

## GROUP 64

# STEERING GEAR

## DESCRIPTION

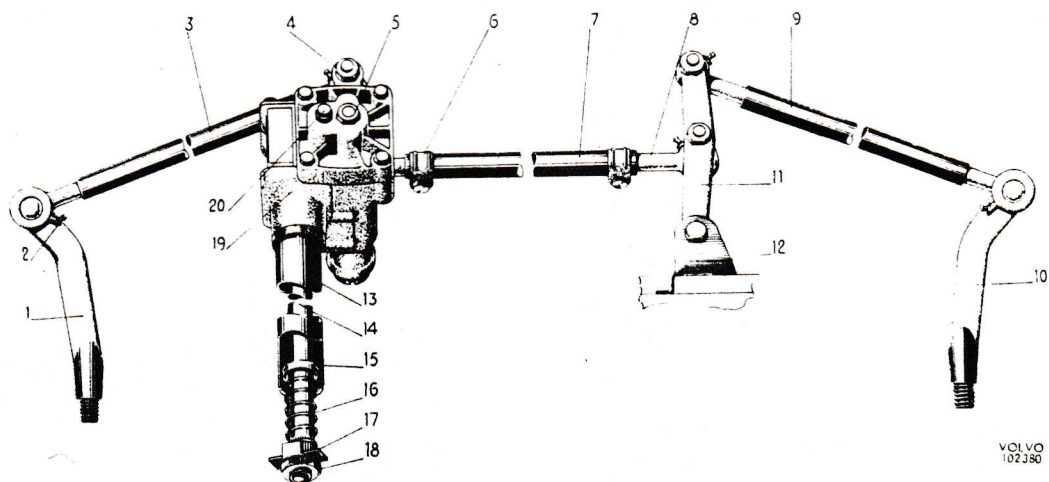


Fig. 23. Steering gear

- |  |  |                    |
|--|--|--------------------|
| 1. Left steering arm                     | 8. Ball joint                          | 15. Ball bearing   |
| 2. Grease nipple (early production only) | 9. Right steering rod with ball joints | 16. Spring         |
| 3. Left steering rod with ball joints    | 10. Right steering arm                 | 17. Locking washer |
| 4. Pitman arm                            | 11. Idler arm                          | 18. Nut            |
| 5. Cap nut over adjusting screw          | 12. Bracket for idler arm              | 19. Steering box   |
| 6. Clamp (locknut in late production)    | 13. Steering column jacket tube        | 20. Filling plug   |
| 7. Tie-rod, early production             | 14. Steering column                    |                    |

The construction of the steering gear is illustrated in Fig. 23.

When the steering is turned, the movement is transmitted through the steering column (14) to the steering box (20) and pitman arm (4). From here the movement is transmitted through the tie-rod (7), idler arm (11), steering rods (3 and 9) and steering arms (1 and 10) to the wheels.

The type of steering box is "Gemmer, cam and roller".

The turning circle is approx. 9.8—10.8 metres (34' 2"—35' 5") depending on the vehicle model and steering gear. With effect from PV 544 C and P 210 B, the rods are provided with plastic lined ball joints. This means that it is not necessary to lubricate them so that the ball joints concerned do not have grease nipples (2, Fig. 23).

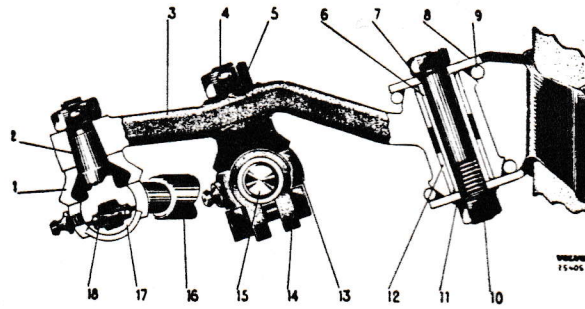


Fig. 24. Idler arm mounting, early production

- |                       |                      |                                  |
|-----------------------|----------------------|----------------------------------|
| 1. Rubber dust shield | 7. Bolt              | 13. Ball joint                   |
| 2. Ball stud          | 8. Bracket           | 14. Clamp                        |
| 3. Idler arm          | 9. Rubber dust cover | 15. Tie-rod                      |
| 4. Split pin          | 10. Nut              | 16. Steering rod with ball joint |
| 5. Castle nut         | 11. Washer           | 17. Bearing unit                 |
| 6. Spacing sleeve     | 12. Bush             | 18. Spring                       |

