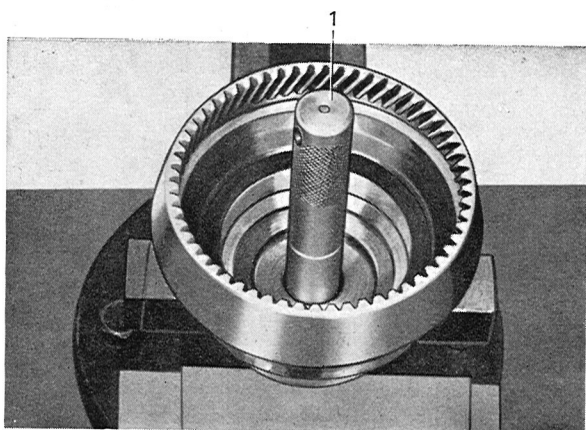


Fig. 4-58. Output shaft bushing installation

1. Drift 2417

REAR CASING ASSEMBLY

1. Push the bushing on the output shaft with drift 2417, see Fig. 4-58. Press the front bearing to the output shaft with drift 2412.
2. Press the rear bearing on to the rear casing section with drift 2412.
3. Place a wooden block under the output shaft as support. Install the speedometer driving gear and spacer. Press on the rear casing with drift 2412, see Fig. 4-59.

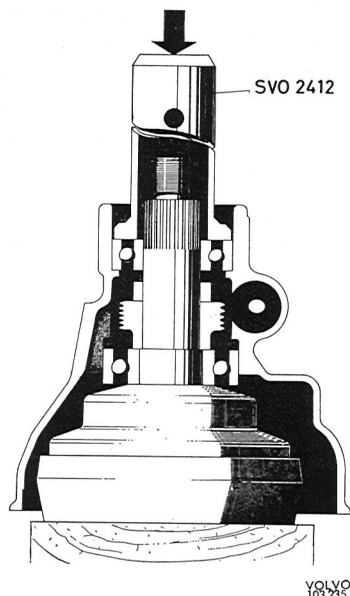


Fig. 4-59. Output shaft installation

4. Press in the oil seal with drift 2412. Fit the coupling flange, the washer and nut. Tighten the nut to a torque of 110—140 Nm (11—14 kgm = 80—100 lb.ft.).

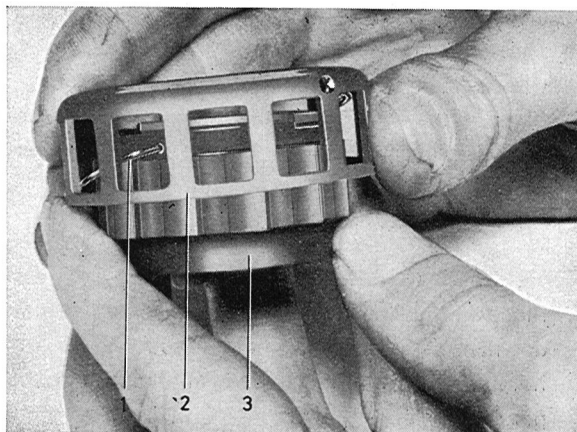


Fig. 4-60. One-way clutch assembly, I

1. Spring 2. Cage 3. One-way clutch hub

5. Assemble the one-way clutch, spring and roller cage. see Fig. 4-60.

Turn the roller cage clockwise as far as it will go and lock it in this position with a key as shown in Fig. 4-61.

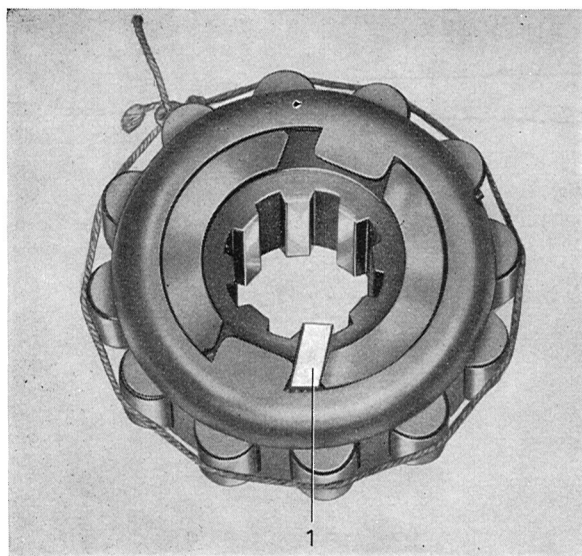


Fig. 4-61. One-way clutch assembly, II

1. Key

Install the rollers. Tie a piece of rubber band or string round the rollers.

6. Install the thrust washer and then the one-way clutch in position on the output shaft, see Fig. 4-62.

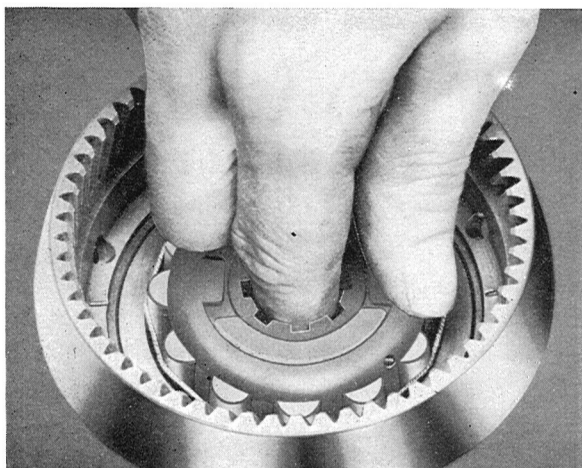


Fig. 4-62. One-way clutch installation

Install the oil thrower and install the circlip, see Fig. 4-63.

7. Install the speedometer pinion and bushing. Install the retainer and bolt.
8. Place the planet carrier complete with planet gear in position on the output shaft. Guide the splines into the planet carrier and one-way clutch with drift 2835, Fig. 4-64.

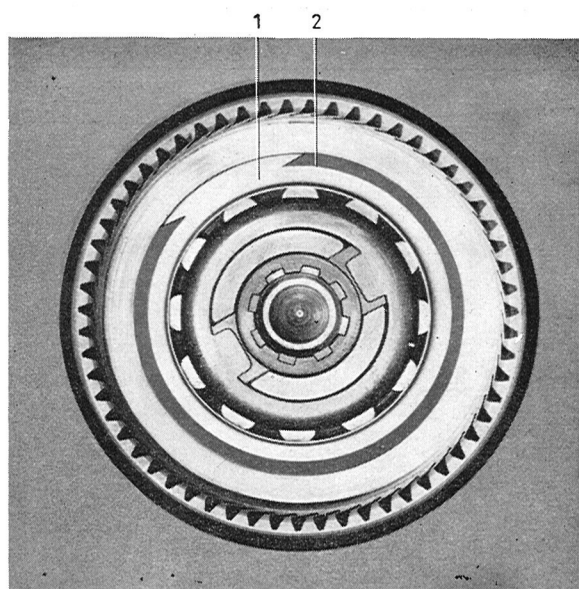


Fig. 4-63. Oil thrower installation

1. Oil thrower plate 2. Circlip

CLUTCH UNIT ASSEMBLY

1. Press the ball bearing into the retainer and install the circlip.
2. Install the bolts on the bearing retainer. Then press the bearing with retainer on to the clutch sliding member. Install the circlip.
3. Install the sun wheel to the clutch sliding member. Install the circlip.
4. Install the clutch unit in position on the output shaft. Install the four thrust springs on the bolts.

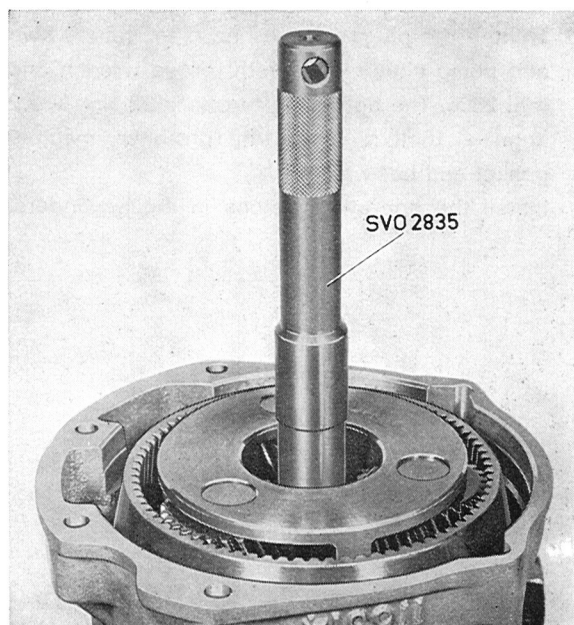


Fig. 4-64. Planet gear installation

FRONT CASING ASSEMBLY INSTALLATION

1. Install the fine filter. Also install the relief valve parts in the following order: End washer, cylinder, small piston, low-pressure spring, large piston and plug, see Fig. 4-65.

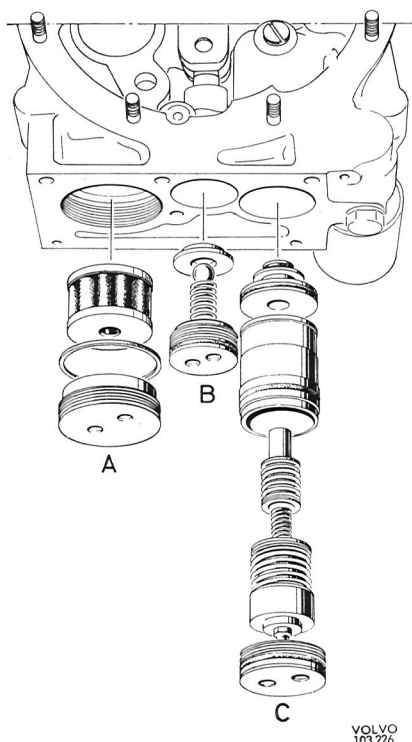


Fig. 4-65. Installation of fine filter, oil pump check valve and relief valve

2. Place the connecting rod and pump plunger in position in the casing. Then push in the cylinder. After that, install 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 2836. The tightening torque is $22 \text{ Nm} = 2.2 \text{ kgm} = 16 \text{ lb.ft.}$ Install the pre-filter, magnet, gasket and base plate.
4. Install the operating pistons in their cylinders.

5. Install the brake ring on the front casing. Place the front casing on the rear one. Install washers and nuts, see Fig. 4-66.

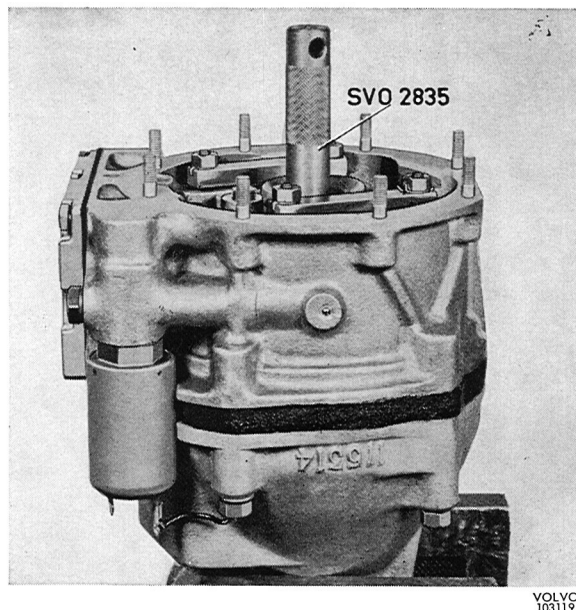


Fig. 4-66. Front casing assembly

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

OVERDRIVE INSTALLATION

(Volvo Standard Times 43313=replace overdrive=remove and install overdrive)

Install the overdrive in reverse order to removal. Fill oil. Check the oil in the transmission after the vehicle has been driven 10—15 km (5—10 miles).

GROUP 44

AUTOMATIC TRANSMISSION

TOOLS

The following special tools are required for repair of automatic transmissions.

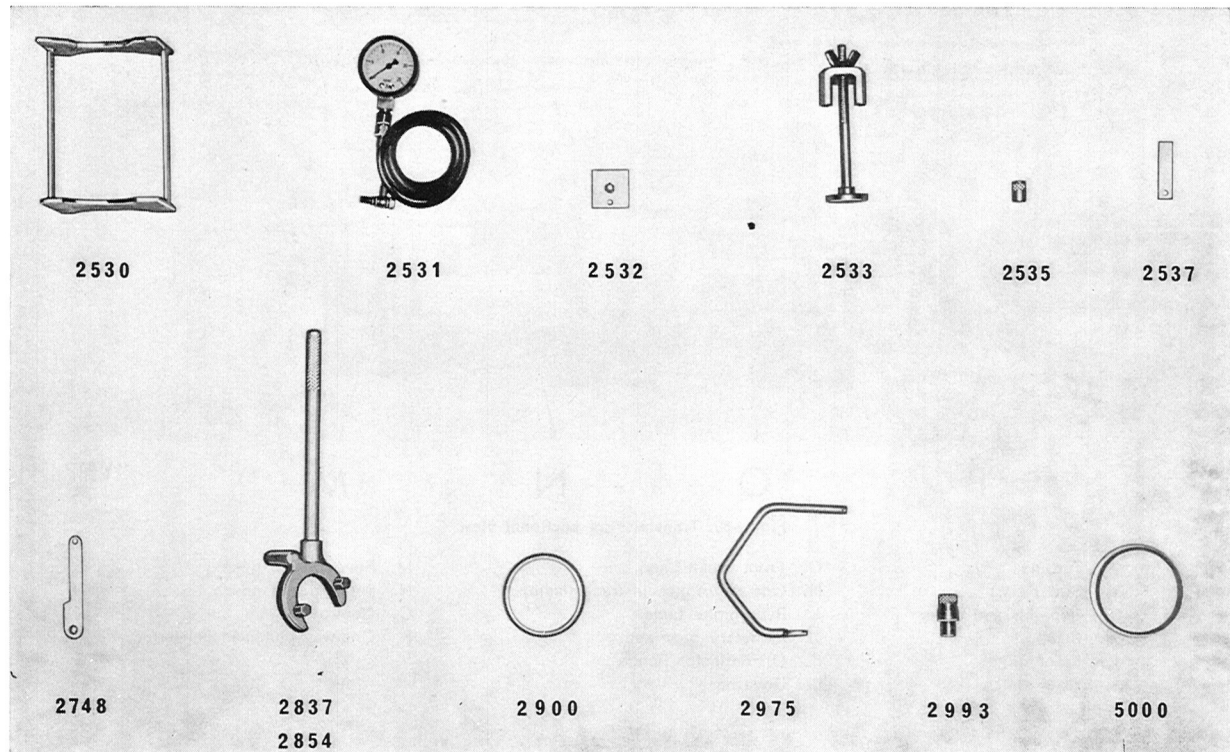


Fig. 4-67. Special tools

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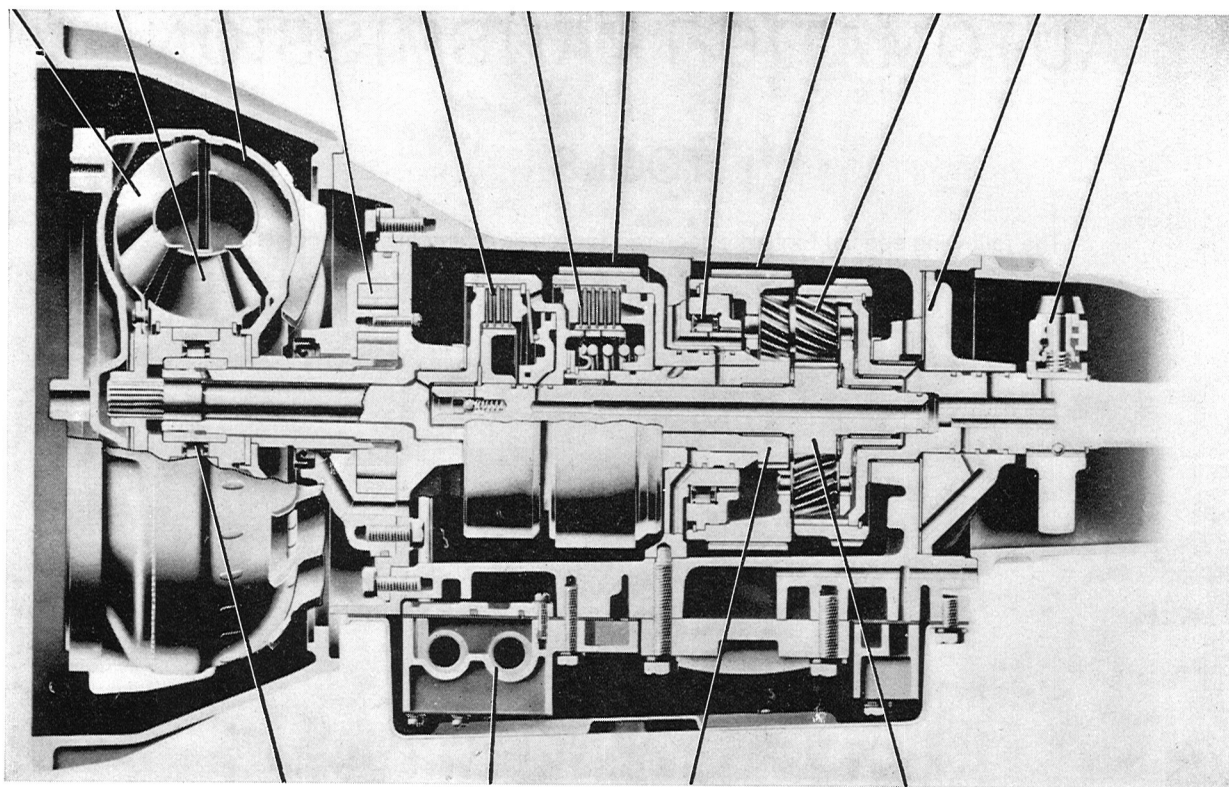
- 2530 Fixture for transmission disassembly and assembly
- 2531 Pressure gauge with hose and connection for oil pressure checks
- 2532 Attaching plate for magnetic holder when measuring end float of input shaft
- 2533 Press tool for compressing rear clutch during snap ring removal and installation
- 2535 5/16" square socket for rear brake band adjustment
- 2537 Spacer for front brake band adjustment
- 2746 Fixture for removal and installation of transmission, see Fig. 4-85
- 2748 Wrench for front brake band adjustment

999

(SVO)

- 2837 Counterhold for flange (cars with B20 E engine)
- 2854 Counterhold for flange (cars with B20 A, B or F engines)
- 2900 Ring for installation of piston in front clutch (used together with 2993)
- 2975 Special tool for starter inhibitor switch
- 2993 Guide for installation of piston in front clutch
- 5000 Ring for installation of piston in rear clutch
- Instead of bench stand 2530, the following can be used during disassembly and assembly, see Fig. 4-86:
- 2520 Stand
- 2934 Fixture

A B C D E F G H I J K L



P

O

N

M

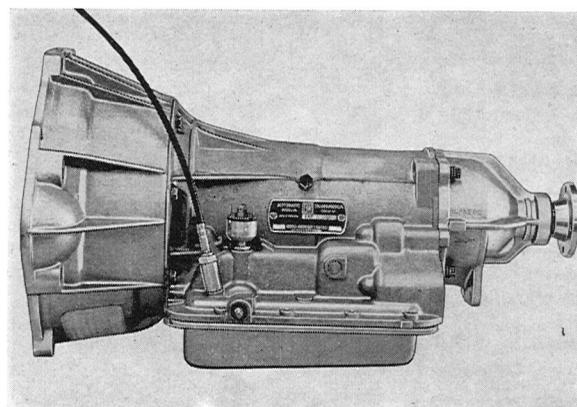
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Fig. 4-68. Transmission sectional view

- A. Turbine
- B. Stator
- C. Impeller and cover
- D. Pump
- E. Front clutch
- F. Rear clutch

- G. Front brake band
- H. One-way clutch in transmission
- I. Rear brake band
- J. Planetary gear set
- K. Oil deflector flange
- L. Governor

- M. Reverse sun gear
- N. Forward sun gear
- O. Control system
- P. One-way clutch in converter



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Fig. 4-69. The Borg-Warner Automatic Transmission type 35

GENERAL INFORMATION

The Volvo automatic transmission is the Borg-Warner type 35. It consists of two main components:

1. A three-element hydrokinetic torque converter coupling, capable of torque multiplication at an infinitely variable rate between 2:1 and 1:1.
2. A hydraulically operated transmission comprising a planetary gear set with a valve system which automatically selects a suitable gear in relation to the speed of the car and position of the accelerator pedal.

There is also a selector control with positions "P", "R", "N", "D", "2" and "1", see Fig. 4-70.

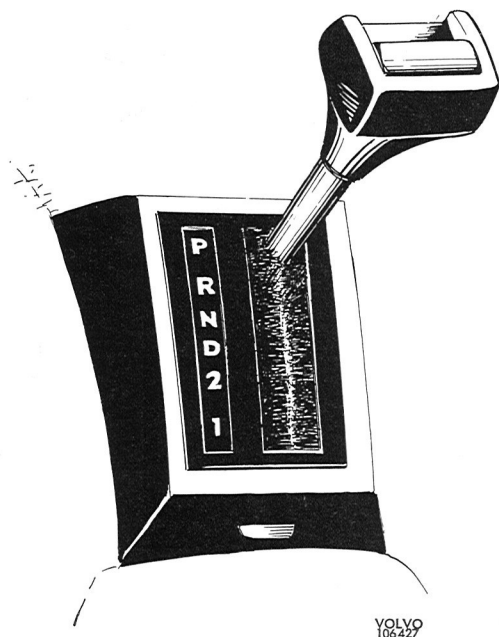


Fig. 4-70. Selector lever positions

TORQUE CONVERTER

The torque converter serves both as a clutch and as an extra (hydraulic) gear between the engine and transmission. It provides a smooth application of engine power to the driving wheels and additional engine torque multiplication to the 1st and 2nd gears of the transmission. The converter also provides extreme low-speed flexibility when the transmission is in 3rd gear, and, since it can multiply engine torque, it gives good acceleration from

very low road speed without having to resort to a downshift in the transmission.

The converter consists of three main components — a turbine connected to the input shaft of the transmission

— a stator mounted on a sprag-type one-way clutch supported on a fixed hub, projecting from the transmission case.

The converter functions as follows:

The impeller is rotated by the engine and converts the engine power into hydrokinetic energy. The fluid flows from the impeller vanes to the turbine vanes and returns to the impeller vanes through the stator vanes. The curvature of the various vanes is so designed that when a speed differential exists between the impeller and the turbine, the angle of the fluid flow from the turbine is changed by the stator vanes in such a way that the discharge of fluid from the stator assists in driving the impeller. Under such conditions, torque multiplication occurs and varies from 2:1 when the turbine is stalled (i.e. when, with any of the driving ranges selected, the vehicle is held stationary and the engine is operating at maximum throttle opening) to 1:1 when the turbine reaches a speed approximately 90 % of that of the impeller. When this speed differential between the impeller and turbine is achieved, the fluid angle from the turbine is such that the stator is driven in the same direction as the turbine and the impeller. Under these circumstances the converter becomes a fluid flywheel or coupling and there is no torque multiplication.

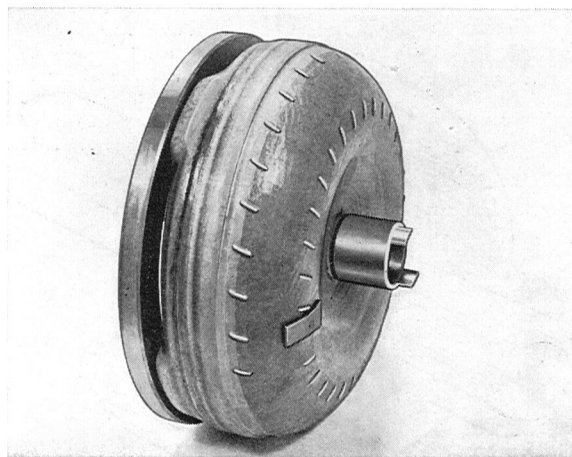


Fig. 4-71. Converter

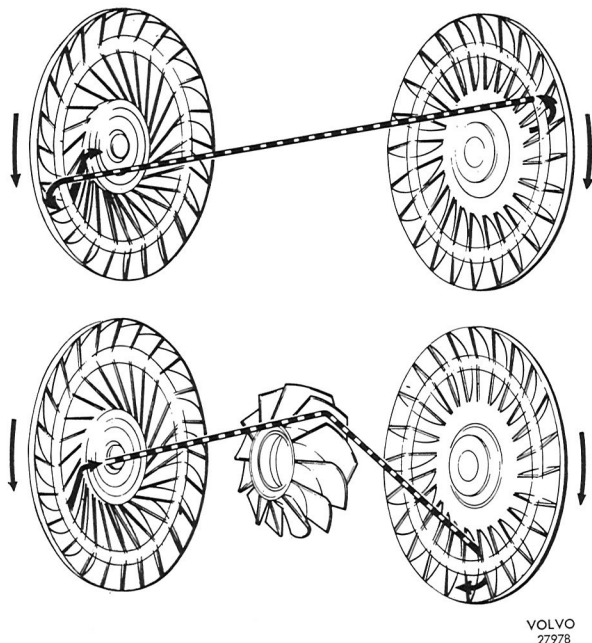


Fig. 4-72. Converter function

TRANSMISSION

The transmission consists of a mechanical power transmission system (planetary gear, two clutches, two brake bands and a one-way clutch) and a hydraulic system (an oil pump, centrifugal governor and a control valve system which regulates the fluid pressure and directs the fluid to the various gearbox components).

MECHANICAL POWER TRANSMISSION SYSTEM

Planetary gear

The planetary gear set consists of two sun gears, two sets of pinions, a pinion carrier and a ring gear, see Fig. 4-73.

Helical involute tooth forms are used throughout. In all forward gears, power enters through the forward sun gear, in reverse, power enters through

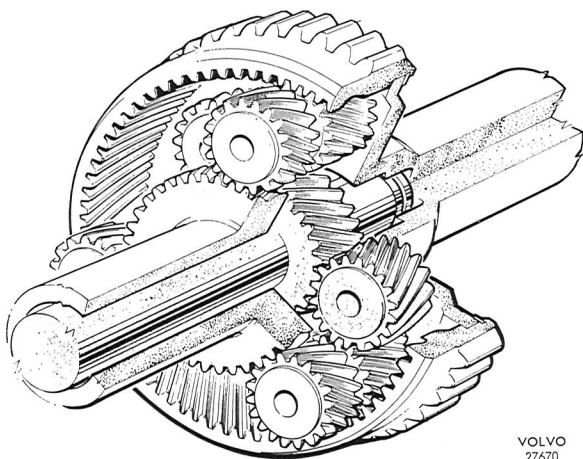


Fig. 4-73. Planetary gear

the reverse sun gear. Power leaves the gear assembly by the ring gear. The pinions are used to transmit power from the sun gears to the ring gear. In reverse, a single set of pinions is used which causes the ring gear to rotate in the opposite direction to the sun gear. In forward gears, a double set of pinions is used to cause the ring gear to rotate in the same direction as the sun gear. The carrier locates the pinions in their correct positions relative to the two sun gears and the ring gear (and also forms a reaction member under certain conditions). The various mechanical ratios of the gear set are obtained by the engagement of hydraulically operated multi-disc clutches and brake bands.

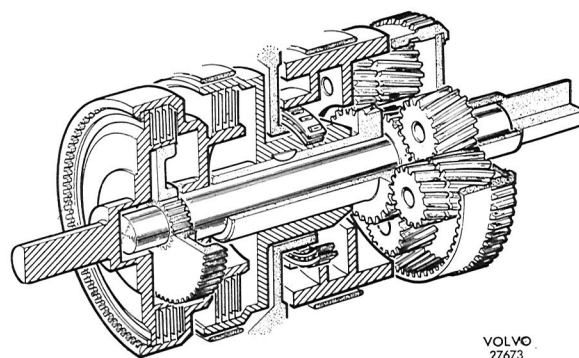


Fig. 4-74. Planetary gear, clutches and brake bands

Clutches

The clutches, see Fig. 4-74, consist of multi-disc units operated by hydraulic pistons. In all forward gears, the front clutch connects the converter to the forward sun gear, for reverse, the rear clutch connects the converter to the reverse sun gear.

Brake bands

Brake bands, operated by power pistons, hold elements in the gear set stationary to effect an output speed reduction and a torque increase. In "lockup" the rear band holds the pinion carriers stationary and provides the 1st gear ratio of 2.39:1 and, in reverse, a ratio of 2.09:1. The front band holds the reverse sun gear stationary to provide the 2nd gear ratio of 2.45:1.

One-way clutch

In the drive position "D", a one-way clutch is used in place of the rear band to prevent the pinion carrier from turning opposite to engine rotation, thus also providing a 1st gear ratio of 2.39:1. This one-way clutch, allowing the transmission to free-wheel in 1st gear, provides smooth ratio changes from 1st to 2nd and vice versa.

