

SERVICE MANUAL

CARS AND VANS

P

Part. 3 b

GEARBOX

(M 30 - M 40)

Export Service Department

AKTIEBOLAGET

VOLVO

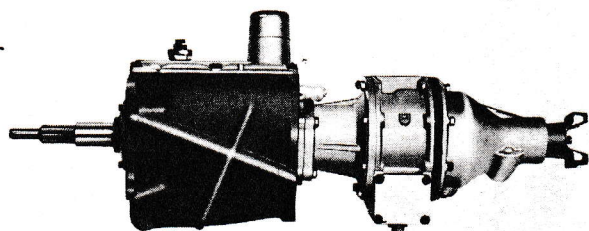
GÖTEBORG . SWEDEN

CONTENTS

Description	1
Repair instructions	3
Work which can be done with gearbox in position	3
Removing	3
Dismantling	4
Inspection	6
Assembling	6
Fault tracing	10
Tools	11
Specifications	12

DESCRIPTION

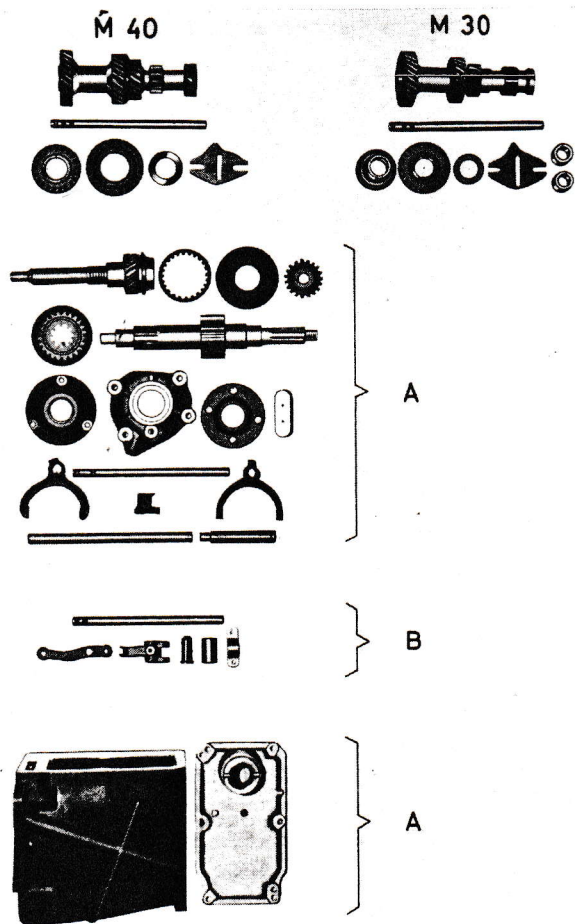
(Concerning gearbox with overdrive (M 31, M 41), see also P 1200, Part 3 a).



VOLVO
26162

Fig. 1. Gearbox with overdrive.

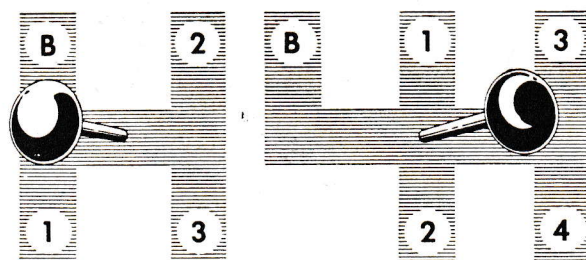
Volvo's new fully synchronized gearboxes have type designations M 30 and M 40. The M 30 is a three-speed gearbox and M 40 four-speed. The fact that the gearboxes are fully synchronized means that there is synchronization on all forward speeds. The gearboxes are constructed with as many common parts as possible, see Fig. 2.



VOLVO
26163

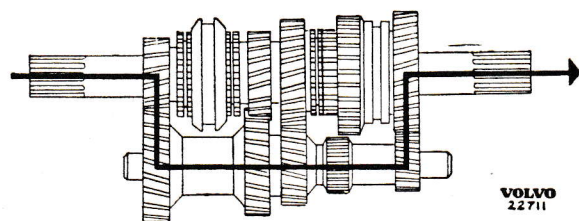
Fig. 2. Comparing component parts, M 30—M 40.

A. Identical parts B. Not included on M 30



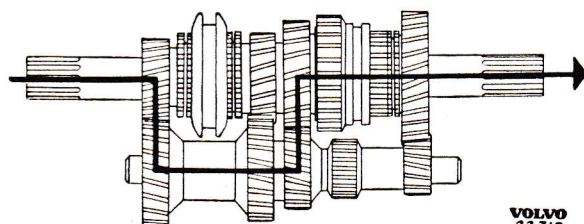
VOLVO
26171

Fig. 3. Gear lever positions.



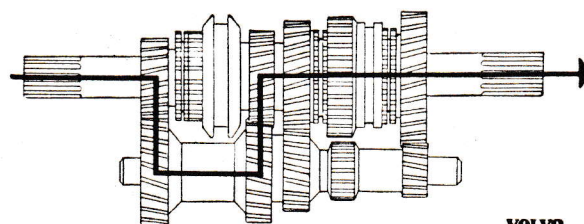
VOLVO
22711

Fig. 4. 1st speed, M 40



VOLVO
22712

Fig. 5. 1st speed, M 30 2nd speed, M 40



VOLVO
22713

Fig. 6. 2nd speed, M 30 3rd speed, M 40

The chief difference between the gearboxes is that on the M 40 the 1st speed gear is replaced with a spacing sleeve and 2nd and 3rd speed gears have become 1st and 2nd respectively. The sliding reverse gear on the M 40 has been fixed by means of two spacing sleeves on the M 30.

The construction of the gearboxes is shown in Figs. 1 and 2 and Illustrations I and II. All gears with the exception of the reverse gears are in constant mesh with each other. In the neutral position the gears on the main shaft rotate freely. For this reason they are provided with bronze

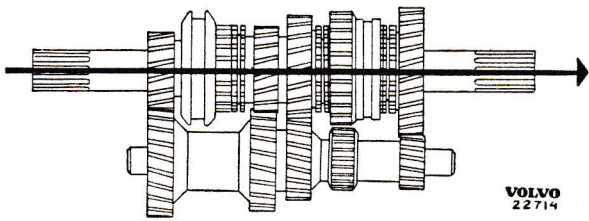


Fig. 7. 3rd speed, M 30 4th speed, M 40

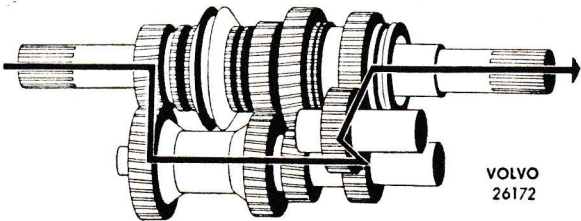


Fig. 8. Reverse M 30.

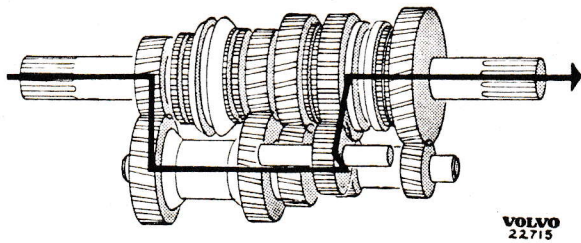
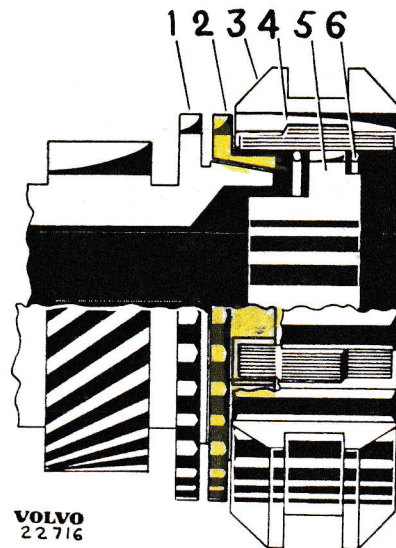


Fig. 9. Reverse M 40.

bushings. When engaging a gear, the corresponding gear wheel is connected to the main shaft by means of an engaging sleeve.