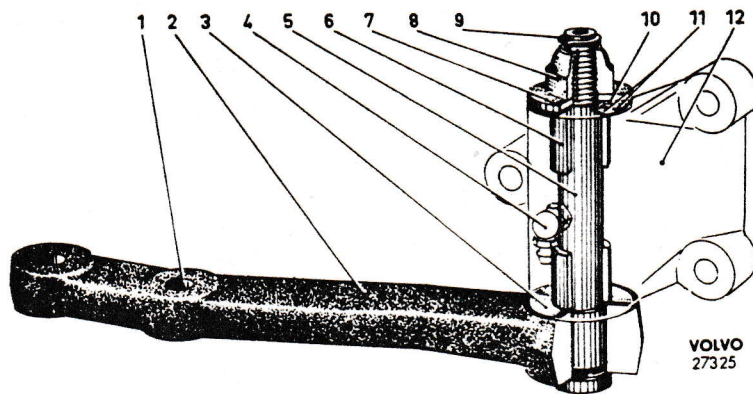
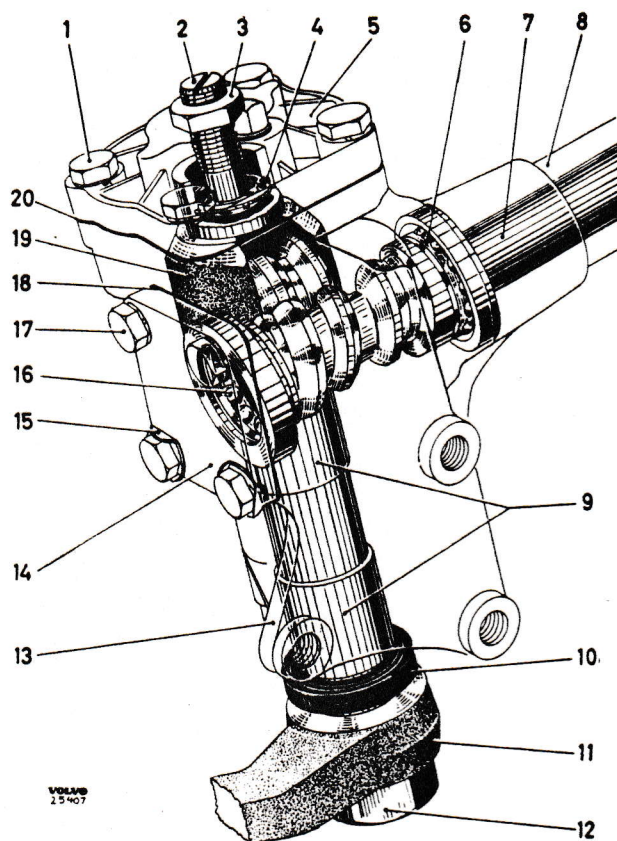


Fig. 25. Idler arm mounting, late production

- |                            |                             |
|----------------------------|-----------------------------|
| 1. Hole for tie-rod        | 7. Washer                   |
| 2. Idler arm               | 8. Nut                      |
| 3. Washer (methane rubber) | 9. Locking ring             |
| 4. Grease nipple           | 10. Washer (methane rubber) |
| 5. Pin                     | 11. Adjusting shims         |
| 6. Bush                    | 12. Bracket                 |



1. Bolt
2. Adjusting screw
3. Locknut
4. Locking ring
5. Upper cover
6. Upper ball bearing
7. Steering column
8. Jacket tube
9. Pitman arm shaft bush
10. Sealing ring
11. Pitman arm
12. Nut
13. Steering box housing
14. Lower cover
15. Locking washer
16. Lower ball bearing
17. Bolt
18. Adjusting shims
19. Pitman arm shaft
20. Gasket