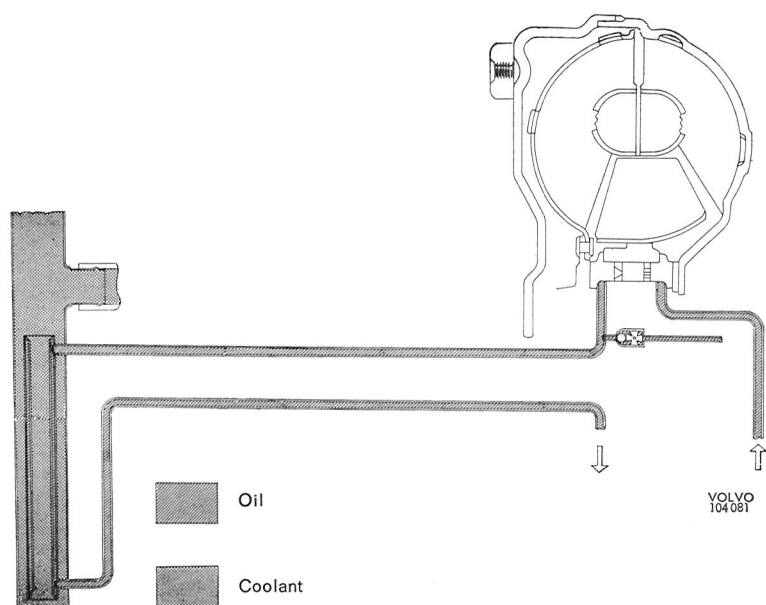
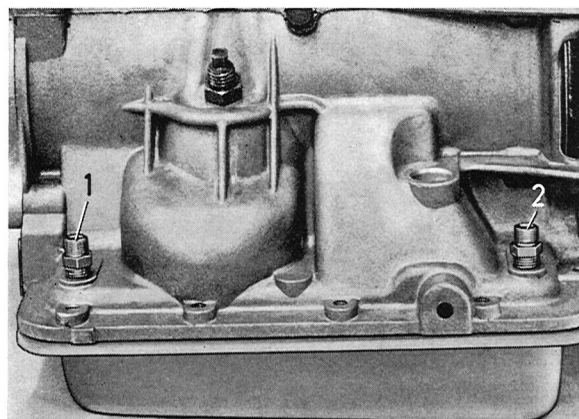


Fig. 4-75. Oil cooler operation

Oil cooler

The automatic transmission is connected to an oil cooler. This is housed in the bottom tank of the engine radiator and is connected as shown in Fig. 4-75. The oil cooler is connected to the nipples (1, 2, Fig. 4-76) on the right-hand side of the transmission.

Fig. 4-76. Oil cooler connection
1—2. Oil cooler connection nipples



SERVICE PROCEDURES

When working on the vehicle, the selector lever should be in position "P".

Provided the transmission is operating satisfactorily, the car may be towed in position "N", on condition that the transmission is properly adjusted and the fluid level is correct.

If the transmission is inoperative, the propeller shaft should be disconnected before towing is started.

The control system of the automatic transmission is manufactured with the same degree of precision as the injection equipment of a diesel engine. Fluid circulates through the converter, transmission gear system and control system.

It is therefore necessary to observe the utmost cleanliness when working on the transmission.

WORK ON TRANSMISSION IN VEHICLE

FLUID LEVEL CHECK

Normally, oil changing is only required when the transmission has been reconditioned. However, the oil level should be checked every 10 000 km (6 000 miles).

When checking the oil level, the car should be on level ground. Move the selector to position "P" and let the engine idle. The filler pipe with dipstick is located in front of the bulkhead on the right-hand side of the engine. Pull the dipstick, and wipe it with nylon cloth or clean paper. Fluffy rags must not be used. Insert the dipstick, then pull it up and note the oil level, see Fig. 4-77.

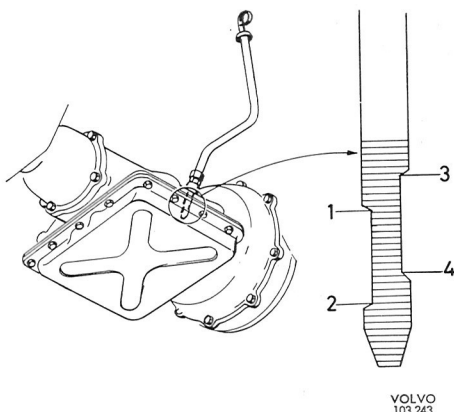


Fig. 4-77. Dipstick

1. Max. oil level, cold transmission
2. Min. oil level, cold transmission
3. Max. oil level, warm transmission
4. Min. oil level, warm transmission

NOTE:: There are different oil level marks for a warm or cold transmission.

When the transmission is warm, after the car has been driven approx. 8—10 km (5—7 miles), the upper area (3 and 4, Fig. 4-77) applies. The lower area (1 and 2) applies when the transmission is cold. The text on the dipstick also mentions this difference.

If necessary, top up with oil to the "Max" mark. Do not exceed this mark, otherwise the transmission can become overheated. The difference between the "Min" and "Max" marks is about 1 pint (.5 liter). Use an oil which is approved as "Automatic Transmission Fluid, type F (USA: FLM)". If topping up with oil is required often, there must be leakage, which should be attended to immediately.

VALVE BODIES ASSEMBLY, REMOVAL AND INSTALLATION

1. Jack up and put the vehicle on stands. Drain the oil into an absolutely clean pan. See Fig. 4-84.

NOTE: The oil may be very hot and scald if contact is made with the skin.

2. Release the bolts for the oil sump and remove the sump. Carefully remove the oil tubes (Fig. 4-87).
3. Release the throttle cable from the cam. Remove the three bolts, see Fig. 4-88, which secure the valve bodies assembly to the transmission casing. Remove the valve bodies assembly straight downwards so that it releases from the oil tubes at the front end.
4. Make sure that the oil tubes are in position on the pump body. Place the valve bodies assembly in position and secure it with the three bolts, see Fig. 4-88.

5. Install the throttle cable on the cam. Install the oil tubes as shown in Fig. 4-87. Check that the magnetic element lies in the oil sump and install the sump. Use a new gasket. Coat the threads on the oil drain plug with sealing fluid 277691 and then install the plug.
6. Lower the vehicle, fill oil.

SELECTOR CONTROLS ADJUSTMENT

1. Disconnect the shift rod from the transmission lever. Place the lever in position "2". Also set the selector lever to position "2".

Adjust the length of the shift rod to provide a small clearance (min. 1 mm=.04", see B, Fig. 4-78) between the selector lever inhibitor and the inhibitor plate when the rod is connected to the lever on the transmission.

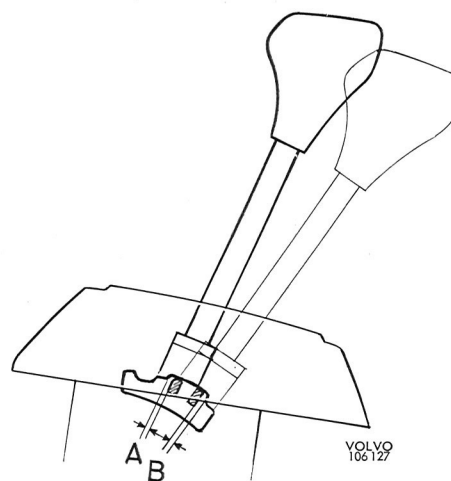


Fig. 4-78. Selector controls adjustment

3. Move the selector lever to position "D" and check that the clearance to the sliding place is the same or somewhat greater than in position "2". Adjust if necessary.
4. Lock the bolt with the circlip and tighten the lock nut. Make sure that the control rod lug follows with the yoke.
5. Check that the clearances (A and B) are the same in positions "D" and "2" after the yoke has been moved to positions "P" and "1". Also check that the output shaft is locked with the selector lever in position "P".

THROTTLE CABLE ADJUSTMENT

Correct adjustment of this cable is most important for satisfactory operation of the transmission. There are three different methods.

Adjust first in accordance with A, see Fig. 4-79. Method B is to be applied if the transmission is not functioning satisfactorily and method C when replacing the cable.

- A. 1. Check that engine idling speed is correctly

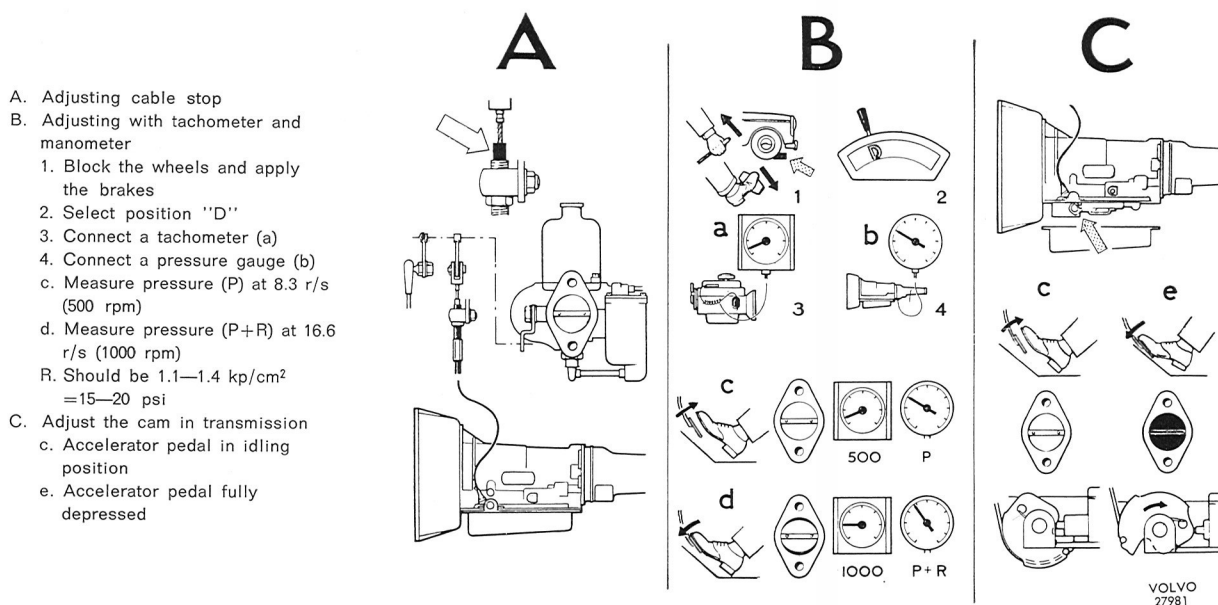


Fig. 4-79. Throttle cable adjustment

adjusted and that the inner cable and outer cable are correctly attached.

2. Screw up the threaded sleeve until it almost lies against the stop (for vehicles with single carburetor), and 1 mm (1/32") from the stop for vehicles with twin carburetors, the stop bearing crimped on the cable.

3. With the accelerator pedal fully depressed, check that:

- a. the carburetor lever is at the fully open stop.
- b. the line pressure at converter stall speed amounts to at least 11 kp/cm² (160 psi).

- B. If the cable stop has been damaged or moved, the cable must be adjust as follows:

1. Connect a tachometer to the engine and a pressure gauge to the transmission as shown in Fig. 4-80.

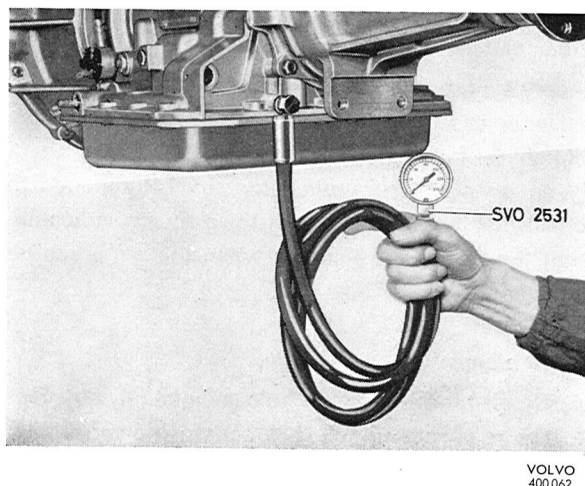


Fig. 4-80. Pressure gauge connection

2. Block the wheels and apply the brakes. Start the engine and move the lever to "D" Read

the pressure at 8.3 and 16.6 r/s (500 and 1 000 rpm). At 16.6 r/s (1 000 rpm) the pressure should be 1.1—1.4 kp/cm² (15—20 psi) higher than at 8.3 r/s (500 rpm). If the pressure rise is less than 1.1 kp/cm² (15 psi) the effective length of the outer cable should be increased by means of the adjuster. Conversely, if the rise is more than 1.4 kp/cm² (20 psi) the effective length of the outer cable should be decreased.

NOTE: On vehicles with an exhaust emission control system, it may be more suitable to measure the pressure at 11.6 and 20 r/s (700 and 1 200 rpm). The pressure increase also in this case should be 1.1—1.4 kp/cm² (15—20 psi).

- C. If a new cable has to be installed, the transmission oil pan must be removed. In this event it is often simpler to adjust the cable by observing the movement of the cam in relation to accelerator pedal movement as follows:

1. With the accelerator pedal fully released and the carburetor lever at the idling stop, the heel of the cam should contact the full diameter of the downshift valve, with all the slack of the inner cable taken up.
2. With the accelerator pedal fully depressed and the carburetor lever at the full open stop, the constant radius area of the cam should be the point of contact with the downshift valve.

NOTE:

1. The cable is pre-lubricated with silicon or molybdenum disulphide lubricant and must not be oiled.
2. Ensure that at all times the outer cable is correctly located in the adjuster.

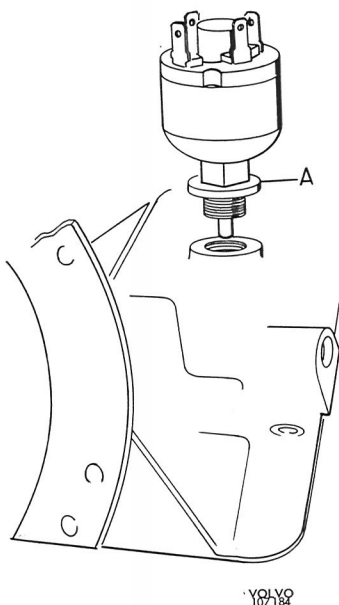


Fig. 4-81. Starter inhibitor installation
A. Gasket

STARTER INHIBITOR SWITCH REPLACEMENT

Volvo Standard Times Op. No. 44418

1. Disconnect the switch wires. Use tool 2975 to remove the contact.
2. Install new gasket (A, Fig. 4-81) on the contact. Screw in the contact and tighten it to a torque of 8—11 Nm = 8—11 kgm = 6—8 lb.ft.) with the tool 2975. Connect the wires.
3. Check that the engine can only be started with the shift selector in positions "P" and "N", that the back-up lights go on with the selector in position "R" and that the seat belt reminder functions in "D", "2" and "1".

REAR BRAKE BAND ADJUSTMENT

(Volvo Standard Times Op. No. 44212)

When adjusting this band in the car, a hole has been introduced in the body tunnel, which is ac-

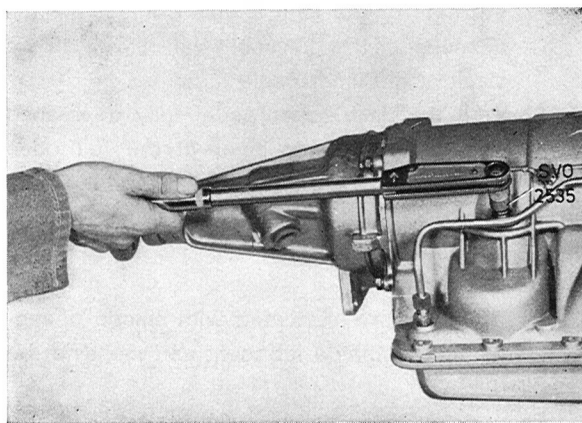


Fig. 4-82. Rear brake band adjustment

cessible after the mats have been moved to on side, the air duct has been released and the rubber removed. Adjusting is made as follows:

1. Slacken the lock nut for the adjusting screw.
2. Use the special socket 2535 and connect the torque wrench to the adjusting screw, see Fig. 4-82. Tighten the screw to 14 Nm (= 1.4 kgm = 10 lb.ft.). Back off the adjusting screw one turn.
3. Tighten the lock nut and restore.

AIR PRESSURE CHECKS

Air pressure checks can be made on the transmission assembly to determine whether the clutches and brake bands are operating. These checks can be made with the transmission in the car or on the bench. In either event, drain the fluid from the transmission and remove the oil pan as well as the valve bodies assembly with oil tubes. The air used must be clean and dry.

If the clutch and bands operate satisfactorily with air pressure, faulty operation of the transmission must be due to malfunction of the hydraulic control system. The valve bodies assembly must then be disassembled, cleaned, inspected and re-assembled.

Front clutch and governor feed "A"

Apply air pressure to the passage 5 of the transmission case rear wall, see Fig. 4-83. Listen for a thump, indicating that the clutch is functioning. On the bench, also verify by rotating the input shaft with air pressure applied.

If the extension housing has been removed, rotate the output shaft so that the governor weight will be at the bottom of the assembly. Verify that the weight moves inwards with air pressure applied.

Rear clutch "B"

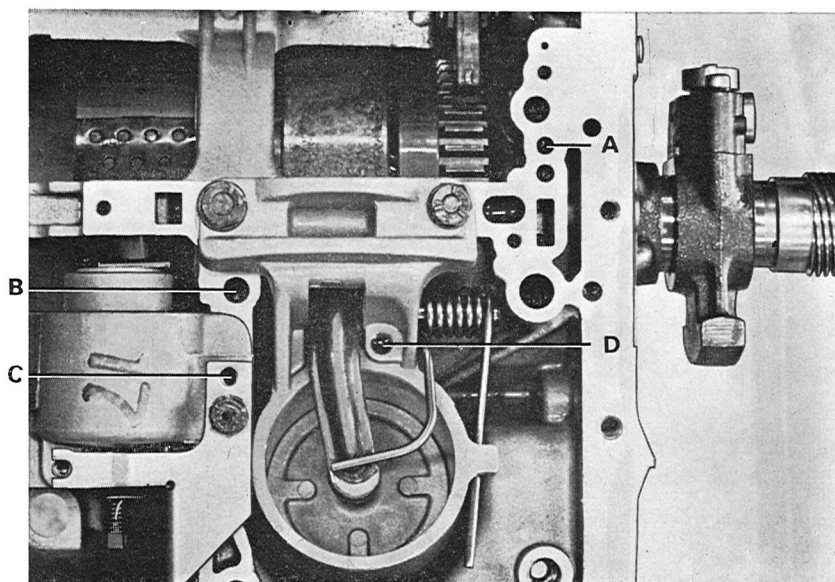
Apply air pressure to the passage (15) of the transmission case web. On the bench, verify that the clutch is functioning by turning the input shaft. Keep air pressure applied for several seconds to check for leaks. Then listen for a thump indicating that the clutch is releasing when the air pressure is removed.

Front piston "C"

Apply air pressure to the hole immediately adjacent to the rear retaining bolt. Observe the movement of the piston pin.

Rear piston "D"

Apply air pressure to the hole on the body. Observe the movement of the piston lever.



- A. Front clutch (5)
- B. Rear clutch (15)
- C. Front piston application
- D. Rear piston

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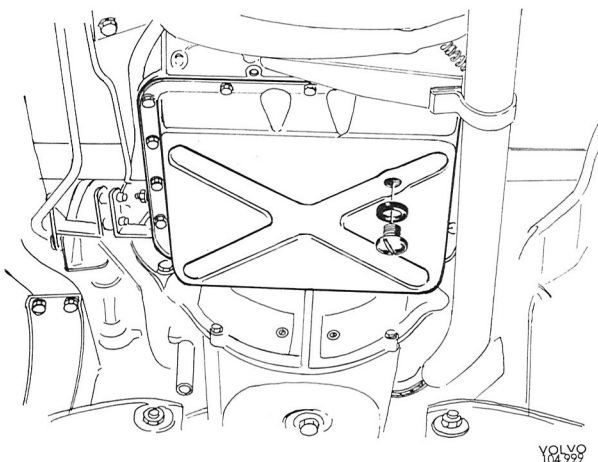
Fig. 4-83. Function test with compressed air

AUTOMATIC TRANSMISSION REMOVAL

Volvo Standard Times Op. No. 44274

1. Remove the oil dipstick and remove the filler pipe clamp. Remove the bracket and the throttle cable from the dashboard and the throttle control respectively. Disconnect the exhaust pipe at the manifold flange. Jack up the car and put stands under the front and rear axles.
2. Drain the oil into a clean container, see Fig. 4-84.

NOTE: The oil may be very hot and scald if contact is made with the skin.

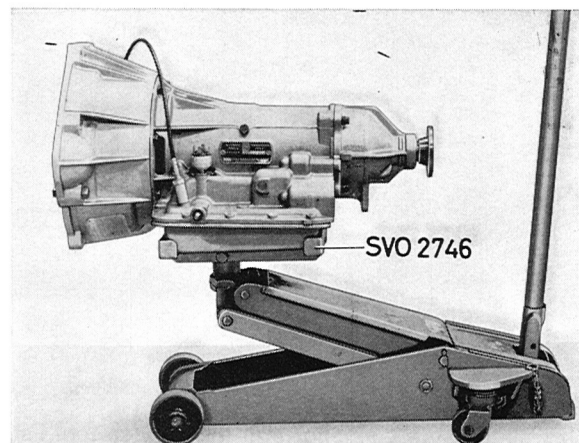


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Fig. 4-84. Oil drain plug

3. Disconnect the propeller shaft from the transmission flange. Disconnect the controls from the selector shaft lever as well as the reinforcing bracket under the oil pan.

4. Remove the attaching bolts for the converter. Turn the crankshaft forwards with a wrench on the crankshaft pulley bolt. Also use the wrench as a counterhold.
5. Install fixture 2746 on a jack. Support the transmission with the jack, see Fig. 4-85.



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Fig. 4-85. Transmission fixture

6. Remove the nut for the rear engine mounts and remove the cross-member. Disconnect the brackets for the exhaust pipe and the rear engine mounts. Remove the speedometer cable from the transmission. Release the oil filler pipe.
7. Install a wooden block between the engine and the firewall and lower the jack until the engine is aligned against the wooden block. Observe due care with the battery lead. If any tensions arise, disconnect the battery lead.

8. Disconnect the electric wires at the starter inhibitor switch. Remove the screws for the starter. Remove the attaching bolts for the converter casing. Pull the transmission backwards and release the guide pin on the converter at the same time. Lower and remove the transmission.

TRANSMISSION DISASSEMBLY

Re-build transmission = Volvo Standard Times Op. No. 44273

As a general rule it is advisable only to disassemble those components requiring attention as indicated by road-testing or trouble shooting procedure.

Prior to removal of any components, the outside of the transmission must be thoroughly washed with alcohol or a suitable solvent. A high standard of cleanliness is required when handling or storing components.

When disassembling, the transmission should be inverted and placed on the bench cradle or in the fixture 2934 as shown in Fig. 4-86.

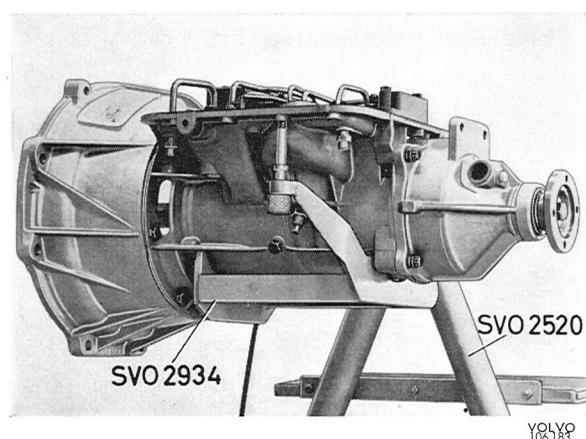


Fig. 4-86. Transmission fixture 2934

Use special tools as shown in the service tool list. Treat the various components with great care, particularly light-alloy parts. When the transmission is to be completely disassembled, follow the following procedures:

1. Remove the six bolts and withdraw the converter housing.
2. Remove the "Wedglok" screw for the drive flange on the output shaft. Pull out the driver flange and catch the 3/8" plain washer. Loosen and withdraw the rear housing. Remove the speedometer gear.
3. Remove the oil pan bolts and the oil pan. Lever out the oil tubes B-E carefully as shown in Fig. 4-87.

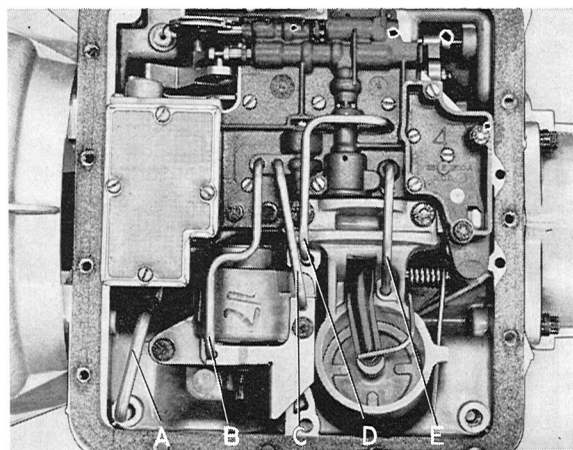


Fig. 4-87. Oil tubes

- A. Converter outlet
- B. Front piston release
- C. Front piston application
- D. Rear clutch
- E. Rear piston

VALVE BODIES ASSEMBLY

Work on the assembly should preferably be carried out in a Diesel test-room or in a room with a similar standard of cleanliness.

4. Disconnect the downshift valve cable from the downshift valve cam. Remove the three screws which retain the valve bodies assembly to the transmission case, see Fig. 4-88. Lift the valve bodies assembly straight up so that it releases from the oil tubes at the front end.
5. Remove the two screws for the bracket of the downshift valve cam.
6. Remove the oil pump strainer.
7. Remove from above the screws which retain the upper valve body. Turn the valve bodies assembly round and unscrew the other six screws from underneath.

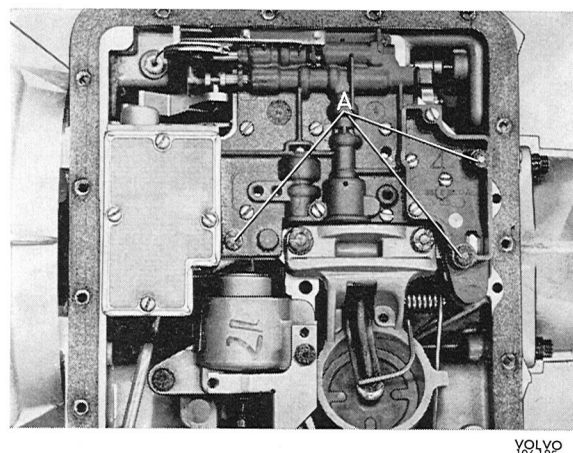
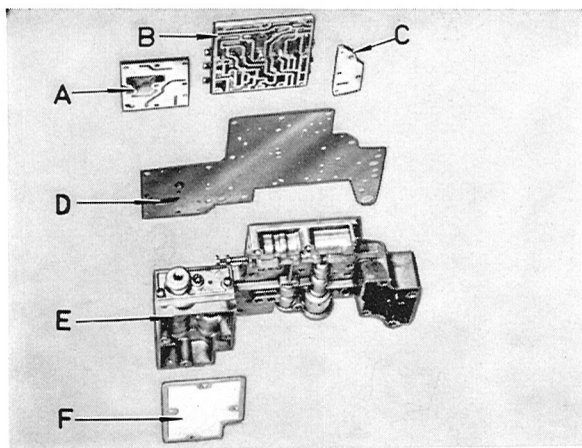


Fig. 4-88. Valve bodies assembly

- A. Attaching bolts

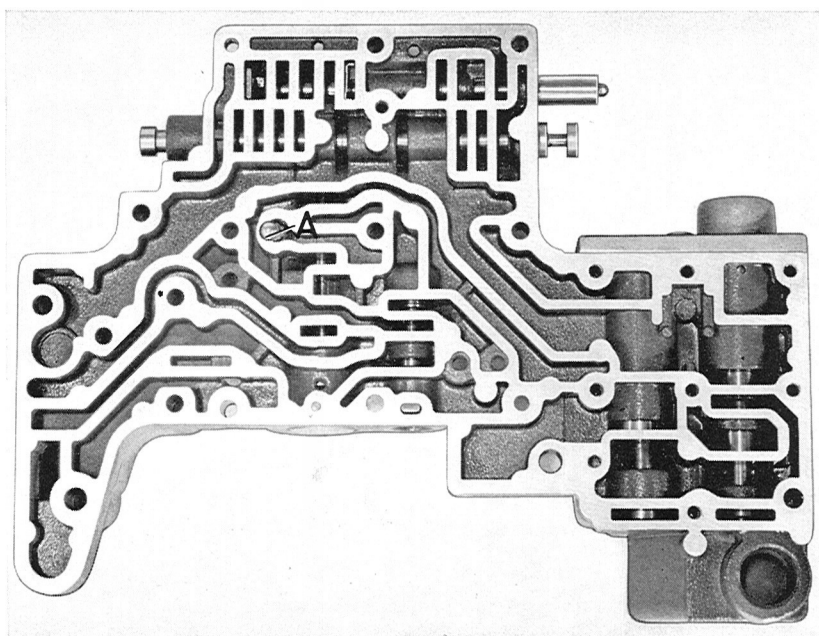


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Fig. 4-89. Main components of valve bodies assembly

- A. Oil tube collector
- B. Upper valve body
- C. Governor line plate
- D. Separating plate
- E. Lower valve body
- F. Pump strainer

8. Remove the eight screws retaining the oil tube collector.
9. Remove the four screws retaining the governor line plate. Note that two screws are under one of the strainers.
10. Remove the separating plate and then the check valve for the fast 3—2 shifting, see Fig. 4-90. Withdraw the manual control valve, see "A", Fig. 4-91.
11. Remove the stops for the throttle valve and the return spring. Then withdraw the downshift valve, spring and throttle valve, see "B", Fig. 4-91.



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Fig. 4-90. Check valves in lower valve body

12. Remove the dowel pin which retains the plug for the modulator valve. Then remove the plug, valve and then the spring and valve.
13. Remove the stop for the servo orifice control valve and then the spring and valve.
14. Remove the following components from the manual valve side of the lower valve body: three screws, lower body and plate, primary regulator spring, primary regulator valve sleeve, primary regulator valve, secondary regulator valve spring and secondary regulator valve.
15. Remove the six screws and end plate from the upper valve body, see Fig. 4-92. Remove the following parts from the rear end of the body: shift valve 2—3, inner spring and plunger together with shift valve 1—2. The spring and plunger for shift valve 1—2 are removed in the other direction.