The gear lever positions are shown in Fig. 3. The power transmission path of the different speeds is shown in Figs. 4—9.

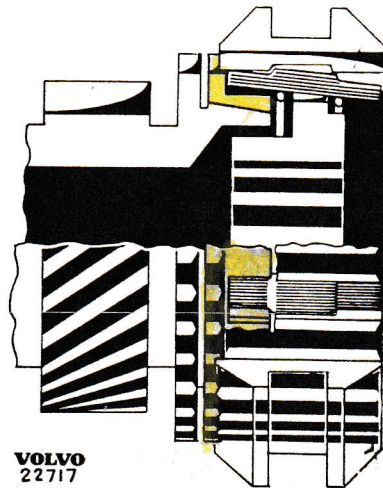
The design and function of the synchronizing mechanism is shown in Figs. 10—12. When a gear is engaged, the gear selector fork presses the engaging sleeve (3, Fig. 10) towards the corresponding gear wheel. The guides (4) then press the synchronizing cone (2) against the cone on the gear wheel (1). If the synchronizer and gear wheel are rotating at different speeds, the synchronizing cone will turn in relation to the engaging sleeve. The synchronizing cone is prevented from turning more than half a tooth-width by the guides, see Fig. 11. The teeth on the synchronizing cone have half their width in contact with the teeth on the engaging sleeve and in this way prevent it from engaging. Through friction between the synchronizing cone and the cone on the gear wheel, the gear wheel attains the same speed of rotation as the synchronizer. When they are both rotating at the same speed the engaging sleeve is able to turn back the synchronizing cone and the gear engages, see Fig. 12.



VOLVO
22716

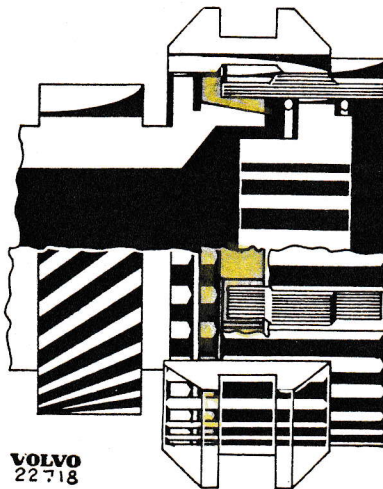
Fig. 10. Neutral position.

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



VOLVO
22717

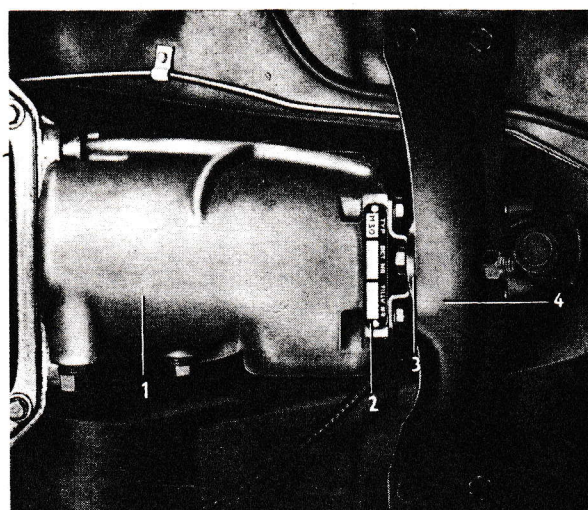
Fig. 11. Synchronizing.



VOLVO
22718

Fig. 12. Gear engaged.

REPAIR INSTRUCTIONS



VOLVO
26185

Fig. 13. Gearbox in position.

- 1. Gearbox
- 2. Number plate
- 3. Rubber cushion
- 4. Supporting member

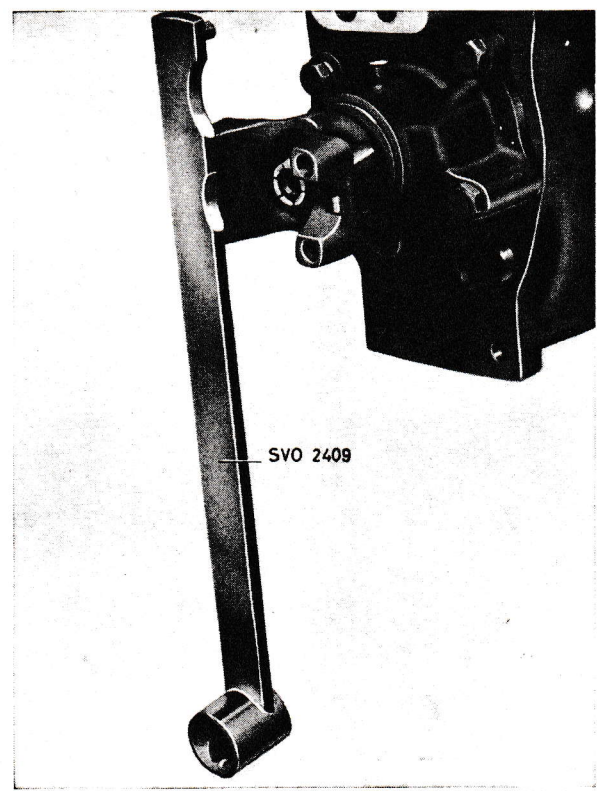
Work which can be done with gearbox in position

Replacing sealing ring

1. Carry out operations 1—4 under the heading "Removing" as far as necessary.
2. Slacken the nut for the flange. Use spanner SVO 2409 as a counterhold, see Fig. 14. Pull off the flange. Use puller SVO 2261 for round flanges and SVO 2262 for other flanges, see Fig. 15.
3. Pull out the old sealing ring with puller SVO 4030, see Fig. 16. Fit the new sealing ring with the help of sleeve SVO 2413, see Fig. 17.
4. Press on the flange with SVO 2304, see Fig. 18. Fit on remaining parts.

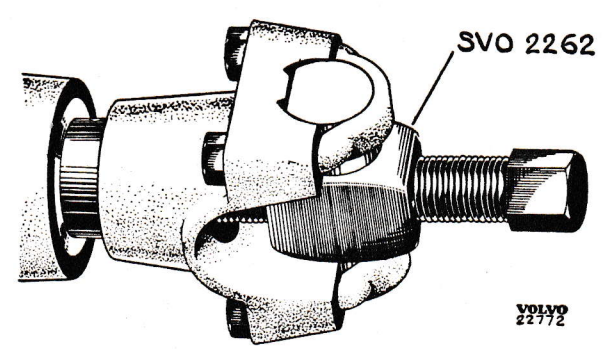
Removing

1. Drain off the coolant. Slacken the upper radiator hose and the hoses from the engine to the heater. Slacken the exhaust pipe at the manifold flange. Disconnect the battery cable and the cable to the oil pressure gauge. Unscrew the thermometer body and the sensitive head of the oil pressure gauge. Disconnect the accelerator pedal rod.
2. Remove the rubber protector and gear lever.
3. Jack up the car and block up underneath. Drain the oil from the gearbox.
4. Place a jack beneath the gearbox to take the weight. Slacken and remove the sup-



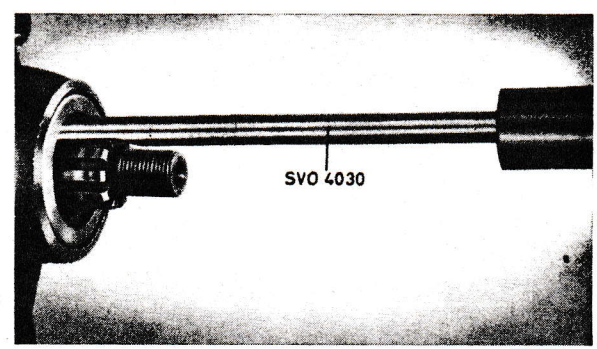
VOLVO
24597

Fig. 14. Counterhold for flange.



