

SERVICE MANUAL

VOLVO
P 1800

Export Service Department

AKTIEBOLAGET

VOLVO

GÖTEBORG · SWEDEN

TRANSMISSION

DESCRIPTION

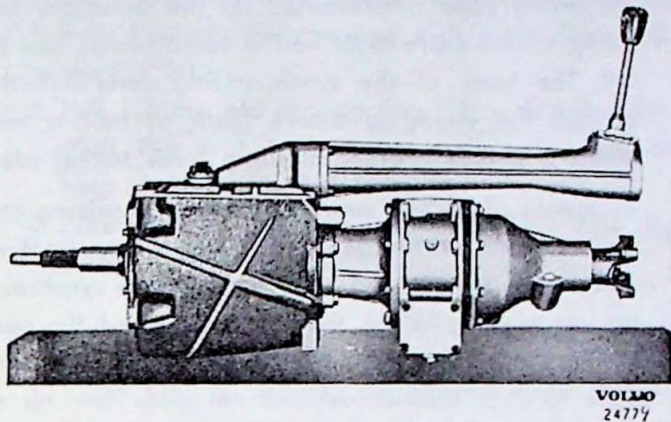


Fig. 3-1. Transmission (M 41), external view

The M 40 transmission (with overdrive = M 41) for the P 1800 is a four-speed transmission with all four speeds synchronised. It can also be provided with an overdrive connected to the fourth speed of the transmission so that a total of five forward speeds can be obtained.

The construction of the transmission is shown in Fig. 3-1 and illustration III-A. All gears except the reverse gears are spirally cut and in constant mesh. The gears on the mainshaft are carried on needle bearings. When one of the gears is engaged the corresponding gear is locked to the mainshaft by means of an engaging sleeve.

The gearshift lever positions are shown in Fig. 3-2. The power transmission path of the different speeds is shown in Figs. 3-3—3-7.

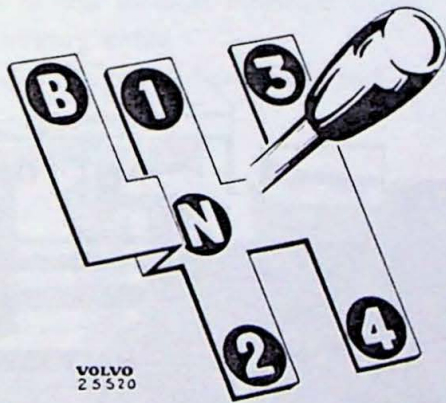


Fig. 3-2. Position of gears

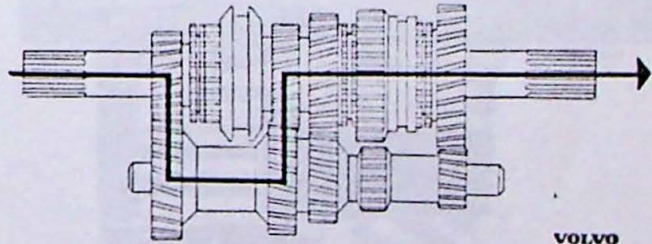


Fig. 3-5. 3rd speed

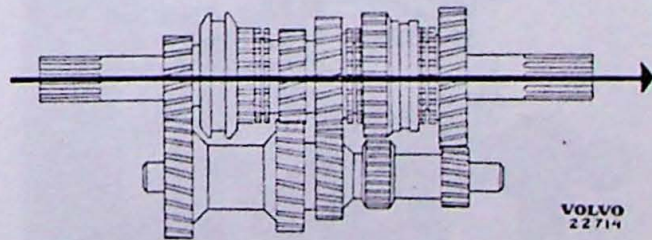


Fig. 3-6. 4th speed

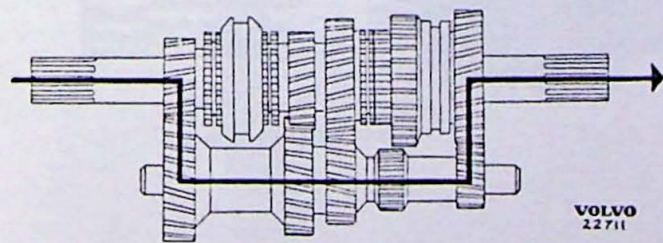


Fig. 3-3. 1st speed

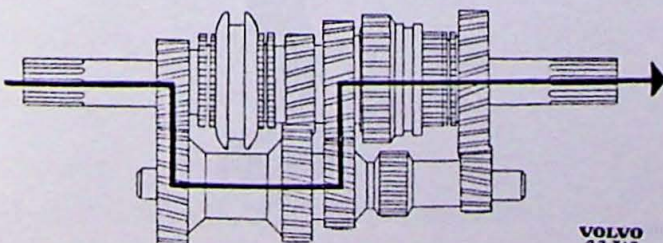


Fig. 3-4. 2nd speed

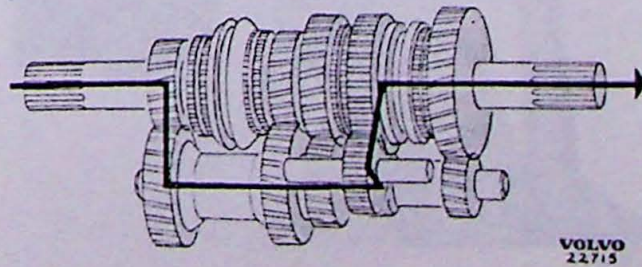
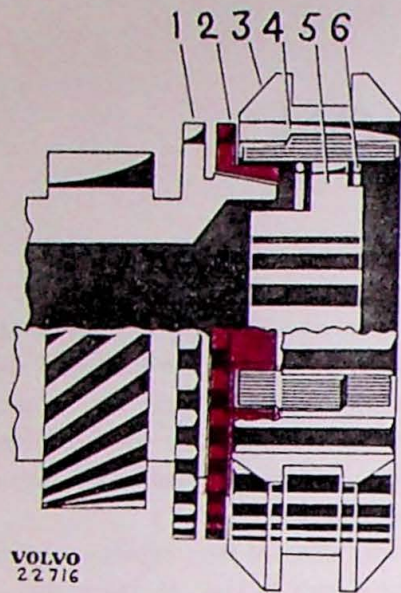


Fig. 3-7. Reverse



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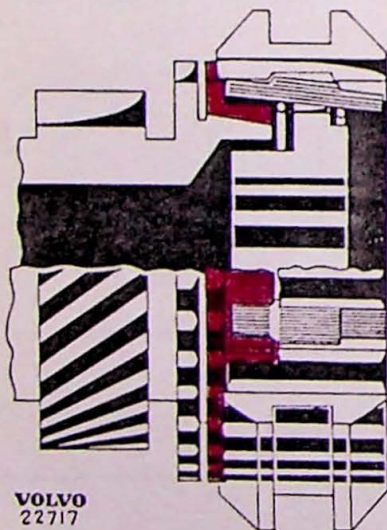
Fig. 3-8. Neutral position

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

The design and function of the synchronizing mechanism is shown in Figs. 3-8—3-10. When a gear is engaged, the engaging sleeve (3, Fig. 3-8) is pressed by the shift fork in the direction of the gear wheel concerned. The actuators (4) then press the synchronizing cone (2) against the cone on the gear wheel (1).

