

SERVICE MANUAL

VOLVO
P 1800

Export Service Department

AKTIEBOLAGET

VOLVO

GÖTEBORG · SWEDEN

OVERDRIVE

DESCRIPTION

The overdrive on the P 1800 is of the planetary gear type and is attached to the rear end of the main transmission. The design is shown in Fig. 3-32 and illustration III-B.

The overdrive functions as follows:

In the direct gear position the clutch disk (41, illustration III-B) is in the position shown in I, Fig. 3-33. When driving forward, power from the transmission mainshaft (57) is transmitted through the free wheel (33, 34) to the overdrive output shaft (23). When reversing or using the engine as a brake, torque is transmitted through the clutch disk. This is possible since the clutch disk is pressed against the tapered portion of the output shaft by means of four springs (52). In the overdrive position the clutch disk is pressed against the brake drum (39), see II, Fig. 3-33. In this position the sun wheel is locked. When driving, the planet wheels (36) are therefore caused to rotate around the sun wheel (44). As a result of this the output shaft will rotate more quickly than the mainshaft.

Engagement of the overdrive is done electro-hydraulically. There is a contact on the transmission cover which cuts in when 4th speed is engaged. The overdrive can only be engaged when this contact is cut in, that is to say, with 4th speed engaged.

When engaging the overdrive a contact fitted on the instrument panel is operated. Current passes through

this contact and goes via the contact on the transmission to a solenoid on the overdrive, see Fig. 3-34. The solenoid has two windings, a heavy control winding and a fine retaining winding. The control winding influences the solenoid armature in such a way that a control valve in the overdrive is opened. When the valve has opened, the current through the control

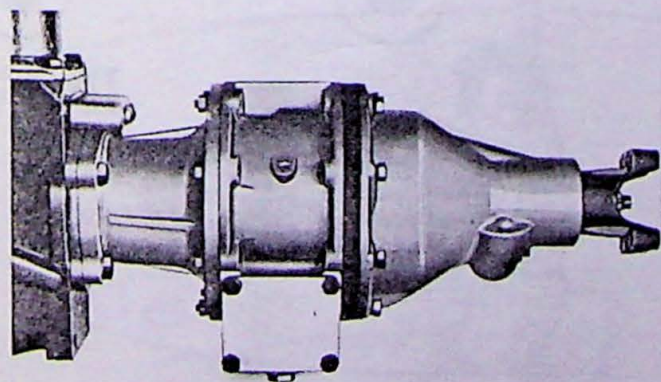
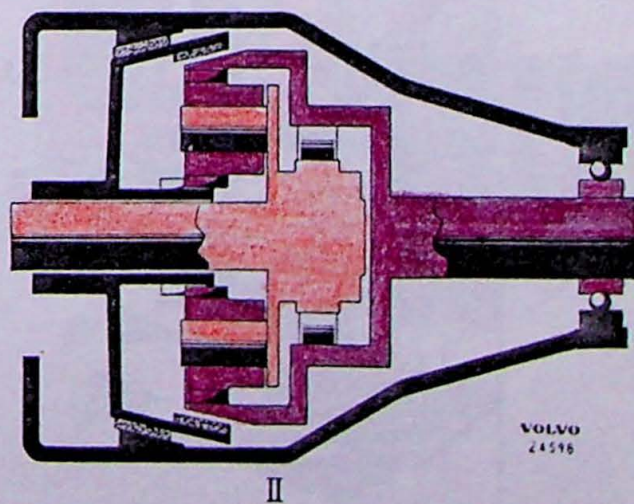
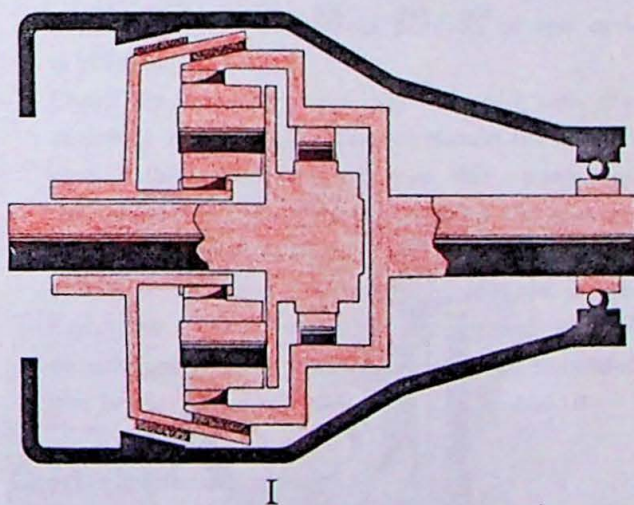


Fig. 3-32. Overdrive unit
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- Non-rotating parts
- Rotating at same speed as input shaft
- Rotating at higher speed than input shaft

Fig. 3-33. Function of overdrive
I. Direct drive position II. Overdrive position

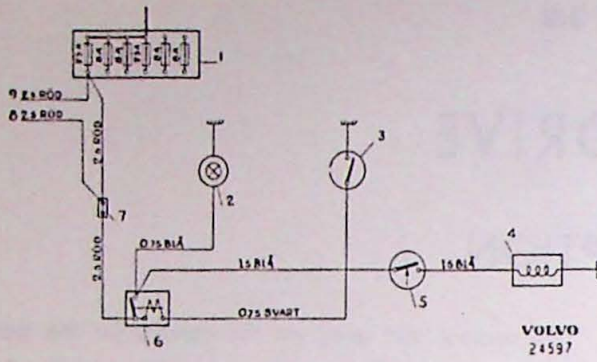


Fig. 3-34. Electrical wiring diagram

1. Fusebox
2. Control lamp for overdrive
3. Switch on instrument panel
4. Solenoid on overdrive
5. Switch on transmission
6. Relay for overdrive
7. Junction block
8. Lead to flasher unit
9. Lead to horn