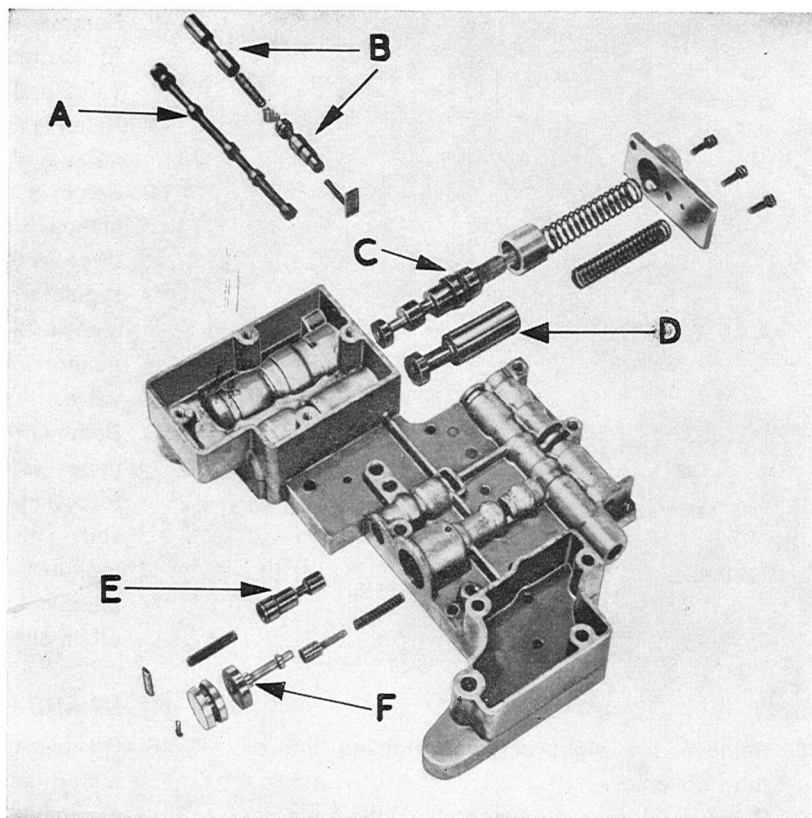
FRONT AND REAR PISTONS

16. Remove the two screws which retain the front piston assembly to the body, withdraw the assembly and the strut for the band.
17. Remove the snap ring in the cylinder with a small screwdriver. Take out the piston and separate the various parts. Drive out the clotted spring pin and lever pivot pin if necessary.
18. Remove the two screws which retain the rear piston assembly and withdraw this and the strut.
19. Unhook the spring. Drive out the pivot pin and the lever. Pull out the piston.

A. Check valve for fast 3—2.

Fig. 4-91. Lower valve body

- A. Manual control valve
- B. Downshift and throttle valve
- C. Primary regulator valve
- D. Secondary regulator valve
- E. Servo orifice control valve
- F. Modulator valve



VOLVO
103 838

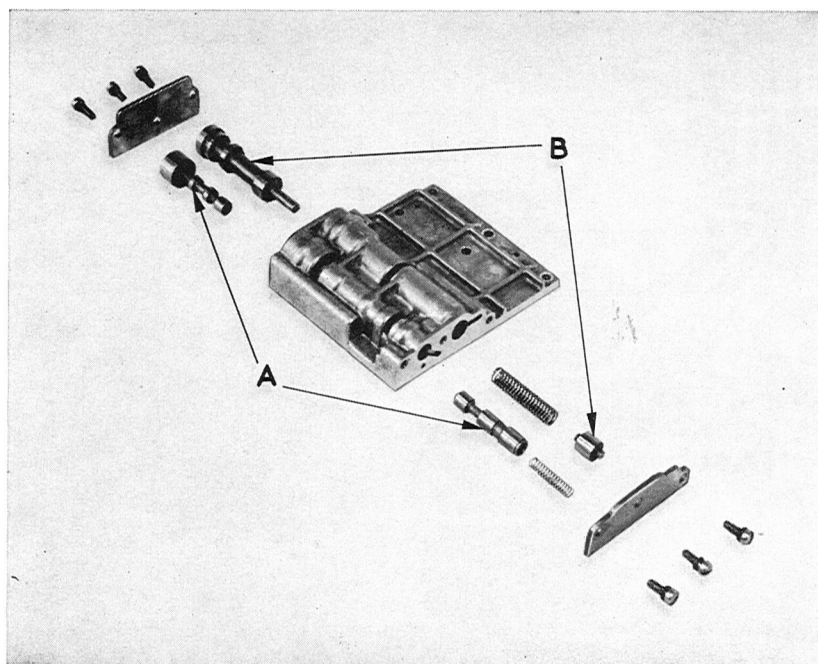


Fig. 4-92. Upper valve body

- A. 1—2 shift valve and plunger
- B. 2—3 shift valve and plunger

VOLVO
102 640

PUMP ASSEMBLY

20. Remove the oil tubes in the housing. If necessary, pull them out with needle-nose pliers as shown in Fig. 4-93.

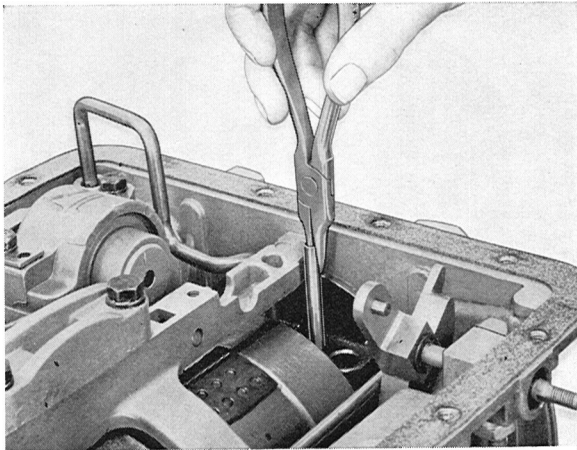


Fig. 4-93. Removing converter inlet and outlet tubes using needle-nose pliers

21. Set up the dial indicator gauge as shown in Fig. 4-94 with plate 2532 and magnetic attachment.

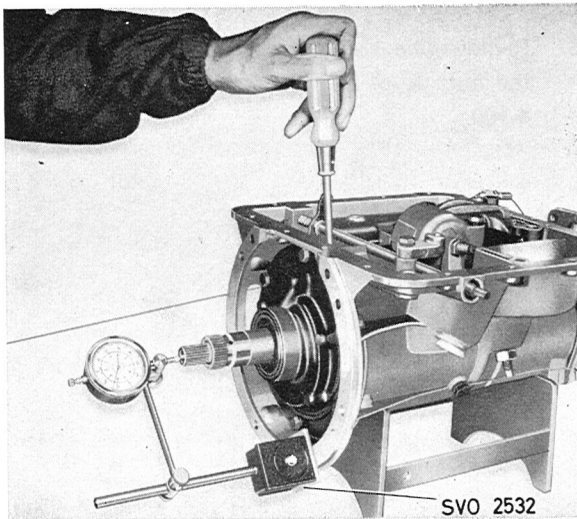


Fig. 4-94. Checking end float

Place the point of the gauge against the shaft end, move the shafts and gears backwards and forwards and read off the end-float. This should be .25—.75 mm (.010—.030"). Note the play.

22. Remove the six bolts securing the pump to the body. Withdraw the pump and remove the gasket. Push the shaft inwards when withdrawing the pump, see Fig. 4-95.

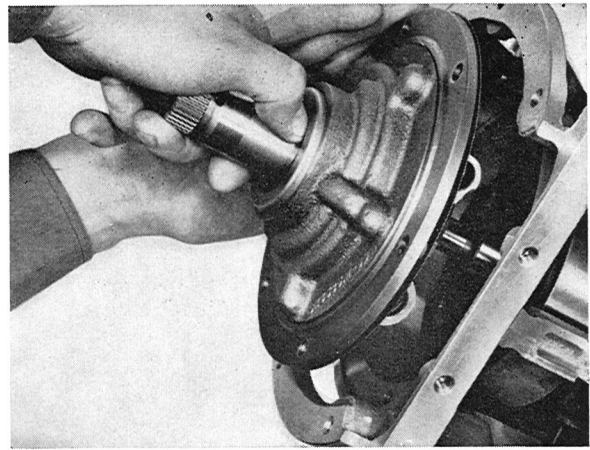


Fig. 4-95. Pump removal

23. Remove the five hexagon bolts and the slotted screw. Separate the pump body, gears and other parts, see Fig. 4-96.

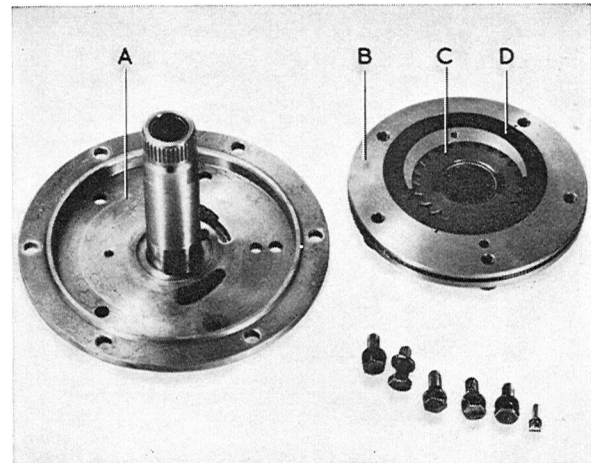
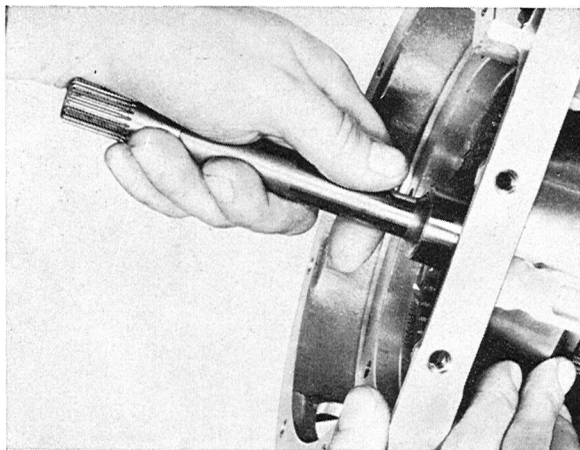


Fig. 4-96. Converter support separated from pump

- A. Pump adapter and converter support assembly
- B. Body and bushing assembly
- C. Driving gear
- D. Driven gear

FRONT CLUTCH ASSEMBLY

24. Withdraw the front clutch assembly and input shaft complete, see Fig. 4-97.
25. Remove the snap ring with a screwdriver. Withdraw the input shaft. Take out the inner and outer plates and the clutch hub.
26. Remove the snap ring, spring and piston. If the piston is tight, lay the clutch body with the opening downwards on a bench and blow out the piston with compressed air.

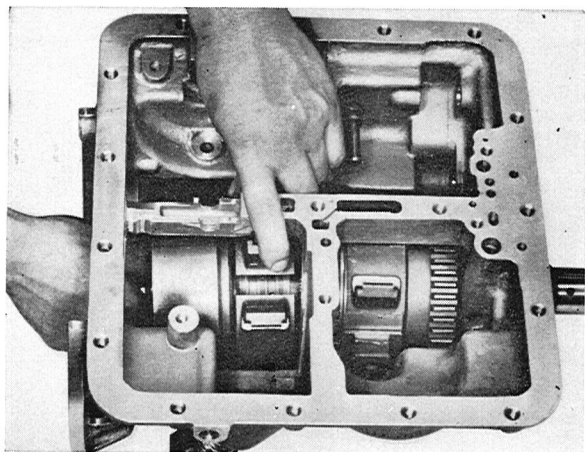


VOLVO
27970

Fig. 4-97. Front clutch assembly removal

REAR CLUTCH ASSEMBLY

27. Withdraw the rear clutch assembly together with the forward sun gear shaft, see Fig. 4-98.

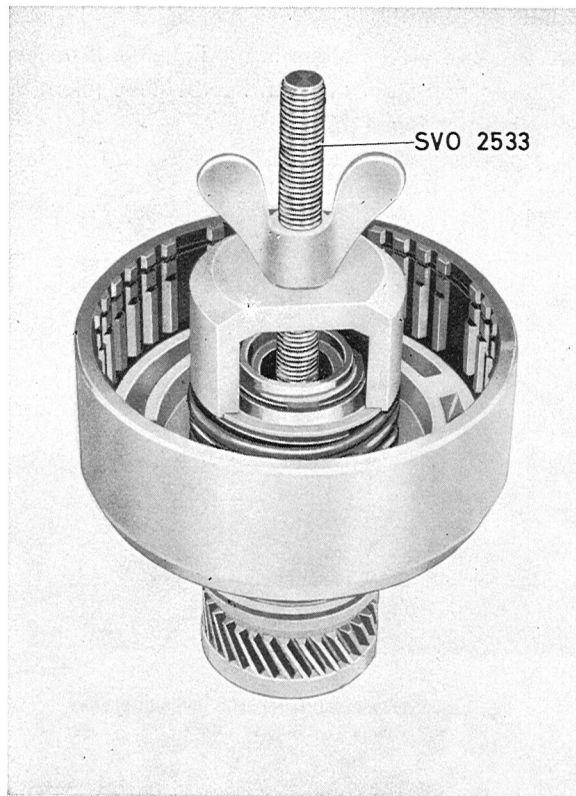


VOLVO
27668

Fig. 4-98. Withdrawing rear clutch and forward sun gear assembly

28. Remove the two oil rings at the front of the shaft. Then withdraw the shaft. Take care of the two needle thrust bearings.
29. Remove the three oil rings from the clutch body hub.
30. Remove the snap ring and take out the pressure plate, inner and outer plates.
31. Place special tool 2533 on the clutch as shown in Fig. 4-99.

Tighten the wing nut until the snap ring releases. Remove the snap ring and screw back the wing nut. Remove the special tool, then retainer and spring. Withdraw the piston. If necessary blow out the piston with compressed air.

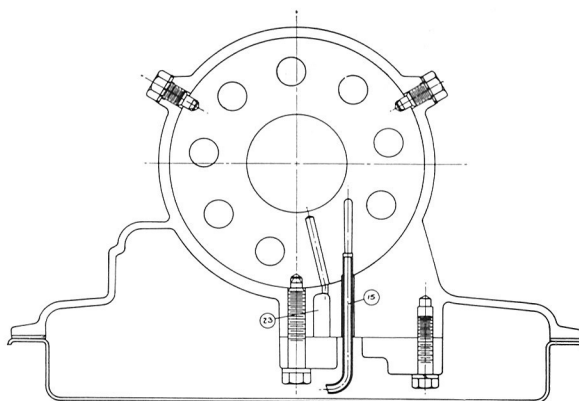


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Fig. 4-99. Rear clutch disassembly

CENTER SUPPORT AND PLANET GEARS

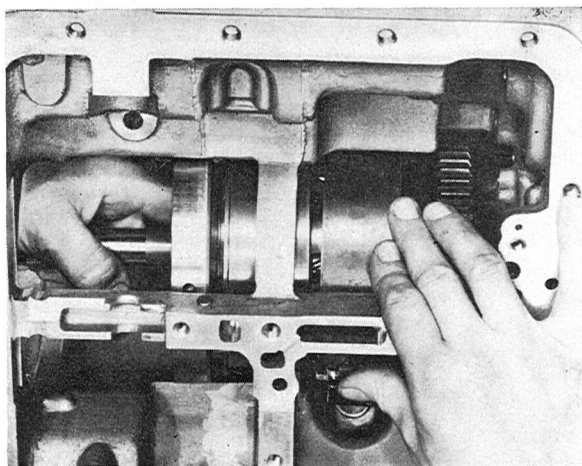
32. Remove the two center support screws from the outside of the transmission case, see Fig. 4-100.



VOLVO
27959

Fig. 4-100. Center support, retention and passages

Withdraw the center support and planet gears, see Fig. 4-101. Remove the rear brake band. Separate the center support, one-way clutch and planet gears. Remove the snap ring and the outer race of the one-way clutch.

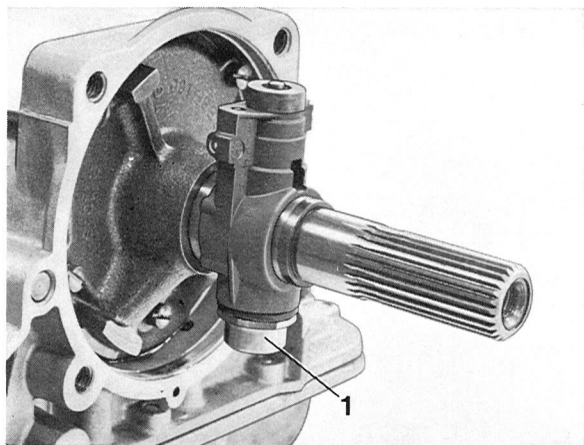


VOLVO
27963

Fig. 4-101. Withdrawing center support planet gears

GOVERNOR

33. Release the bolt (1) and pull the governor off the shaft, see Fig. 4-102.
34. Press the valve unit together and remove the clip. Remove the various parts.



VOLVO
107189

Fig. 4-102. Governor removal
1. Bolt

OIL DEFLECTOR FLANGE

35. Remove the five slotted screws. Withdraw the oil deflector flange.
36. Remove the three oil sealing rings from the driven shaft.

DRIVEN SHAFT

37. Withdraw the driven shaft. Remove the thrust washer. If necessary remove the snap ring and separate the ring gear from the driven shaft.

SHAFT, PARKING PAWL, AND LEVERS

38. Remove all locking clips. Push the manual valve lever in on the shaft and remove the slotted spring pin. Separate the parts. The anchor pin for the parking pawl can be withdrawn with a magnet or shaken out. If the manual valve lever shaft is to be removed, drive the spring pin out of the housing.
39. The throttle cable and other parts in the body are removed as necessary.

INSPECTION

After the cleaning, all parts should be thoroughly checked for wear or damage. Check the white metal bushing for the driven shaft and the pins for the parking pawl linkage are firmly secured in the case. If they are loose, the case must be replaced. Check the thrust washers and needle bearings for wear and any seizing. If the end-float is within the permissible limits, it can be taken for granted that the thrust washers are not worn.

Check the gears for wear, seizing or tooth fractures. Also check that the pinions in the planet gear pinion carrier run easily on the needle bearings.

Check the brake bands and discs for wear, overheating or other damage.

ASSEMBLY

The utmost cleanliness must be observed during assembly of the transmission.

Before assembly, all parts must be carefully cleaned in alcohol or suitable solvent.

Use new gaskets when assembling. Lubricate the parts with "Automatic Transmission Fluid, type F (USA: FLM)".

Tighten all bolts with a torque wrench in accordance with the torque chart in the "Specifications". Use sealing compound 277961 on the threads of the inhibitor switch, the pressure point plug and the oil drain. Locking fluid "Loctite CV" or corresponding is used for the flange bolt and "Loctite AV" for the nipples for the oil cooler connections. Note that items not described in this section are assembled in the reverse order to disassembly.

TRANSMISSION CASE, SHAFT, PARKING PAWL AND LEVERS

1. The transmission case is inverted on the bench cradle or in the fixture.
2. Assemble the shaft, parking pawl and levers in the reverse order to disassemble. Make sure that the springs for the levers are correctly installed, see Fig. 4-103. Installation of the detent ball is facilitated by pressing down the ball, using a short piece of tubing as shown in Fig. 4-104.

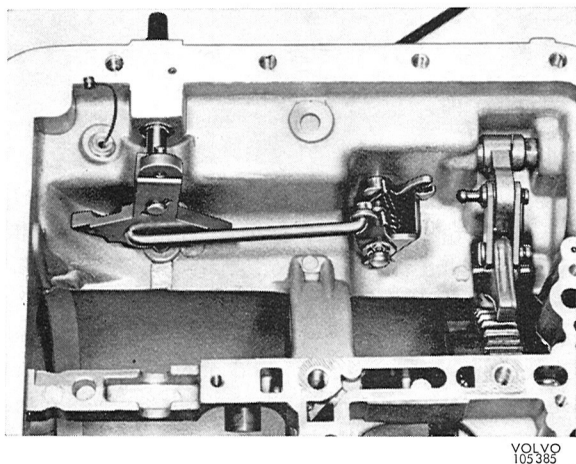


Fig. 4-103. Locating manual valve lever on detent ball spring

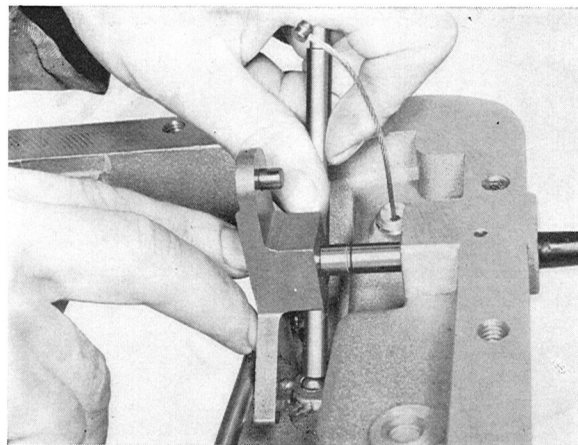


Fig. 4-104. Parking pawl and linkage installed

DRIVEN SHAFT

3. The thrust washers for the driven shaft, see Fig. 4-105, are stuck onto the transmission case with vaseline. The driven shaft complete with ring gears is then installed into the transmission case.

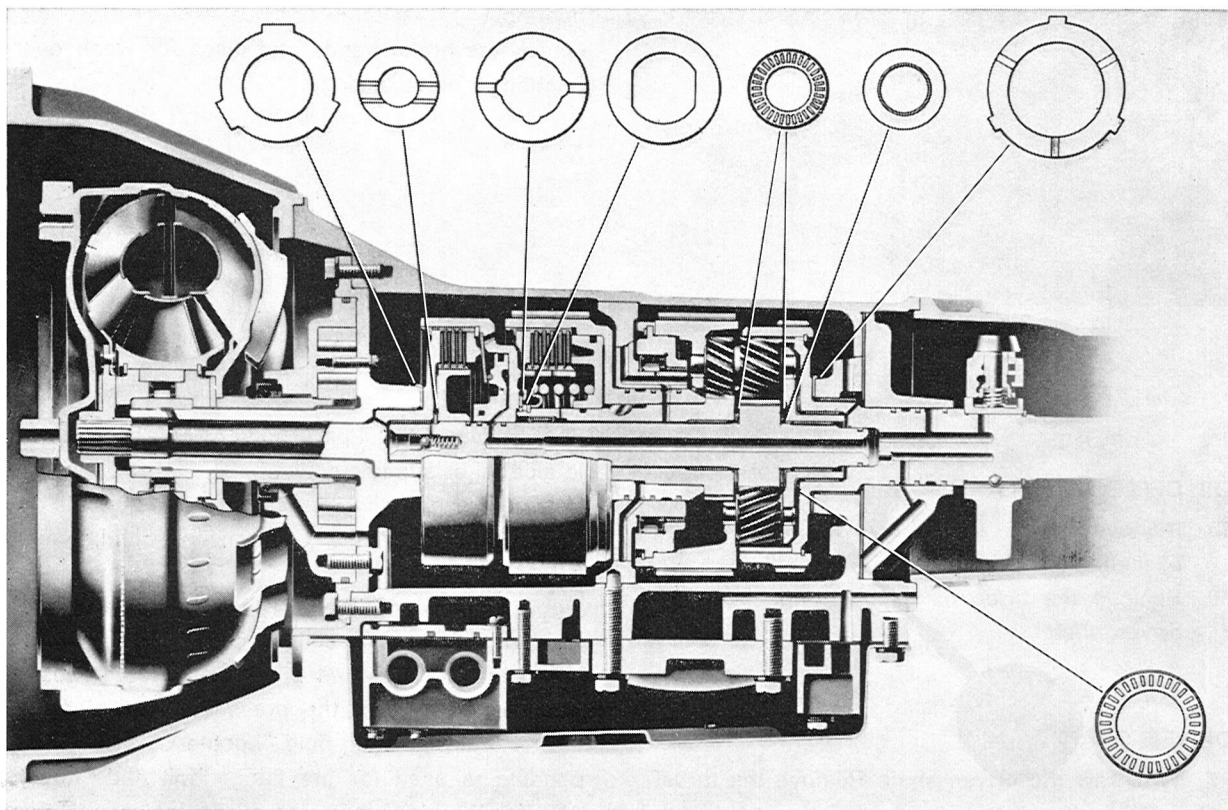


Fig. 4-105. Location of thrust washers

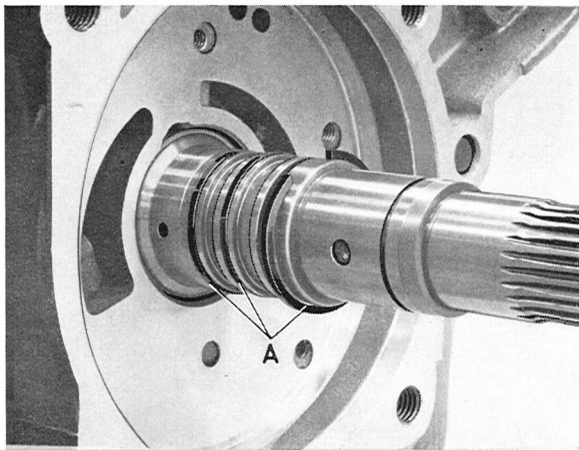


Fig. 4-106. Installation of oil rings on driven shafts

4. Install the three oil seal rings on the shaft, see Fig. 4-106. Exercise care when doing this as the oil seal rings are very fragile. Stand the box on its front end and support under the shaft. Center the oil rings. The oil deflector is then installed.

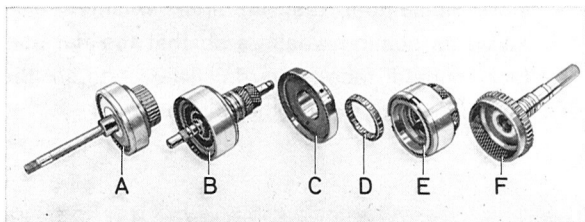


Fig. 4-107. Gear train components

- A. Input shaft and front clutch group
- B. Rear clutch and forward sun gear group
- C. Center support
- D. One-way clutch
- E. Planet gears and rear drum assembly
- F. Driven shaft and ring gear assembly

GOVERNOR

5. Push the governor onto the shaft as shown in Fig. 4-109. Make sure that the bolt enters the recess in the shaft. Tighten the bolt to a torque of 20—25 Nm (2.0—2.5 kgm = 15—18 lb.ft.). The torque must not be exceeded. NOTE: It is not certain that the spring washer will be fully compressed when tightening the bolt.

REAR BRAKE BAND AND SERVO

6. Place the brake band in position in the case, see Fig. 4-110. Then install the rear servo assembly. Tighten only the rear (short) piston screw since the long one also locates the center support.

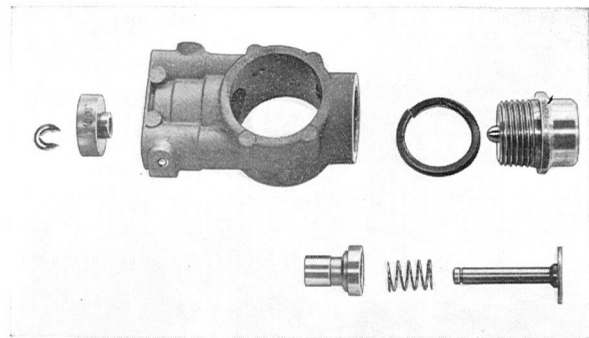


Fig. 4-108. Governor disassembled

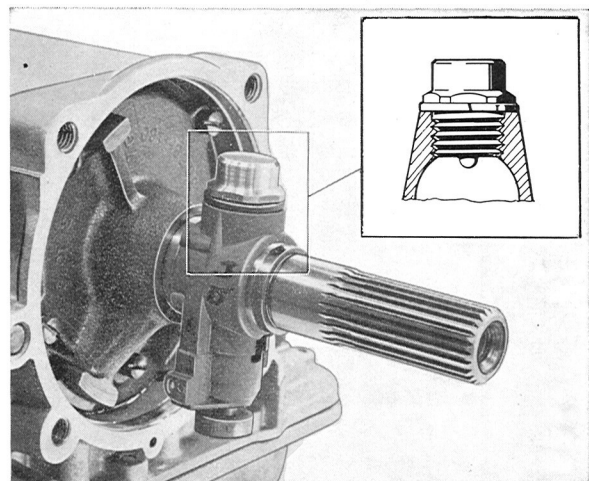


Fig. 4-109. Governor and driven shaft

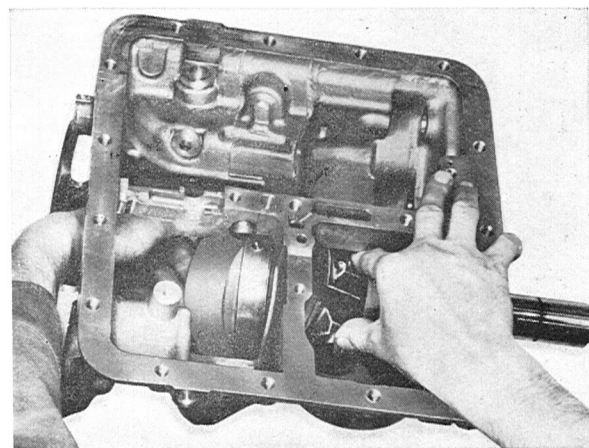


Fig. 4-110. Rear brake band installation

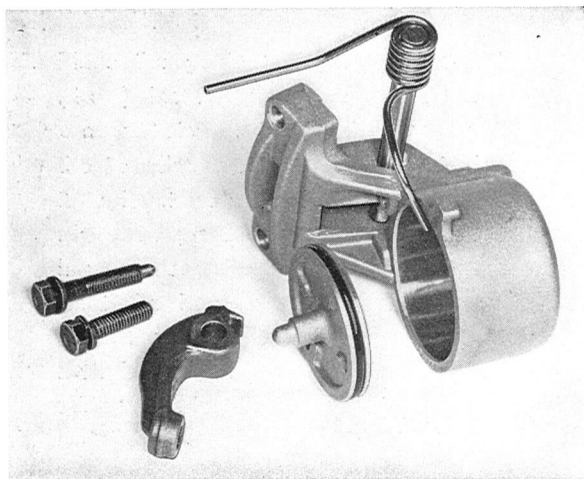


Fig. 4-111. Rear Servo disassembled

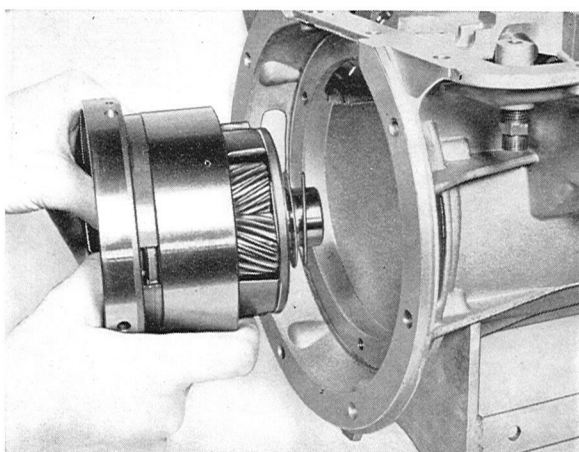


Fig. 4-112. Installation of center support and planet gears with needle thrust bearing and plate washer

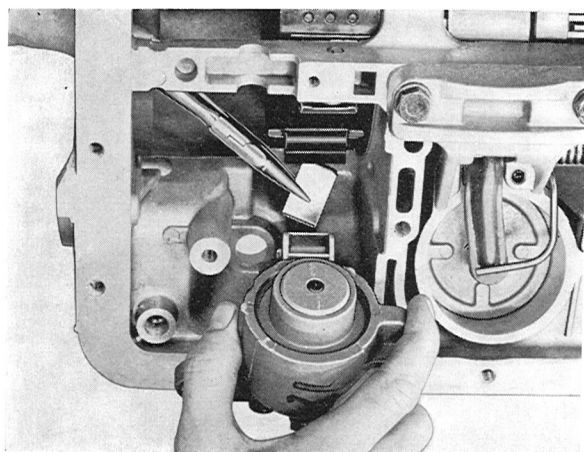


Fig. 4-113. Front servo and strut installation

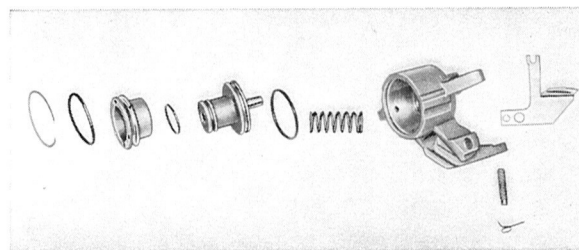


Fig. 4-114. Front servo disassembled

PLANET GEAR AND CENTER SUPPORT

7. Assemble the planet gear, one-way clutch and center support, see Fig. 4-112. Stick the thrust plate and needle thrust bearing to the planet cover with vaseline.
8. Turn the fluid passage holes in the support upwards and install the assembled unit into the transmission case. (Note that the holes point downwards when the transmission is turned right way up, see Fig. 4-100).
9. Install the two center support screws from outside. Remember that the lock washers also serve as sealing washers so that the flat surface should face inwards. Then tighten the piston screw locating the support.