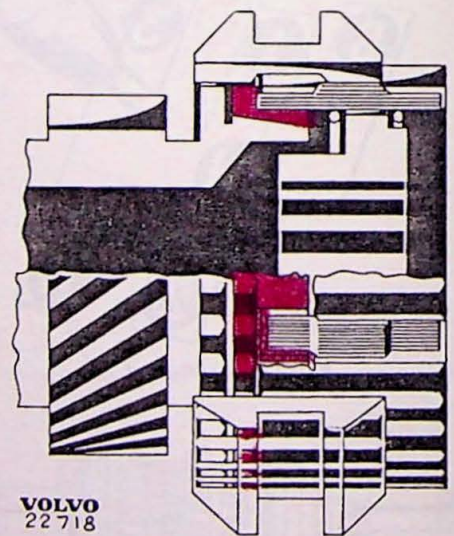
If the synchronizing mechanism and gear wheel have different speeds of rotation, the synchronizing cone will turn in relation to the engaging sleeve. The synchronizing cone is prevented by the actuators from being turned more than half a tooth width, see Fig. 3-9. The teeth of the synchronizing cone will then contact the engaging sleeve teeth at half a tooth width and thus prevent meshing from taking place.

By means of friction between the synchronizing cone and the cone on the gear wheel, the gear wheel will assume the same speed of rotation as the synchronizing mechanism. When they have reached the same speed, the engaging sleeve causes the synchronizing cone to turn backwards and the gear can be engaged, see Fig. 3-10.



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Fig. 3-9. Synchronizing



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Fig. 3-10. Gear engaged

REPAIR INSTRUCTIONS

WORK WHICH CAN BE DONE WITH TRANSMISSION IN POSITION

Replacing sealing ring

1. Carry out points 1—4 under the heading "Removing" as far as necessary.
2. Unscrew the nut for the coupling (19, illustration III-A). Use key SVO 2409 as counterhold, see Fig. 3-11. Pull off the coupling with puller SVO 2262, see Fig. 3-12.
3. Pull out the old sealing ring (18) with puller SVO 4030, Fig. 3-13. Fit the new sealing ring with the help of drift SVO 2413, Fig. 3-14.
4. Press on the coupling with tool SVO 2304, Fig. 3-15. Fit the other parts.