Röd = Red Blå = Blue Svart = Black

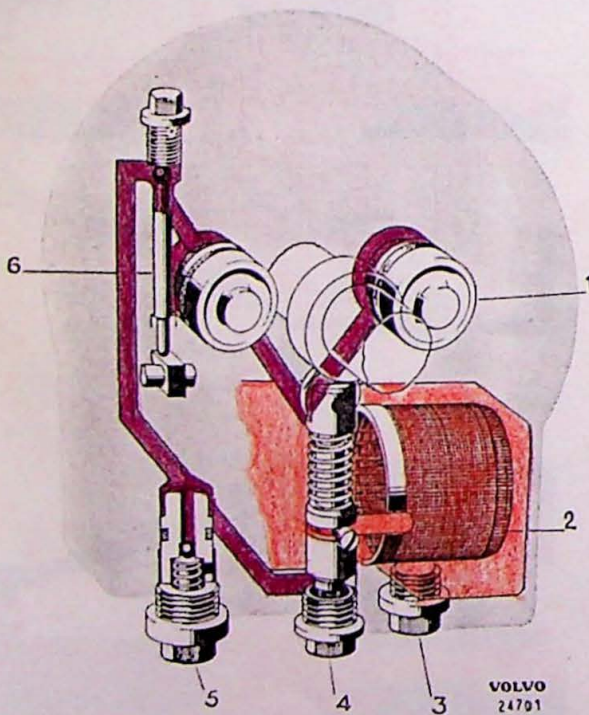


Fig. 3-35. Hydraulic system

1. Hydraulic cylinder and plunger
2. Oil strainer
3. Drain plug
4. Oil pump
5. Reducing valve
6. Control valve

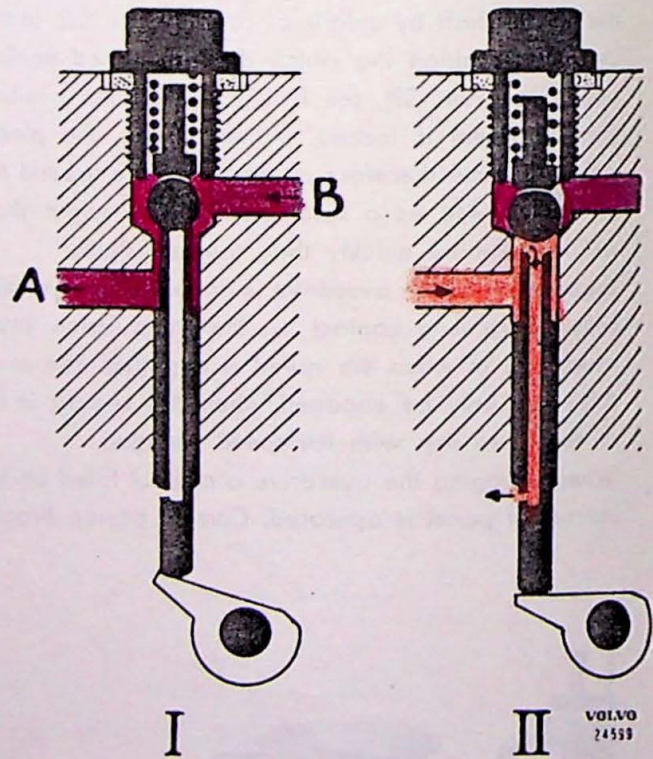


Fig. 3-36. Control valve

- I. Overdrive position
- II. Moving over from overdrive to direct drive
- A. To hydraulic cylinder
- B. From oil pump

winding is cut off. The valve is then held in the open position by the retaining winding.

There is a plunger type pump in the overdrive (4, Fig. 3-35) which is driven by a cam on the mainshaft. When the control valve (6) opens (position I, Fig. 3-36), oil under pressure from the pump flows via the valve to two cylinders (1). The plungers in the cylinders then press the clutch disk forwards to make contact with the brake drum. When the overdrive is disengaged, the control valve shuts off the connection between the pump and cylinders. The clutch disk is then pressed rearwards by the springs. The oil in the cylinders flows out through the hollow valve rod into the overdrive housing, see II, Fig. 3-36.

REPAIR INSTRUCTIONS

WORK WHICH CAN BE CARRIED OUT WITH THE OVERDRIVE UNIT FITTED

Checking oil pressure

1. Engage and disengage the overdrive 10—12 times (with the engine stopped) in order to remove any residual oil pressure.
2. Remove the plug over the control valve and connect oil pressure gauge SVO 2415, see Fig. 3-37.

NOTE. The spring (47, illustration III-B), stud (50) and ball (51) should remain in position.

3. Start and drive the car. (The test can also be done with the car jacked up). At a speed of 12.4—15.5 m.p.h. (20—25 km. p.h.) with the overdrive direct drive engaged (16.2—20.6 m.p.h. = 26—33 km.p.h. on the overdrive), the gauge should show a pressure of 525—570 lb/sq.in. (37—40 kg/cm²). If the gauge gives too low a reading, see "Fault tracing" concerning the reason and remedy.

Cleaning the oil strainer

The oil strainer should be cleaned at every oil change. First drain off the oil by removing the plug (3, Fig. 3-35. Marked "Drain") under the oil strainer. Cleaning should then be done as follows:

1. Remove the cover (2) and take out the oil strainer

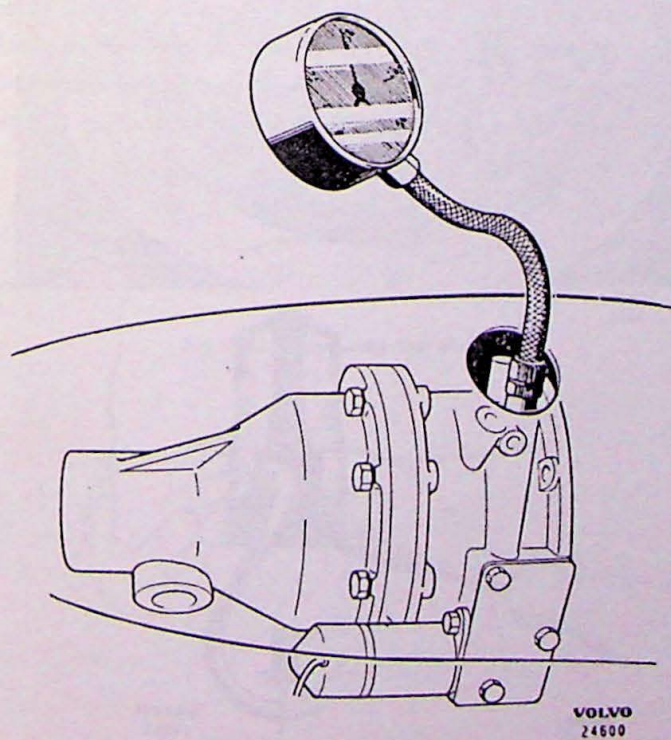


Fig. 3-37. Checking oil pressure with pressure gauge SVO 2415

(1), see Fig. 3-38. Clean the oil strainer in gasoline or white spirit. Blow dry with compressed air.

2. Check that the gasket (3) is intact and place it in position. Fit the oil strainer, new gasket (4) and cover.

Checking and adjusting the control valve

1. Jack up the car and place blocks under the front and rear axles.
2. Remove the cover over the control valve arm. Engage the overdrive (with the engine stopped and 4th speed engaged). If the control valve is correctly adjusted, it should be possible to push a 3/16" (4.75 mm) diameter pin through the hole in the arm and into the housing, see Fig. 3-39. If not, adjust until the correct position of the arm is obtained.
3. Check the current through the solenoid with the overdrive engaged. The current should be max. 1 amp. If the current is 8—10 amp. this means that the solenoid armature does not go in far enough to cut off the control current.

NOTE. If the current through the solenoid is too high, the reason must be ascertained and if necessary measures taken otherwise the solenoid can be destroyed.