FRONT BRAKE BAND AND PISTON

10. Place the front brake band in position, see Fig. 4-113. Stick the strut to the piston lever with vaseline.

Install the piston. The shorter bolt is installed at the front. Make sure that the piston strut is correctly engaged with the slot in the brake band. The cam for self-adjusting is installed later.

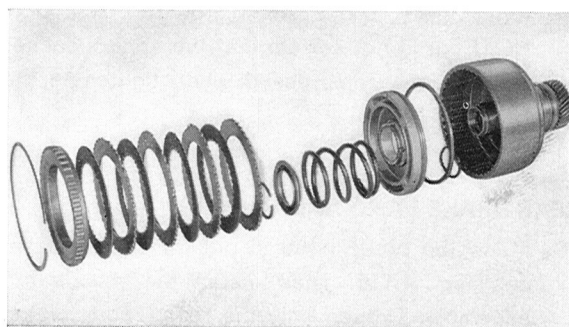


Fig. 4-115. Rear clutch disassembled

REAR CLUTCH

11. Install the seal rings for the piston. Use installation ring 5000 and install the piston in the clutch case, see Fig. 4-116.

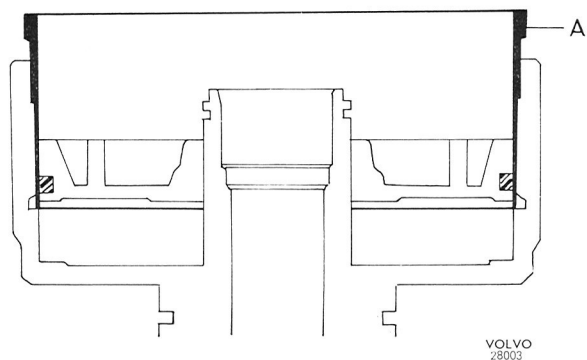


Fig. 4-116. Installation of piston for rear clutch

A. Installation ring 5000

12. Install the spring, spring seat and snap spring using special tool 2533, which also was used for disassembly, see Fig. 4-99.
13. Install the clutch plates. Note that the outer plates are coned and that all the plates should be installed with the cone facing in the same direction. Begin with an outer plate and then install inner and outer plates alternately. Install the pressure plate and snap ring.
14. Locate the front needle thrust bearing on the rear sun gear shaft. Install the shaft in the rear clutch assembly. Install the oil seal rings, see Fig. 4-117.

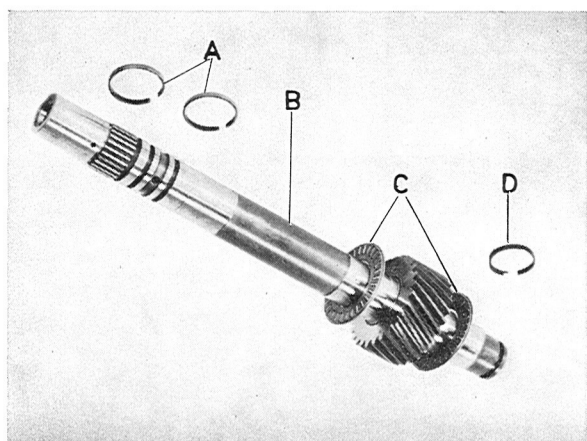


Fig. 4-117. Forward sun gear components

- A. Oil seal rings, front clutch
- B. Forward sun gear assembly
- C. Needle thrust washers
- D. Oil seal ring, governor feed

15. Install the rear needle thrust bearing and install the clutch in the transmission as shown in Fig. 4-118.

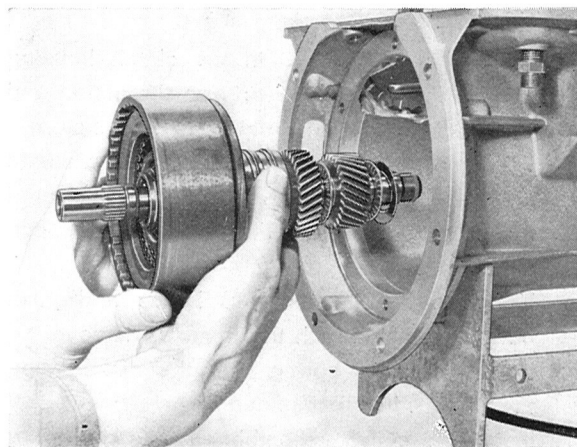


Fig. 4-118. Rear clutch and forward sun gear group installation

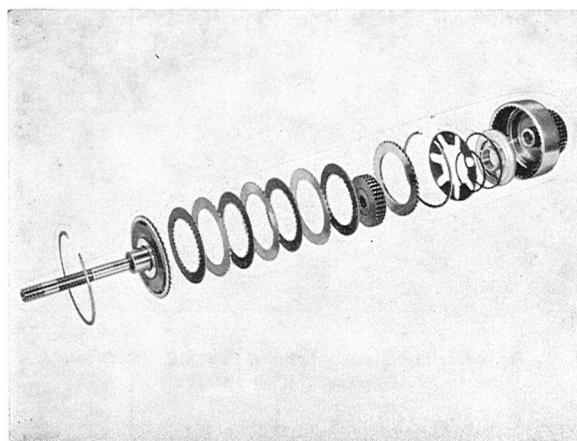


Fig. 4-119. Front clutch disassembled

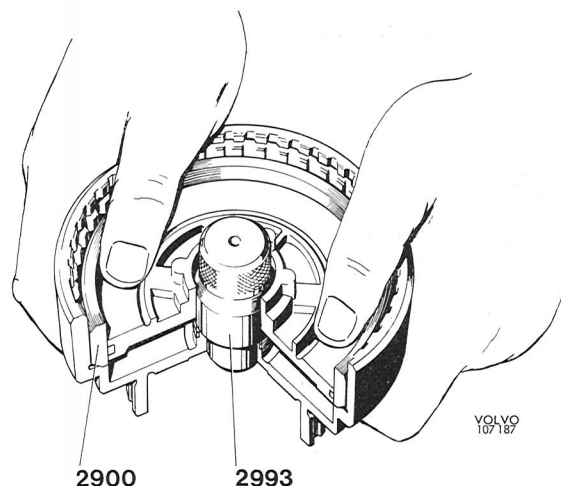


Fig. 4-120. Installation of piston for front clutch

FRONT CLUTCH

16. Place the guide 2993 in the clutch housing (drum). Install the seal ring on the piston and a new O-ring in the drum. Place the piston in the installation ring 2900. Press it down until it is level with the lower edge of the ring. Place the piston over the guide in the clutch housing according to Fig. 4-120. Hold the housing in your hands and push down the piston with the thumbs. Remove the tool. Install the spring with the dished side facing rear. Install the snap ring.
17. Install the clutch assembly with its two different thrust washers in the transmission, see Fig. 4-121.

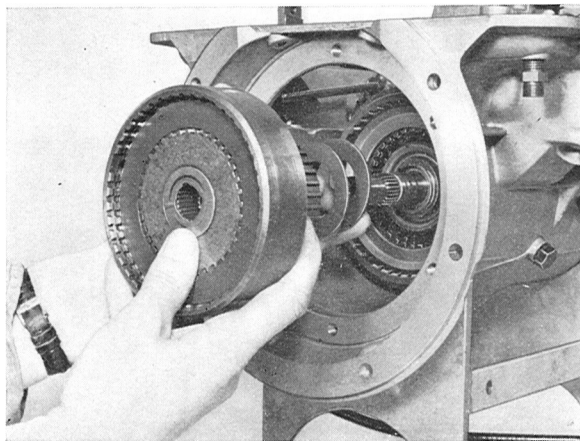


Fig. 4-121. Installation sequence, front clutch cylinder, thrust and backing washers

Be careful not to damage the oil seal rings. For identification of the thrust washers, see Fig. 4-105.

18. Install the pressure plate, inner and outer plates, and hub. Install thrust washer for the clutch hub and input shaft into the front clutch, see Fig. 4-122. Install the snap ring.

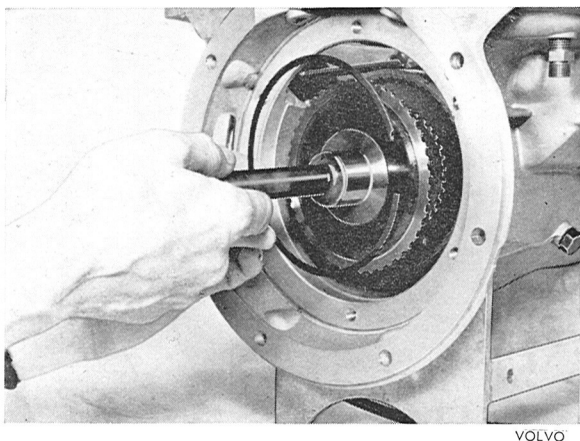


Fig. 4-122. Installation sequence, front clutch snap ring, input shaft and thrust washer

The front and rear clutches can also be installed in transmission as an assembly. In this case they are first assembled individually. The rear clutch is then stood straight up, the thrust washer for the clutch hub centered, both the rear thrust washers placed on, and then the rear clutch and sun gear are assembled with the front clutch.

PUMP

19. Install the O-ring on the pump body, then assemble the pump in reverse order to disassemble.
20. Stick on the trust washer with vaseline and then install the pump with a new gasket on the transmission case, see Fig. 4-123. Re-check the axial play in accordance with point 21, page 4:37.

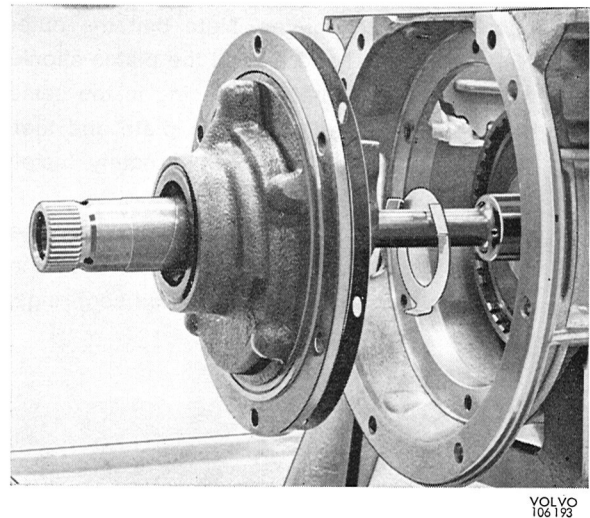


Fig. 4-123. Installation sequence, front pump assembly, thrust washer and gasket

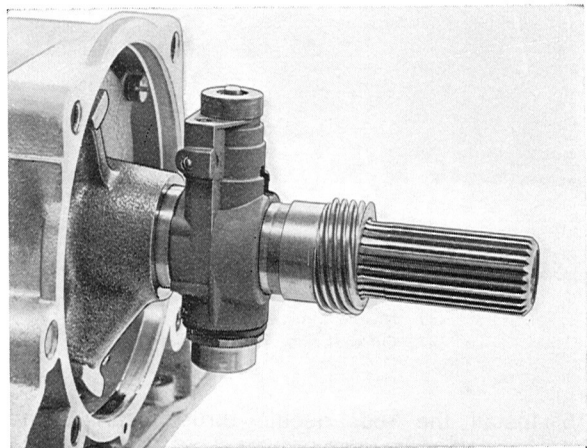


Fig. 4-124. Speedometer gear installation

EXTENSION HOUSING

21. Place the speedometer gear correctly on the driven shaft as shown in Fig. 4-124. Install the extension housing with a new gasket and install the drive flange with washer and nut.

VALVE BODIES ASSEMBLY

22. When assembling, all the component parts which have been disassembled should be thoroughly cleaned and lubricated with oil approved as "Automatic Transmission Fluid, type F (USA: FLM)" prior to reassembly in the reverse order to disassembly. Line up the component parts of the valve bodies assembly by using two of the retaining bolts. Check the free movement of all valves in their bores. Check that the strainer is flat so that it makes a complete seal when screwed down. Tighten the screws to the specified torque.

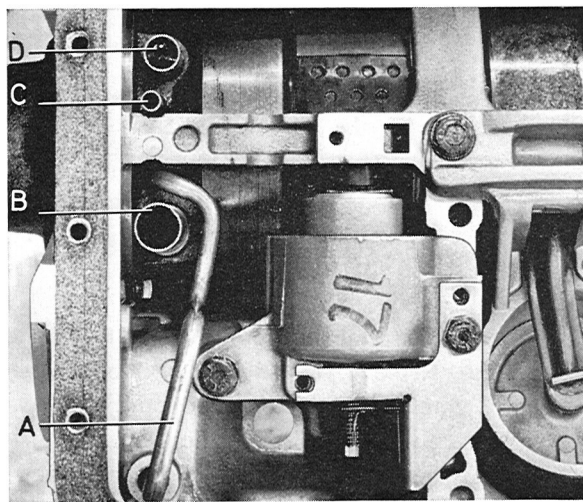


Fig. 4-125. Location of oil tubes, front of transmission

- A. Converter outlet
- B. Pump inlet
- C. Converter inlet
- D. Pump outlet

23. Install the oil tubes for the pump and converter on the pump body, see Fig. 4-125. Do not forget the O-ring for the pump inlet tube.
24. Install the valve bodies assembly to the transmission. Connect the throttle cable.

MISCELLANEOUS

25. Place the spacer block 2537 between the bolt and cylinder, see Fig. 4-126. Tighten the bolt with torque wrench 2748 until the ratchet handle clicks out. This corresponds to a torque of 115 Ncm (10 lb.in.).

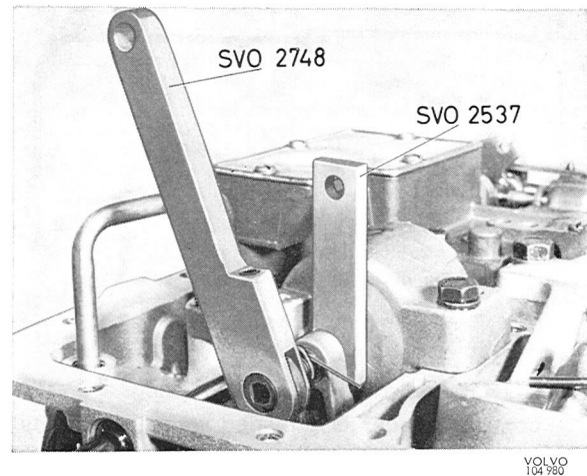


Fig. 4-126. Front brake band adjustment

26. Adjust the position of the spring on the adjusting screw. It should be 1—2 threads from the lever. Remove the torque wrench and spacer block and then install the cam. Insert the longer end of the spring in the cam, see Fig. 4-127.

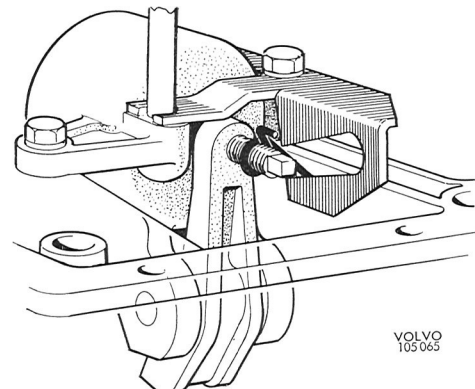


Fig. 4-127. Self-adjustment

27. Install the four oil tubes according to Fig. 4-128.

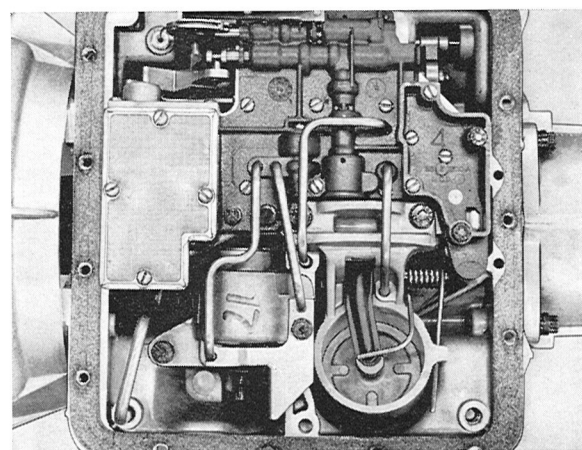


Fig. 4-128. Retention of pump strainer

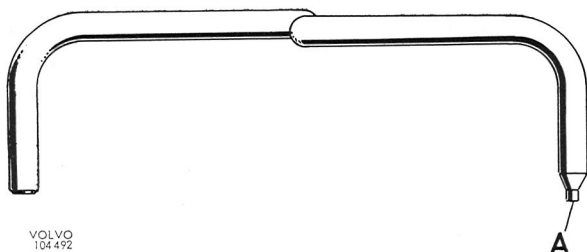


Fig. 4-129. Oil tube with restriction

NOTE: The oil tube for releasing the front control cylinder is provided with a restriction (A, Fig. 4-129) on vehicles with a B20 E and B20 F engine. This end is installed in the control system.

28. Adjust the rear brake band, see "Adjusting the rear brake band", and "rear brake band adjustment" on page 4:32. Install the starter inhibitor switch, see "Starter inhibitor switch replacement" on page 4:32.
29. Place the magnet in the oil pan. Install the oil pan with a new gasket.

TRANSMISSION INSTALLATION

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The converter, converter housing and transmission are installed in the reverse order to removal. Reconnect the starter inhibitor switch wires, back-up light and seat belt reminder, see Fig. 4-130.

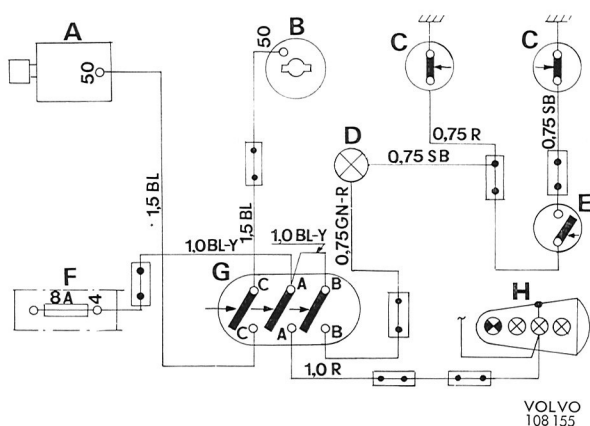


Fig. 4-130. Wiring diagram

(Not USA. See wiring diagram, section 3)

- | | |
|--------------------------------|------------------------------|
| A. Starter motor | E. Contact in passenger seat |
| B. Ignition | F. Fuse box |
| C. Contact for seat belt | G. Contact on transmission |
| D. Reminder lamp for seat belt | H. Back-up light |

Color code:
 BL = blue
 BL-Y = blue-yellow
 GN-R = green-red
 R = red
 SB = black

SELECTOR CONTROLS

REMOVAL AND DISASSEMBLY

1. Set the selector control in position "P". Put the vehicle on stands. Remove the shift rod from the selector lever on the selector lever housing.
2. Use a knife to pry up the front edge of the cap on the selector lever knob and remove it. Press down the spring washer and push the button forwards so that it releases from the trust rod. Remove the washer and spring and pull up the lower part of the selector lever knob.

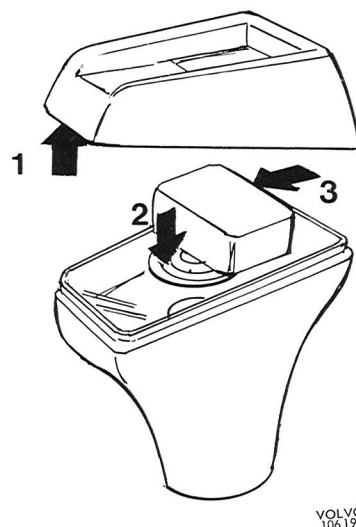


Fig. 4-131. Knob disassembly

3. Remove the retaining screws and lift off the console. Remove the socket for the console light. Remove the selector lever housing screws and lift up the selector lever housing.
4. Release the nut and remove the lever. Remove the screws and take the cover off the selector lever housing.
5. Knock up the tubular studs. Remove the push rod and inhibitor. Drive out the shaft. Release the screws from the gating. Drive out the bushings from the bracket.

INSPECTION

Check the various parts, especially for wear. Replace worn bushings, link rods, etc.

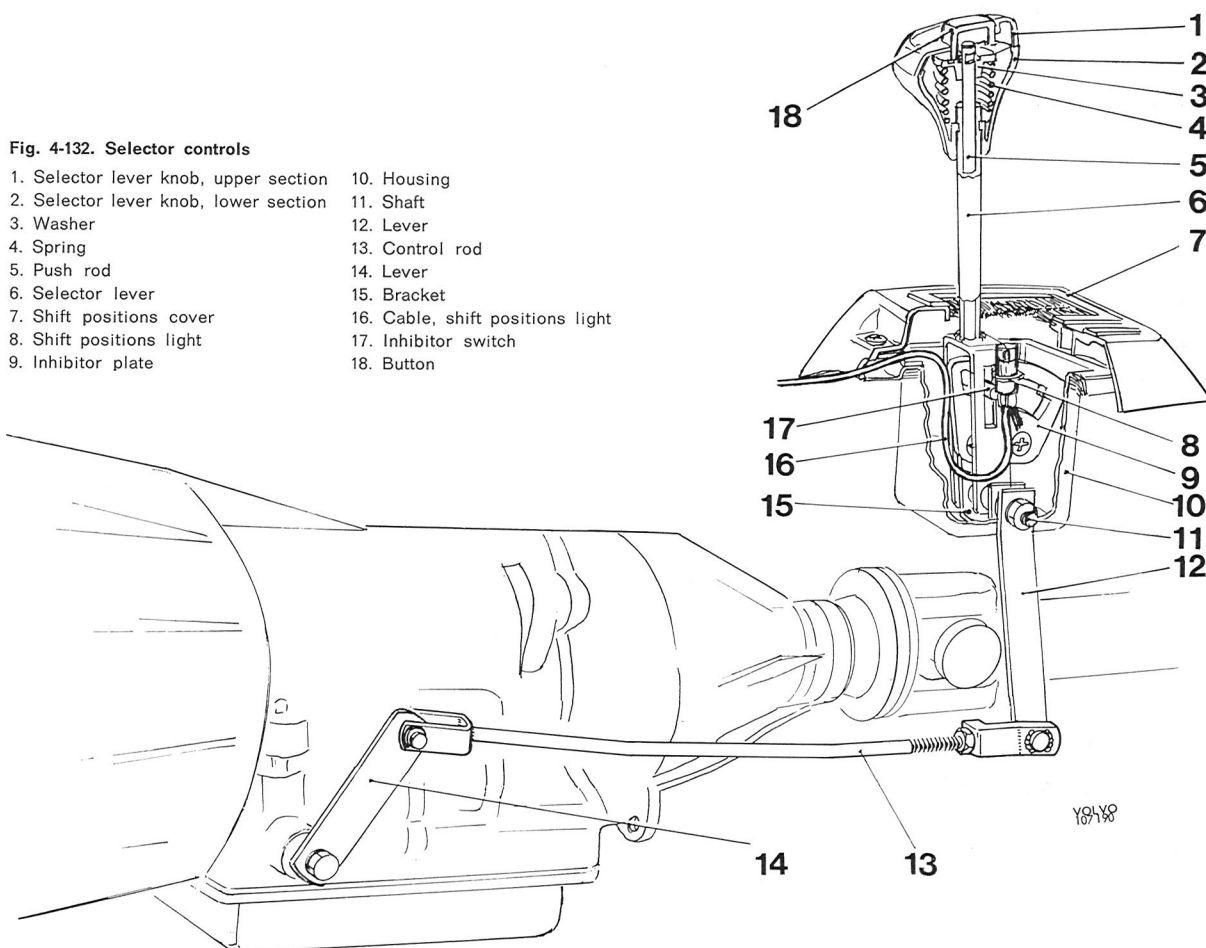
ASSEMBLY AND INSTALLATION

1. Press the bushings into the bracket and tighten the gating. Grease the slide surfaces on the bushings, inhibitor and lower part of the push rod.
2. Assemble the selector lever and bracket and press in the shaft. Lock it with the tubular stud.

3. Install the push rod and inhibitor. Drive in the tubular stud. Assemble the selector lever housing and gear positions console.
4. Grease the seal. Install it together with the washer and lever on the shaft.
5. Adjust the sealing strip round the tunnel opening. Install the complete selector lever housing. Note that the ground cable for the gear positions console light should be connected to one of the screws. Install the light socket and then the console for the gear positions.
6. Install the lower part of the selector lever knob. Put on the washer and spring. Press down the washer and install the button. Snap the selector lever knob cap into position. Set the selector lever to position "P".
7. If the shift rod has been disassembled, its length should be 405 mm (16") from the center for the bolts. Grease the bushings and then connect the shift rod to the levers. Make sure that the lock on the shift rod comes on the inside of the lever on the selector lever housing.
8. Check the clearance for the selector gating in positions "D" and "2". The clearance (A and B, Fig. 4-80) should be the same in both shift positions or somewhat greater in position "D". (Min. 1 mm = .04"). Adjust if necessary. Check that there is still the same clearance after the selector lever has been shifted to positions "1" and "P". Also check that the output shaft is locked with the lever in position "P".
9. Lower the vehicle.

Fig. 4-132. Selector controls

- | | |
|---------------------------------------|----------------------------------|
| 1. Selector lever knob, upper section | 10. Housing |
| 2. Selector lever knob, lower section | 11. Shaft |
| 3. Washer | 12. Lever |
| 4. Spring | 13. Control rod |
| 5. Push rod | 14. Lever |
| 6. Selector lever | 15. Bracket |
| 7. Shift positions cover | 16. Cable, shift positions light |
| 8. Shift positions light | 17. Inhibitor switch |
| 9. Inhibitor plate | 18. Button |



SERVICE DIAGNOSIS

ROAD-TEST

(Used together with the service diagnosis chart)

It is important to gain as much information as possible on the precise nature of any fault. If possible, have the customer demonstrate the fault. The following road-test procedure should be carried out completely as there may be more than one fault.

TEST NO.

1. Check that the starter only operates with the selector in "P" and "N" and that the reversing light operates only in "R".
2. Apply the brakes and, with the engine running at normal idling speed, select "N"- "D", "N"- "2", "N"- "1" and "N"- "R". Transmission engagement should be felt in each position selected.
3. Check the converter stall speed with the transmission in "1" and "R". Check for slip or clutch squawk.

NOTE: Do not stall for longer than 10 seconds or the transmission will overheat.

4. With the transmission at normal running temperature, select "D". Release the brakes and accelerate with minimum throttle opening. Check upshifts 1—2 and 2—3.

NOTE: At minimum throttle openings, the shifts may be difficult to detect. Confirmation that the transmission is in 3rd gear may be obtained by selecting "2" or "1" when a 3—2 downshift should be felt.