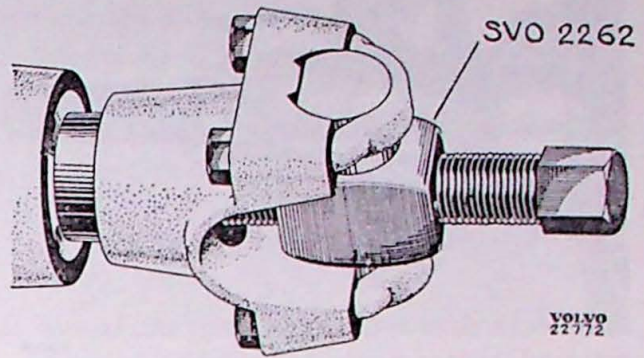


Fig. 3-12. Removing coupling

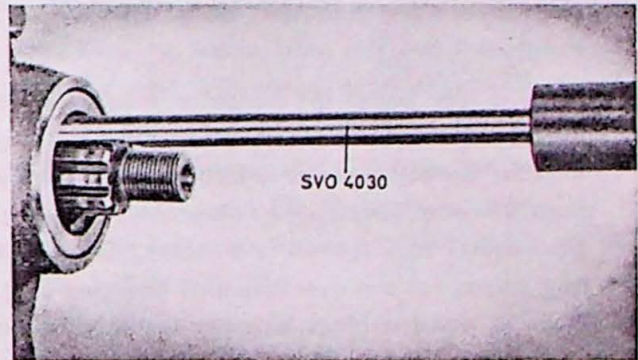


Fig. 3-13. Removing sealing ring

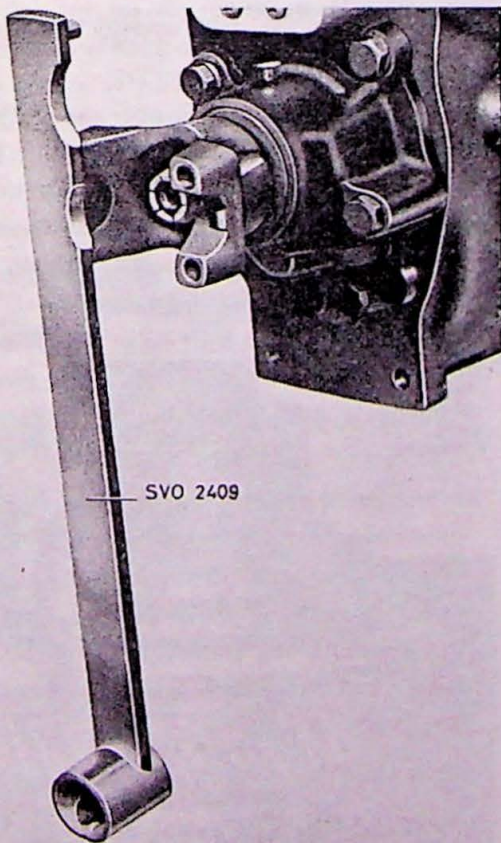


Fig. 3-11. Counterhold for coupling

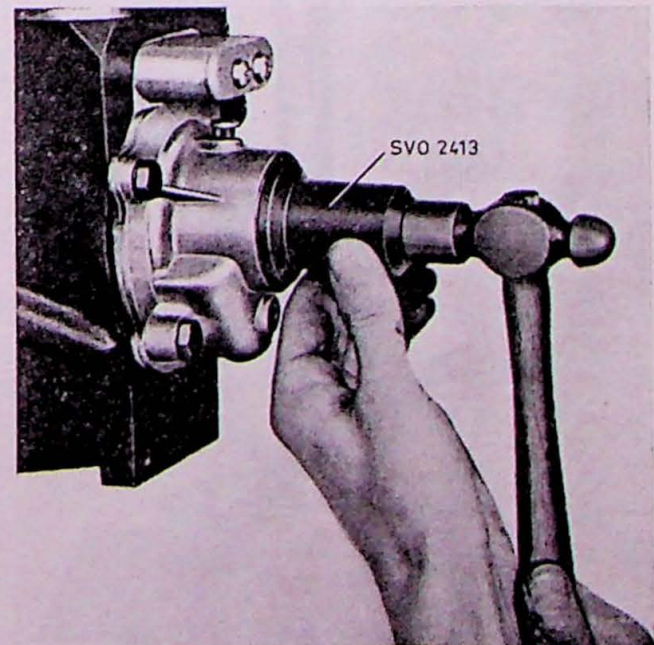


Fig. 3-14. Fitting sealing ring

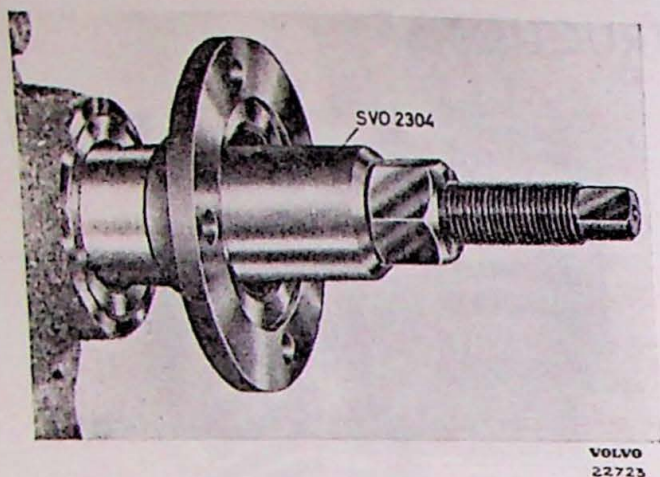


Fig. 3-15. Fitting coupling

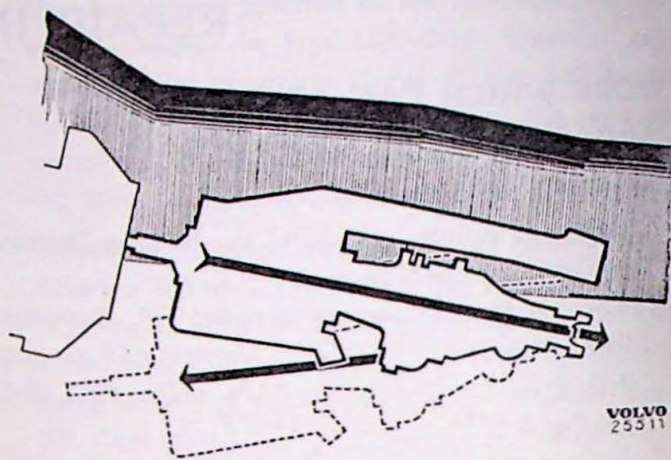


Fig. 3-17. Removing the transmission

3. Jack up the car and block up underneath. Drain the oil from the transmission. Remove the exhaust pipe from the attaching plate on the clutch casing.
4. Place a jack under the transmission to take the weight. Slacken and remove the supporting member beneath the transmission. Disconnect the front universal joint from the transmission coupling. Disconnect the speedometer cable. Disconnect any cables for the overdrive and reversing light. Place a wooden block between the engine and cowl and lower the jack.
5. Unscrew the bolt which holds the transmission to the clutch casing. Use spanner SVO 2431 and ball joint SVO 2427, see A, Fig. 3-16. Tool SVO 2432 is then used for screwing out the bolts, see B, Fig. 3-16. Pull out and lower the transmission, see Fig. 3-17.

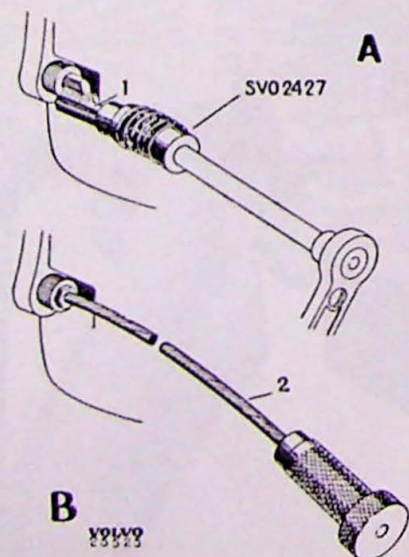


Fig. 3-16. Removing the transmission bolts

- | | |
|------------------------------|-------------------------------|
| A. Slackening and tightening | B. Unscrewing and screwing in |
| 1. SVO 2431 | 2. SVO 2432 |

DISASSEMBLING

The instructions given below apply for transmissions without overdrive. If the transmission is provided with an overdrive, unscrew the bolts which hold the overdrive to the intermediate flange and then remove the overdrive. After this the instructions below apply with one or two small differences.

1. Fit together SVO 4109 and fixture SVO 2044 in a vice. Place the transmission in the fixture.
2. Slacken the bolts for the transmission cover (35, illustration III-A) and lift off the cover. Remove the springs (56) and interlock balls (57) for the shift rails.
3. Remove the casing (13) over the shift rails. Slacken the shift fork bolts. Move the shift fork (37) back to 1st speed position. Drive out the pin slightly (it must not foul 1st speed gear wheel). Then move the shift fork forward sufficiently to allow the pin to pass in front of the gear wheel. Drive out the pin. Slide out the shift rails. When doing this hold against the shift forks so that they do not lie obliquely and distort the rails. Remove the shift forks.
4. Unscrew the bolts for the rear cover (17). Turn the cover so that it does not lock the shafts (2, 5) for the intermediate gear wheels and reverse gear wheel (4,6). Drive out the intermediate gear wheel shaft. The shaft should be driven out to the rear. Let the wheel fall into the bottom of the transmission housing.
5. Pull out the mainshaft.
6. Unscrew the bolts and remove the cover (67) over the input shaft (68). Remove the sealing ring (66) from the cover with a screwdriver or similar.

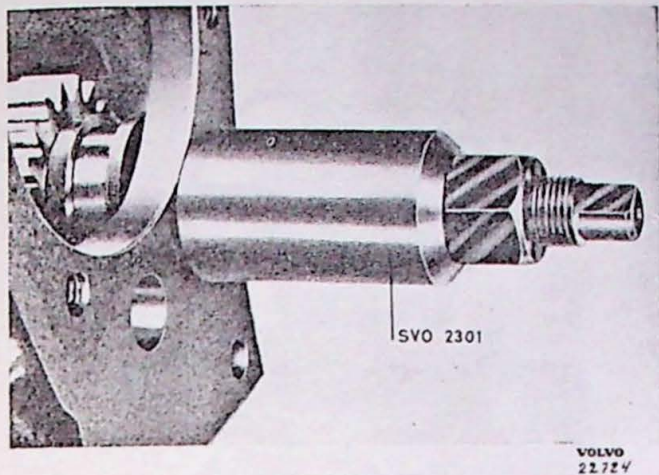


Fig. 3-18. Removing reverse gear

7. Drive out the input shaft. If necessary remove the locking ring and press off the ball bearing (64) from the input shaft.
8. Take out the idler gear wheel. Pull out the shaft (5) for the reverse gear wheel (6) with puller SVO 2301, Fig. 3-18. Take out the reverse gear wheel and lever (8).