Checking the oil pump

1. Engage and disengage the overdrive 10—12 times so that any residual oil pressure is removed. Jack

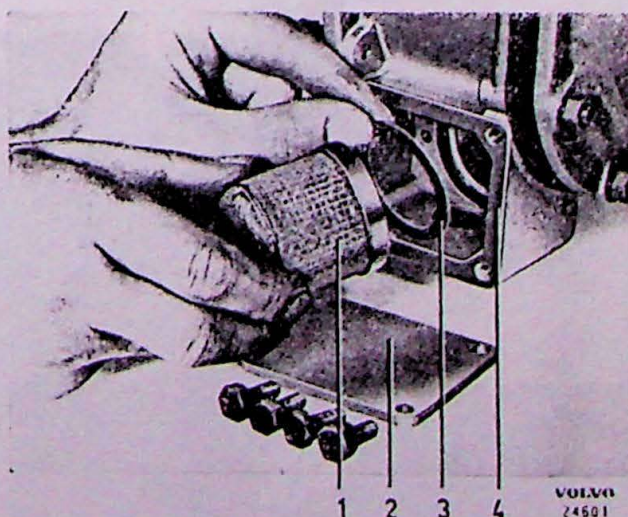


Fig. 3-38. Removing the oil strainer

1. Oil strainer
2. Cover
3. Gasket for oil strainer
4. Gasket for cover

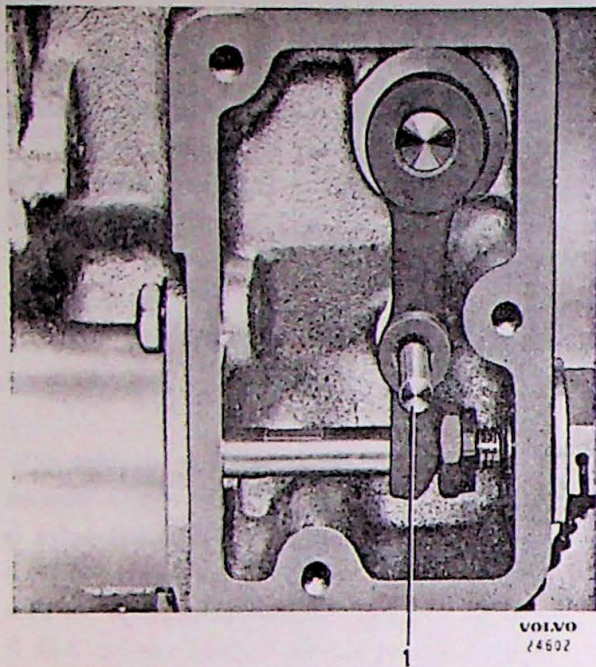


Fig. 3-39. Adjusting the control valve
1. Control gauge, diam. 3/16" (4.75 mm)

up the car and place blocks under the front and rear axles. Remove the drain plug and let the oil run out into a container.

2. Remove the plug and take out the spring (8) and ball (6). Remove the valve seating (7) with key SVO 2419, see Fig. 3-40. Clean and check the parts.
3. Feel with a piece of wire or similar against the pump plunger that the pump works when the output shaft is rotated. The plunger stroke should be 0.126" (3.2 mm). If the plunger stroke is shorter

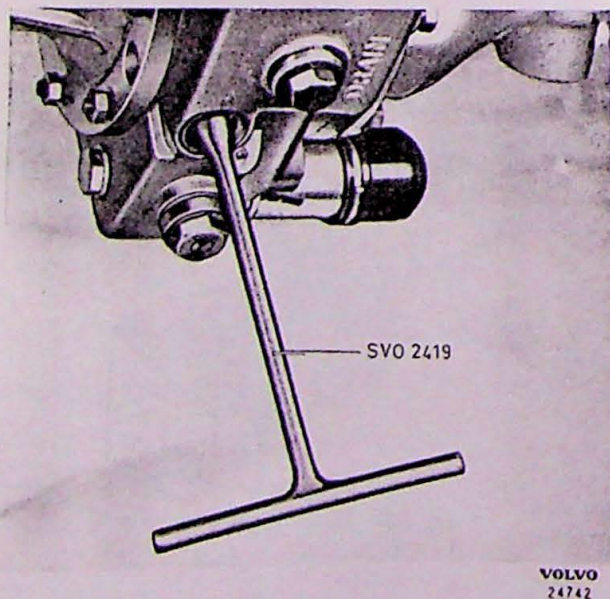


Fig. 3-40. Removing the valve seating, oil pump

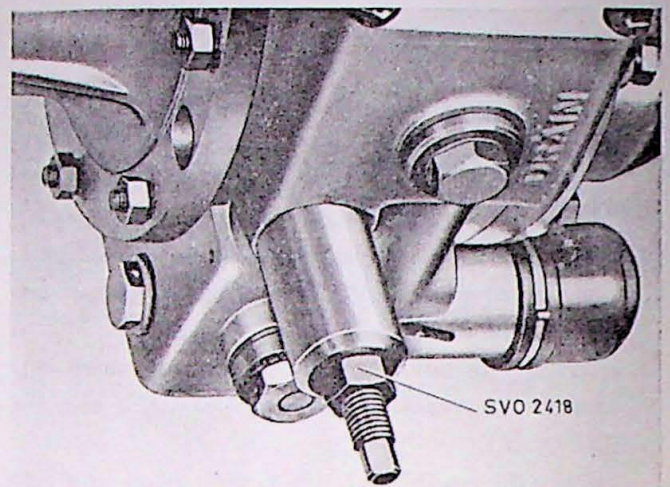


Fig. 3-41. Removing the oil pump

the pump must be removed and the reason ascertained.

4. The pump is removed in the following manner: Unscrew the bolt which holds the pump through the hole in the extension piece (56). Screw puller SVO 2418 into the place of the valve seating and pull out the pump, see Fig. 3-41. Disassemble and check the various parts of the pump.
5. The pump and pump valve are fitted in the reverse order to removing. Check that the gasket for the plug (4, Fig. 3-35) is intact. Fill up with oil.

Checking the reducing valve

1. Engage and disengage the overdrive 10—12 times so that any residual oil pressure is removed. Jack up the car and place blocks under the front and rear axles. Remove the drain plug and let the oil run out into a container.

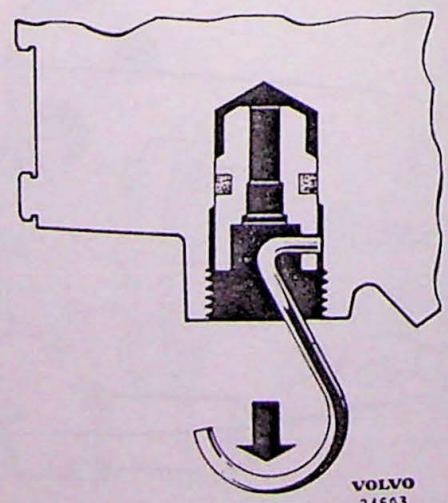


Fig. 3-42. Removing the valve seating, reducing valve

2. Remove the plug and take out the spring (11) and valve (12). Pull out the valve seating (10) with the help of a small hook, see Fig. 3-42.
3. Clean and check all parts thoroughly. Fit the parts in the reverse order to removing.

REMOVING THE OVERDRIVE

1. Carry out operations 1—4 according to "Removing the transmission". Also drain out the oil from the overdrive.
2. Disconnect the cable to the solenoid.
3. Unscrew the bolts which hold the overdrive unit to the intermediate flange and remove the overdrive unit.

DISASSEMBLING THE OVERDRIVE

The following section describes how the overdrive unit is completely disassembled. It is, however, seldom necessary to disassemble it completely. When carrying out disassembly, therefore, follow the appropriate parts of the instructions given below.