- 5b. At 40 kmph (25 mph) in 3rd gear, depress the accelerator pedal to full throttle position. The car should now downshift to 2nd gear. Repeat at 65 kmph (40 mph). The car should accelerate in 3rd gear and should not downshift.
- c. At 50 kmph (30 mph) in 3rd gear, depress the accelerator pedal to the kick-down position. The transmission should downshift to 2nd gear.
- d. At 25 kmph (15 mph) in 3rd gear, depress the accelerator pedal to the kick-down position. The transmission should downshift to 1 st gear.

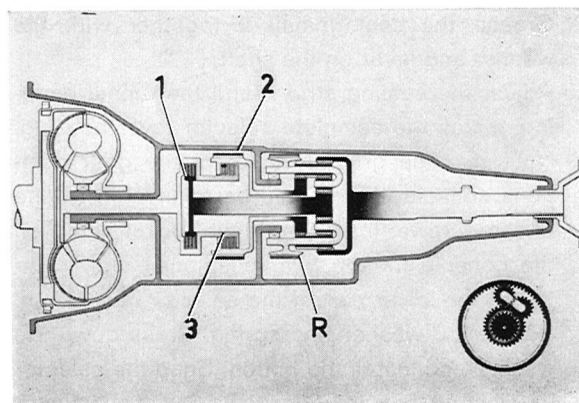


Fig. 4-133. Principle diagram for service diagnosis

1. Front clutch gives 1st gear
 2. Front brake band gives 2nd gear
 3. Rear clutch gives 3rd gear
 - R. Rear brake band gives reverse and engine braking in "L"
- 6a. Stop and restart using forced acceleration. Check upshifts 1—2 and 2—3 according to the shift speed table in the "Specifications".
 - b. At 65 kmph (40 mph) in 3rd gear, release the accelerator and select "1". Check for downshift 3—2 and engine braking. Check for roll-out downshift 2—1 at about 8 kmph (5 mph) and engine braking.
 7. Stop, and with "1" still engaged, release brakes and, using full throttle, accelerate to 30 kmph (20 mph). Check for: no slip, no upshifts, or clutch squawk.
 8. Stop and select "R". Release brakes and reverse using full throttle if possible. Check for no slip or clutch squawk.
 9. Stop on the brakes, facing downhill on a gradient, and select "P". Release the brakes and check that the parking pawl will hold the car. Re-apply the brakes before disengaging the parking pawl. Repeat with the car facing uphill. Check that the selector is trapped by the gate in "P".

TEST	ACTION	POSSIBLE CAUSE
1.	Starter will not operate in "P" or "N"	19
	Starter operates in all selector positions	20
2.	Excessive bump on engagement of "D", "1" or "R"	4, 3
3.	If stall speed higher than specified:	
	a. with slip and squawk in "1"	1, 2, 3, 13, 11
	b. with slip and squawk in "R"	1, 2, 3, 13, 12
	If stall speed lower than specified, check engine performance	
	If stall speed more than 600 rpm lower than specified	21
4.	No drive in "D" (if normal in "1", omit 11 and 13 if no drive in "D", "2", "1" or "R", and 17)	1, 2, 3, 13, 11, 16
	Delayed or no 1—2 shift	3, 14, 13, 5, 6
	Slip on 1—2 shift	2, 3, 5, 6, 7, 13
	Delayed or no 2—3 shift. (If normal in "R", omit 12)	3, 14, 13, 5, 6, 12
	Slip or engine run-up on 2—3 shift	2, 3, 5, 13, 12
	Bumpy gear shifts	3
	Drag in "D 2" and "D 3"	8
	Drag on 2—3 shift	5, 6
5a.	Slip and squawk or judder on full throttle take-off in "D"	1, 2, 3, 13, 11
	Loss of performance and overheating in "D 3" (seized stator)	21
	Continue as for test 4 above	
b.	Transmission downshifts too easily	3
c. d.	Transmission will not downshift	3, 13, 14
6a.	As test 6a above	
b.	No 3—2 downshift or engine braking	1, 5, 6, 7, 12
	No 2—1 downshift or engine braking	8, 9, 10
7.	Slip and squawk or judder on take-off in "1"	1, 2, 3, 13, 11
	Transmission upshifts	1
8.	Slip and squawk or judder on take-off in "R"	1, 2, 3, 13, 12
	Slip but no judder on take-off in "R" (if engine braking available in "1", 1st gear omit 8, 9, 10)	1, 2, 3, 8, 9, 10
	Drag in "R"	5
	No drive in "R" (if engine braking available in "1", 1st gear omit 8, 9, 10)	1, 2, 3, 8, 13, 9, 10, 12
9.	No park	1, 15
Mis-	Screech or whine, increasing with engine speed	17
cell-	Grinding or grating noise from transmission	18
aneous	Knocking noise from torque converter area	22
	At high speeds in "D 3", transmission downshifts to "D 2" and immediately back to "D 3"	12

POSSIBLE CAUSE

1. Check manual linkage adjustment
2. Check fluid level
3. Check adjustment of downshift valve cable using pressure gauge and tachometer
4. Reduce engine idling speed
5. Check front band adjustment
6. Check front piston seals and tubes for leakage
7. Check front band for wear
8. Check rear band adjustment
9. Check rear piston seal and attachment of tubes
10. Check rear band for wear
11. Examine front clutch and seals, also front sun gear shaft rings. Verify that cup plug in driven shaft is not leaking or dislodged
12. Examine rear clutch, check valve and seals. Check attachment of tubes
13. Strip valve bodies and clean
14. Strip governor valve and clean
15. Examine parking pawl, gear and internal linkage
16. Examine one-way clutch
17. Strip and examine front pump and drive fingers
18. Strip and examine gear train
19. Adjust start inhibitor switch outwards
20. Adjust start inhibitor switch inwards
21. Replace torque converter
22. Examine torque converter drive plate for cracks or fractures

CONVERTER SERVICE DIAGNOSIS

The converter housing is welded together and cannot be repaired and has to be replaced if defective. There is no drain plug since fluid changes do not occur and fluid filling is done through the transmission.

The stall speed means the speed obtained at full throttle on the engine with the engine engaged but the car braked. Check that the transmission has the correct running temperature and that the fluid level is correct before the stall speed test. The duration of the test must not exceed 10 seconds, otherwise the transmission will overheat.

Converter service diagnosis:

1. If the vehicle general performance is below standard, check the converter stall speed with an accurate tachometer by applying maximum pressure on the footbrake pedal, selecting a gear and fully depressing the accelerator. If the stall speed is up to 5 r/s (300 rpm) below the specified speed, the engine is not developing its full power.
2. Inability to start on steep gradients combined with poor acceleration from rest indicates that the converter stator one-way clutch is slipping or that the stator support is fractured. This condition permits the stator to rotate in an opposite direction to the turbine and torque multiplication cannot occur. Check the stall speed and, if it is more than 10 r/s (600 rpm) below the specified speed, the converter assembly must be replaced.
3. Below standard acceleration in 3rd gear above 50 kmph (30 mph) combined with a substantially reduced maximum speed, indicates that the stator one-way clutch has locked in the engaged condition. The stator will then not rotate with the turbine and impeller, therefore the fluid phase of the converter performance cannot occur. This condition will also be indicated by excessive overheating of the transmission, also the stall speed will remain as specified. In this converter assembly must be replaced.
4. Stall speed which is higher than that specified, indicates that the converter is not receiving its required fluid supply or that the automatic transmission clutches are slipping.

PROPELLER SHAFT

GENERAL INFORMATION

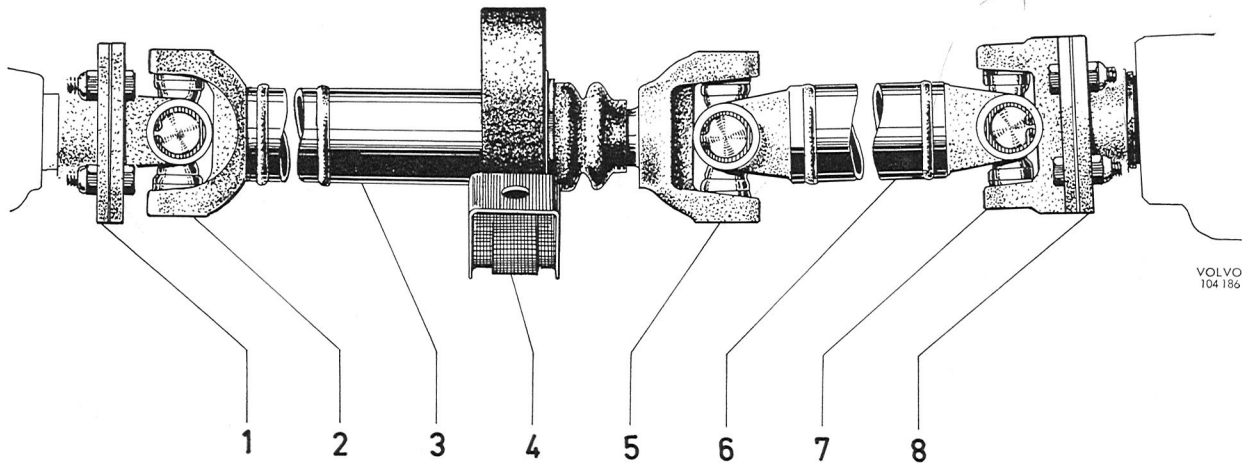


Fig. 4-134. Propeller shaft with support bearing

- | | |
|-------------------------------------|---------------------------------|
| 1. Flange on gearbox | 5. Intermediate universal joint |
| 2. Front universal joint | 6. Rear propeller shaft |
| 3. Front section of propeller shaft | 7. Rear universal joint |
| 4. Support bearing | 8. Flange on rear axle |

The propeller shaft is a divided, tubular type shaft, see Fig. 4-134. The front section of the propeller shaft has rear end formed as a splined sleeve. The corresponding splined shaft carries one of the intermediate universal joint yokes. The rear end of the propeller shaft front section is supported by a ball bearing. The ball bearing is in turn installed in a rubber bearing housing, which is attached to the propeller shaft tunnel with a cover, see Fig. 4-135. The propeller shaft has three universal joints. Each joint consists of a cross with four trunnions which are carried in flange yokes by needle bearings. Cars equipped with B20 A, B and F engines have the propeller shafts paired and balanced together. The front and rear sections are individually marked with a yellow dot and an arrow. The propeller shaft must be replaced only as a paired unit and the front and rear sections have to be installed so that the arrows (the dots) point towards each other.

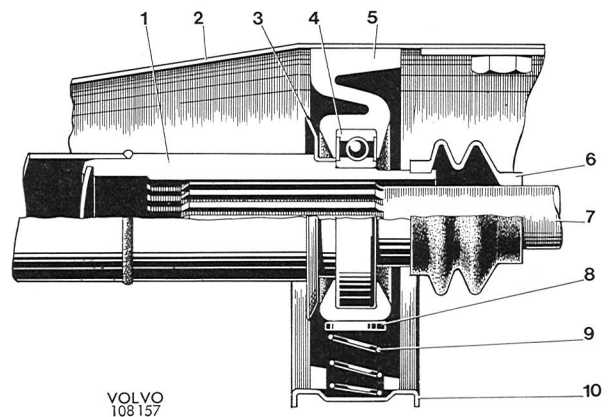


Fig. 4-135. Support bearing

- | | |
|-------------------------------------|------------------------------------|
| 1. Front section of propeller shaft | 7. Nut |
| 2. Floor tunnel | 8. Rear section of propeller shaft |
| 3. Dust cover | 9. Rubber cover |
| 4. Ball bearing | 10. Washer |
| 5. Rubber housing | 11. Suspension spring |
| 6. Dust cover | 12. Cover |

SERVICE PROCEDURES

SUPPORT BEARING REPLACEMENT

Volvo Standard Times Op. No. 45371=replace, propeller shaft removed

1. Jack up the vehicle and put it on stands. Slacken the propeller shaft from the rear axle flange. Bend back the lock washer and remove the nut at the sliding joint. Pull out the propeller shaft to the rear.
2. Loosen the support bearing cover. Pull off the complete support bearing.
3. Press the old bearing out of the rubber housing. Install the new bearing.
4. Install the support bearing and the other parts in the reverse order to removal. If the splined joint appears dry, lubricate it with grease mixed with molybdenum disulphide (Molykote). Make sure that the arrows point towards each other on propeller shafts paired and balanced together.

REMOVAL

Volvo Standard Times

Op. No.

Replace front propeller shaft, 142—144	45106
Replace rear propeller shaft	45104
Replace front and rear propeller shaft, 145	45112

Jack up the vehicle. Slacken the propeller shaft from the transmission and rear axle flanges. The bolts can be loosened by an impact air wrench and special socket 2846 for cars with a B 20 E. Loosen the support bearing cover and take down the complete propeller shaft.

For cars equipped with B20 A, B and F use tool 2779 for the front flange bolts and tool 2746 for the rear flange bolts, see Fig. 4-136.

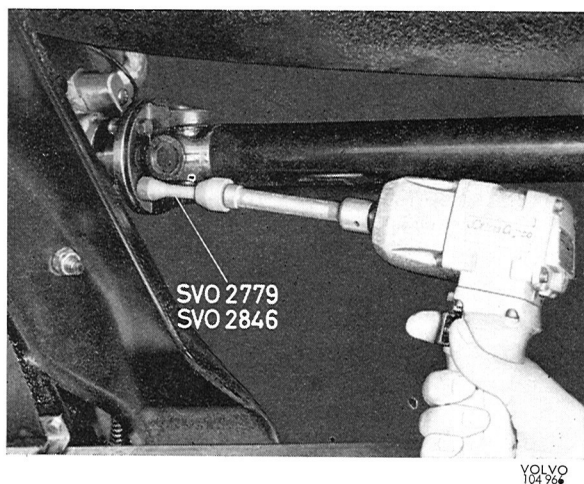


Fig. 4-136. Removal of bolts

DISASSEMBLY

PROPELLER SHAFT DISASSEMBLY

1. Bend back the lock washer and remove the nut for the support bearing. Remove the propeller shaft rear section. Pull off the support bearing.
2. Take the support bearing out of the housing.

DISASSEMBLING UNIVERSAL JOINTS

1. Remove the snap rings which secure the needle bearings in the yokes, see Fig. 4-137.

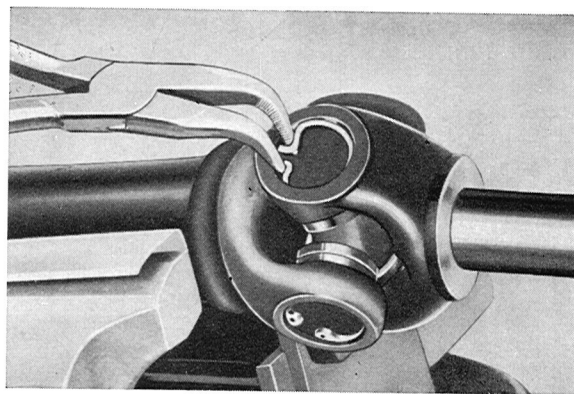


Fig. 4-137. Snap ring removal

2. Secure the shaft in a vise so that the universal joint come as near as possible to the vise jaws. Remember that the propeller shaft is tubular and can easily be deformed.
3. Use a hammer and metal punch to drive the spider as far as it will go in one direction. The needle bearing will then come about half way out.
4. Then drive the spider as far as it will go in the opposite direction, see Fig. 4-138.

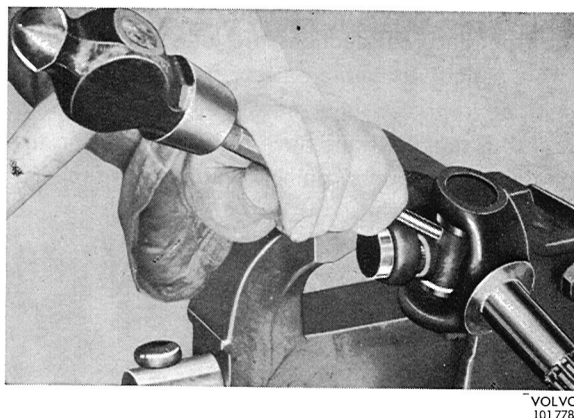


Fig. 4-138. Spider removal, I

5. Drive out one of the needle bearings with a thin metal punch. Remove the spider, see Fig. 4-139. Drive out the other needle bearing.

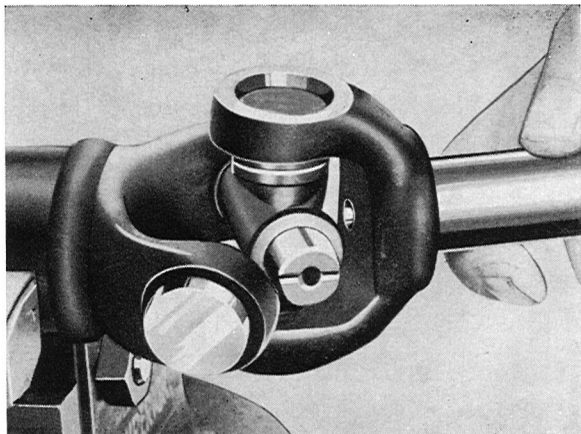


Fig. 4-139. Spider removal, II

INSPECTION

It is extremely important to make sure that the propeller shaft is straight. The inspection must be made very carefully, since even minor damage on the propeller shaft can cause vibration. The shaft should be set up between centers and checked along its entire length with an indicator gauge while it is rotating. If it is out-of-true more than .25 mm (.010"), the shaft must be replaced.

NOTE: No attempt should be made to straighten a damaged propeller shaft; replace it.

Examine the support bearing by pressing the bearing races against each other by hand and turning them in opposite directions. The bearing should run easily without binding at any point. If it binds, scrap the bearing and replace it with a new one.

Check needle bearings and spiders, worn or damaged parts should be replaced.

ASSEMBLY

ASSEMBLING UNIVERSAL JOINTS

1. If old needle bearings are installed, check that they are filled with grease and that the rubber seals are not damaged. New bearings should be half-filled with grease.
2. Insert the spider in the flange yoke. Push the spider in one direction so that the needle bearing can be installed in the trunnion, see Fig. 4-140. Then press in the needle bearing so far



Fig. 4-140. Spider installation

that the snap ring can be installed. Use a drift with a diameter slightly less than that of the needle bearing sleeve.

3. Install the other needle bearing and snap ring in the same way. Install the spider in the other yoke in the same way as now described.

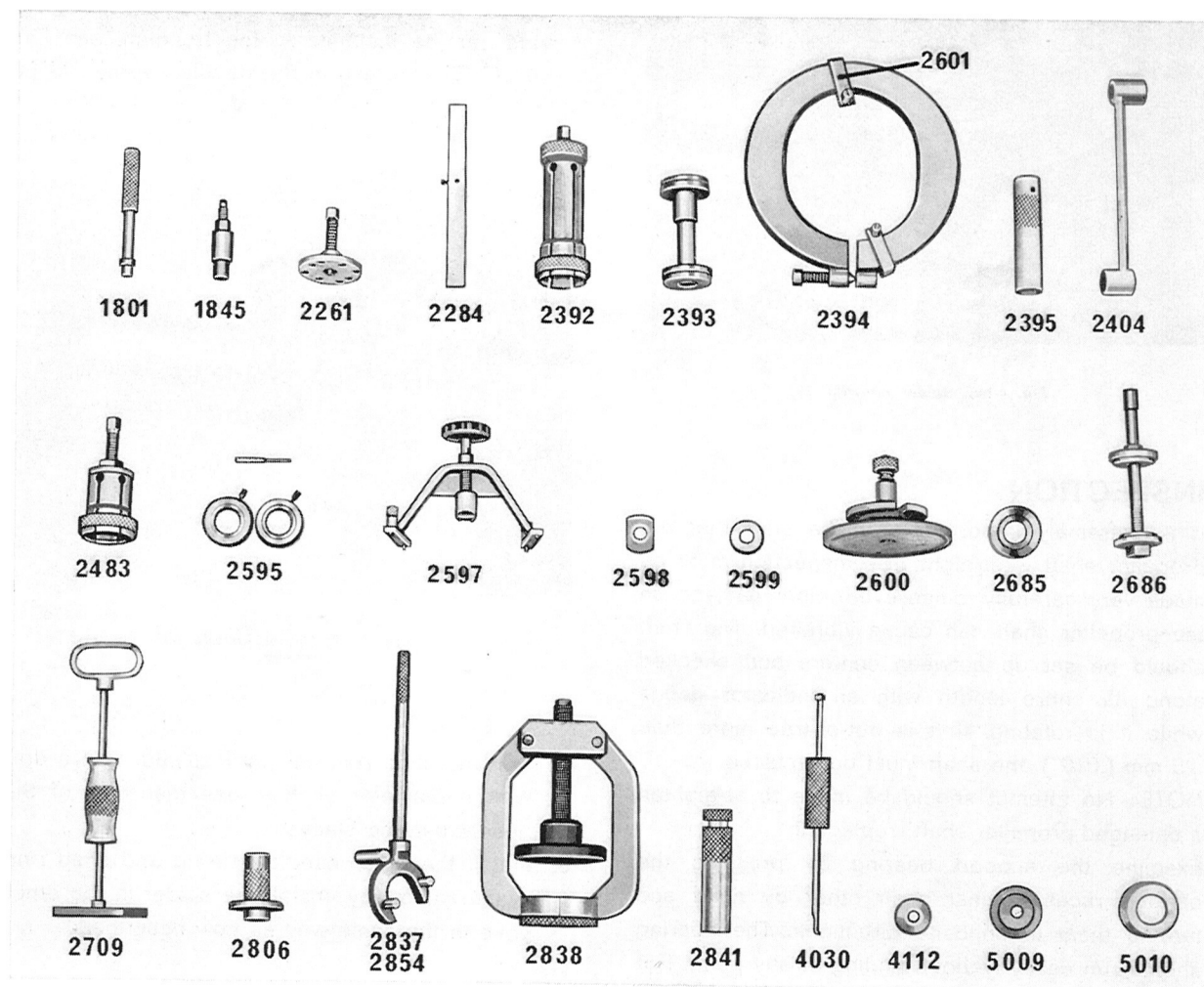
INSTALLATION

Installation is in reverse order to removal.

GROUP 46

REAR AXLE

TOOLS



VOLVO
108158

Fig. 4-141. Special tools for rear axle

999

(SVO)

- 1801 Standard handle 18×200 mm
- 1845 Press tool for flange installation
- 2261 Flange puller
- 2284 Indicator retainer, final drive adjustment
- 2392 Rear pinion bearing puller
- 2393 Measuring tool, pinion adjustment
- 2394 Expander tool, differential removal and installation
- 2395 Sleeve, rear pinion bearing inner ring installation
- 2404 Tool, front pinion bearing installation
- 2483 Puller, differential carrier bearings
- 2520 Stand (Fig. 4-142)
- 2522 Fixture for rear axle (used with stand 2520 for work on the final drive, Fig. 4-142)
- 2595 Adjusting rings, differential
- 2597 Brake for ring gear, used when checking tooth contact
- 2598 Drift for removing outer ring, rear pinion bearing
- 2599 Drift for removing outer ring, front pinion bearing
- 2600 Measuring fixture for adjusting rings

999

(SVO)

- 2601 Holder for expander tool 2394 (installed on tool)
- 2685 Adjustment ring for pinion
- 2686 Press tool for installation of outer races, pinion bearing
- 2709 Puller, drive shaft
- 2714 Fixture for rear axle, used on jack for rear axle removal and installation
- 2806 Tool, installation oil seal in flange
- 2837 Counterhold for flange (cars with B20 E)
- 2838 Press tool, removal and installation of bearing and ring on drive shaft lock
- 2841 Tool for adjustment ring 2685
- 2854 Counterhold for flange (cars equipped with B20 A, B and F engines)
- 4030 Puller, oil seal in flange
- 4112 Drift for installation of differential carrier bearings
- 5009 Drift, drive shaft bearing seal
- 5010 Ring for installation bearing and lock ring on drive shaft. Used together with 2838

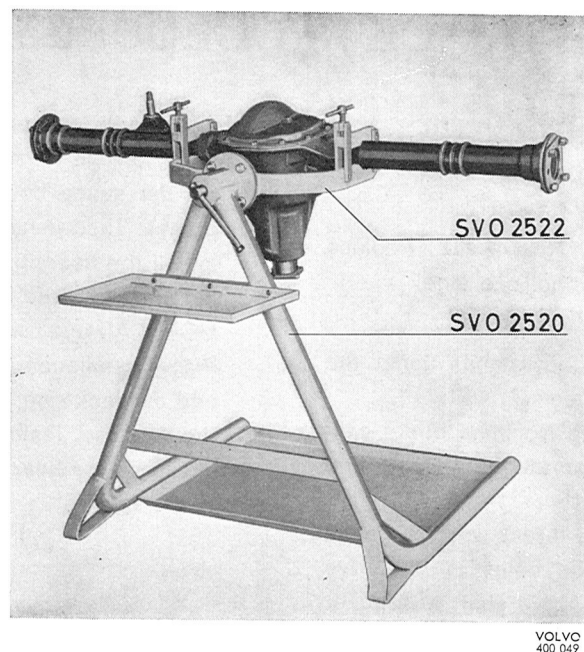


Fig. 4-142. Stand and fixture for rear axle

GENERAL

The rear axle is kept in place by two trailing arms which are connected to the rear axle housing by welded brackets and to the body by bushing brackets. In order to take up the rear axle torque, there are two torque rods (support rods) attached to the rear axle housing and to the body. A track bar (Panhard rod) prevents the body and rear axle from moving sideways in relation to each other. The rear axle suspension is shown in Fig. 4-181. The design of the rear axle is shown in Illustration 4E.

The final drive is of the hypoid type, which means that the drive pinion lies below the center of the ring gear. The final drive consists of pinion, ring gear and differential gear. The gear backlash and differential carrier bearing tension are adjusted by shims inside the differential carrier bearings. The differential carrier and the ring gear are journaled in the final drive housing by two taper roller bearings. The ring gear is attached to the differential carrier by bolts. The differential gears in the differential carrier consist of two bevel pinions on a trunnion and two side gears in which drive shafts are carried by internal splines. The differential gears are journaled so that they can rotate and permit the drive shafts to rotate at different speeds when the car is being driven in curves. There is a thrust washer under each of the differential gears.

The pinion bearings are taper roller bearings. The axial location of the pinion relative to the ring gear is adjusted by shims under the outer race of the rear pinion bearing.

The outer ends of the drive shafts are journaled in taper roller bearings. Bearing clearance is not adjustable and is determined by the construction of the bearing, see Fig. 4-143. The drive shaft bearings are on the outside provided with oil seals.

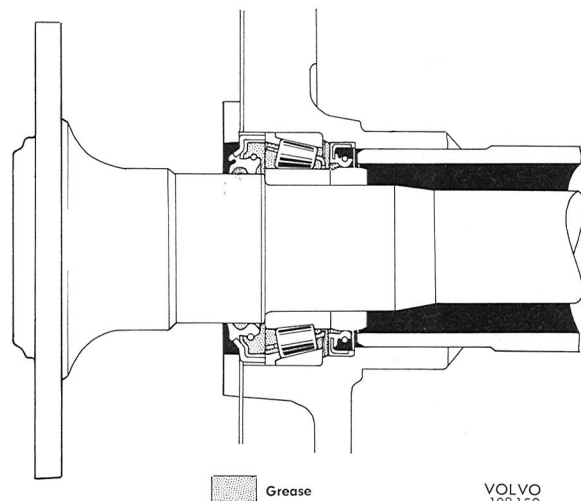


Fig. 4-143. Drive shaft journaling

SERVICE PROCEDURES

WORK ON REAR AXLE IN VEHICLE REPLACING BEARINGS AND DRIVE SHAFT OIL SEALS

Volvo Standard Times Op. No. 46606: Replace drive shaft seals and/or bearing, one side
Op. No. 46620: Both sides

1. Jack up the vehicle and put stands under the rear axle. Remove the wheels.
2. Disconnect the brake line from the brake caliper. Loosen the bolts for the brake disc and remove the disc.
3. Loosen the bolts for the thrust washer. These are loosened through the holes in the drive shaft flange. Pull out the drive shaft with puller 2709, see Fig. 4-144.

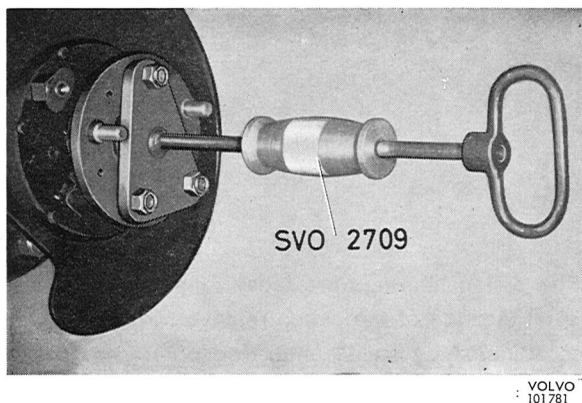


Fig. 4-144. Drive shaft removal

4. Pull out the inner seal ring with puller 4030 or brake it out, using a sturdy screwdriver.
5. Install press tool 2838 in a vise. Secure the drive shaft to the spindle plate. Screw in the spindle so that the tool arms can be placed against the bearing, see Fig. 4-145. Screw out

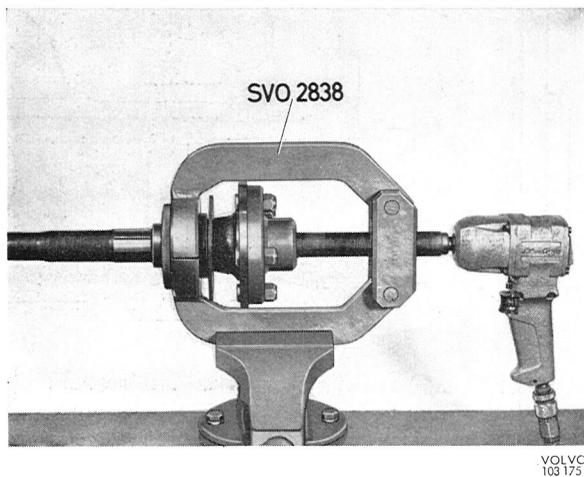


Fig. 4-145. Drive shaft bearing removal

the spindle and press off the bearing and lock ring. Remove the oil seal.