DISASSEMBLING MAINSHAFT

1A. Transmission without overdrive:

Unscrew the nut for the coupling. Use tool SVO 2409 as a counterhold on the coupling. Move the engaging sleeve (41) for 1st and 2nd speeds forwards. Place the shaft in a press and support

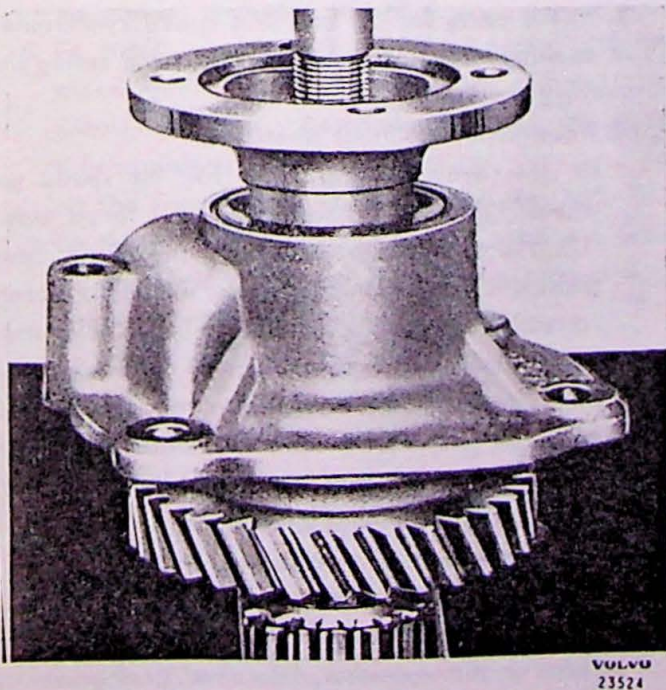


Fig. 3-19. Disassembling mainshaft, I

under 1st speed gear wheel (10). Press out the shaft with a drift, Fig. 3-19.

1B. Transmission with overdrive:

Remove the locking ring and press off the cam for the overdrive oil pump. Remove the locking ring for the mainshaft rear bearing. Slide the engaging sleeve (41) for 1st and 2nd speeds forwards. Place the shaft in a press and support under 1st speed gear wheel (10). Press out shaft, see Fig. 3-20.

2. Remove the synchronising cone, thrust washer, engaging sleeves, guides and springs from the shaft.
3. Remove the locking ring on the front end of the shaft. Pull off the synchronising hub (53) and 3rd speed gear wheel (49). Remove the needle bearing (50) and thrust washer (48).
4. Remove the locking ring (47) and then the thrust washer (46), 2nd speed gear wheel (45), needle bearing (44), synchronising cone (42) and spring.
5. Remove the sealing ring (18) from the rear cover (17) and take out the speedometer gear (11). If necessary, remove the locking ring and press out the ball bearing (15).

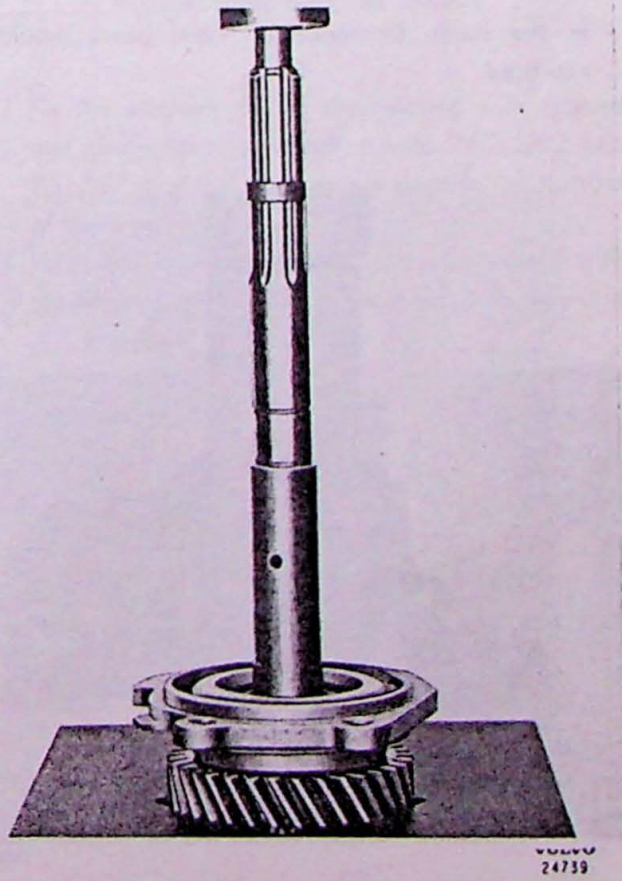


Fig. 3-20. Disassembling mainshaft, II

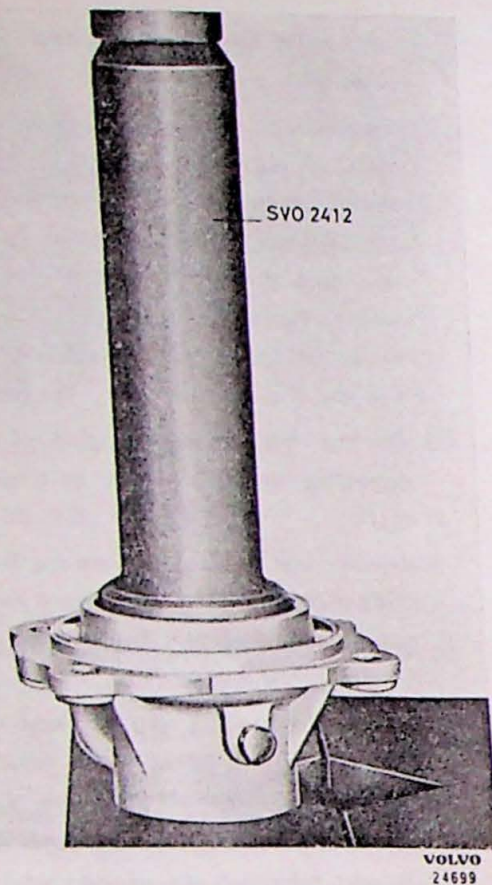


Fig. 3-21. Fitting ball bearing in rear cover

INSPECTION

Check the gear wheels especially for cracks or chips in the teeth. Damaged or worn gears should be replaced.