1. Remove the cover over the oil strainer and over the lever (13, illustration III-B) for the control

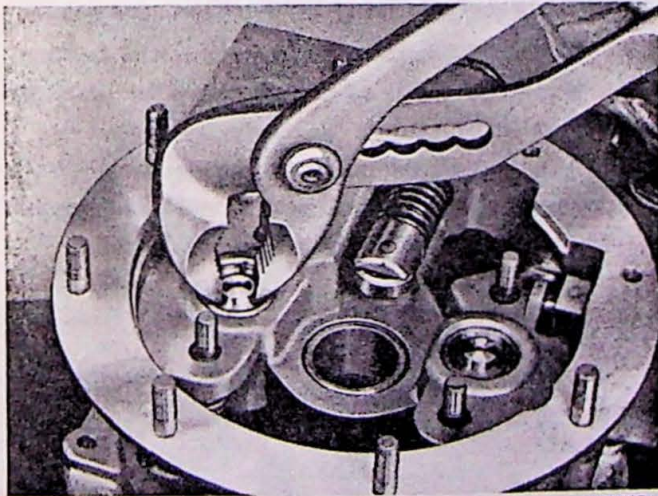


Fig. 3-43. Removing the plungers

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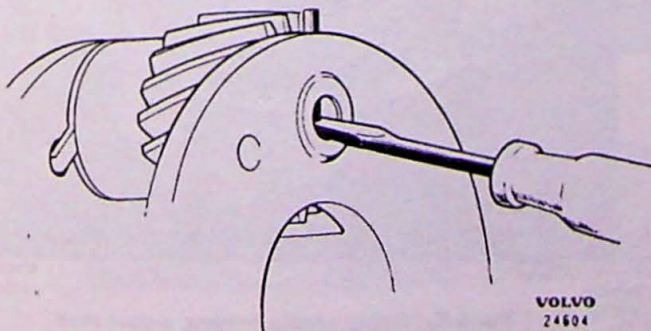


Fig. 3-44. Removing the locking pins in the planet wheels

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- valve. Remove the oil strainer. Unscrew the bolts and lift out the solenoid (17).
2. Bend down the locking plate, unscrew and remove the nuts for the plunger pressure plate (54). Remove the pressure plates. Pull out the plungers with the help of a pair of pliers, see Fig. 3-43.
3. Unscrew the nuts which hold together the brake drum (39), the front (46) and rear (20) housing halves. Slacken the nuts successively all round so that there is no oblique tension from the springs. Lift off the front housing half and brake drum.
4. Lift out the clutch disk (41) complete with thrust bearing and sun wheel. Remove the four springs and pressure plate. Remove the locking rings for the sun wheel (44) and bearing. Remove the sun wheel. Pull off the bearing from the clutch disk. Press out the bearing from the retainer.
5. Lift off the planet wheel (36) and carrier (43). Remove the locking pins (40) for the planet wheel shafts by first pressing them out with a drift or similar, see Fig. 3-44 and then removing them with a pair of pliers. If this is not possible, drill out the pins with a suitable drill. Press out the planet wheel shafts and remove the planet wheels.

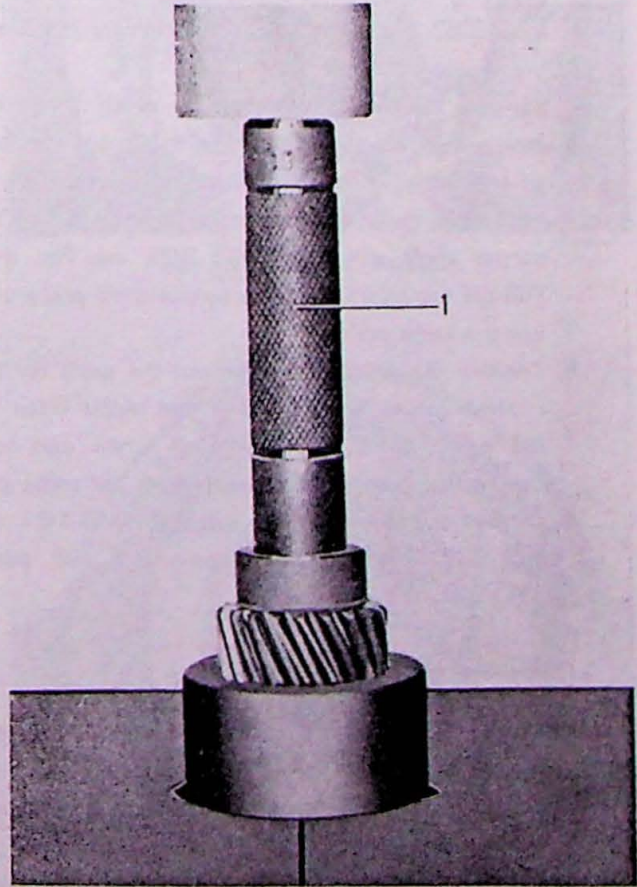


Fig. 3-45. Removing needle bearing in planet wheel
1. Drift SVO 2417

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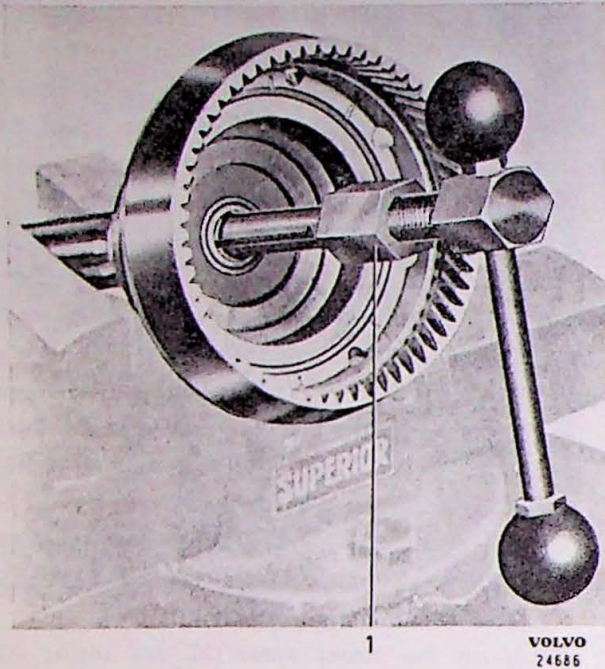


Fig. 3-46. Removing needle bearing, output shaft
1. Puller SVO 2423

- The needle bearings in the planet wheels can be pressed out with drift SVO 2417, see Fig. 3-45.
6. Unscrew the bolt and pull out the bushing and small speedometer gear wheel. Unscrew the nut for the coupling (24). Pull off the coupling with puller SVO 2262. Place the housing in a press and press out the output shaft (23).
 7. Remove the brass washer (35) which holds the free wheel on the output shaft. Lift out the free wheel parts. Remove the thrust washer (32). If necessary, pull out the needle bearing (31) in the output shaft with tool SVO 2423, see Fig. 3-46. Pull off the bearing on the output shaft preferably using a knife puller.
 8. Remove the plugs and take out the parts for the control valve, reducing valve and outlet valve for the pump. Remove the locking screw and take out the oil pump. If the pump does not come out, remove the valve seating with key SVO 2419, see Fig. 3-40. Then pull the pump out with puller SVO 2418, see Fig. 3-41.

INSPECTING THE OVERDRIVE

Before inspecting wash all parts thoroughly in kerosene or white spirit. Then check all parts carefully for wear, cracks or other damage. Defective parts should be replaced.

Check the ball and needle bearings for cracks, wear or other damage to the balls, needles and races.

Check the free wheel. Rollers and races must not be

cracked or scored. Check that the outer race fits securely in the rear housing half.

Check the gear wheels. If the teeth on any gears should be damaged, they must be replaced.

Check that the facings on the clutch disk are not burnt or worn. Check that the springs are intact and have not become fatigued. Check the surface on the thrust bushings for the sun wheel in the front housing half. The bushing requires replacing only if the surface is deeply scratched.

Check the oil pump for damage on the pump plunger and roller.