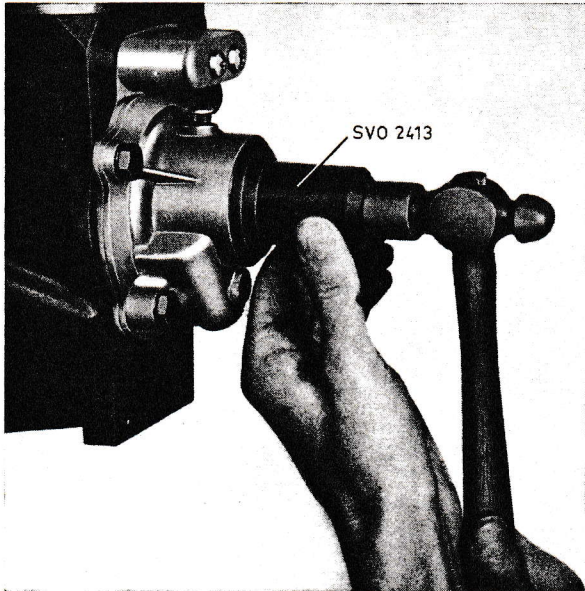
VOLVO
22772

Fig. 15. Removing flange.



VOLVO
22721

Fig. 16. Removing sealing ring.



VOLVO
24738

Fig. 17. Fitting sealing ring.

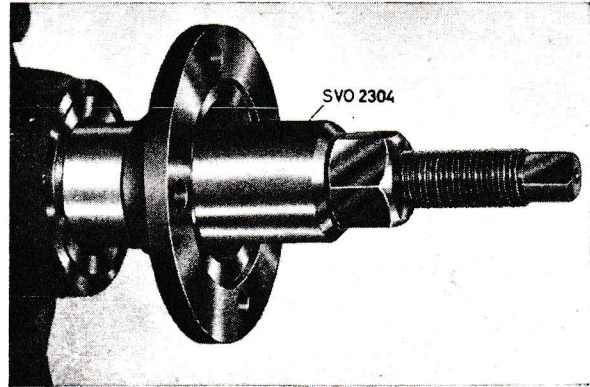
porting member under the gearbox. Uncouple the front universal joint from the gearbox flange. Disconnect the speedometer cable. Place a wooden block between the engine and the cowl and lower the jack.

5. Unscrew the bolts which hold the gearbox and clutch housing together with the help of spanner SVO 2426 (for B 16) or SVO 2431 (for B 18) and ball joint connector SVO 2427, see A, Fig. 19. Tool SVO 2428 (for B 16) or SVO 2432 (for B 18) is then used for screwing out, see B, Fig. 19. Pull out the gearbox backwards.

Dismantling

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

1. Fit together SVO 4109 and jig SVO 2044 in a vice/. Place the gearbox in the jig.
2. Slacken the bolts for the gearbox cover. Lift off the cover. Remove the springs and interlock balls for the selector rails.
3. Remove the cover over the selector rails. Unscrew the selector fork bolts.
- 4a. M 30:
Slide the selector fork back to the reverse position. Drive out the pin.
- 4b. M 40:
Slide the selector fork back to 1st speed position. Drive out the pin slightly (it must not foul the 1st speed gear wheel). Then move the selector fork forwards sufficiently



VOLVO
22723

Fig. 18. Fitting flange.

to allow the pin to pass in front of the gear wheel. Drive out the pin.

5. Slide out the selector rails. When doing this, hold against the selector forks so that they do not come skew and jam on the rails. Remove the selector forks.

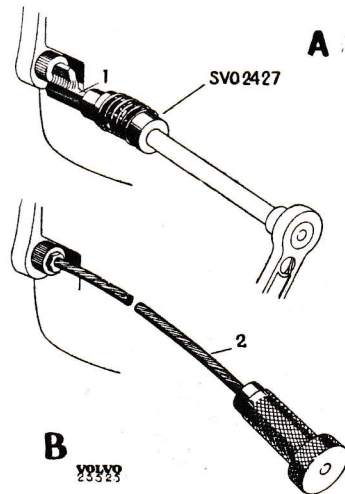
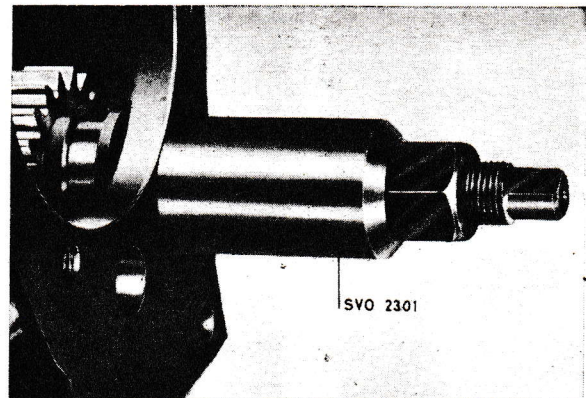


Fig. 19. Removing gearbox bolts.

- A. Slackening and tightening
- B. Screwing in and out
1. SVO 2426 (B 16) SVO 2431 (B 18)
2. SVO 2428 (B 16) SVO 2432 (B 18)



VOLVO
22724

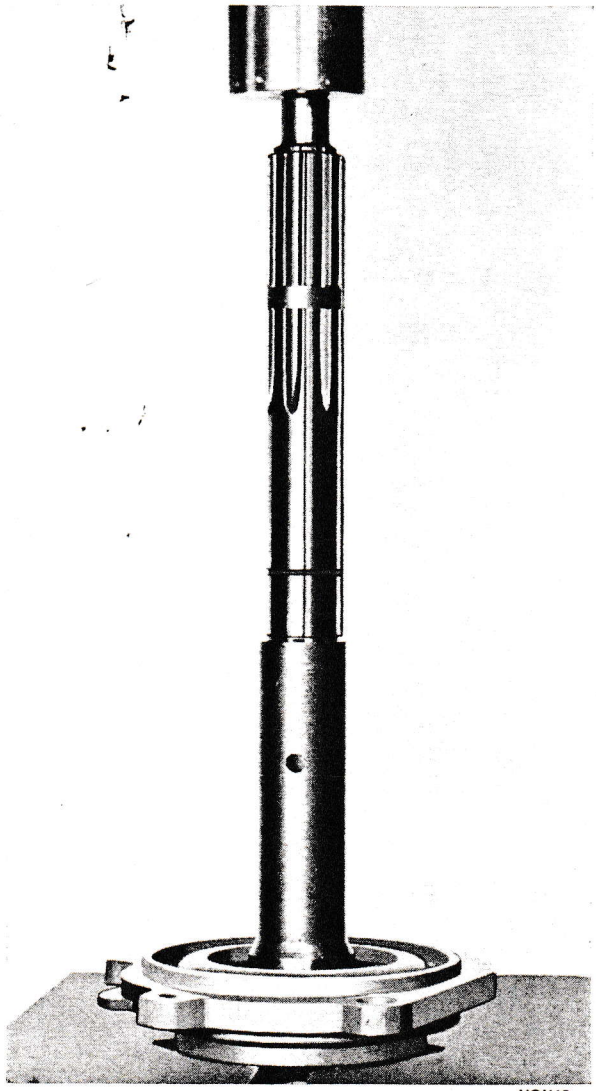
Fig. 20. Removing reverse gear.

- 6. Unscrew the bolts for the rear cover. Turn the cover so that it does not lock the shaft for the idler and reverse gears. Drive out the shaft for the idler gear. *Note. The shaft must be driven out backwards.* Let the idler gear fall into the bottom of the gearbox.
- 7. Pull out the main shaft.
- 8. Unscrew the bolts and remove the cover over the input shaft. Prise out the sealing ring from the cover with a screwdriver or similar.
- 9. Drive out the input shaft. If necessary, remove the locking ring and press the ball bearing off the shaft.
- 10. Take out the idler gear. Pull out the shaft for the reverse gear with puller SVO 2301, Fig. 20. Take out the reverse gear and other parts.