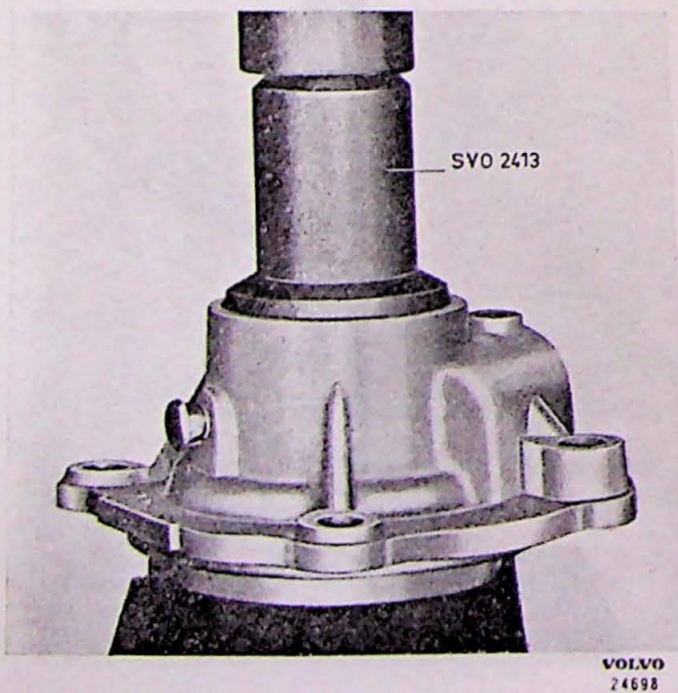


Fig. 3-22. Fitting sealing ring in rear cover

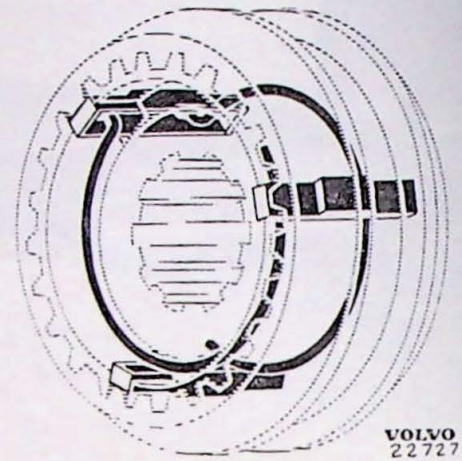


Fig. 3-23. Assembling synchronising mechanism

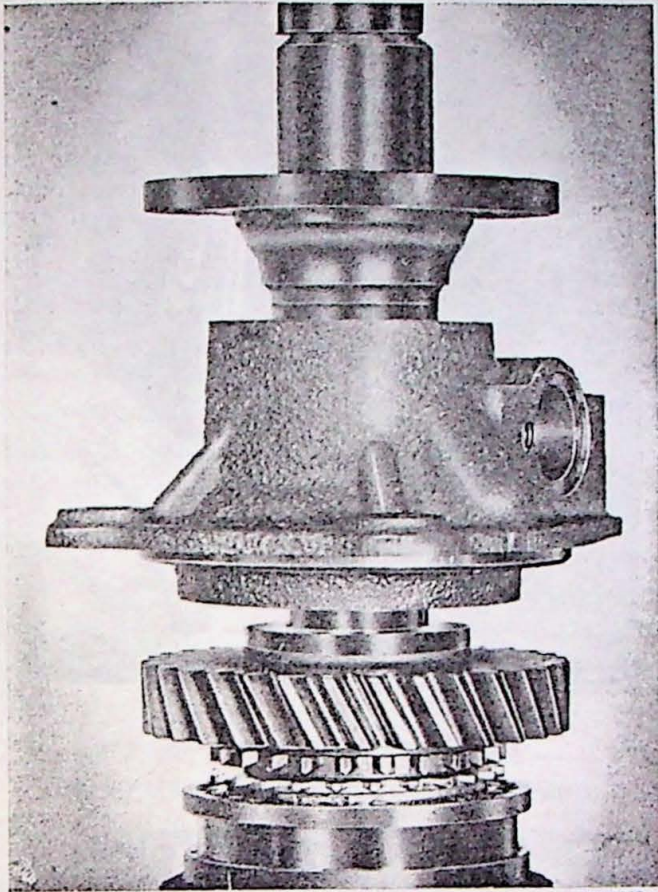
Check the synchronising cones and all the other synchronising components. Damaged or worn parts should be replaced.

Check the ball bearings and needle bearings especially for scoring or cracks in the bearing races or on the balls or needles respectively.

ASSEMBLING

Assembling mainshaft

1. Press the ball bearing (15, illustration III-A) into the rear cover (17) with drift SVO 2412, Fig. 3-21 and fit the locking ring. There are different thicknesses of locking ring so select one which completely fills the locking ring groove.
2. Transmission without overdrive:
Place the speedometer gear (11) on the bearing in the rear cover. Press in the sealing ring (18) with drift SVO 2413, see Fig. 3-22.
3. Fit the parts for 1st and 2nd speed synchronising mechanism onto the mainshaft. Fit the spring rings correctly, see Fig. 3-23.
- 4A. Transmissions without overdrive:
Fit the synchronising cone for 1st speed gear wheel (10), needle bearing (9) and thrust washer (12). Place the rear cover on the shaft. Ensure that the speedometer gear wheel is located correctly. Fit on the coupling (19). Use a sleeve which fits into the turned cavity in the coupling, press on the cover and coupling, see Fig. 3-24. Place on the washer and nuts for the coupling. Use tool SVO 2409 as a counterhold on the coupling and tighten the nut.
- 4B. Transmissions with overdrive:
Place the rear cover and ball bearing on a support ring or sleeve as shown in Fig. 3-25. Place on thrust washer, 1st speed gear wheel with needle bearing and synchronising cone. Press in



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Fig. 3-24. Fitting rear cover

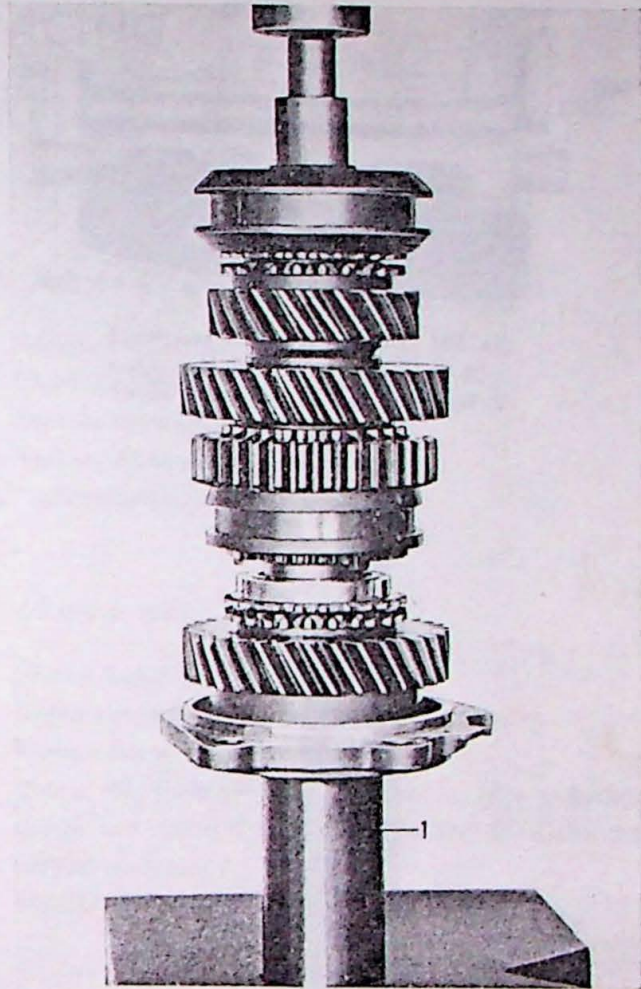
the shaft. Select a locking ring of suitable thickness and fit it. Fit the key, cam for oil pump and locking ring.