6. Fill the space between the new seal lips with grease. Then install the seal on the drive shaft, install the bearing and lock ring. Turn the bearing correctly, see Fig. 4-143.

NOTE: Always use a new lock ring.

Place installation ring 5010 against the bearing and the lock ring. Close the tool arms and lock them round installation ring, see Fig. 4-146. Press on the bearing and lock ring by screwing in the spindle.

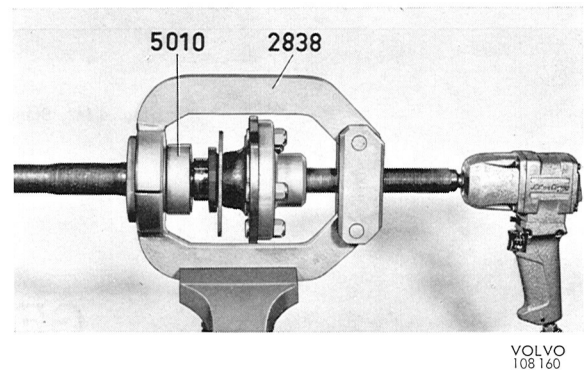


Fig. 4-146. Drive bearing installation

7. Install the inner seal ring with drift 5009 and handle 1801. The drift will automatically accomplish correct seal installation, see Fig. 4-147.

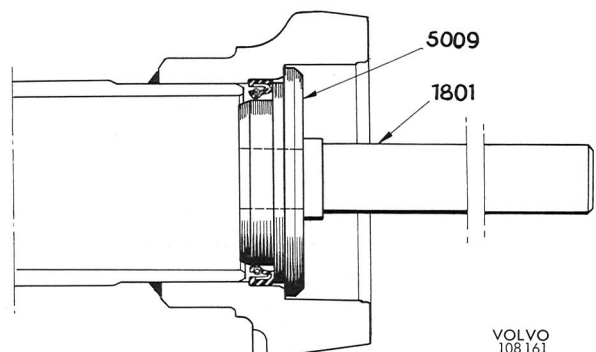


Fig. 4-147. Inner seal installation

8. Fill the bearing with a good quality grease. Also fill the space between the seals and the space between the seal lips with grease, see Fig. 4-143. Install the drive shaft. Tighten the bolts for the thrust washer to a torque of 50 Nm = 5 kpm = 36 lb.ft. Install the brake disc and brake caliper. Re-connect the brake line. Bleed and adjust the brakes, see Section 5.
9. Install the wheels and wheel nuts. Lower the vehicle. Tighten the wheel nuts.

PINION OIL SEAL REPLACEMENT

Volvo Standard Times Op. No. 46514

1. Disconnect the rear section of the propeller shaft from the flange on the pinion. Check for looseness of the pinion in its bearing. If it is loose, this must be remedied before a new oil seal is installed. See the instructions under the heading "Assembly".
2. Remove the nut for the flange. For this purpose, use tool 2854 as a counterhold for cars equipped with B20 A and B engines and 2834 for cars equipped with B20 E and F engines, see Fig. 4-148.



Fig. 4-148. Counterhold for flange

Pull off the flange with puller 2261, see Fig. 4-149.

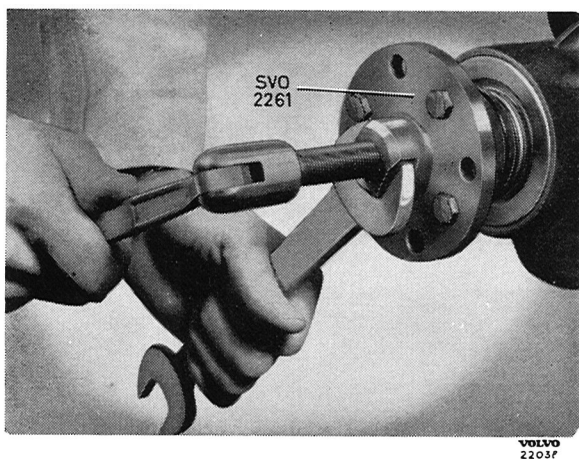


Fig. 4-149. Flange removal

Pull out the old seal with puller 4030, see Fig. 4-150.

3. Coat the lips of the new seal with grease. Lubricate also the spring coil so that it does not jump off during installation. Then install the oil seal with tool 2806, see Fig. 4-151.

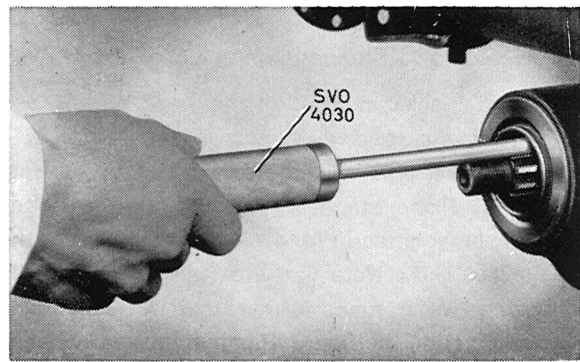


Fig. 4-150. Oil seal removal

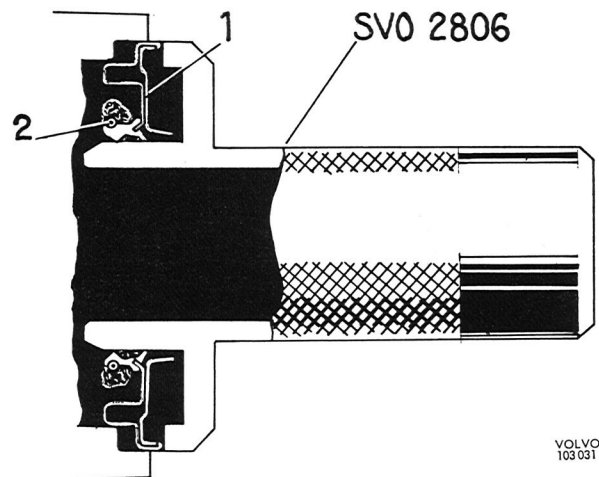


Fig. 4-151. Oil seal installation

1. Pinion oil seal
2. Spring coil with grease

4. Press on the flange with press tool 1845, see Fig. 4-152. Install the washer and nut. Tighten the nut to a torque of 280—300 Nm = 28—30 kpm = 200—220 lb.ft.

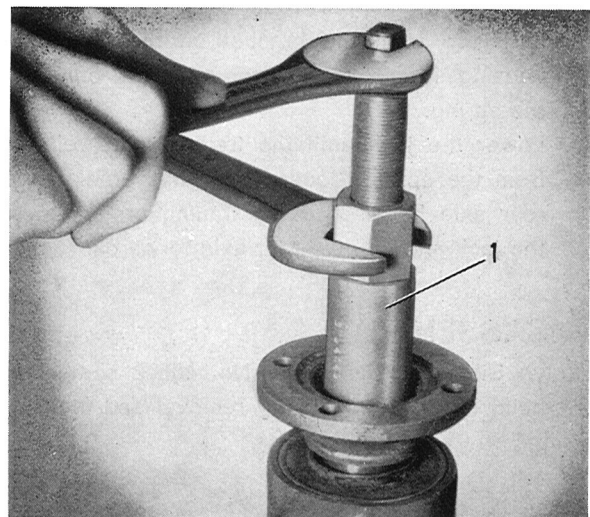


Fig. 4-152. Flange installation

1. Press tool 1845

REAR AXLE ASSEMBLY REMOVAL

Replace=Volvo Standard Times Op. No. 46016

1. Place blocks in front of the front wheels and loosen the rear wheel nuts. Place fixture 2714 on a jack and lift the rear axle. See also Fig. 4-181. Place stands in front of the rear jack attachments, see Fig. 4-153, and then lower the jack slightly. Note that the stands must not be placed at a point further than the dash line indicated in the figure. Remove the rear wheels.

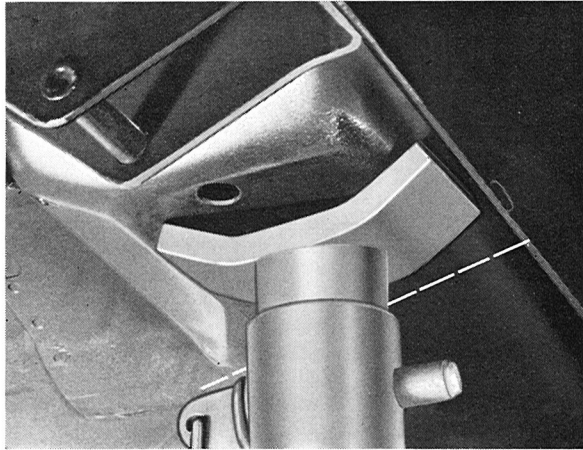


Fig. 4-153. Locating rear axle stand

2. Loosen the upper attaching bolts for the shock absorbers. Disconnect the parking brake wires from the levers and brackets on the brake backing plate. Use a spring fixture for this purpose, see Section 5.
3. Remove the propeller shaft from the flange on the pinion. Remove the brake pipe union from the rear axle housing.
4. Loosen the front attaching bolts for the trailing arms approximately one turn. Remove the rear bolts for the support rods. Disconnect the Panhard rod from the bracket on the rear axle housing. Remove the lower attaching bolts for the spring.
5. Lower the jack until the trailing arms release from the spring. Loosen the bolts holding the rear axle housing to the trailing arms. Lower the jack and pull the rear axle forwards.

DISASSEMBLY

Volvo Standard Times Op. No. 46502 comprises Re-build rear axle, including removal and installation.

1. Place the rear axle in fixture 2522, see Fig. 4-142.
Place the rear axle with the underside facing inwards to the fixture support, when the pinion

is pointing downwards. Remove the brake lines.

2. Loosen the bolts for the brake backing plates and brake shoe retainer. They are loosened through the holes in the drive shaft flanges. Pull out the drive shafts with puller 2709, see Fig. 4-144.
3. Remove the inspection cover.
4. If the final drive is being reconditioned because of noise, the contact pattern should be checked before dissassembly, as this might assist in locating the fault. Before doing this, clean the teeth so that no misleading contact pattern is obtained.
5. Check the alignment markings on the cap and carrier, see Fig. 4-154.

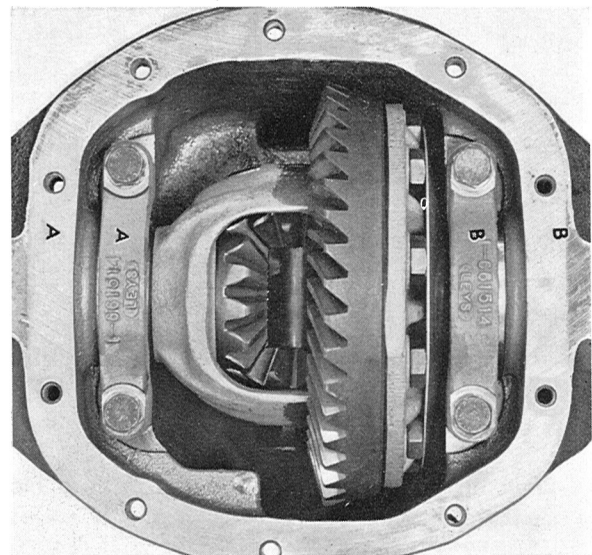


Fig. 4-154. Alignment marking on cap and carrier

If there are no markings, or if they are difficult to see, mark one side with a punch. Remove the cap.

6. Install tool 2394 in the holes in the drive pinion carrier as shown in Fig. 4-155.

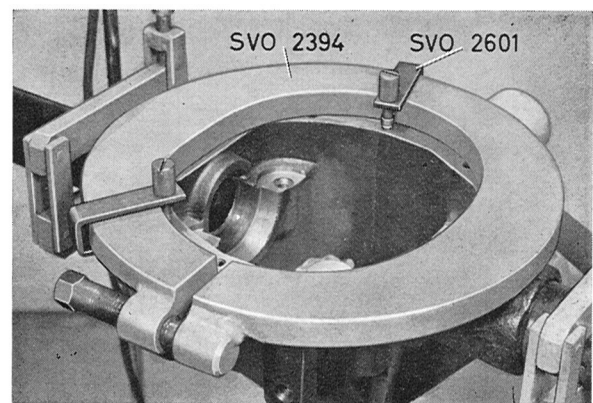


Fig. 4-155. Expanding drive pinion carrier

Install the tool with retainers 2601. Tension the tool until it fits exactly in the holes in the carrier. Then tension the bolt a further 3—3½ turns. Lift out the differential carrier with ring gear. Tool 2337 can be used for this purpose.

7. Turn the rear axle and drain the oil. Remove the nut for the flange. Use tool 2837 resp. 2854 for this purpose. Pull off the flange with puller 2261, see Fig. 4-149. Press out the pinion.
8. Drive out the front pinion bearing, the washer and the oil seal with standard handle 1801 and drift 2599.
9. If necessary, drive the rear bearing out of position, see Fig. 4-156. Use standard handle 1801 and drift 2598.

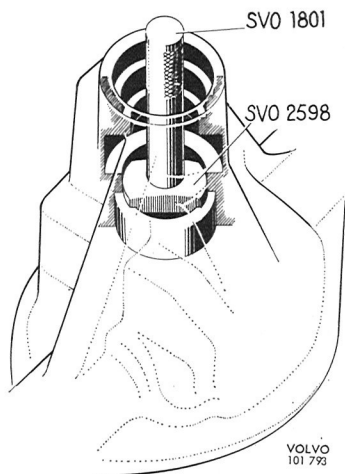


Fig. 4-156. Rear pinion bearing race removal

10. Clean the gasket surface. File off all burr on the surface on which the indicator retainer 2284 will slide.
11. If necessary, pull off the rear bearing from the pinion with puller 2392, see Fig. 4-157. The puller is fitted in the following way: Move the puller down over the rollers and press

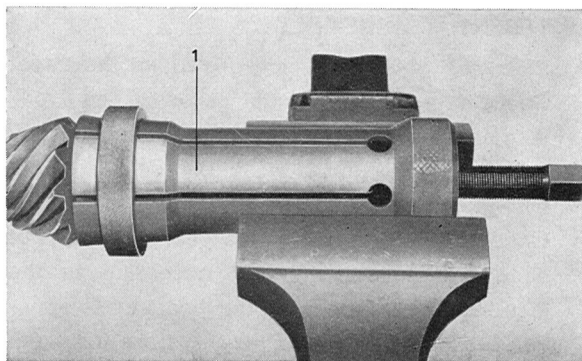


Fig. 4-157. Rear pinion bearing removal
1. Puller 2392

down the lock ring. Then pull up the puller with the bolt until the rollers lie flush with the edge of the inner race and the edge on the puller. Knock out the lock ring with a hammer. See also Fig. 4-158.

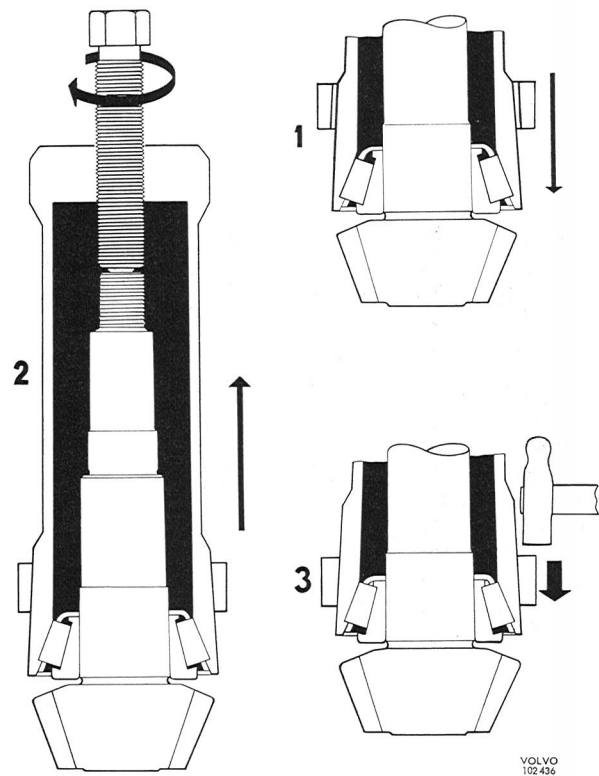


Fig. 4-158. Puller installation

Volvo Standard Times Op. No. 46599 comprises replacements of gear sets and all necessary bearings, rear axle removed

DIFFERENTIAL DISASSEMBLY

1. Pull off the differential carrier bearings with puller 2483, see Fig. 4-159. Do not remove the shims. How to install the puller, see Fig. 4-158.

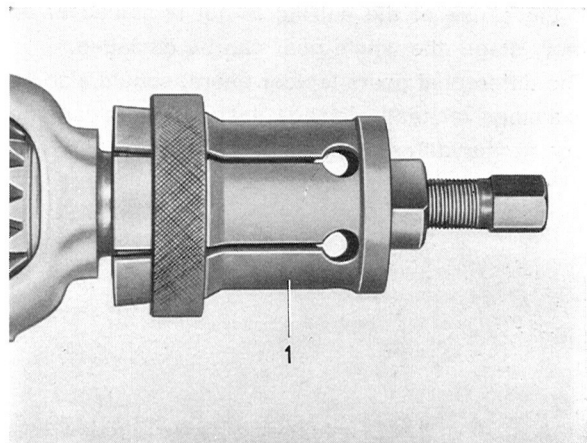


Fig. 4-159. Removing differential carrier bearings
1. Puller 2483

2. Remove the cover over the ring gear bolts. Loosen the ring gear bolts and remove the ring gear.
3. Drive out the lock pin, see Fig. 4-160, and the shaft for the differential gears. Lift out the block, the differential gears and the thrust washers.

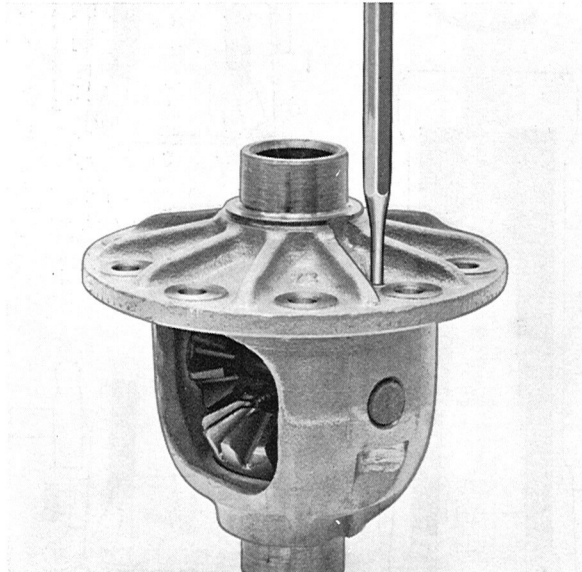


Fig. 4-160. Removing lock pin

INSPECTION

First clean all the parts thoroughly. Check all bearing races and bearings. Races, rollers or roller retainers must not be scratched or damaged. All damaged bearings and bearing races must be replaced.

Check the pinion and ring gear carefully for teeth damage. The most common damage is from seizing gear teeth, see Figs. 4-161 and 4-162. This is caused by incorrect running-in, wrong oil, insufficient tooth flank clearance or faulty tooth contact. If the cause of the seizing is not remedied at an early stage, the whole gear can be damaged.

The differential gears (spider gears) should also be examined for teeth damage. Install them clean and dry in the differential carrier with the shaft and

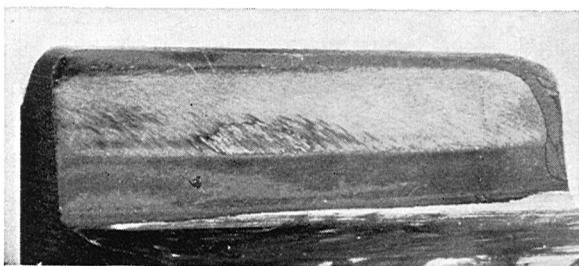


Fig. 4-161. Gear seizing

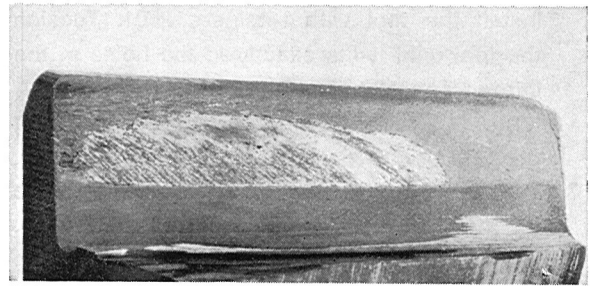


Fig. 4-162. Gear seizing

thrust washers. Play should then be checked by marking blue behind both the differential side gears. If the play exceeds .06 mm (.0024"), when the gears have been rotated to maximum play, replace with thicker spacer washers. These are available in seven thicknesses from .74 mm (.029") to .98 mm (.039") with .04 mm (.0016") difference.

Also check the cylindrical part of the flange which goes into the seal for wear or scratches. If necessary, replace the flange with the oil seal.

The pinion nut is provided with a slot for locking. In time, this slot loses its locking effectiveness. For this reason, the nut should be replaced if it has been removed a couple of times. The washer under the nut should also be replaced if deformed.

Check the oil seals and replace them if they are damaged or worn.

Make sure that there are no cracks in the rear axle housing. Check that the brackets for the trailing arms and Panhard rod are intact.

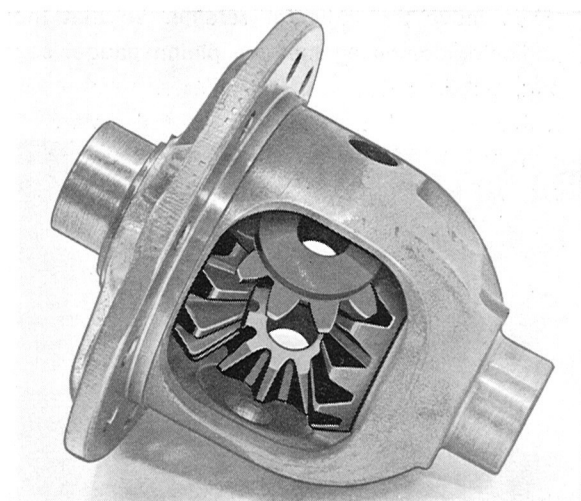
ASSEMBLING

Observe greatest cleanliness when assembling and adjusting final drives. Dirt in a taper roller bearing can result in completely inaccurate measurements.

If a bearing is measured for clearance or pre-load, it should be oiled and rotated several turns under load.

DIFFERENTIAL ASSEMBLY

1. Place the differential side gears and the thrust washers in the differential carrier. Then "roll" in the differential pinions both simultaneously with the dished thrust washers. see Fig. 4-163. Drive in the shaft.
2. Check the differential. If the gear play has not been determined, check it according to the instructions given under the heading "Inspection". If oversize spacer washers are installed, the play can be checked by turning the gears one turn. The necessary torque should not exceed 10 Nm = 1 kgm = 7.0 lb.ft. The tool for



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Fig. 4-163. Differential gear installation

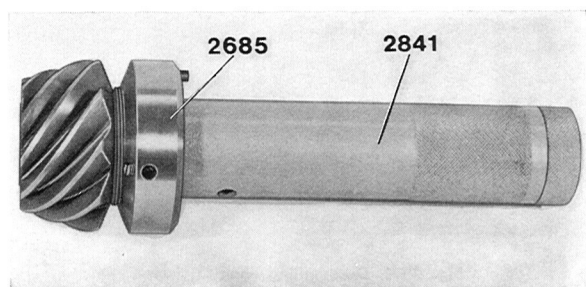
this check can easily be made from a shortened drive shaft which is adapted to a suitable torque wrench. After the checking and any replacement of the thrust washers, install the lock pin.

3. Install the ring gear. Make sure that the contact surfaces are clean and without burr. Tighten the bolts, torque $65-90 \text{ Nm} = 6.5-9.0 \text{ kgm} = 45-60 \text{ lb.ft.}$

NOTE: Always use new bolts for those gears where the bolts are locked by friction in the thread and the contact surface of the screw head. To achieve the effect intended, the bolts are tightened to their limit. A certain permanent elasticity is thereby obtained in the bolt, which becomes distorted if further tightening is attempted.

PINION INSTALLATION

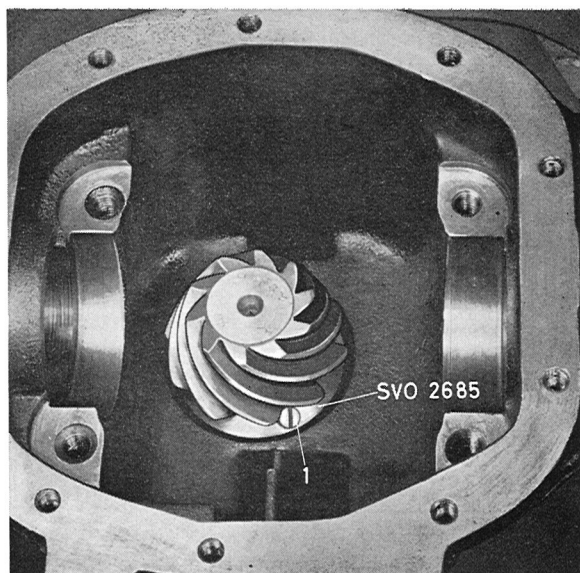
1. Clean the marking surface on the pinion with extremely fine emery cloth. Install the adjusting ring 2685 and tool 2841 (or 2684) on the pinion, see Fig. 4-164.



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Fig. 4-164. Adjusting ring and tool for pinion location

Place the pinion in the carrier so that the bolt on the adjusting ring faces the large side of the carrier, see Fig. 4-165.

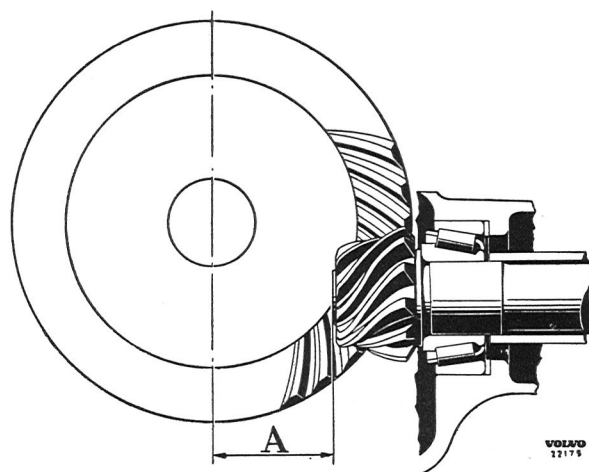


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Fig. 4-165. Locating pinion with adjusting tool

1. Lock screw

2. The pinion should have a certain nominal measurement (A, Fig. 4-166) to the center line of the ring gear.



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Fig. 4-166. Pinion location

A. Nominal measurement = 2.55"

Due to tolerances in the manufacturing, there are deviations from the nominal measurements. This is indicated with a figure on the ground surfaces on the pinion. The surface is generally ground down .30 mm (.012") so that the deviation is always indicated by plus tolerance and in hundredths of a millimeter. The plus sign is excluded.

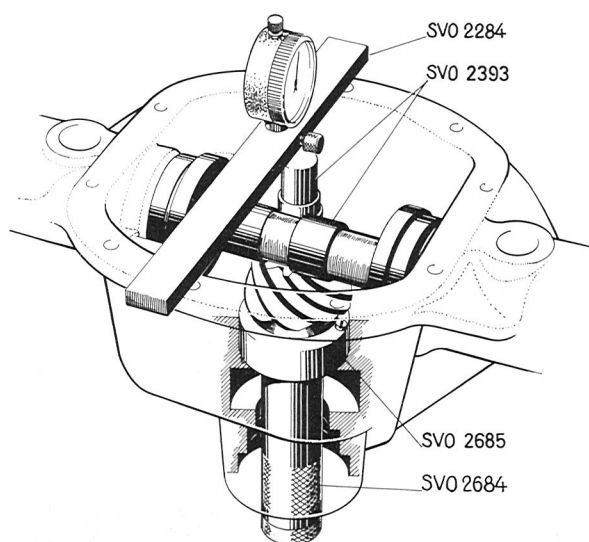
To check the location of the pinion, use a dial indicator, indicator retainer 2284 and a measuring tool 2393, which consists of two parts: a pinion gauge and an adjuster fixture.

Check the following way:

Place the pinion on the ground surface of the

Conversion table, millimetres to inches			
mm	inches	mm	inches
0.20	0.0079	0.31	0.0122
0.21	0.0083	0.32	0.0126
0.22	0.0087	0.33	0.0130
0.23	0.0091	0.34	0.0134
0.24	0.0094	0.35	0.0138
0.25	0.0098	0.36	0.0142
0.26	0.0102	0.37	0.0146
0.27	0.0106	0.38	0.0150
0.28	0.0110	0.39	0.0154
0.29	0.0114	0.40	0.0157
0.30	0.0118		

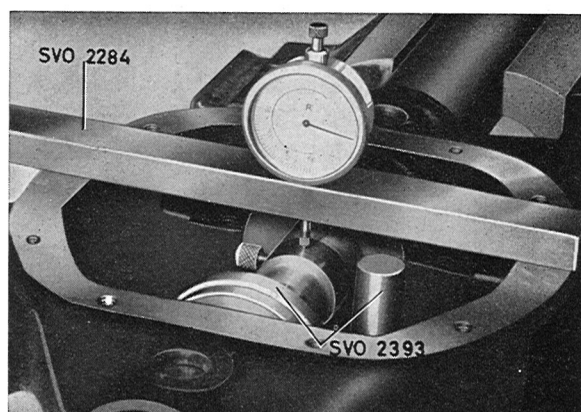
pinion and the adjustment jig in the differential bearing position as shown in Fig. 4-167.