Dismantling main shaft

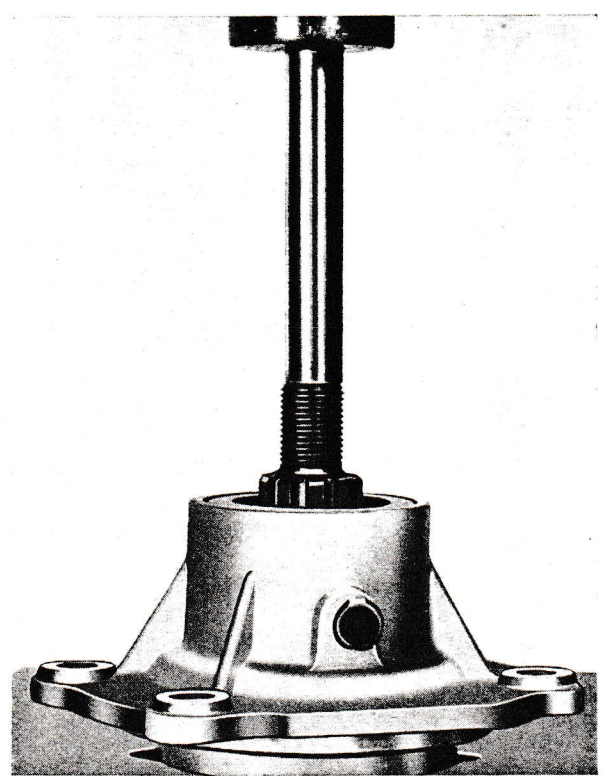
M 30 Gearbox

- 1a. Gearbox with overdrive (M 31):
Remove the locking ring and press off the rotor for the overdrive oil pump. Remove the locking ring for the main shaft rear bearing. Slide the engaging sleeve for 1st speed and reverse forwards. Place the shaft in a press and support under the rear cover. Press out the shaft, see Fig. 21.
- 1b. Gearbox without overdrive:
Unscrew the nut for the flange. Use tool SVO 2409 as a counterhold, see Fig. 14. Pull off the flange. Use puller SVO 2261 for round flanges and SVO 2262 for other flanges, see Fig. 15. Slide the engaging sleeve for 1st speed and reverse forward. Place the shaft in a press and support under the rear cover. Press out the shaft with a drift, see Fig. 22.
- 2. Remove the thrust washer, spacing sleeve, engaging sleeves, guides and springs from the shaft.
- 3. Remove the locking ring on the front end of the shaft. Pull off the synchronizer hub and 2nd speed gear wheel with a suitable puller, see Fig. 23. Remove the thrust washer.
- 4. Remove the locking ring and then the thrust washer, 1st speed gear wheel, synchronizing cone and spring.



VOLVO 26165

Fig. 21. Dismantling main shaft, M 31.



VOLVO 26164

Fig. 22. Dismantling main shaft, M 30.

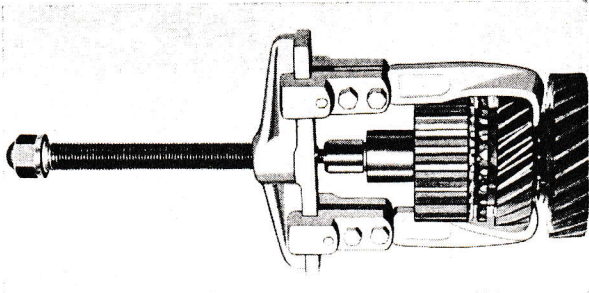
VOLVO
26166

Fig. 23. Removing front synchronizer.

5. Remove the sealing ring from the rear cover and take out the speedometer gear. If necessary, remove the locking ring and press out the ball bearing.

M 40 Gearbox

- 1a. Gearbox with overdrive (M 41):
Support under the 1st speed gear wheel when pressing out the shaft. Then follow the instructions in point 1a under M 30 gearbox, page 5.
- 1b. Gearbox without overdrive:
Unscrew the nut for the flange. Use tool SVO 2409 as a counterhold on the flange. Slide the engaging sleeve for 1st and 2nd speeds forward. Place the shaft in a press and support under the 1st gear wheel. Press out the shaft with a drift, see Fig. 24.
2. Remove the synchronizing cone, thrust

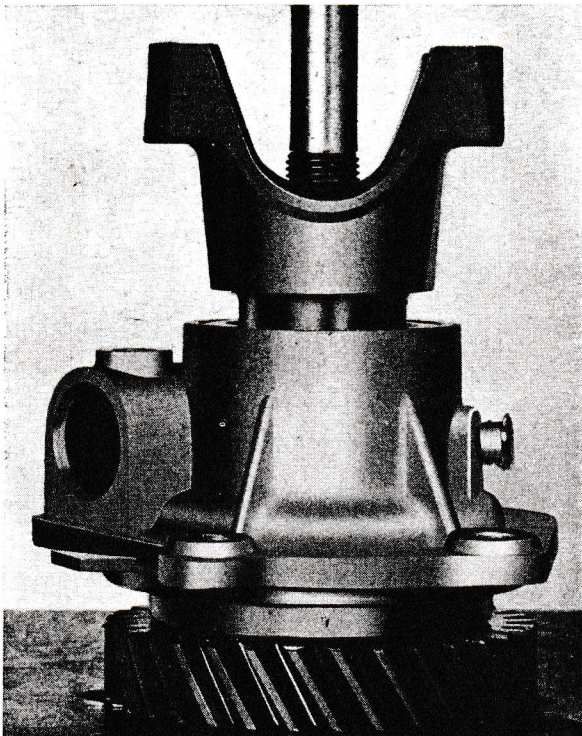
VOLVO
26167

Fig. 24. Dismantling main shaft, M 40.

washer, engaging sleeves, guides and springs from the shaft.

3. Remove the locking ring on the front end of the shaft. Pull off the synchronizer hub and 3rd speed gear wheel with a puller. Remove the thrust washer.
4. Remove the locking ring and then the thrust washer, 2nd speed gear wheel, synchronizing cone and spring.
5. Remove the sealing ring from the rear cover and take out the speedometer gear. If necessary, remove the locking ring and press out the ball bearing.

Inspection

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

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

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

Assembling

Assembling main shaft

M 30 Gearbox

1. Press the ball bearing into the rear cover with drift SVO 2412, see Fig. 25, and fit the

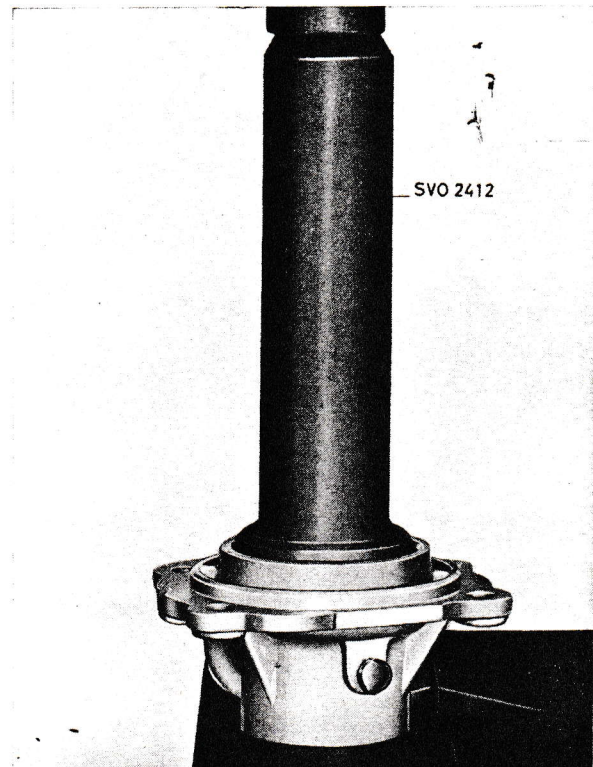
VOLVO
24699

Fig. 25. Fitting ball bearing in rear cover.

locking ring. There are different thicknesses of locking ring so select one which completely fills the locking ring groove.

2. Gearbox without overdrive:
Place the speedometer gear on the bearing in the rear cover. Press in the sealing ring with drift SVO 2413, see Fig. 26.
3. Fit the spring rings, guides and engaging sleeve for the 1st speed synchronizer on the main shaft. Fit the spring rings correctly, see Fig. 27. Fit the spacing sleeve and thrust washer.