5. Fit the synchronising cone (42), needle bearing (44), 2nd speed gear wheel (45) and thrust washer (46) onto the shaft. Select a locking ring (47) of the correct thickness and fit it.
6. Fit thrust washer (48), needle bearing (50), 3rd speed gear wheel (49) and synchronising cone onto the shaft. Assemble 3rd and 4th speed synchronising mechanisms.

Fit the spring rings correctly, see Fig. 3-23. Then fit the synchronising mechanism onto the mainshaft. Select a locking ring of the correct thickness, see Fig. 3-26, and fit it.

Assembling the transmission

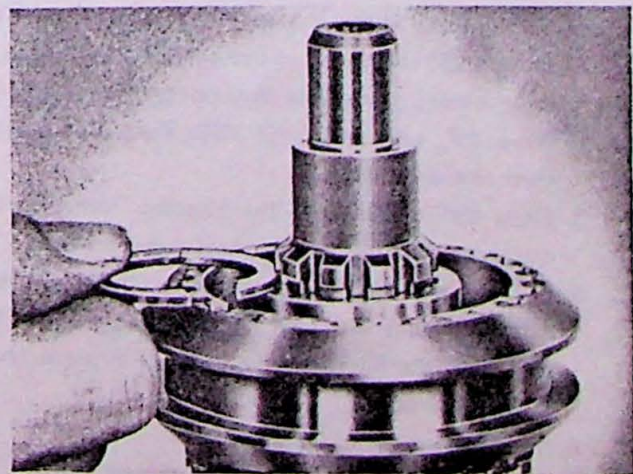
1. Fit the lever (8) and guide stud. Fit on the reverse gear wheel (6) and reverse shaft (5). Ensure that the groove in the reverse shaft faces correctly.
2. Place locating tool SVO 2303 in the intermediate gear wheel (4). Put in spacing washers (3, 69) and needles (24 in each bearing). Use grease to hold the needles and washers in place.



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Fig. 3-25. Fitting rear cover, overdrive
1. Sleeve

3. Fix the washers (70) to the housing with grease and guide them into position with SVO 2302, see Fig. 3-27. Lay the intermediate gear in the bottom of the housing.
4. Press the bearing (64) onto the input shaft with the help of drift SVO 2412 see Fig. 3-28. Select a



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Fig. 3-26. Selecting a locking ring

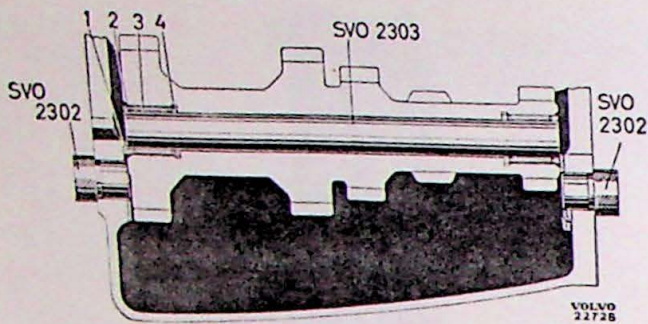


Fig. 3-27. Fitting intermediate gear wheel
 1. Thrust washer 3. Needle bearings
 2. Spacing washer 4. Spacing washer

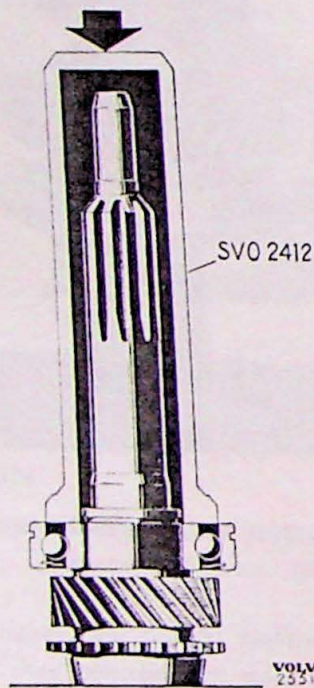


Fig. 3-28. Fitting ball bearing on input shaft

locking ring of suitable thickness and fit it. Place the 14 bearing rollers for the mainshaft in position on the input shaft. Use grease to keep the rollers in position. Press the input shaft into position in the housing. Press the sealing ring (66) into the cover (67) with drift SVO 2010. Then fit the cover over the input shaft.

5. Place the mainshaft in the housing. Turn the rear cover so that the countershaft can be fitted.
6. Turn the transmission upside down. Fit the countershaft (2) from the rear. Hold locating tool SVO 2303 with the hand. Ensure that the thrust washers do not fall down.

7A. Transmissions without overdrive:

Turn the rear cover correctly so that it locks the reverse shaft. Fit the cover bolts.

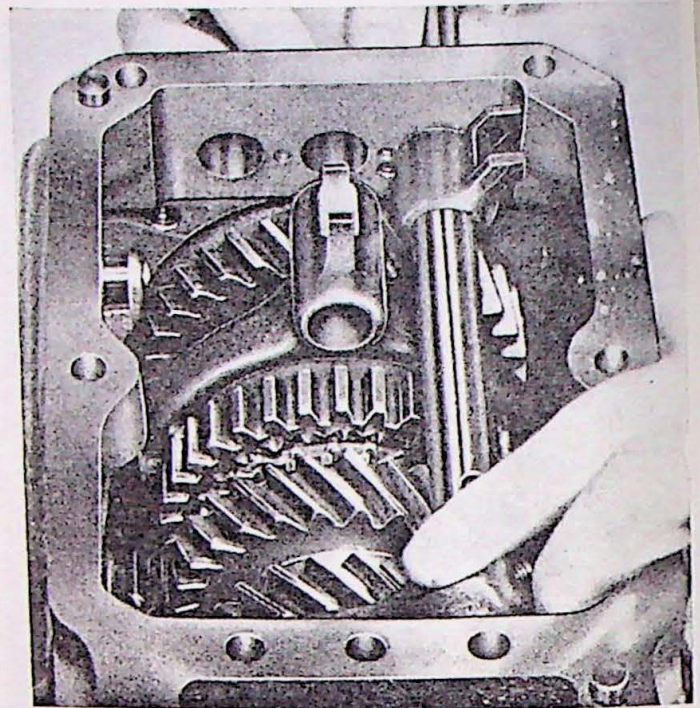


Fig. 3-29. Fitting the shift forks and rails

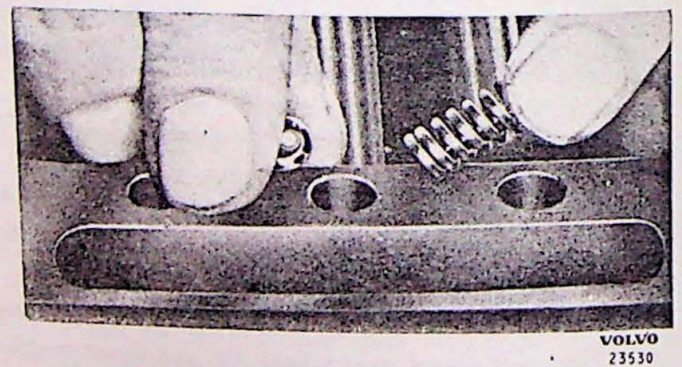


Fig. 3-30. Fitting interlock balls and springs

7B. Transmissions with overdrive:

Turn the rear cover correctly so that it locks the reverse shaft. Ensure that the cam for the overdrive oil pump faces upwards. Fit the intermediate flange and overdrive unit.