Check that the plunger moves easily in the cylinder. Ensure that the plunger spring is not damaged. Check the valve seating and balls to make sure that they are not scratched and are free from burr.

Check the control valve for damage. Ensure that it moves easily in the bore in the front housing half.

Check the reducing valve. NOTE. The reducing valve plunger and seating are machined together. If either part is damaged then both parts must be replaced. Check the cylinders of the control plungers for scratches and wear.

Make sure that the oil channels are clean.

ASSEMBLING THE OVERDRIVE

1. Place the front locking rings for the bearing (26) in the rear housing half. Press in the bearing with drift SVO 2413.
2. Press the guide bearing (31) for the transmission mainshaft in the output shaft (23) with drift SVO

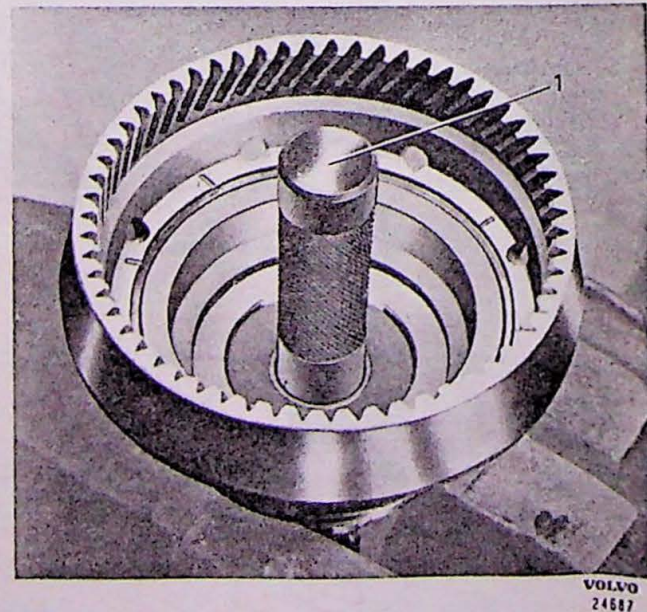


Fig. 3-47. Fitting needle bearing, output shaft
1. Drift SVO 2417

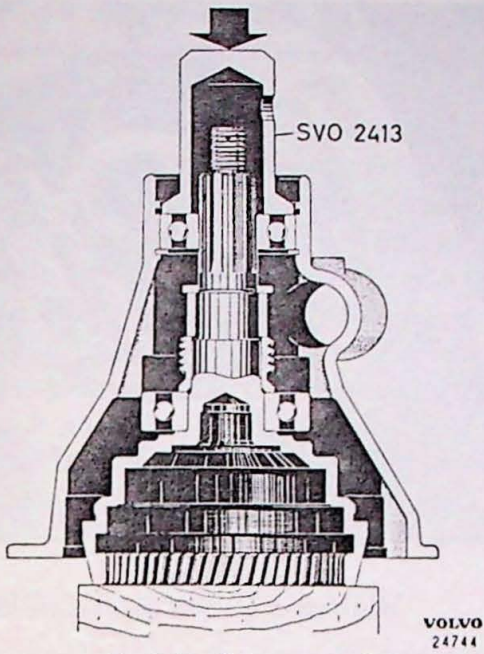


Fig. 3-48. Fitting output shaft

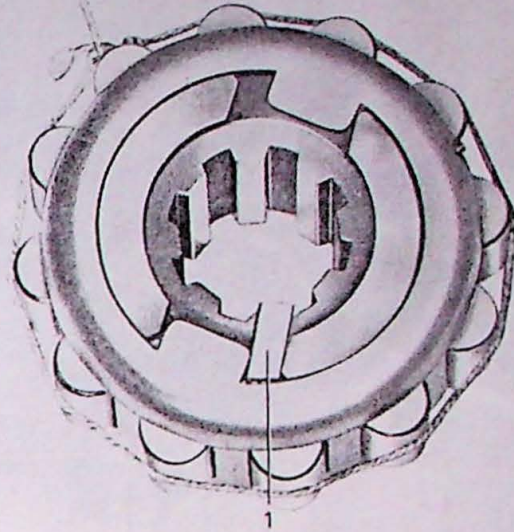


Fig. 3-50. Assembling the free wheel, II
1. Key

2417. Press the bearing on the output shaft with drift SVO 2412.

3. Support under the output shaft with a block of wood. Place on the speedometer gear (29), spacing sleeve (28) and thrust washer (27). Press on the rear housing half with drift SVO 2413, see Fig. 3-48. Place in the locking ring for the rear bearing. Press in the sealing ring (25) with drift SVO 2422. Press on the coupling (24) with a suitable sleeve or with press tool SVO 2421. Fit washer and nut. Tighten and lock the nut.
4. Assemble the free wheel hub (34), spring and roller retainer, see Fig. 3-49. Turn the roller retainer clockwise as far as it will go and lock it in this position with a key as shown in Fig. 3-50.