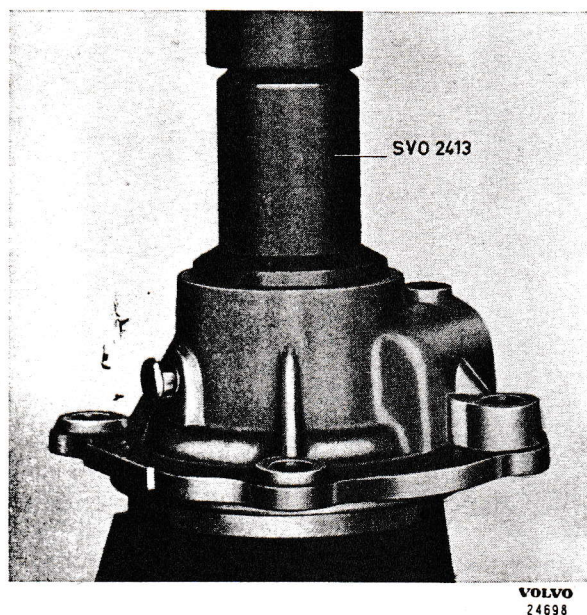


Fig. 26. Fitting sealing ring in rear cover.

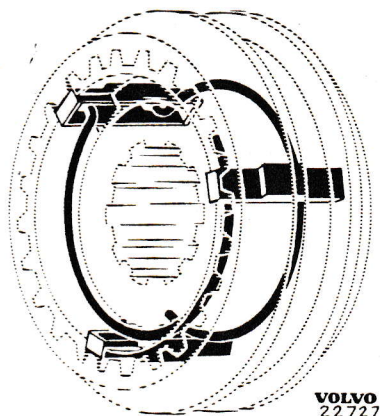


Fig. 27. Assembling synchronizer.

- 4a. Gearbox without overdrive:
Place the rear cover on the shaft. Ensure that the speedometer gear is positioned correctly. Place on the flange. Use a sleeve which fits into the recess in the flange and press on the cover and flange, see Fig. 28. Place on the washer and nut for the flange. Use tool SVO 2409 as a counterhold on the flange and tighten the nut.

- 4b. Gearbox with overdrive (M 31):
Place the rear cover and ball bearing on a support ring or sleeve as shown in Fig. 29. Place on the thrust washer and spacing sleeve. Press in the shaft. Select a locking ring of suitable thickness and fit same. Fit the key, eccentric for the oil pump and locking ring.
5. Fit the synchronizing cone, 1st speed gear wheel and thrust washer on the shaft. Select a locking ring which fits well into the groove on the shaft and fit it.
6. Fit the thrust washer, 2nd speed gear wheel and synchronizing cone on the shaft. Assemble the 2nd and 3rd speed synchronizing parts. Fit the spring rings correctly, see Fig. 27. Then fit the synchronizing ring on the main shaft. Select a locking ring which fits well into the groove and fit it.

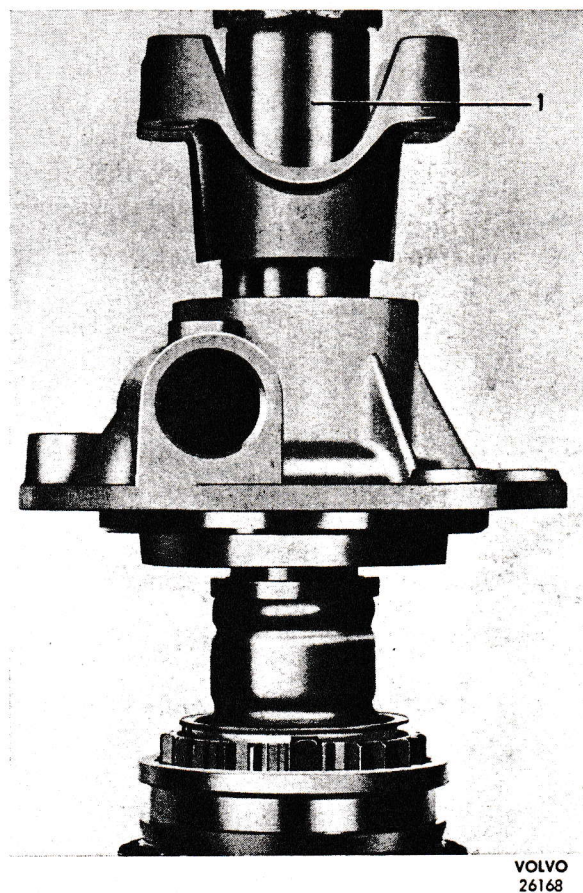


Fig. 28. Fitting rear cover, M 30.

1. Sleeve

M 40 Gearbox

1. Press the ball bearing into the rear cover, see Fig. 25, and fit the locking ring. There are different thicknesses of locking ring so select one which completely fills the locking ring groove.

2. Gearbox without overdrive:
Place the speedometer gear on the bearing in the rear cover. Press in the sealing ring with drift SVO 2413, see Fig. 26.
3. Fit the parts for 1st speed and 2nd speed synchronizer on the main shaft. Fit the spring rings correctly, see Fig. 27.
- 4a. Gearbox without overdrive:
Fit the synchronizing cone, 1st speed gear wheel and thrust washer. Place the rear cover on the shaft. Ensure that the speedometer gear is positioned correctly. Place on the flange. Use a sleeve which fits into the recess in the flange, press on the cover and flange, see Fig. 30. Place on the washer and nut for the flange. Use tool SVO 2409 as a counterhold on the flange and tighten the nut.
- 4b. Gearbox with overdrive (M 41):
See point 4b under M 30 gearbox, page 7.
5. Fit synchronizing cone, 2nd speed gear wheel and thrust washer on the shaft. Select a locking ring which fits well into the groove on the shaft and fit it.
6. Fit the thrust washer, 3rd speed gear wheel and synchronizing cone on the shaft. Assemble the 3rd and 4th speed synchroniz-

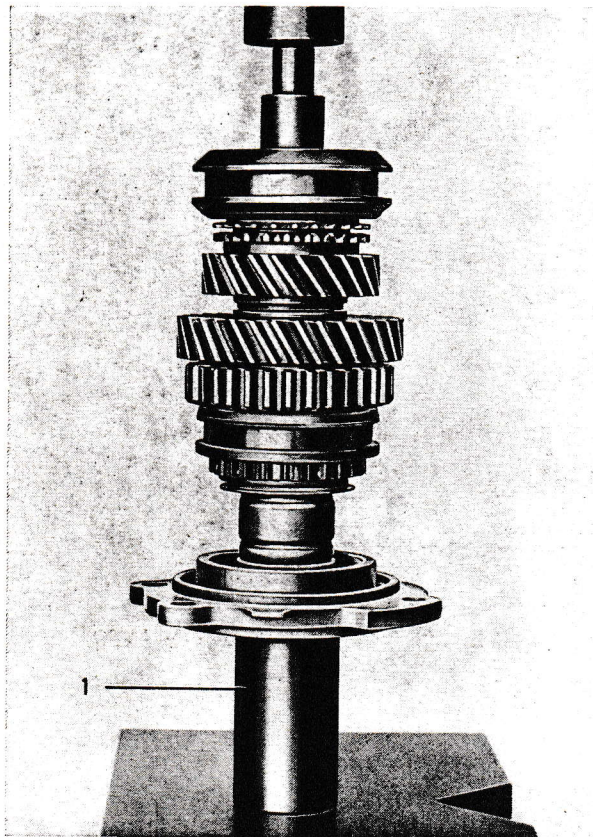
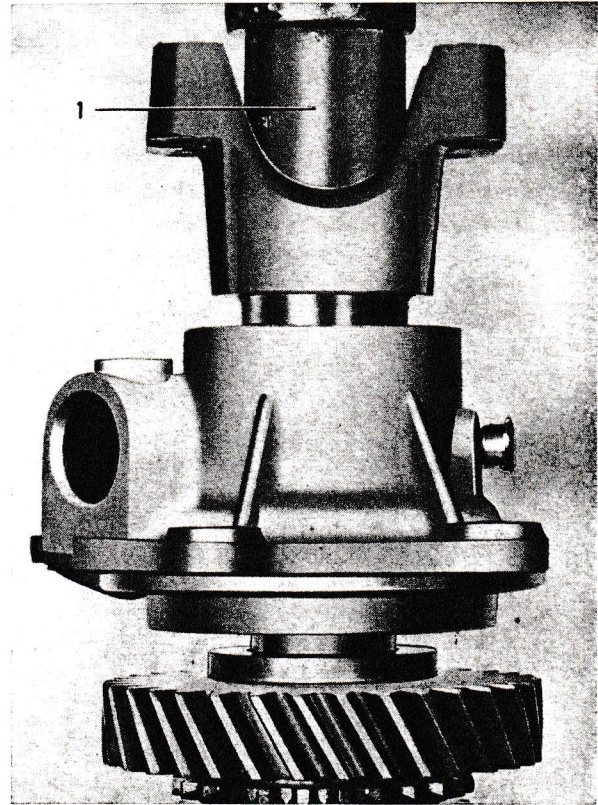