8. Fit shift rails and forks. Place both forks in position before fitting the rails, see Fig. 3-29. Move over the shift fork (37) to 1st speed position when fitting the pin. Use a new pin. Fit the cover over the shift rails.
9. Place the interlock balls and springs in position, Fig. 3-30. Fit the transmission cover. Check that all gears engage and disengage easily.

FITTING

Fitting is done in the reverse order to removing. Fill up the transmission with oil.

FAULT TRACING

FAULT

Reason _____ Remedy

Gears difficult to engage

Clutch does not release.	Adjust or repair the clutch. See Part 2.
Oil too thick.	Check that the correct oil is used.
Synchronizing device worn.	Replace the worn parts.
Bearing bushings or gear wheels worn.	Replace damaged or worn parts.
Shift rails or gear wheels bind.	Replace damaged or worn parts.

One of gears jumps out

Worn bearings on shafts or gear wheels.	Fit new bearings or bushings.
Worn grooves in shift rails or weak springs.	Replace damaged or worn parts.
Badly worn gear wheels.	Replace the worn gear wheels.
Transmission fits obliquely on flywheel housing.	Check the flywheel housing with a dial indicator gauge and adjust if necessary (see Part 2). Clean the contact surfaces.
Support bearing in flywheel worn.	Replace the bearing.

Noise

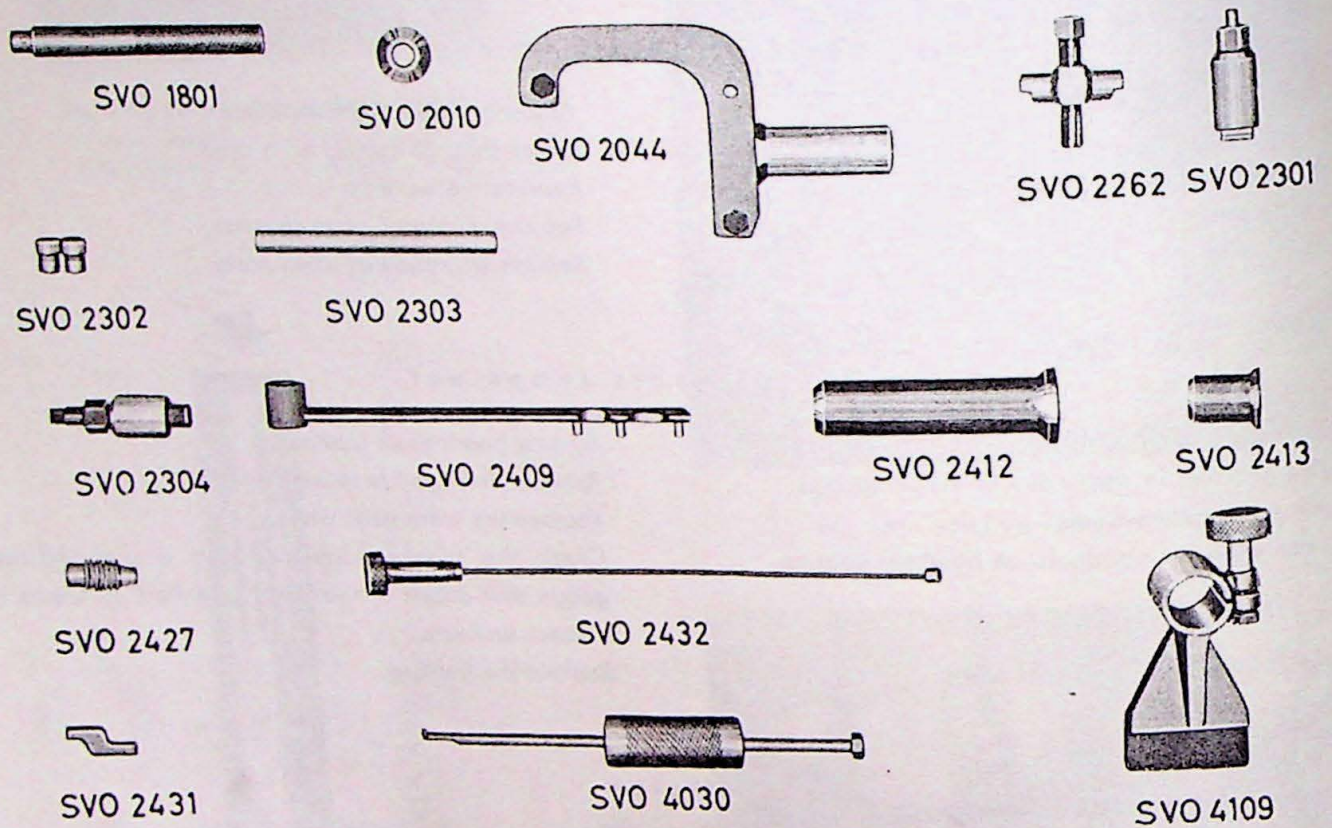
Oil level too low.	Fill up with the necessary quantity of oil.
Worn or damaged bearings on shafts and gear wheels.	Replace the bearings or bushings.
Badly worn gear wheels.	Replace the worn gear wheels.

Oil leakage

Flange sealing surface worn.	Fit new flange and sealing ring.
Rear sealing ring and bearing worn.	Fit new bearing and new sealing ring.
Leakage between housing and rear cover.	Fit new paper gasket.
Leakage between housing and front bearing cover.	Fit new paper gasket. Clean out the return hole.
Front sealing ring worn.	Fit new sealing ring in the front bearing cover.
Leakage between housing and cover.	Fit new cork gasket.

TOOLS

The following special tools are required for carrying out repairs to the transmission.



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Fig. 3-31. Special tools

- | | | | |
|----------|---|----------|---|
| SVO 1801 | Standard handle 18x200 | SVO 2412 | Fitting drift for bearings on input shaft and in rear cover |
| SVO 2010 | Fitting drift for sealing ring in input shaft cover | SVO 2413 | Fitting drift for sealing ring in rear cover |
| SVO 2044 | Fixture for disassembling and assembling. Used together with SVO 4109 | SVO 2427 | Ball joint for spanner SVO 2431 |
| SVO 2262 | Puller for coupling | SVO 2431 | Spanner for slackening and tightening transmission bolts |
| SVO 2301 | Puller for removing reverse shaft | SVO 2432 | Spanner for screwing in and screwing out transmission bolts |
| SVO 2302 | Drift for thrust washer. Used together with SVO 2303 when fitting intermediate gear wheel | SVO 4030 | Puller for sealing ring in rear cover |
| SVO 2303 | Drift for fitting intermediate gear wheel | SVO 4109 | Support for fixture SVO 2044 |
| SVO 2304 | Press tool for fitting coupling | | |
| SVO 2409 | Counterhold for coupling | | |