Fig. 26. Steering box, type Gemmer

## REPAIR INSTRUCTIONS

### REPLACING THE STEERING WHEEL

1. Remove the fuse for the horn.
2. Unscrew the two attaching bolts, turn the horn ring slightly and lift it up. Bend down the locking washer and remove the steering wheel nut and washer.
3. **Check that the direction indicator switch is in the neutral position.** Pull off the steering wheel with puller SVO 2325, see Fig. 27.
4. Fit the new steering wheel. Check that the switch ins in the neutral position and that corresponding points on the steering wheel spokes come horizontally when the front wheels are pointing straight forward. Place on the locking washer and tighten the steering wheel nut to a torque of 3.5—5 kgm (25—35 lb.ft.). Lock the nut.

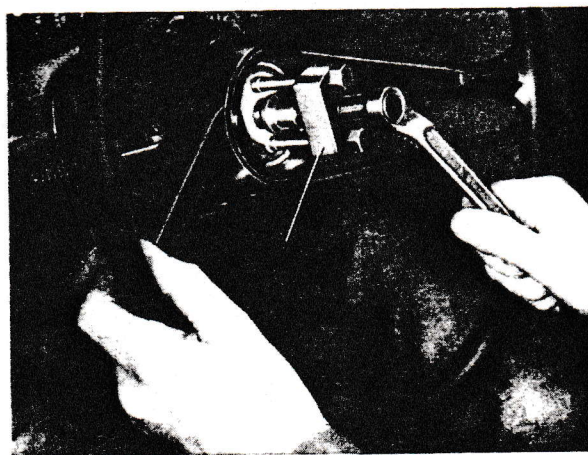


Fig. 27. Removing the steering wheel

A=SVO 2325



Fig. 28. Removing pitman arm

## STEERING BOX

### Removing

1. Remove the steering wheel, see points 1—3 under "Replacing the steering wheel".
2. Disconnect the horn lead on the steering box. Pull the lead with bush, spring and cover, up through the steering column. Unscrew the screw and remove the housing for the direction indicator switch in cases where this is fitted.
3. Remove the jacket tube support under the instrument panel. Lift the driving seat out of the way.
4. Screw off the nut for the pitman arm. Pull off the pitman arm from the pitman arm shaft with puller SVO 2370 (Fig. 28).
5. Disconnect the steering box from the body (on P 210, the frame) and lift out the steering box with jacket forwards and upwards.

### Dismantling

1. Wash the steering box clean externally.
2. Remove the bolts for the upper cover, pull up the cover and pitman arm shaft a little and drain off the oil. Pull out the cover and pitman arm shaft.

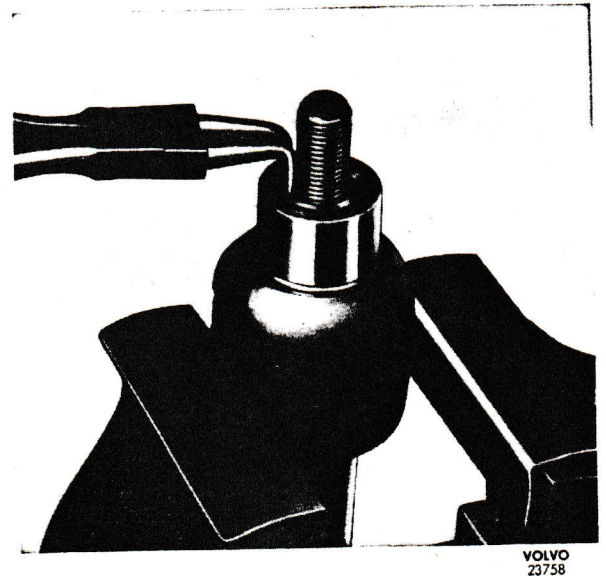


Fig. 29. Removing adjusting screw

3. Remove the lower cover and take care of the adjusting shims. Tap the steering column carefully and pull it out with the worm and bearings.
4. Slacken the locknut (on early production, the cap and locking washer) and screw the adjusting screw out of the cover. The adjusting screw can be removed from the pitman arm shaft after the locking ring has been removed, see Fig. 29.

### Inspecting

Clean all parts in white spirit.