Fig. 29. Fitting rear cover.
1. Sleeve

VOLVO
26169

ing parts. Fit the spring rings correctly, see Fig. 27. Then fit the synchronizer on the main shaft. Select a locking ring of the correct thickness and fit it.



VOLVO
26170

Fig. 30. Fitting rear cover, M 40.
1. Sleeve

Assembling gearbox

- 1a. M 30 gearbox:
Fit the reverse gear, spacing sleeves and reverse shaft. Ensure that the groove in the reverse shaft is turned correctly.
- 1b. M 40 gearbox:
Fit the lever and guide stud. Fit the reverse gear and reverse shaft. Ensure that the groove in the reverse shaft is turned correctly.
2. Place mandrel SVO 2303 in the idler gear. Place in spacing washers and needles (24 in each bearing). Use grease to hold the needles and washers in position.
3. Fix the washers to the housing with grease, and guide them into position with SVO 2302, see Fig. 31. Lay the idler gear in the bottom of the housing.
4. Press the bearing onto the input shaft with the help of drift SVO 2412, see Fig. 32. Select a locking ring of suitable thickness and fit it. Place the 14 bearing rollers for the main shaft in position on the input

shaft. Use grease to hold the rollers in place. Press the input shaft into position in the housing. Press the sealing ring into the cover with drift SVO 2010. Then fit the cover over the input shaft.

5. Place the main shaft in the housing. Turn the rear cover so that the countershaft can be fitted.
6. Turn the gearbox upside down. Fit the countershaft from the rear. Hold against SVO 2303 with the hand. Ensure that the thrust washers do not loosen and fall down.

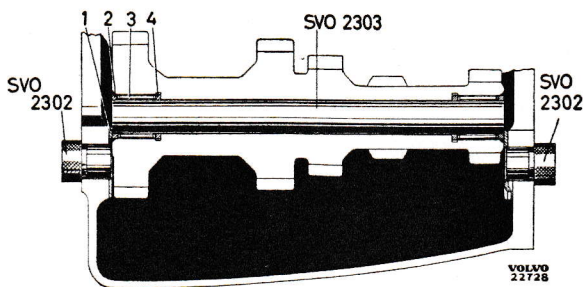


Fig. 31. Fitting idler gear.

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

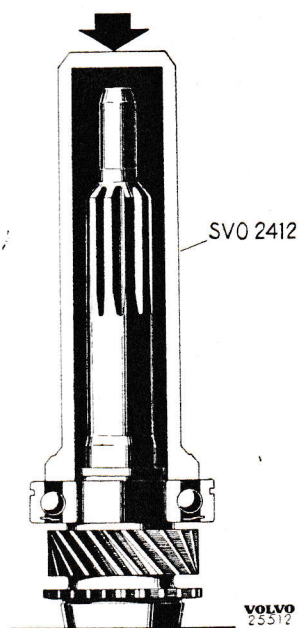


Fig. 32. Fitting ball bearing on input shaft.

- 7a. Gearboxes without overdrive:
Turn the rear cover correctly so that it locks the reverse shaft. Fit the bolts for the cover.
- 7b. Gearboxes with overdrive:
Turn the cover correctly so that it locks the reverse shaft. Ensure that the eccentric

for the overdrive oil pump is turned upwards. Fit the overdrive unit.

8. Fit selector rails and forks. Move over the selector fork to the rear position when fitting the pin. Use a new pin. Fit the cover over the selector rails.

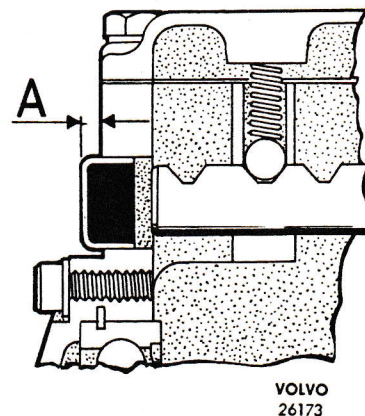


Fig. 33. Fitting end cap over selector rail.

A = approx. 4 mm (5/32")

Note. If the end caps in the front end of the housing have been removed, these should be fitted in the same way as previously, that is to say, the centre end cap should project about 4 mm (5/32") outside the face of the housing, see Fig. 33.

9. Place the interlock balls and springs in position, see Fig. 34. Fit the gearbox cover. Check that all gears engage and disengage freely.

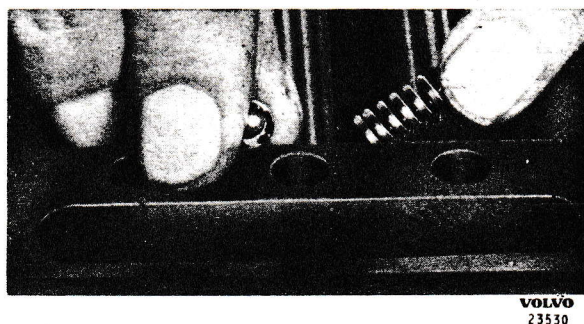


Fig. 34. Fitting interlock balls and springs.

Fitting

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

FAULT TRACING

FAULT	
REASON	REMEDY

Gears difficult to engage

<p>Clutch does not disengage. Oil too thick. Synchronizing mechanism worn. Bearing bushings or gears worn. Selector rail or gears binding.</p>	<p>Adjust or repair the clutch. See Part 2. Make sure that the correct oil is used. Replace the worn parts. Replace damaged or worn parts. Replace damaged or worn parts.</p>
--	---

One of the gears jumps out

<p>Worn bearings on shafts or gears. Worn grooves in selector rails or weak springs. Badly worn gears. Gearbox out of alignment with flywheel housing.</p> <p>Worn flywheel pilot bearing.</p>	<p>Fit new bearings or bushings. Replace damaged or worn parts. Replace any worn gears. Check the flywheel housing with a dial indicator gauge and adjust if necessary (see Part 2). Clean all contact surfaces. Replace the bearing.</p>
---	---