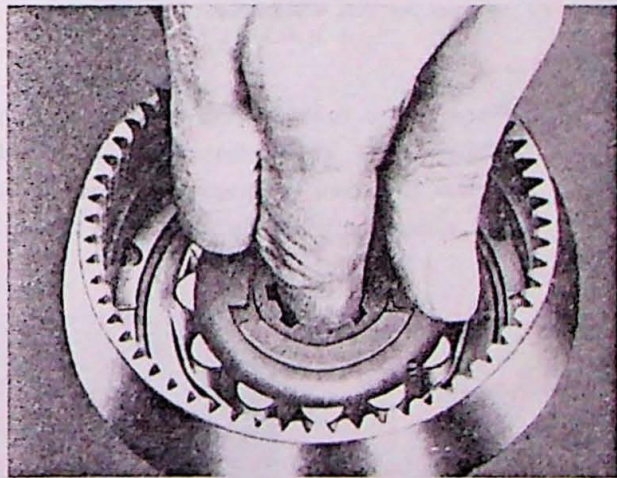


Fig. 3-51. Fitting the freewheel, I

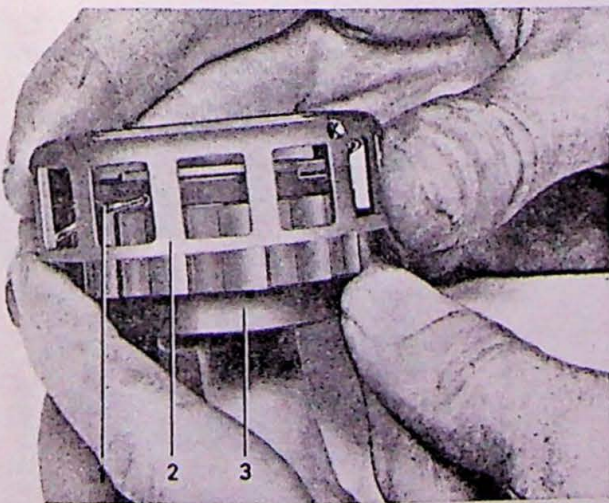


Fig. 3-49. Assembling the free wheel, I

1. Spring
2. Retainer
3. Free wheel hub

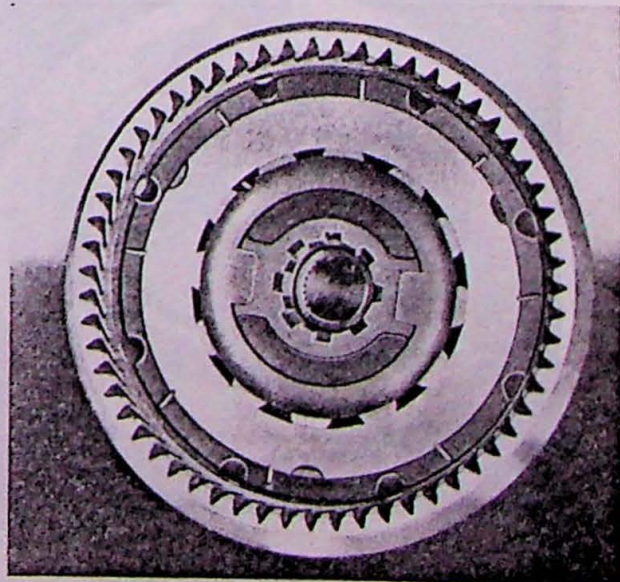


Fig. 3-52. Fitting the freewheel, II

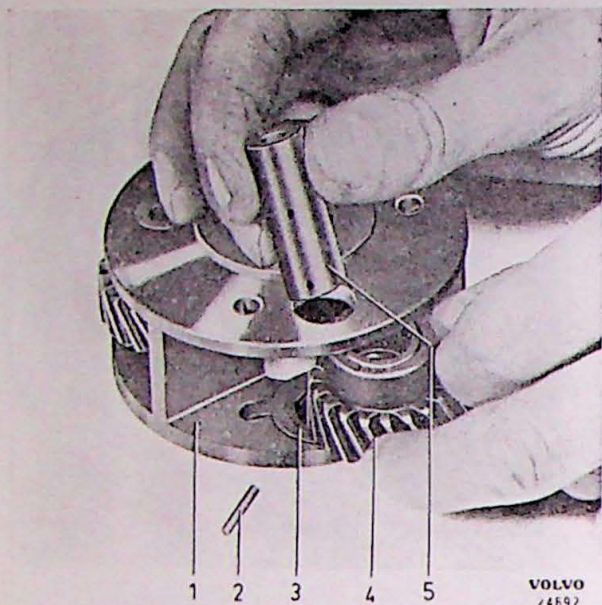


Fig. 3-53. Fitting a planet wheel, I

1. Planet wheel carrier
2. Locking pin
3. Thrust washer
4. Planet wheel
5. Shaft

Place in the rollers. Wind a piece of string or rubber band round the rollers. Fit the thrust washer and then the free wheel into position in the output shaft, see Fig. 3-51. Place in the brass

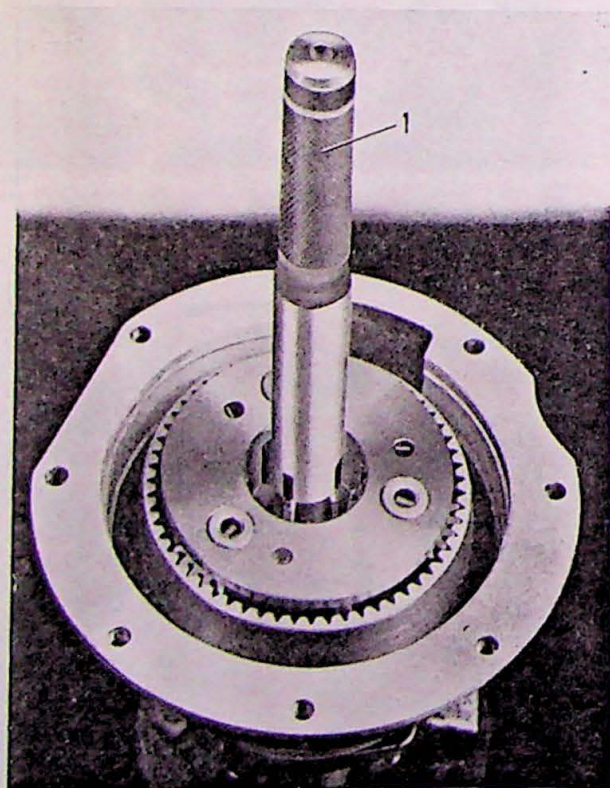


Fig. 3-54. Fitting a planet wheel, II
1. Centering mandrel SVO 2420

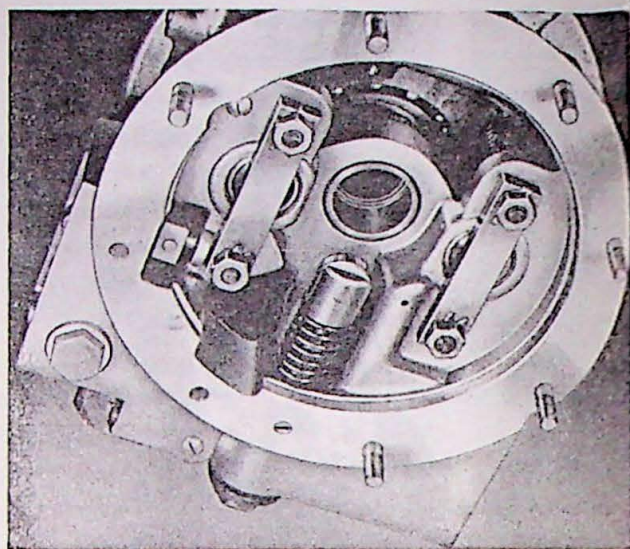


Fig. 3-55. Assembling front housing half

- washer as shown in Fig. 3-52. The washer is secured with center punch or chisel marks.
5. Press the needle bearings (37) in the planet wheel (36) with drift SVO 2417. The bearings should lie flush with or slightly below the side surfaces of the wheels. Assemble the planet wheel carrier, shaft, washers and planet wheels, see Fig. 3-53. Guide the splines into the planet wheel carrier and free wheel hub with drift SVO 2420, see Fig. 3-54.
 6. Fit the sun wheel (44) into the clutch disk (41). Fit bolts, thrust bearing and thrust bearing retainer. Fit the thrust bearing on the clutch disk.
 7. Fit the plungers (14) in the front housing half. Assemble the clutch disk, brake drum (39), pressure springs (52), front housing half and pressure plates

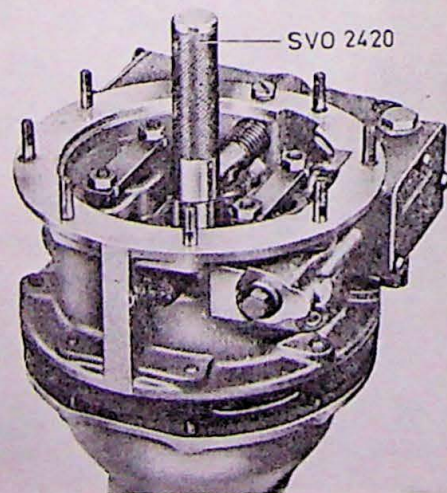
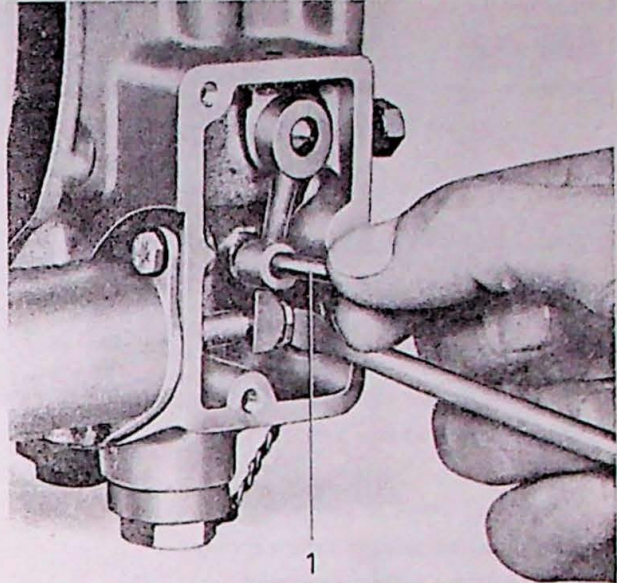


Fig. 3-56. Fitting front housing half

(48, 54) into one unit, see Fig. 3-55. When assembling, coat both sides of the brake drum with sealing compound.