Check the pitman arm shaft. The roller must not be scratched, scored or worn on the contact surfaces or be loose in the pitman arm shaft. If so, the pitman arm shaft must be replaced.

Examine the steering worm contact surfaces against the roller and the inner races of the ball bearings. If there are any scratches, scoring or heavy wear, the steering worm with steering column must be replaced.

Examine the outer rings and balls of the bearings. Any bearing parts which are scored or otherwise damaged must be replaced. The upper bearing outer ring is removed with puller SVO 1819.

Check to see whether the pitman arm shaft is loose in the bushes. If so, replace bushings. The bushes are removed independently in either direction with puller SVO 1819, when the sealing ring also comes out, see Fig. 30.

The bush in the light alloy cover is cast in so that the complete cover must be replaced.

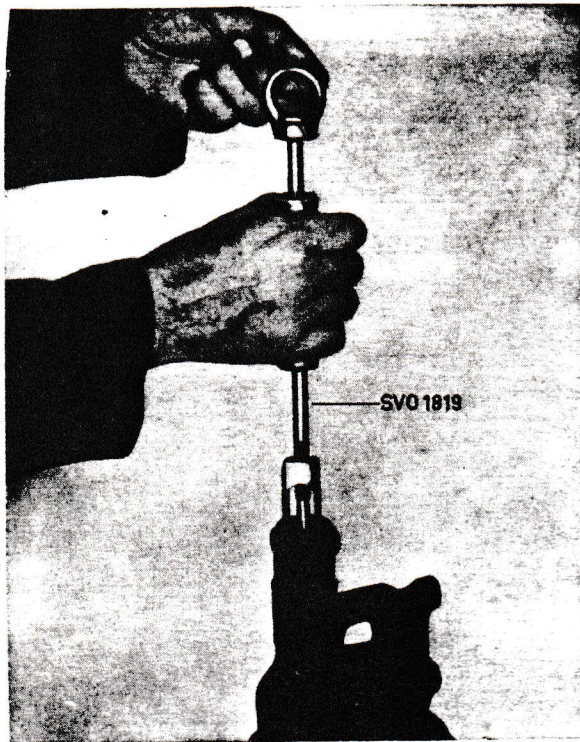


Fig. 30. Removing pitman arm shaft bush and sealing ring

If the pressed-in jacket tube has to be separated from the housing for any reason, this is pressed out with a suitable drift.

The jacket tube bearing is removed with puller SVO 4078.

### Assembling

1. Press the pitman arm shaft bushes into the housing from each direction with tool SVO 2228 and SVO 1801, see Fig. 31. In late production steering boxes the upper of the original bushings is provided with oil grooves. In this way the bushings receive slightly better lubrication when they are new. Such oil grooves are not, however, necessary and in order to avoid the risk of faulty fitting the bushes are alike and without oil grooves when they are sold separately.
2. Ream the bushes in the housing with reamer SVO 2225. First insert the reamer in the housing after which the guide SVO 2254 is screwed on and reaming can begin, see Fig. 32. After reaming all metal chippings must be removed from the steering box. In the case of light alloy covers, the bush is ready machined.
3. Fit the sealing ring for the pitman arm shaft with drift SVO 2227.