Noise

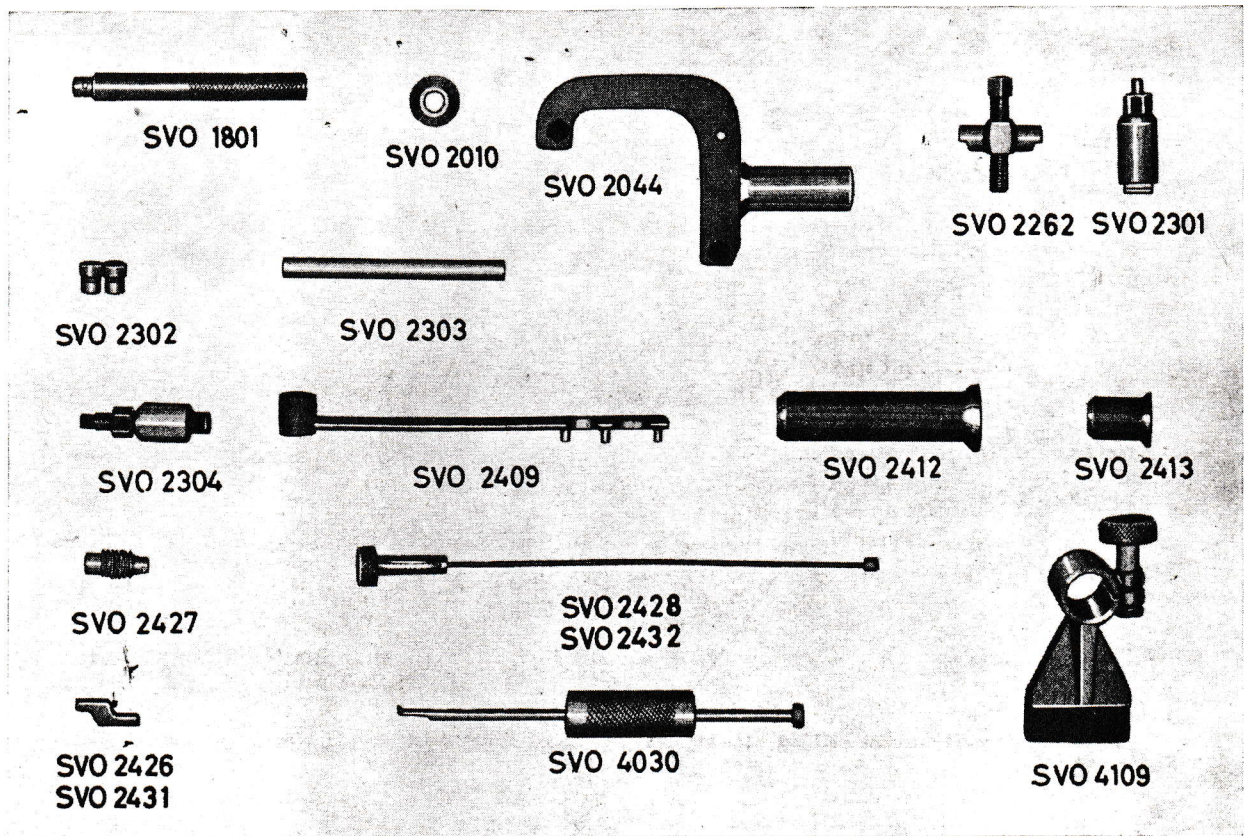
<p>Oil level too low. Worn or damaged bearings on shafts or gear wheels. Badly worn gear wheels.</p>	<p>Top up with oil as necessary. Replace the worn bearings or bushings.</p> <p>Replace the worn gear wheels.</p>
--	---

Oil leakage

<p>Sealing surface of flange worn. Rear sealing ring and bearing worn. Leakage between housing and rear cover. Leakage between housing and front bearing cover. Front sealing ring worn. Leakage between housing and cover.</p>	<p>Fit a new flange and sealing ring. Fit a new bearing and sealing ring. Fit a new paper gasket. Fit a new paper gasket. Clean out the return hole.</p> <p>Fit a new sealing ring in the front bearing cover. Fit a new cork gasket.</p>
--	---

TOOLS

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



VOLVO
26186

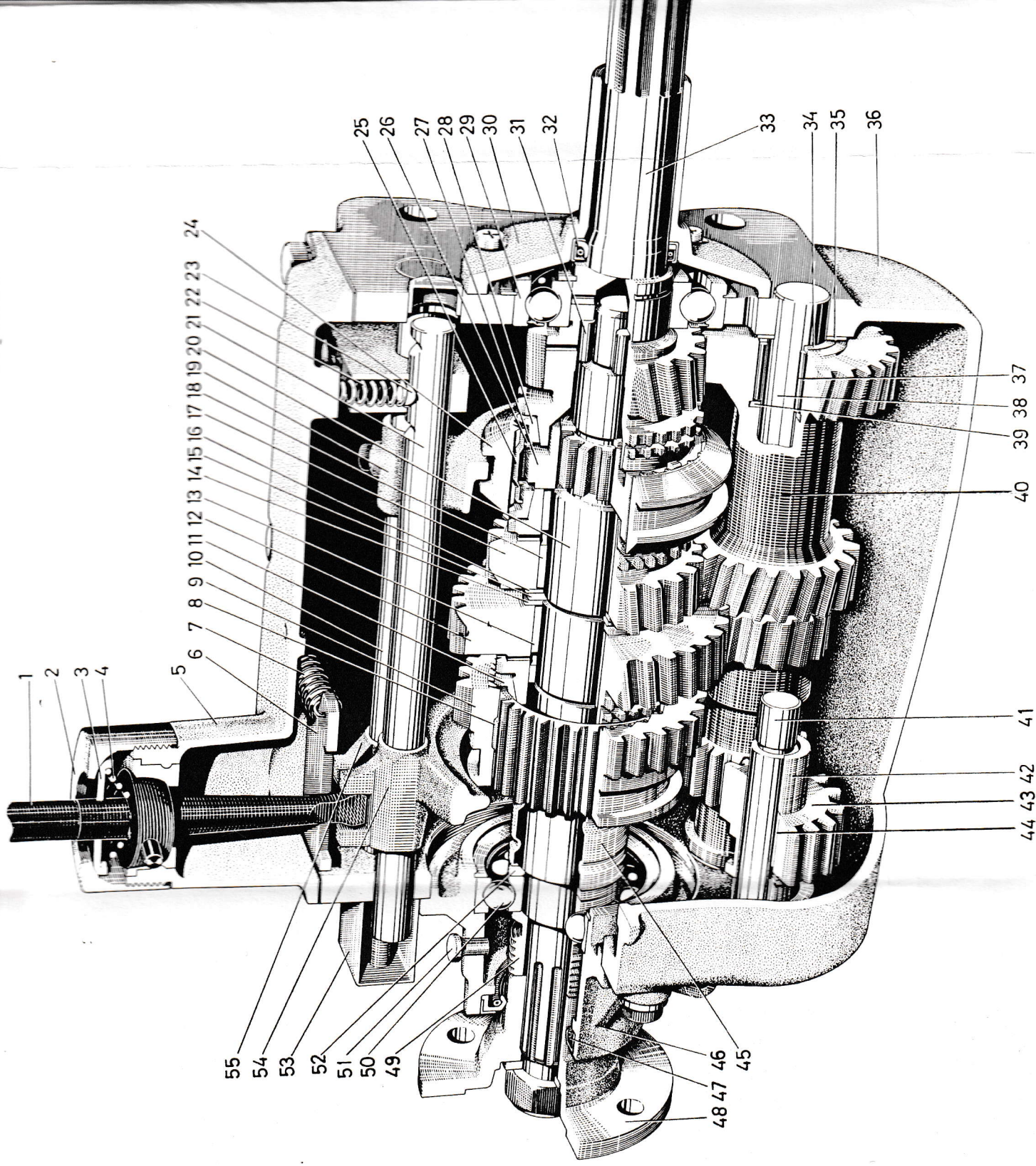
- | | | | |
|----------|---|----------|--|
| SVO 1801 | Standard handle 18×200 mm. | SVO 2413 | Tool for fitting sealing ring in rear cover. |
| SVO 2010 | Drift for fitting sealing ring in cover for input shaft. | SVO 2426 | Spanner for slackening and tightening gearbox bolts (used in connection with B 16 engine). |
| SVO 2044 | Jig for dismantling and assembling. | SVO 2427 | Ball joint connector for spanner SVO 2426. |
| SVO 2261 | Puller for flange on PV 444, 445, 544, P 210. (Not shown in the figure.) | SVO 2428 | Spanner for screwing in and out gearbox bolts (used in connection with B 16 engine). |
| SVO 2262 | Puller for flange on P 1200. | SVO 2431 | Spanner for slackening and tightening gearbox bolts (used in connection with B 18 engine). |
| SVO 2301 | Puller for removing reverse gear shaft. | SVO 2432 | Spanner for screwing in and out gearbox bolts (used in connection with B 18 engine). |
| SVO 2302 | Locating tool for thrust washer. Used together with SVO 2303 when fitting idler gear. | SVO 4030 | Puller for sealing ring on flange. |
| SVO 2303 | Locating tool for fitting idler gear. | SVO 4109 | Support for jig SVO 2044. |
| SVO 2304 | Press tool for fitting flange. | | |
| SVO 2409 | Counterhold for flange. | | |
| SVO 2412 | Tool for fitting bearing on input shaft in rear cover. | | |

SPECIFICATIONS

(Concerning gearboxes with overdrive (M 31, M 41), see also "P 1200, Part 3a").