8. Place the unit assembled as described in point 7 onto the rear housing half. Guide the splines in the planet wheel carrier and free wheel hub with mandrel SVO 2420, see Fig. 3-56. Place on washers and nuts. Tighten the nuts a little at a time until they are evenly tightened all round.
9. Fit the other parts in the reverse order to removing. Press in the solenoid armature as far as it will go and check that a $3/16$ " (4.75 mm) diameter pin can be inserted through the hole in the lever and into the housing, see Fig. 3-57.



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Fig. 3-57. Adjusting the control valve
1. Control gauge, $3/16$ " (4.75 mm) diameter

FITTING THE OVERDRIVE UNIT

Ensure that the oil pump cam (55) on the mainshaft faces upwards. Then fit the overdrive unit in the reverse order to removing. Fill up with oil.

FAULT TRACING

FAULT

Reason _____ Remedy

Overdrive does not engage

Insufficient oil in the unit.	Fill up with oil to the level plug.
Control valve incorrectly adjusted.	Adjust the valve, see page 3:15.
Control valve leaks.	Check the control valve and replace faulty parts.
Oil pressure too low because of faulty reducing valve.	Check the valve and replace faulty parts.
Oil pressure too low because of blocked up oil strainer.	Clean the oil strainer.
Non-return valve at pump leaks.	Check the valve and replace faulty parts.
Broken pump plunger return spring.	Remove the pump and replace the plunger spring.
Solenoids not receiving current.	Check the parts in the circuit (see wiring diagram, Fig. 3-34 on page 3:14).
Faulty solenoid.	Replace solenoid.

Overdrive does not disengage

NOTE. This trouble must be attended to as soon as possible. The car must not be reversed with the overdrive engaged since this can cause damage.

Faulty adjustment of control valve.	Adjust the valve, see page 3:15.
Blocked oil channel in valve rod.	Remove the control valve. Take out and clean the valve rod.
Binding clutch facings.	Disassemble the overdrive and replace the facings.

Clutch slips in overdrive position

Insufficient oil in the unit.	Fill up with oil to the level plug.
Worn or glazed clutch facings.	Disassemble the overdrive and replace the facings.
Oil pressure too low.	Check the oil pressure, see page 3:15. See also under "Overdrive does not engage".

Clutch slips in direct drive position when reversing or when using engine as brake

Worn or glazed clutch facings.	Disassemble the overdrive and replace the facings.
Blocked oil channel in valve rod.	Remove the control valve. Take out and clean the valve rod.
Spring pressure on the clutch too low.	Disassemble the overdrive and check the springs for the clutch drum. Replace faulty springs.

Fault tracing with pressure gauge SVO 2415

Insufficient oil pressure on both direct drive and overdrive

Oil level too low.	Fill up with oil to the level plug.
Oil strainer blocked up.	Clean the oil strainer.
Non-return valve leaks.	Check the valve and replace faulty parts.
Broken pump plunger return spring.	Remove the pump and replace the plunger spring.
Pump plunger binds.	Remove the pump. Clean and if necessary replace plunger and cylinder.
Faulty reducing valve.	Check the valve and replace faulty parts.

Oil pressure too low on direct drive

The control valve ball does not seal against the seating in the housing.

Check the control valve and replace faulty parts. If necessary, knock the ball lightly against the seating with the help of a brass or copper drift.

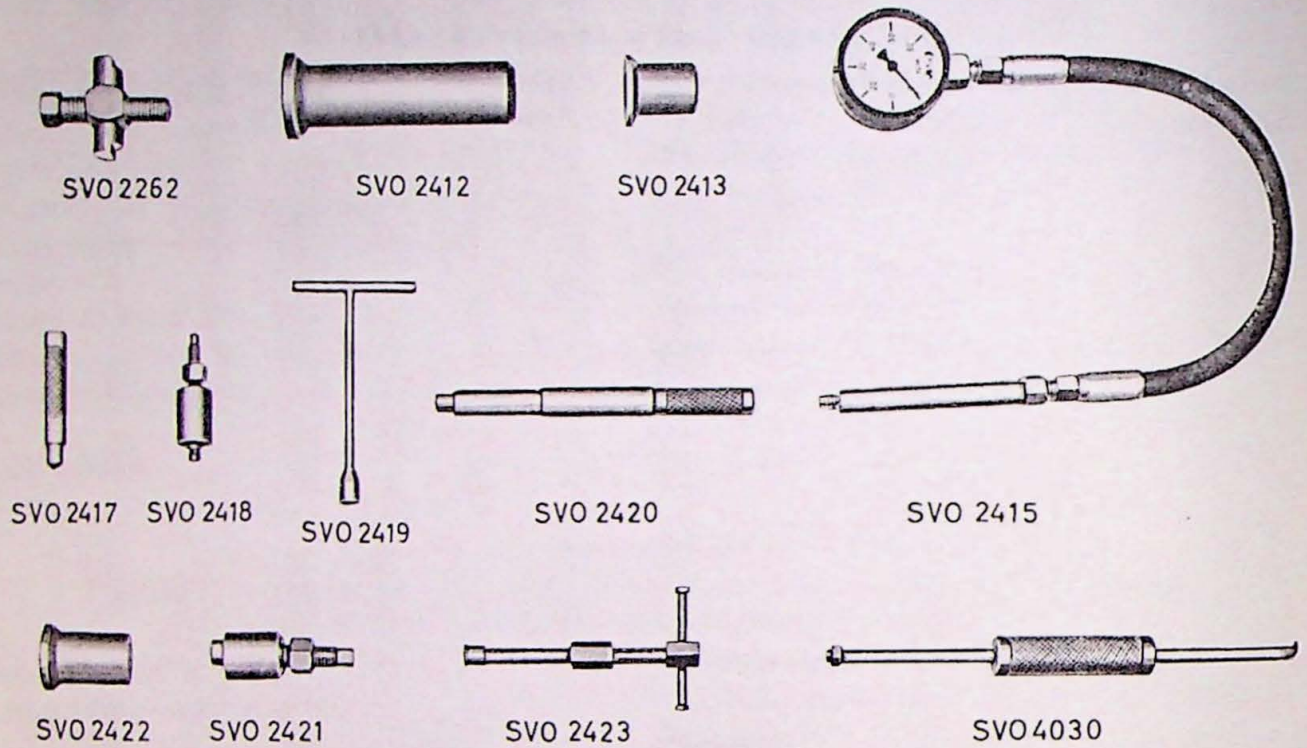
Oil pressure too low on overdrive

The control valve ball does not seal against the valve rod seating.