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Fig. 4-167. Locating measuring tools

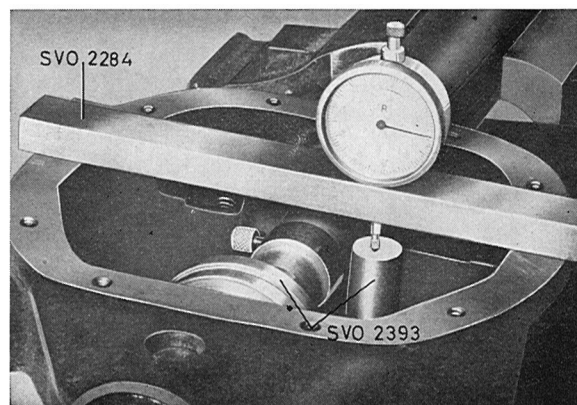
Place the indicator retainer on the drive pinion carrier and zero-set the gauge against the adjusting jig, see Fig. 4-168.



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Fig. 4-168. Zero-setting indicator

Then move the indicator retainer so that the indicator comes against the pinion gauge, see Fig. 4-169.



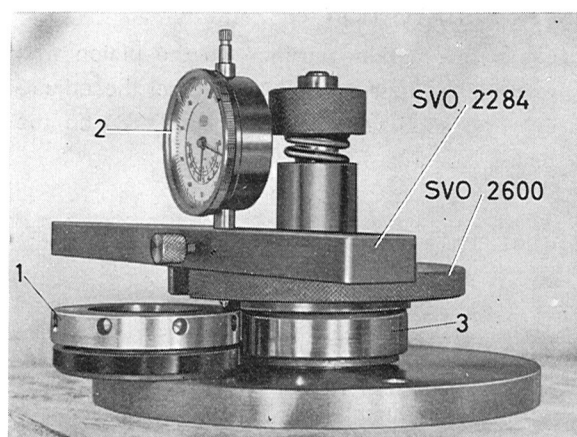
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Fig. 4-169. Measuring pinion location

If the pinion is for example, marked 33, the pinion gauge should lie .33 mm (.013") under the adjuster fixture.

The setting is adjusted by turning the cam on the pinion until the gauge dial shows the correct value. Then lock the adjusting ring with the lock screw. Remove the measuring tool and pinion.

3. Place the complete rear pinion bearing with the outer ring in fixture 2600. Install the plate, spring and nut. Turn the nut with the flat side upwards. The plate, and thereby the bearing, is turned forwards and backwards several times in order to achieve correct positions for the bearing rollers. Place the adjustment ring in the fixture as shown in Fig. 4-170.



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Fig. 4-170. Determining shim thickness

1. Adjustment ring
2. Dial indicator
3. Bearing assembly

Use retainer 2284 and dial indicator and place the measuring point of the indicator opposite the adjustment ring and zero-set the indicator.

Then set the indicator pointer to the outer ring of the bearing. The dial indicator now shows at once the thickness the shims should have. Measure shims for the correct thickness with a micrometer, see Fig. 4-171.

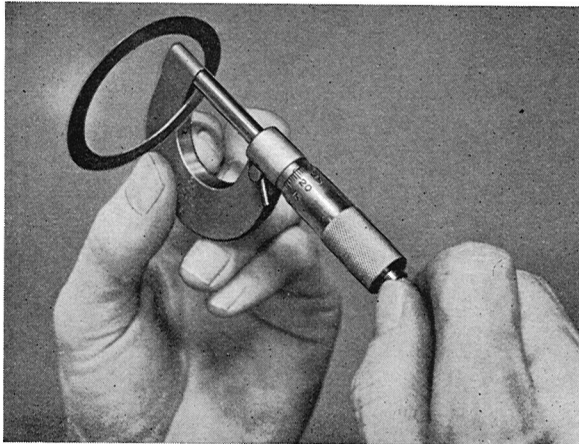


Fig. 4-171. Measuring shims

NOTE: It is almost impossible to obtain a shim with exactly the correct thickness. However, they must not be .03 mm (.0012") thicker than the measured value, but up to .05 mm (.002") thinner.

4. Press the rear bearing on the pinion with sleeve 2395, see Fig. 4-172.

NOTE: The washer under the rear bearing inner ring must not be installed when recondi-

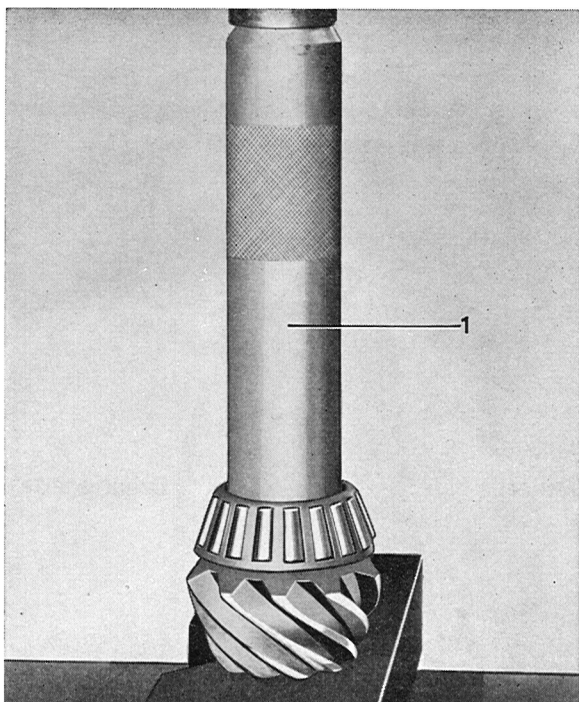


Fig. 4-172. Rear pinion bearing installation
1. Sleeve 2395

tioning. Install the measured shims and press in both the outer rings of the bearings with tool 2686, see Fig. 4-173.

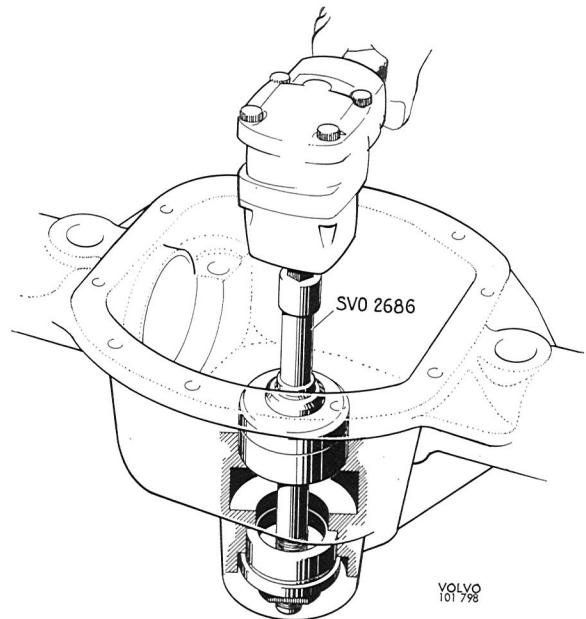


Fig. 4-173. Installing bearing races

5. Insert the pinion in the housing and install three .75 mm (.03") thick shims and the front pinion bearing. Install tool 2404 and press tool 1845 on the front end of the pinion and pull in the pinion, see Fig. 4-174. At installation, and especially when using an impact wrench, guide the pinion so that it does not touch the bearing races.

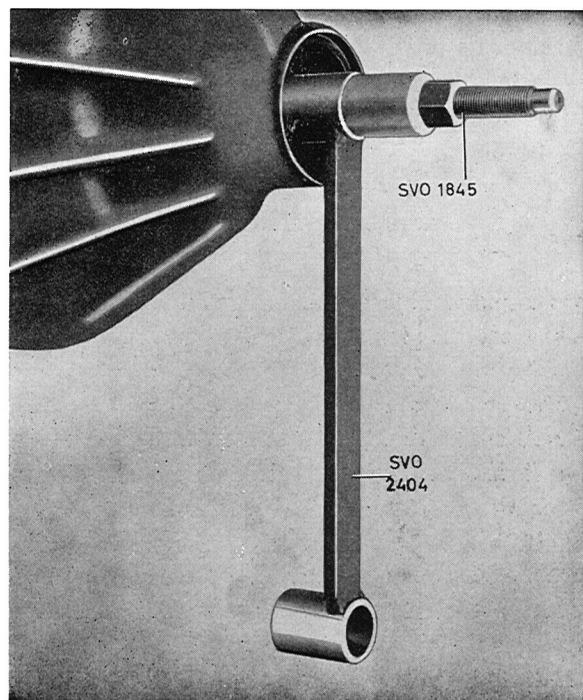


Fig. 4-174. Installing pinion

6. Replace press tool 1845 with washer and nut. Tighten the nut to $280\text{--}300\text{ Nm} = 28\text{--}30\text{ kgm} = 200\text{--}220\text{ lb.ft.}$ Install the pinion gauge and the dial indicator retainer. Pull down the pinion while turning it forwards and backwards at the same time. Zero-set the indicator. Then press the pinion upwards, turning it at the same time forwards and backwards. Read the clearance.
7. Remove the pinion. Remove the shims corresponding to the measured clearance $+ .07\text{ mm} (.003\text{'})$. Install the pinion.
8. Now use the torque gauge to check the pinion bearing installation. For used bearings the torque gauge should show $60\text{--}110\text{ Ncm} = 5.20\text{--}9.55\text{ lb.in.}$, and for new bearings $110\text{--}230\text{ Ncm} (9.55\text{--}20\text{ lb.in.})$ when the pinion rotates. On new final drive units, stresses can be higher due to another type of installation method. In other words, higher stresses does not mean that there is a fault.
Often an alternation in the shim thickness is required because of the tolerances whics must be present.
9. Check the location of the pinion with the dial indicator, retainer 2284 and measuring tool 2393, see also point 2.

DIFFERENTIAL INSTALLATION

1. Lubricate the inside of the adjustment rings 2595 and install them on the differential carrier. The ring with the black-oxidized adjustment ring should be placed on the ring gear side. Also lubricate the bearing location in the carrier. Install the differential carrier and the adjustment rings in the final drive housing, see Fig. 4-175.

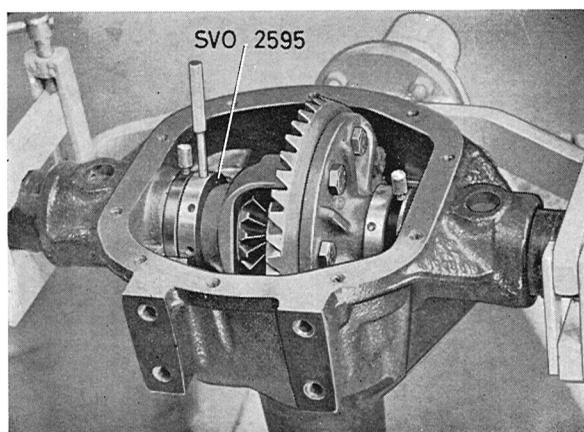


Fig. 4-175. Adjustment rings for differential

Use the dial indicator and adjust the rings so that the correct backlash $.15\text{ mm} (.006\text{'})$ is obtained. The tooth flank clearance may vary between $.13\text{ mm} (.005\text{'})$ and $.20\text{ mm} (.008\text{'})$, but should be kept as near $.15\text{ mm} (.006\text{'})$ as possible. Tighten the lock screws in the adjustment rings.

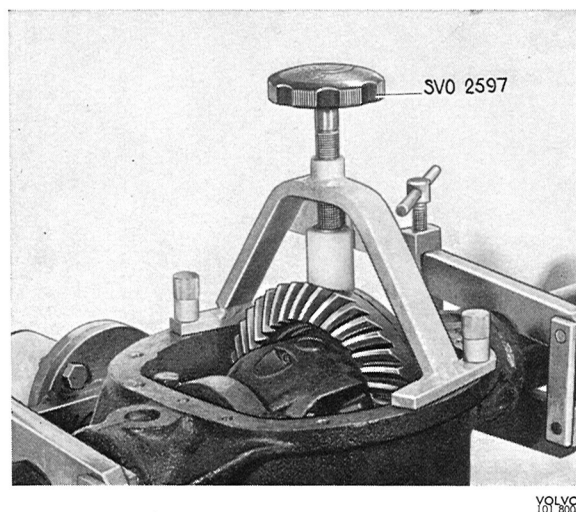


Fig. 4-176. Brake tool for differential

2. Install brake tool 2597 as shown in Fig. 4-176. Mark with color several teeth at three points on the ring gear. This can act as a check for possible ring gear warp. Rotate the pinion $10\text{--}12$ turns in both directions and check the contact marking pattern. At the correct contact, the contact marking pattern should be horizontal in the middle of the tooth but somewhat nearer to the toe than the heel. The pattern on the reverse side and driving side should coincide with each other, see Fig. 4-177.

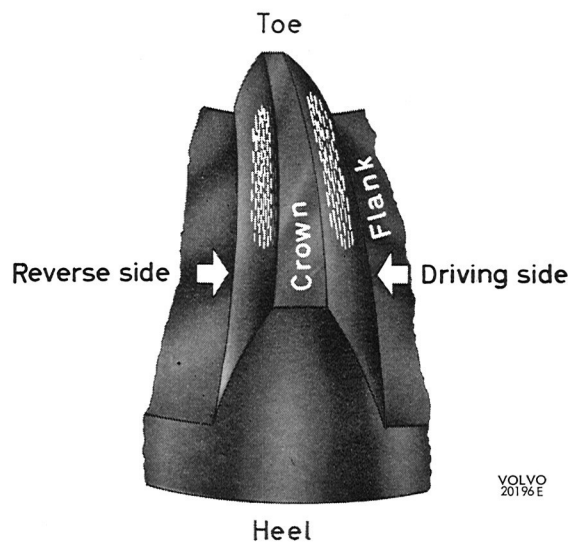


Fig. 4-177. Correct tooth contact

If the patterns do not coincide, the location of the pinion must be adjusted before assembly is continued. If the patterns lie too far towards the heel on the driving side and too far towards the toe on the reverse side, see Fig. 4-178, the pinion should be moved inwards.

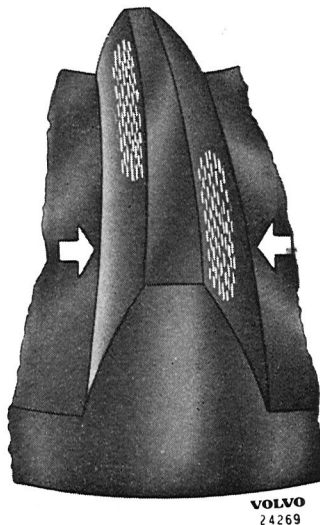


Fig. 4-178. Faulty tooth contact

If the contact patterns lie too far towards the toe on the driving side and too far towards the heel on the reverse side, see Fig. 4-179, the pinion should be moved outwards. Note that the patterns will lie somewhat nearer the toe when the adjustment rings are installed than when the bearings are installed.

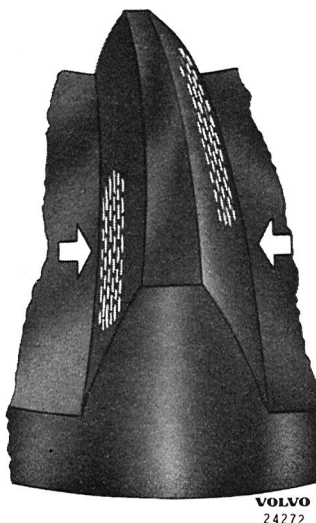


Fig. 4-179. Faulty tooth contact

3. When the correct backlash and contact pattern are obtained, remove the differential and adjustment ring. Then place the center washer on

the measuring fixture. Install a bearing into the measuring fixture, as well as the plate, spring and nut. Install the nut, with the flat side facing downwards. Rotate the plate forwards and backwards several times. Put on the dial indicator and retainer 2284. Zero-set the indicator to the adjustment ring and then place the measuring point facing the bearing, see Fig. 4-170.

Read the indicator. Use a micrometer to measure the shims to a thickness corresponding to the read value + .07 mm (.003"). Place the shims together with the measured bearing to the one side. Repeat the procedure with the other bearing.

NOTE: Make sure which side the respective bearing and shims are to be installed on.

4. Install the shims on the differential carrier and press on the bearings. Do not forget the lock cover for the ring gear bolts, see Fig. 4-180. Use drift 4112. see Fig. 4-181.

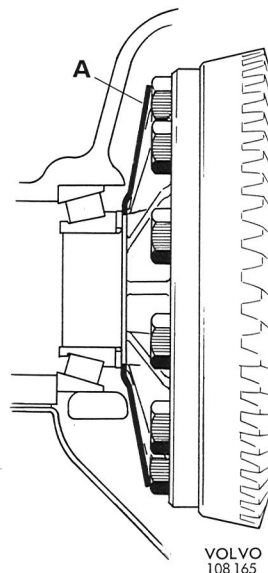


Fig. 4-180. Lock cover for ring gear bolts

A. Lock cover

When the second bearing is installed, use drift 2599 as a cushioning ring in order to prevent damage on the first bearing already pressed on.

5. Install tool 2394 and pinion carrier, see Fig. 4-155.

Expand the tool until the pins are exactly flush against the hole edges in the carrier and then tighten the screws another 3—3 1/2 turns. Install the differential and outer rings. Remove tool 2394. Install the cap and tighten the bolts to a torque of 50—70 Nm = 5—7 kgm = 36—50 lb.ft.

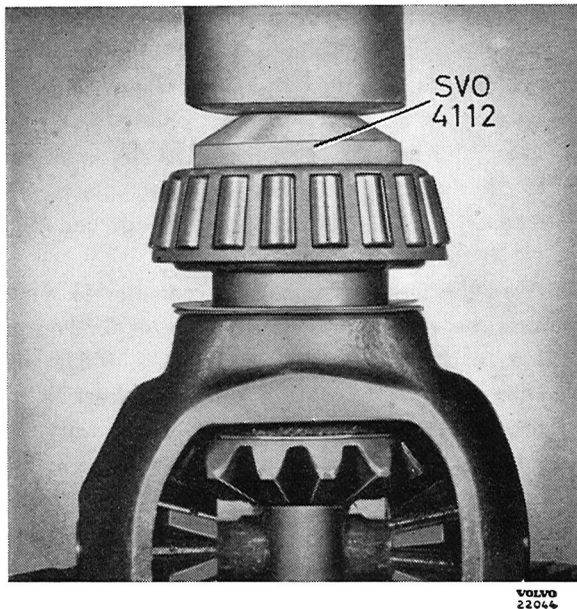


Fig. 4-181. Installing differential bearings

REAR AXLE ASSEMBLY

1. Remove tool 2404. Install the oil slinger. Lubricate the oil seal lips with grease. Also lubricate the spring coil with grease to prevent it from jumping out during installation. Then install the oil seal with drift 2806. Press on the flange with tool 1845, see Fig. 4-152.
Install washer and nut. Tighten the nut to a torque of $280\text{--}300\text{ Nm} = 28\text{--}30\text{ kgm} = 200\text{--}220\text{ lb.ft.}$
2. Install the inspection cover and gasket.
3. Fill the drive shaft bearings with good quality grease. Also fill the space between the seals and the seal ring lips with grease, see Fig. 4-143.
Install the drive shafts. Tighten the bolts for the thrust washers to a torque of $50\text{ Nm} = 5\text{ kgm} = 36\text{ lb.ft.}$
4. Install the brake discs and brake caliper. Finally install the brake lines.

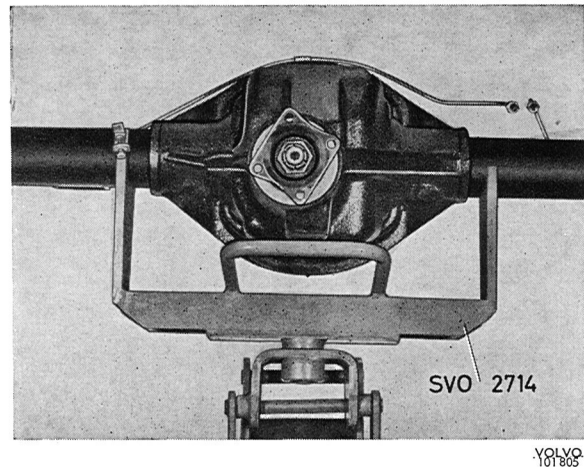
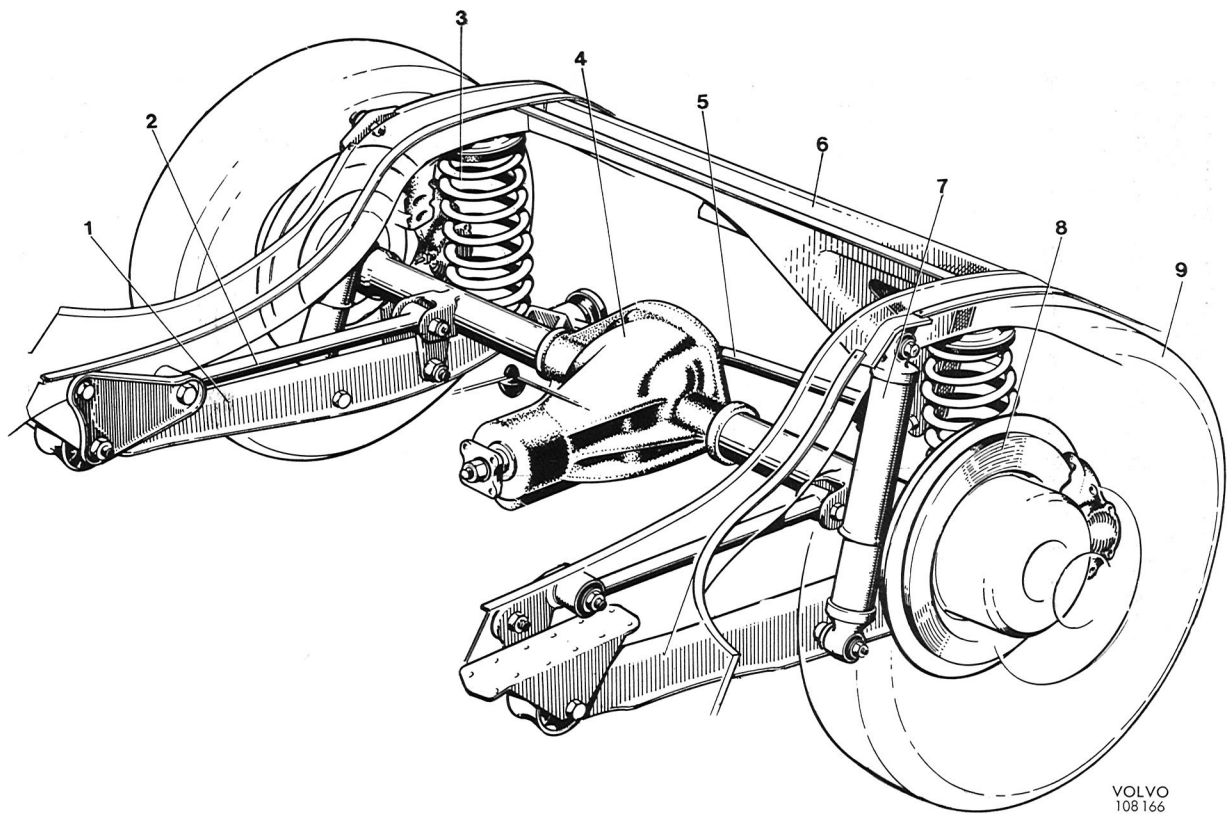


Fig. 4-182. Rear axle fixture

REAR AXLE INSTALLATION

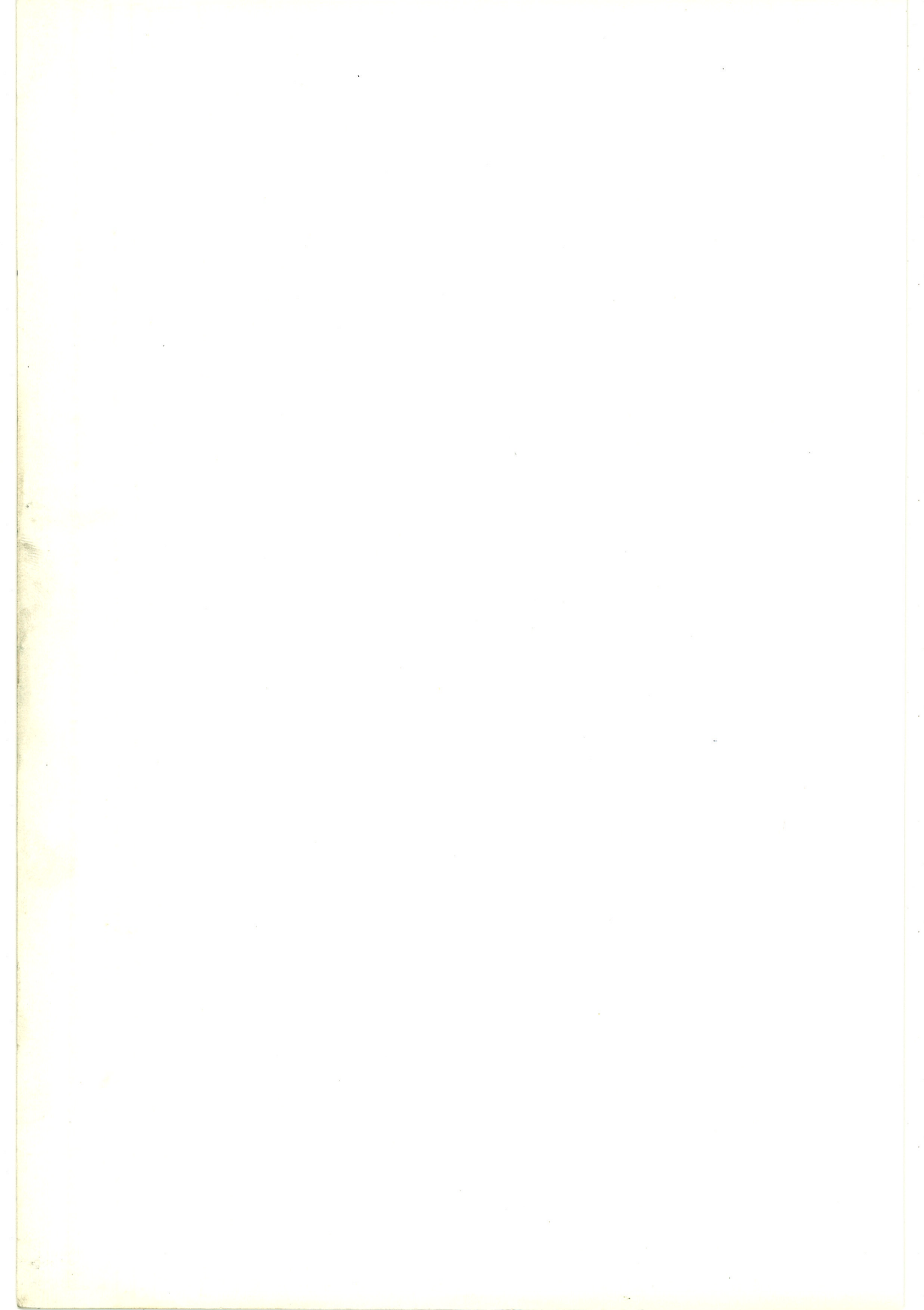
1. Install the rear axle on fixture 2714, which is mounted on a jack, see Fig. 4-182.
Move the rear axle in under the vehicle and install the bolts for the support arms and torque rods.
2. Replace the jack until the Panhard rod attachment on the rear axle is at the same level with the attachment on the body. Install the Panhard rod.
3. Install the attaching bolts for the spring. Tighten the nuts for the support rods and trailing arms.
4. Install bracket, union and brake hoses. Install the universal joint to the flange.
5. Install the upper bolt for the shock absorbers. Install the parking brake wire in the brackets and at the levers. Adjust the parking brake and bleed the brakes, see Section 5.
6. Install wheels and wheel nuts. Lower the vehicle. Tighten the wheel nuts to a torque of $100\text{--}140\text{ Nm} = 10\text{--}14\text{ kgm} = 70\text{--}100\text{ lb.ft.}$
Fill oil. Use only hypoid oil.