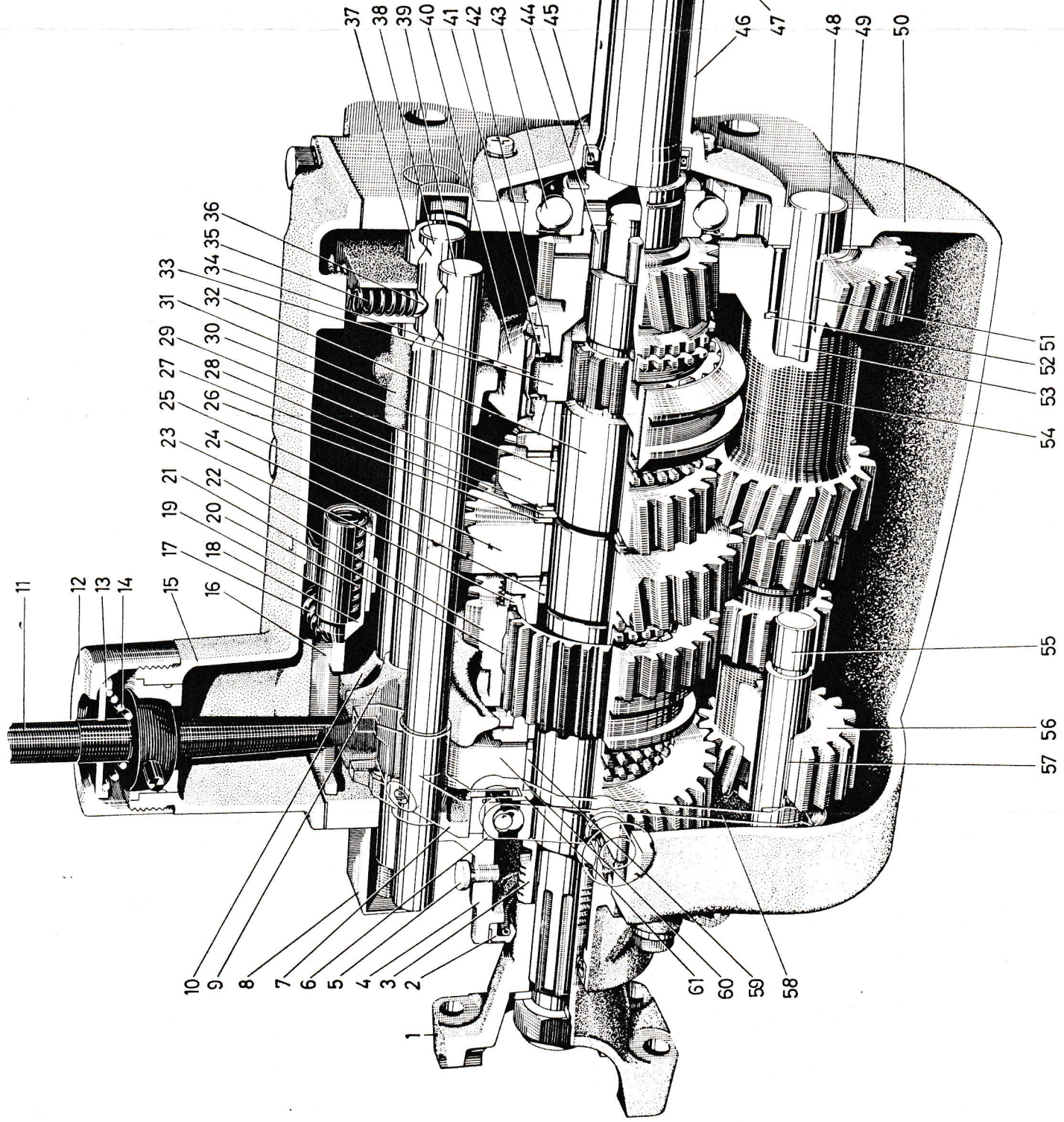
Type designation	M 30	M 40
Gear ratios:		
1st speed	3.13:1	3.13:1
2nd speed	1.55:1	1.99:1
3rd speed	1:1	1.36:1
4th speed	—	1:1
Reverse	3.25:1	3.25:1
Number of teeth on the different gears:		
Input shaft (main drive pinion)	19	19
Countershaft, drive gear	27	27
gear for 1st speed	15	15
" " 2nd speed	22	20
" " 3rd speed	—	23
" " Reverse	14	14
Main shaft, gear for 1st speed	33	33
" " 2nd speed	24	28
" " 3rd speed	—	22
" " Reverse	32	32
Reverse gear	19	19
Lubricant*	Gear oil	
viscosity	SAE 80	
Oil capacity*	0.75 litre (1 1/4 Imp. pints = 1 1/2 US pints.)	

* Concerning lubricant and oil capacity for gearboxes with overdrive, see "P 1200, Part 3a".



1. Gear lever
2. Cover
3. Washer
4. Spring
5. Cover
6. Sliding plate
7. Spring
8. Guide
9. Engaging sleeve and gear for reverse
10. Selector rail, 2nd and 3rd speeds
11. Synchronizing cone
12. Gear for 1st speed
13. Bushing
14. Thrust washer
15. Locking ring
16. Thrust washer
17. Gear for 2nd speed
18. Bushing
19. Selector fork for 2nd and 3rd speeds
20. Main shaft
21. Selector fork, 1st speed and reverse
22. Spring
23. Interlock ball
24. Engaging sleeve, 2nd and 3rd speeds
25. Guide
26. Spring
27. Synchronizer hub
28. Synchronizing cone
29. Ball bearing
30. Front cover
31. Roller bearing
32. Sealing ring
33. Input shaft
34. Spacing washer
35. Thrust washer
36. Housing
37. Needle bearing
38. Countershaft
39. Spacing washer
40. Idler wheel
41. Reverse shaft
42. Spacing sleeve
43. Reverse gear
44. Bushing
45. Spacing sleeve
46. Rear cover
47. Sealing ring
48. Flange
49. Speedometer gear
50. Ball bearing
51. Ventilation nipple
52. Thrust washer
53. Casing
54. Selector fork for 1st speed

Illustration I. M 3C Gearbox.



- 3. Speedometer gear
- 4. Rear cover
- 5. Ventilation nipple
- 6. Ball bearing
- 7. Carrier (X-ray picture)
- 8. Casing
- 9. Selector fork, 1st and 2nd speeds
- 10. Carrier
- 11. Gear lever
- 12. Casing
- 13. Washer
- 14. Spring
- 15. Cover
- 16. Sliding plate
- 17. Spring
- 18. Sleeve (reverse catch)
- 19. Sleeve
- 20. Spring
- 21. Guide
- 22. Engaging sleeve and gear for reverse
- 23. Synchronizing cone
- 24. Bushing
- 25. Gear for 2nd speed
- 26. Thrust washer
- 27. Locking ring
- 28. Thrust washer
- 29. Gear for 3rd speed
- 30. Bushing
- 31. Selector fork for 3rd and 4th speeds
- 32. Main shaft
- 33. Synchronizer hub
- 34. Guide
- 35. Spring
- 36. Interlock ball
- 37. Selector rail for 3rd and 4th speeds
- 38. Selector rail for 1st and 2nd speeds
- 39. Selector rail for reverse
- 40. Engaging sleeve
- 41. Spring
- 42. Synchronizing cone
- 43. Ball bearing
- 44. Roller bearing
- 45. Sealing ring
- 46. Front cover
- 47. Input shaft
- 48. Spacing washer
- 49. Thrust washer
- 50. Housing
- 51. Needle bearing
- 52. Spacing washer
- 53. Countershaft
- 54. Idler wheel
- 55. Reverse shaft
- 56. Reverse gear
- 57. Bushing

Illustration II. M 40 Gear-box.