Remove and clean the ball and valve rod. Check and if necessary replace the parts.

TOOLS

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



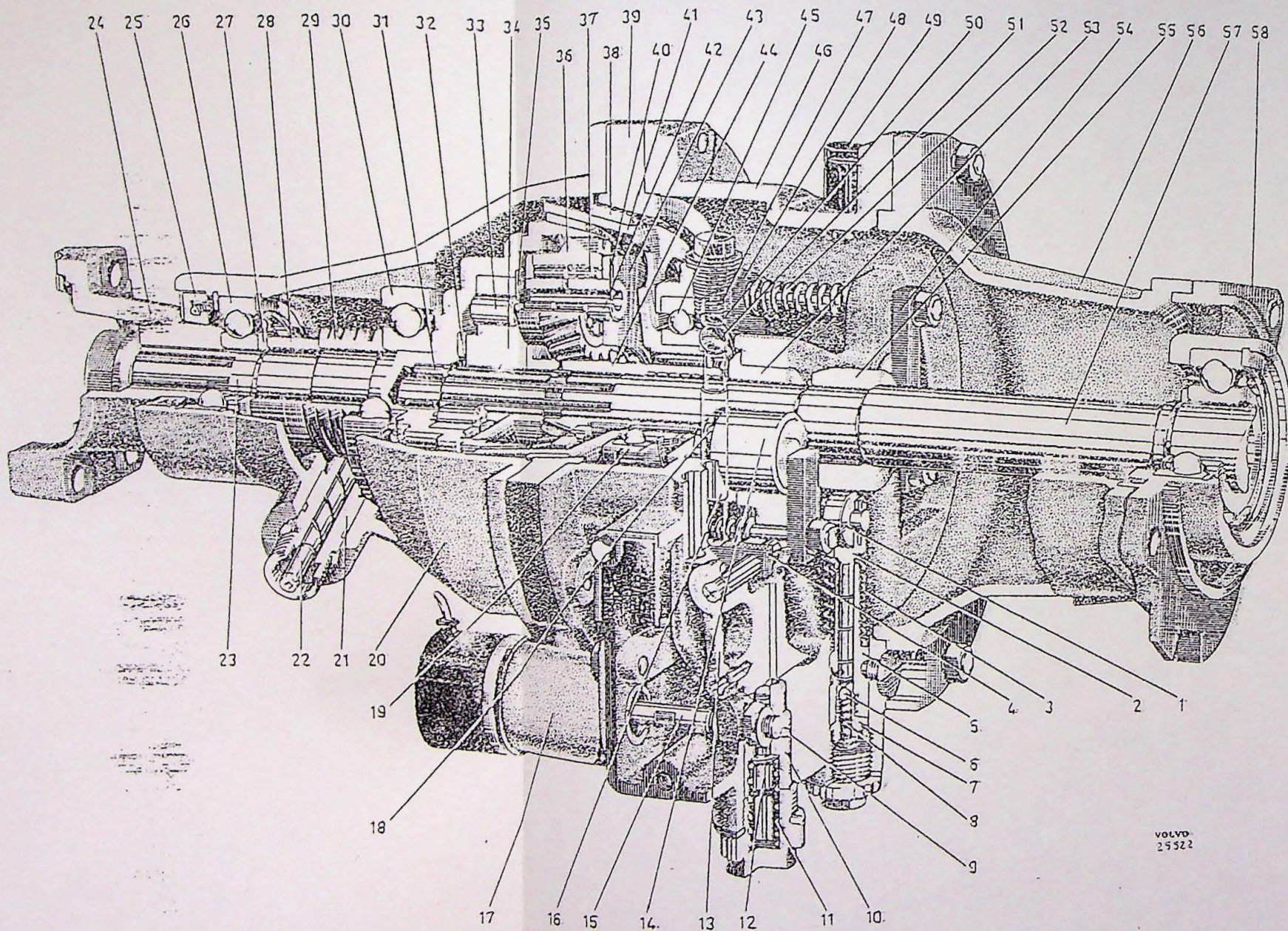
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Fig. 3-58. Special tools

- | | | | |
|----------|--|----------|--|
| SVO 2262 | Puller for coupling | SVO 2419 | Key for valve seating, oil pump |
| SVO 2412 | Drift for fitting front bearing on output shaft | SVO 2420 | Centering mandrel for splines in planet wheel carrier and free wheel hub |
| SVO 2413 | Drift for fitting rear bearing on output shaft | SVO 2421 | Press tool for fitting coupling |
| SVO 2415 | Pressure gauge for checking oil pressure | SVO 2422 | Fitting tool for sealing ring, output shaft |
| SVO 2417 | Drift for removing needle bearings in planet wheels and for fitting bearings in planet wheels and output shaft | SVO 2423 | Puller for needle bearing in output shaft |
| SVO 2418 | Puller for oil pump | SVO 4030 | Puller for sealing ring, output shaft |

SPECIFICATIONS

Gear ratio, overdrive	0.756:1
Oil pump stroke	0.126" (3.2 mm)
Clearance between the plunger and cylinder in oil pump	0.0002—0.0016" (0.005—0.040 mm)
Reducing valve springs, length:	
Loaded with 38 1/2—43 lb. (17.5—19.5 kg)	0.98" (25 mm)
Clutch pressure springs, length:	
Loaded with 47—53 lb (21.5—24 kg)	1.26" (32 mm)
Oil pressure	525—570 lb/sq.in. (37—40 kg/cm ²)
Lubricant	Engine oil
viscosity (all year round)	SAE 30
quality	For Service
	ML, MM, MS, DG, DM, or DS
Oil capacity, transmission and overdrive	3 3/4 US pints = 3 1/8 Imp. pints (1.8 liters)



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Illustration III-B. Overdrive unit

- 1. Roller
- 2. Pump plunger
- 3. Spring
- 4. Lever
- 5. Pump cylinder
- 6. Ball
- 7. Valve seating
- 8. Spring
- 9. Rubber ring
- 10. Reducing valve
- 11. Spring
- 12. Valve cone
- 13. Lever
- 14. Plunger
- 15. Armature for solenoid

- 16. Valve rod ("X-Ray outline")
- 17. Solenoid
- 18. Plunger packing
- 19. Thrust bearing retainer
- 20. Housing, rear part
- 21. Bushing
- 22. Speedometer gear wheel, small
- 23. Output shaft
- 24. Coupling
- 25. Sealing ring
- 26. Ball bearing
- 27. Thrust washer
- 28. Spacing sleeve
- 29. Speedometer gear wheel, large
- 30. Ball bearing

- 31. Needle bearing
- 32. Thrust washer
- 33. Rollers for free wheel
- 34. Free wheel hub
- 35. Washer
- 36. Planet wheel
- 37. Needle bearing
- 38. Clutch facing
- 39. Brake drum
- 40. Locking pin
- 41. Clutch disk
- 42. Shaft
- 43. Planet wheel carrier
- 44. Sun wheel
- 45. Ball bearing

- 46. Housing, front part
- 47. Spring ("X-Ray outline")
- 48. Pressure plate
- 49. Air-venting nipple
- 50. Stud ("X-Ray outline")
- 51. Ball ("X-Ray outline")
- 52. Spring
- 53. Bushing
- 54. Pressure plate
- 55. Cam
- 56. Extension piece
- 57. Input shaft
(transmission mainshaft)
- 58. Rear cover, transmission