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Fig. 4-183. Rear axle with suspension

- | | |
|-------------------------------|-------------------|
| 1. Trailing arm | 6. Body member |
| 2. Support rod | 7. Shock absorber |
| 3. Spring | 8. Disc brake |
| 4. Rear axle | 9. Wheel |
| 5. Panhard rod
(track rod) | |



1. Flywheel housing
2. Clutch cover
3. Clutch plate
4. Flywheel
5. Crankshaft
6. Support bearing in crankshaft
7. Circlip
8. Adjusting nuts
9. Return spring
10. Release fork
11. Dust cover
12. Holding plate
13. Release bearing
14. Thrust spring
15. Clutch plate shaft (input shaft gearbox)
16. Cover, transmission
17. Support rings
18. Pressure plate
19. Retainer
20. Clutch wire
21. Washer
22. Rubber bushing
23. Washer
24. Nut
25. Rubber sleeve
26. Bolt for pedal stop
27. Bracket
28. Bolt for pedal shaft
29. Return spring
30. Clutch pedal

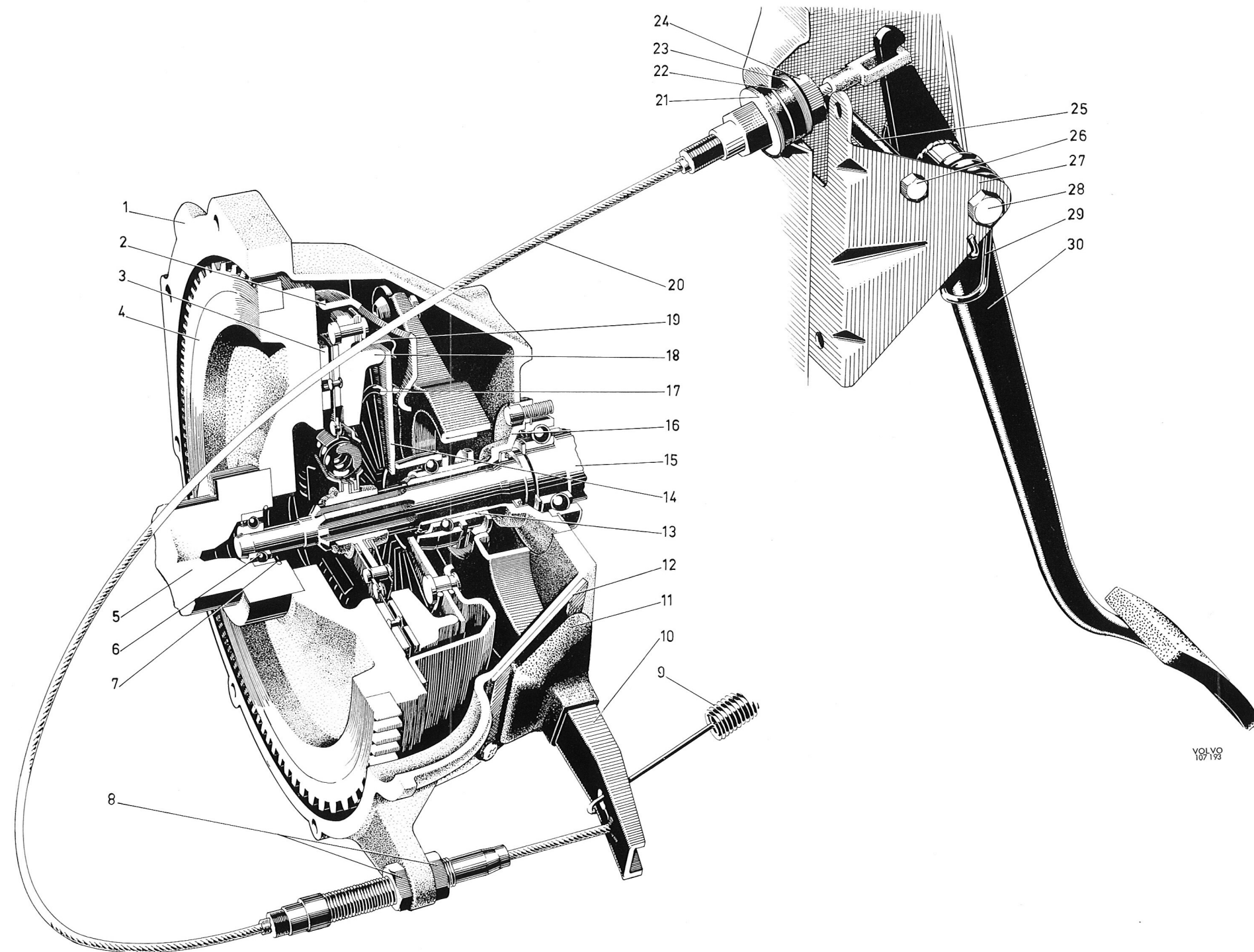


Illustration 4-A. Clutch and clutch controls

1. Gear lever, upper section with knob
2. Rubber bushings
3. Gear lever, lower section
4. Circlip
5. Spring
6. Washer
7. Bushing
8. Protective cover
9. Transmission cover
10. End housing
11. Rear cover
12. Ball bearing
13. Striker (x-ray)
14. Bushing
15. Gear shifter rod
16. Contact for back-up lights and belt reminder
17. Selector fork, 1st and 2nd speeds
18. Gate
19. Sliding plate
20. Sleeve (reverse catch)
21. Spring
22. Sleeve
23. Spring
24. Insert
25. Engaging sleeve and gear wheel for reverse
26. Synchronizing ring
27. Bushing (Needle bearings)
28. Gear wheel for 2nd speed
29. Thrust washer
30. Circlip
31. Thrust washer
32. Gear wheel for 3rd speed
33. Bushing (Needle bearings)
34. Main shaft
35. Spring
36. Interlock ball
37. Synchronizing hub
38. Insert
39. Selector rail for 3rd and 4th speeds
40. Selector rail for 1st and 2nd speeds
41. Selector rail for reverse
42. Engaging sleeve
43. Spring
44. Synchronizing ring
45. Ball bearing
46. Roller bearing
47. Sealing ring
48. Cover
49. Input shaft
50. Spacer washer
51. Thrust washer
52. Housing
53. Needle bearing
54. Spacer washer
55. Countershaft
56. Idler gear
57. Reverse gear shaft
58. Reverse gear
59. Bushing
60. Striker lever (x-ray)
61. Bushing (Needle bearings)
62. Gear wheel for 1st speed
63. Thrust washer
64. Speedometer worm gear
65. Bleeder nipple
66. Oil seal
67. Flange

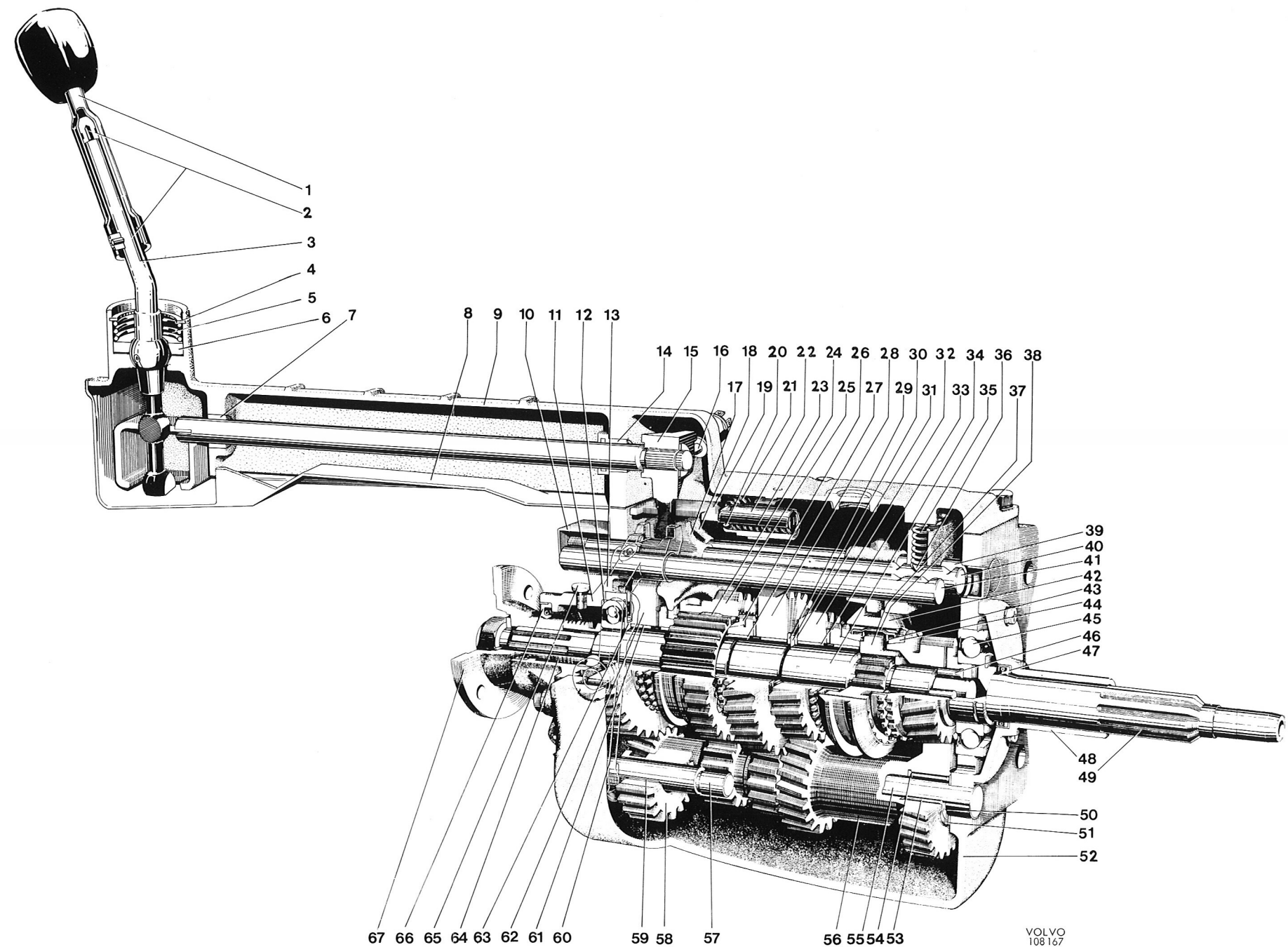


Illustration 4-B. Transmission M 40

- | | |
|-----------------------------|-------------------------------|
| 1. Nut | 57. O-ring |
| 2. Lock washer | 58. Cylinder |
| 3. Bridge piece | 59. O-ring |
| 5. Breather | 60. Plug |
| 6. Front casing | 61. Spring |
| 7. Gasket | 62. Ball |
| 8. Brake ring | 63. Non-return body |
| 9. O-ring | 64. O-ring |
| 10. O-ring | 65. Pump body |
| 11. Seal | 66. Pump plunger |
| 12. Gasket | 67. Washer |
| 13. Solenoid | 68. Fine filter |
| 14. Bolt | 69. Seal |
| 15. Thrust bearing retainer | 70. Plug |
| 16. Spring | 71. Data plate |
| 17. Thrust bearing | 72. Screw |
| 18. Circlip | 73. Planet gear and carrier |
| 19. Circlip | 74. Sur wheel |
| 20. Circlip | 75. Clutch sliding member |
| 21. Stud | 76. Pre-filter |
| 22. Piston seal | 77. Gasket |
| 23. Piston | 78. Magnet |
| 24. Connecting rod | 79. Base plate |
| 25. Non-return ball | 80. Bolt |
| 26. Non-return valve spring | 81. Resilient washer |
| 27. Plug | 84. Bushing |
| 28. Key | 85. Thrust washer |
| 29. Resilient ring | 86. Oil thrower |
| 30. Circlip | 87. Circlip |
| 31. Eccentric | 88. Uni-directional clutch |
| 32. Piston pin | 89. Stud |
| 33. Gasket | 90. Resilient washer |
| 36. Stud | 91. Nut |
| 37. Orifice nozzle | 95. Speedometer pinion |
| 38. Seal | 96. O-ring |
| 39. Plug | 97. Bushing |
| 40. O-ring | 99. Bolt |
| 41. End piece | 100. Retainer |
| 42. Piston | 101. Oil seal |
| 43. Washer | 102. Stud |
| 44. Spring | 106. Speedometer driving gear |
| 45. Retainer | 110. Output shaft |
| 46. Spring | 111. Ball bearing |
| 47. Screw | 112. Spacer |
| 48. Screw | 113. Rear casing |
| 49. Holder | 114. Ball bearing |
| 50. Spring | 115. Oil seal |
| 51. O-ring | 116. Flange |
| 52. Plug | 117. Washer |
| 53. Nut | 118. Nut |
| 54. Piston | |

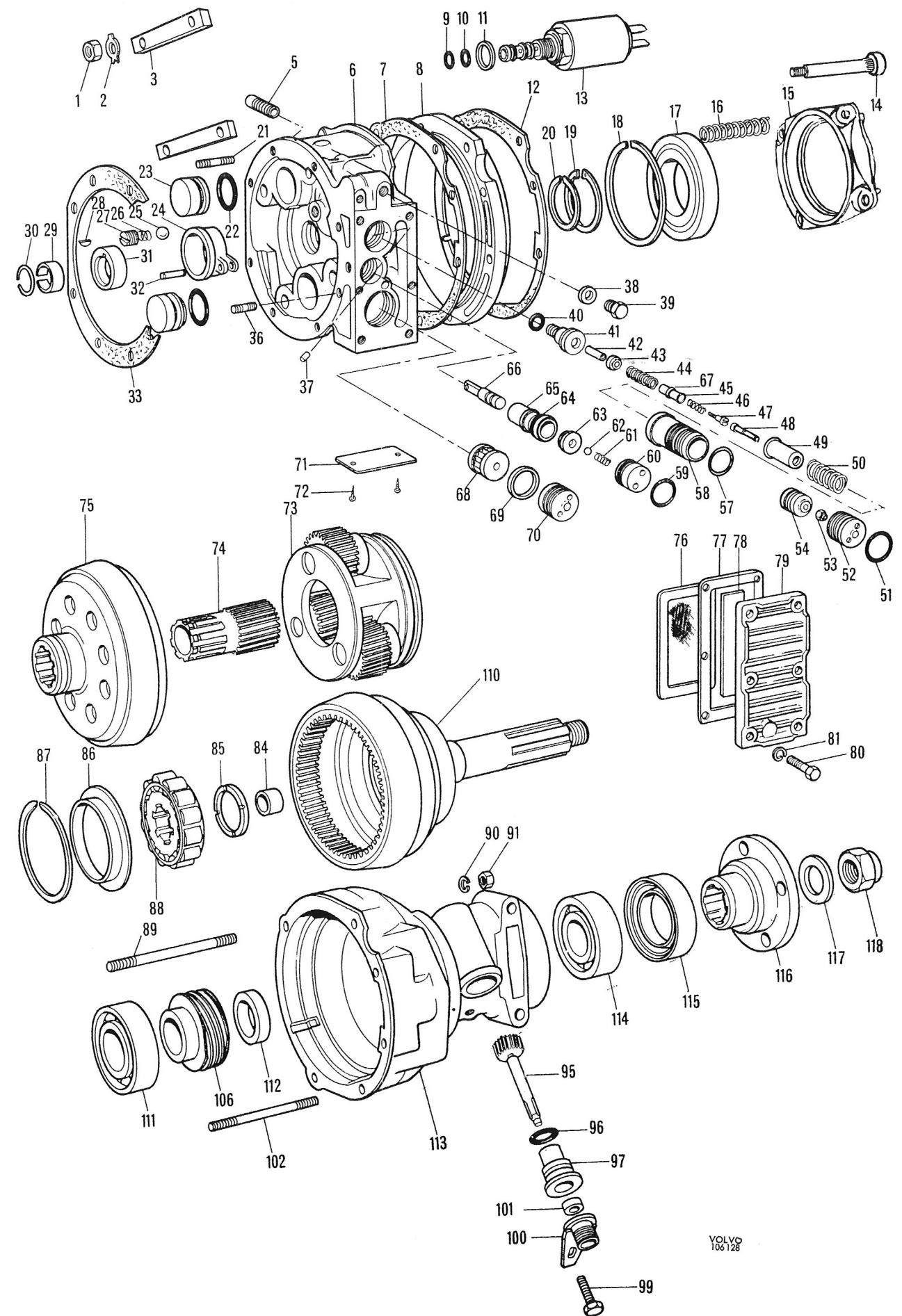


Illustration 4-C. Overdrive

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1. Oil seal
2. Pump
3. O-ring
4. Pump body
5. Gasket
6. Thrust washer
7. Snap ring
8. Input shaft
9. Thrust washer
10. Hub
11. Disc kit
12. Snap ring
13. Spring
14. Ring
15. Piston ring (rubber)
16. Piston and reed
17. Rubber ring
18. Front clutch cylinder
19. Front servo
20. Servo strut
21. Contact pin
22. Brake band
23. Thrust washer
24. Thrust washer
25. Snap ring
26. Spring seat
27. Spring
28. Snap ring
29. Disc kit
30. Piston ring (rubber)
31. Piston
32. Rear clutch cylinder
33. Oil ring
34. Rubber ring
35. Needle bearing
36. Key
37. Reverse sun gear
38. Needle thrust plate
39. Oil rings
40. Forward sun gear
41. Oil ring
42. Center bearing
43. Servo strut
44. Brake band
45. Needle thrust bearing
46. Thrust plate
47. Snap ring
48. Free wheel
49. Brace
50. Planetary gear
51. Thrust plate and bearing
52. Gear
53. Snap ring
54. Driven shaft
55. Washer
56. Oil ring
57. Seal ring
58. Transmission case
59. Rear servo
60. Stop shaft
61. Nipple
62. Plate
63. Oil deflector flange
64. Lock bolt
65. Spindle
66. Spring
67. Valve
68. Centrifugal governor
69. Counterweight housing
70. Spedometer gear
71. Flange

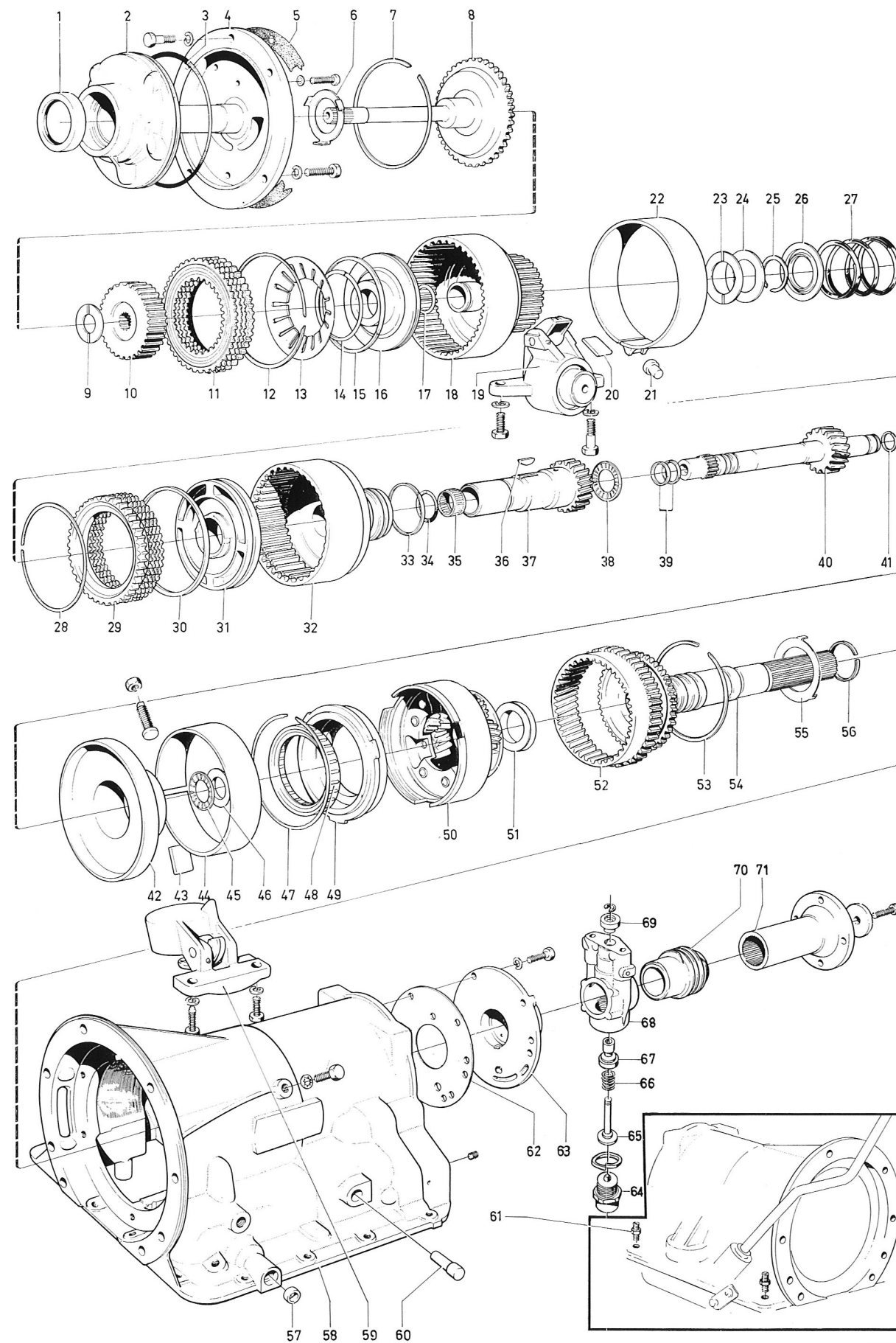


Illustration 4-D. Automatic transmission BW 35

1. Tubular shaft
2. Differential carrier bearing
3. Bearing cap
4. Shims
5. Differential carrier
6. Thrust washer
7. Differential side gear
8. Lock pin
9. Differential pinion
10. Crown wheel
11. Shaft
12. Thrust washer
13. Lock cover
14. Rear axle casing
15. Flange
16. Dust cover plate
17. Oil seal
18. Oil slinger
19. Shims
20. Front pinion bearing
21. Pinion
22. Rear pinion bearing
23. Shims

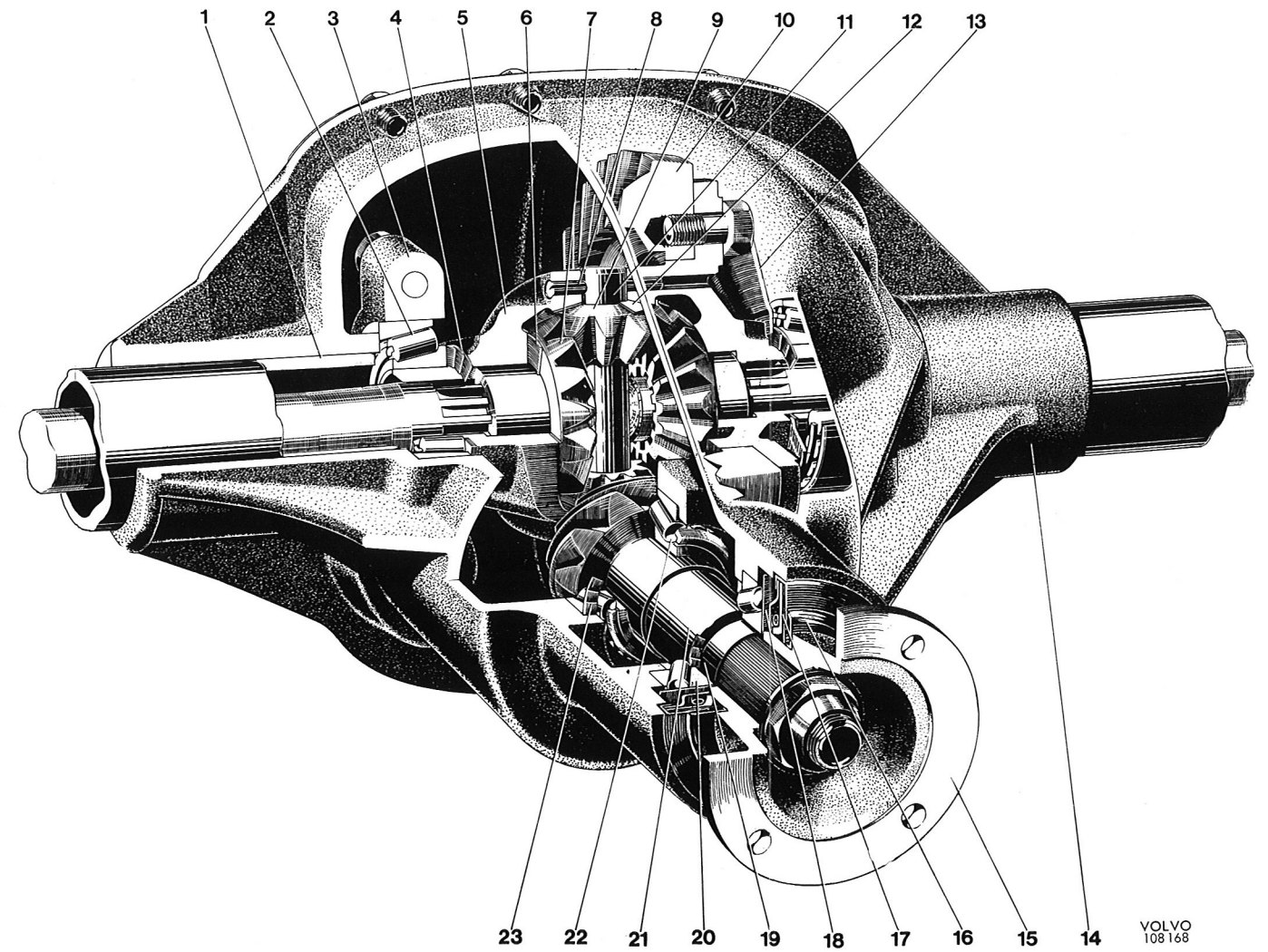


Illustration 4 E. Final drive

VOLVO
108168

Engagement of "R", "D",
"2" or "1"

	A	B	C	D	E	F	a	b	c	d	e	f	g	h	i	m	n	p	s	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
Bumpy	—	2	—	1	—	—	—	—	5	3	—	4	—	—	—	—	—	—	—	—	6	—	7	—	—	—	—	—	—	—	—	—
Delayed	1	—	2	3	—	—	4	7	6	5	—	—	—	—	—	—	—	—	8	9	—	10	—	—	11	—	—	—	—	12	—	—
None	1	—	2	—	—	—	3	4	5	6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	—	7	8	9	—	10

Starting from rest

None forward	—	—	1	—	—	—	—	3	2	—	—	—	—	—	—	—	—	—	—	4	—	—	—	—	—	—	—	—	—	—	—	—
None reverse	—	—	1	—	—	2	7	6	5	—	—	—	—	6	—	3	4	—	—	—	—	9	—	—	8	—	—	—	—	—	—	—
Seizure reverse	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—
No neutral	—	—	1	—	2	—	8	9	3	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—

Upshifts

No 1—2	—	—	1	—	2	—	8	9	10	—	—	6	7	3	—	3	—	—	—	—	—	—	—	5	—	—	—	—	—	—	—	—
No 2—3	—	—	—	—	—	—	8	9	10	—	—	6	7	2	—	—	3	4	—	—	—	5	—	—	—	—	—	—	—	—	—	—
Above normal shift speeds	—	—	1	—	—	—	—	8	9	10	—	2	1	3	—	4	5	6	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Below normal shift speeds	—	—	1	—	—	—	—	5	6	—	—	2	—	3	—	—	—	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Upshifts quality

Slip on 1—2	1	2	3	—	4	—	8	9	10	6	—	7	—	—	—	—	—	—	—	—	—	—	—	5	—	—	—	—	—	—	—	—
Slip on 2—3	1	2	3	—	4	—	9	10	11	7	—	8	—	—	—	—	—	—	—	—	5	—	6	—	—	—	—	—	—	—	—	—
Rough on 1—2	—	1	—	—	2	—	—	—	10	3	—	4	5	6	—	—	—	—	—	9	—	—	—	—	—	7	8	—	—	—	—	—
Rough on 2—3	—	1	—	—	2	—	—	—	6	3	—	—	—	—	—	—	—	—	—	—	—	5	—	—	—	—	—	—	—	—	—	—
Seizure on 1—2	—	—	—	—	—	1	—	5	6	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	3	4	—	—	—	—	—	—
Seizure on 2—3	—	—	—	—	1	—	2	3	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Downshifts

No 2—3	—	1	—	—	—	—	—	—	—	—	—	—	—	3	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
No 3—2	—	1	—	—	—	—	—	—	—	—	—	—	—	3	—	2	—	—	—	—	—	—	4	5	—	—	—	—	—	—	—	—
Involuntary high speed 3—2	1	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3	—	—	—	—	—	—	—	—	—	—	—
Above normal shift speeds	—	1	—	—	—	—	—	5	6	—	—	4	—	2	—	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Below normal shift speeds	—	1	—	—	—	—	—	5	6	—	—	4	—	2	—	7	8	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Downshift quality

Slip on 2—1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—
Slip on 3—2	—	—	—	—	1	—	6	7	8	4	—	5	—	—	3	—	—	—	—	—	9	—	2	—	—	—	—	—	—	—	—	—
Rough on 2—1	—	—	—	—	—	—	—	3	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	1	—	—	—	—	—	—	—
Rough on 3—2	—	—	—	—	1	—	—	—	5	3	—	4	—	—	2	—	—	—	—	—	6	7	8	—	—	—	—	—	—	—	—	—

Line pressure

Low, idling	1	—	2	3	—	—	6	8	5	4	—	—	—	—	—	—	—	—	7	—	—	—	—	—	—	—	—	—	9	—	—	—
High, idling	—	1	—	2	—	—	—	—	—	3	5	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Low at stall	—	—	—	—	—	—	6	8	7	9	—	5	4	9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	10	—	—
High at stall	—	—	—	—	—	—	—	—	4	1	—	2	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Stall speed

More than 10 r/s (600 r/m) below nominal speed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Over 2500	1	—	2	—	—	3	4	5	6	7	—	—	—	—	—	—	—	—	—	8	—	9	—	—	70	11	—	12	—	—	—	13

Overheating

1	—	—	—	2	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

The numbers indicate the recommended sequence of fault investigation

FAULT INVESTIGATION KEY

Preliminary adjustment faults

- A. Incorrect front brake band adjustment.
- B. Incorrect rear brake band adjustment.
- C. Fluid level incorrect.
- D. Downshift valve cable incorrectly assembled or adjusted.
- E. Manual linkage incorrectly assembled or adjusted.
- F. Incorrect engine idling speed.

Hydraulic control faults

- a. Oil tubes missing or not installed correctly.
- b. Sealing rings missing or broken.
- c. Valve bodies assembly screws missing or incorrectly tightened.
- d. Primary regulator valve sticking.
- e. Secondary regulator valve sticking.
- f. Throttle valve sticking.
- g. Modulator valve sticking.
- h. Governor valve sticking, leaking or incorrectly fitted.
- i. Orifice control valve sticking.
- m. 1—2 shift valve sticking.
- n. 1—2 shift valve sticking.

- p. 2—3 shift plunger sticking.
- s. Pump check valve missing or sticking.

Mechanical faults

- N. Front clutch slipping due to worn plate or faulty parts.
- O. Front clutch seized or plates distorted.
- P. Rear clutch slipping due to worn plates or faulty check valve in piston.
- Q. Rear clutch seized or plates distorted.
- R. Front band slipping due to faulty servo, broken or worn brake band.
- S. Rear brake band slipping due to faulty servo, broken or worn brake band.
- T. One-way clutch slipping or incorrectly fitted.
- U. One-way clutch seized.
- V. Input shaft broken.
- W. Front pump drive fingers on converter hub broken.
- X. Front pump worn.
- Z. Converter blading and/or one-way clutch fails.

QUICK-REFERENCE TROUBLE SHOOTING CHART FOR AUTOMATIC TRANSMISSION