SPECIFICATIONS

Type designation	M 40
Gear ratios:	
1st speed	3.13:1
2nd speed	1.99:1
3rd speed	1.36:1
4th speed	1:1
Reverse	3.25:1
Number of teeth on the different gears:	
Input shaft	19 teeth
Countershaft, drive gear	27 "
gear for 1st speed	15 "
gear for 2nd speed	20 "
gear for 3rd speed	23 "
gear for reverse	14 "
Mainshaft, gear for 1st speed	33 "
gear for 2nd speed	38 "
gear for 3rd speed	22 "
gear for reverse	32 "
Reverse gear	19 "
Lubricant, M 40 (without overdrive)	Transmission oil
viscosity	SAE 80
Oil capacity	1 1/2 US pints = 1 1/4 Imp. pints (0.75 liter)
Lubricant, M 41 (with overdrive)	Engine oil
viscosity	SAE 30
Oil capacity	3 3/4 US pints = 3 1/8 Imp. pints (1.8 liters)

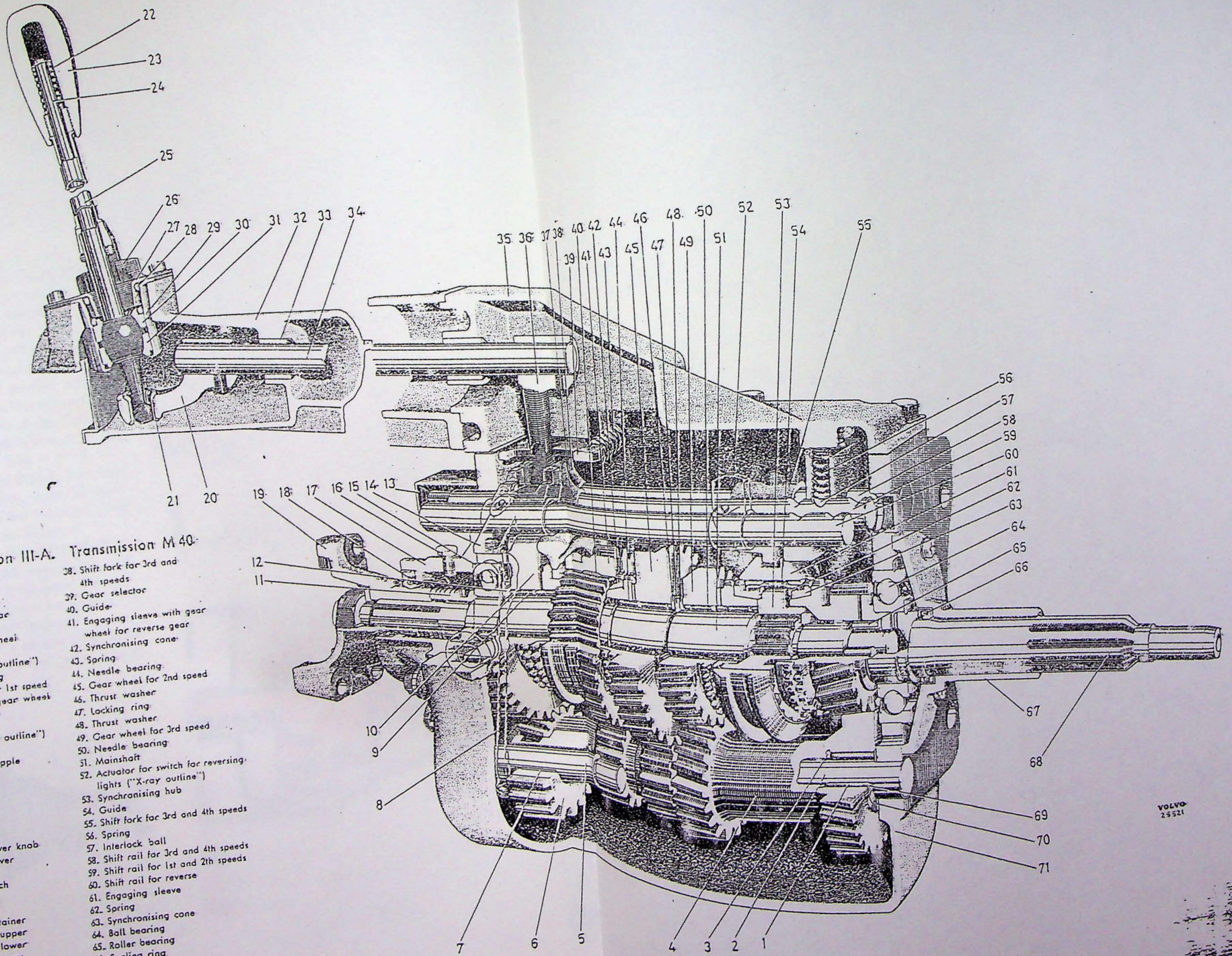


Illustration III-A. Transmission M 40.

- 1. Needle bearing
- 2. Countershaft
- 3. Spacing washer
- 4. Intermediate gear
- 5. Reverse shaft
- 6. Reverse gear wheel
- 7. Bushing
- 8. Lever ("X-ray outline")
- 9. Needle bearing
- 10. Gear wheel for 1st speed
- 11. Speedometer gear wheel
- 12. Thrust washer
- 13. Casing
- 14. Guide ("X-ray outline")
- 15. Ball bearing
- 16. Air-venting nipple
- 17. Rear cover
- 18. Sealing ring
- 19. Coupling
- 20. Guide
- 21. Bushing
- 22. Spring
- 23. Gearshift lever knob
- 24. Gearshift lever
- 25. Sleeve
- 26. Reverse catch
- 27. Washer
- 28. Spring
- 29. Bearing retainer
- 30. Ball cup, upper
- 31. Ball cup, lower
- 32. Bearing sleeve
- 33. Bushing
- 34. Shaft
- 35. Cover
- 36. Gear shifter
- 37. Shift fork for 1st and 2nd speeds
- 38. Shift fork for 3rd and 4th speeds
- 39. Gear selector
- 40. Guide
- 41. Engaging sleeve with gear wheel for reverse gear
- 42. Synchronising cone
- 43. Spring
- 44. Needle bearing
- 45. Gear wheel for 2nd speed
- 46. Thrust washer
- 47. Locking ring
- 48. Thrust washer
- 49. Gear wheel for 3rd speed
- 50. Needle bearing
- 51. Mainshaft
- 52. Actuator for switch for reversing lights ("X-ray outline")
- 53. Synchronising hub
- 54. Guide
- 55. Shift fork for 3rd and 4th speeds
- 56. Spring
- 57. Interlock ball
- 58. Shift rail for 3rd and 4th speeds
- 59. Shift rail for 1st and 2th speeds
- 60. Shift rail for reverse
- 61. Engaging sleeve
- 62. Spring
- 63. Synchronising cone
- 64. Ball bearing
- 65. Roller bearing
- 66. Sealing ring
- 67. Cover
- 68. Input shaft
- 69. Spacing washer
- 70. Thrust washer
- 71. Housing

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