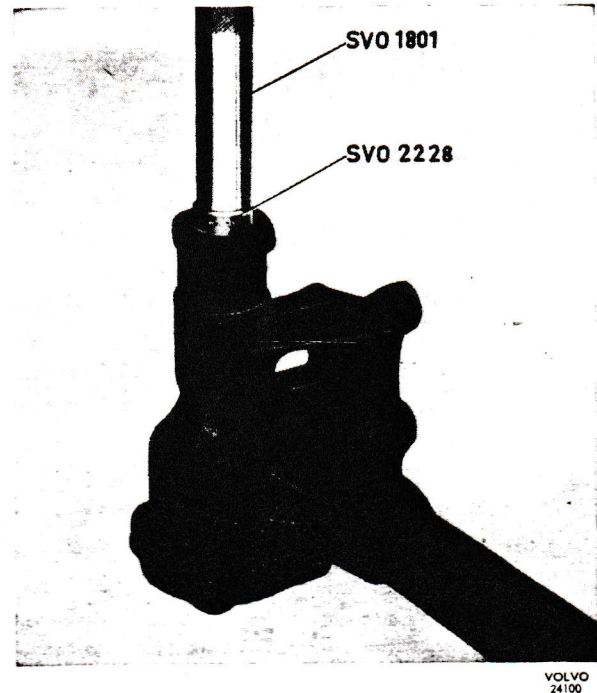


Fig. 31. Fitting bush

4. If the upper bearing outer ring has been removed, it is pressed in with drift SVO 4113. If the jacket tube on a steering box without clamp has been removed, this is pressed into the steering box housing sufficiently far so that

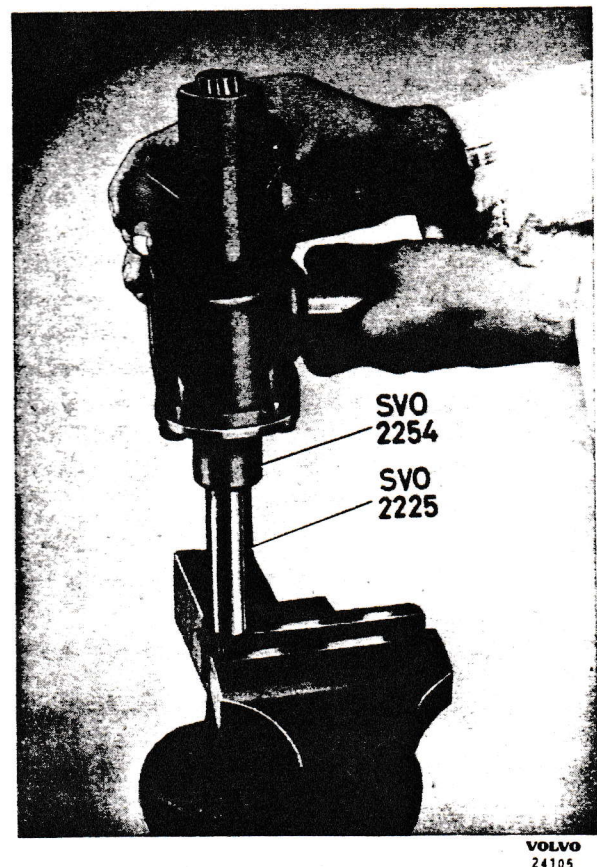


Fig. 32. Reaming bushes

after the jacket tube bearing and steering column have been fitted, the steering column should project 77—79 mm. (3.03—3.11") outside the jacket tube, see Fig. 33.

5. Place the steering column with bearings in the steering box housing. Fit the lower cover with adjusting shims of the same thickness as were there previously. Tighten the bolts and check that the steering column moves easily without any play. When the bearings are correctly adjusted, a torque of maximum 1—2.5 kg/cm (0.87—2.17 lb.in.) should be required to turn the steering column.
6. Fit the adjusting screw, washer and locking ring in the pitman arm shaft. The axial play in the adjusting screw should be as small as possible and should not exceed 0.05 mm (0.002"). The play is reduced by replacing the washer with a thicker one. The adjusting screw must, however, be easy to turn after fitting.
7. Apply the protecting sleeve SVO 2199 as shown in Fig. 34 and fit the pitman arm shaft into the steering box housing. Apply a few drops of oil to the adjusting screw in the pitman arm shaft.
8. Fit the cover and gasket over the pitman arm shaft. Screw up the adjusting screw for enough so that the pitman arm shaft is not pinched when the attaching bolts are tightened.
9. Place on the steering wheel and attach a spring balance to the circumference of the wheel, see Fig. 35. Screw down the adjusting screw until a pull of 0.4—0.7 kg, (0.88—1.54 lb.) is required to turn the steering wheel past the centre position. When the correct setting has been obtained, the locking washer and cap nut are fitted in the case of a cast iron cover. There are two different types of lock washer in order to permit fine adjustment of the adjusting screw. In the case of a light alloy cover, the adjusting screw is locked with a nut. Repeat the test after locking.
10. Fill up with oil, see "Specifications". Due to the viscosity of the oil the whole quantity can-

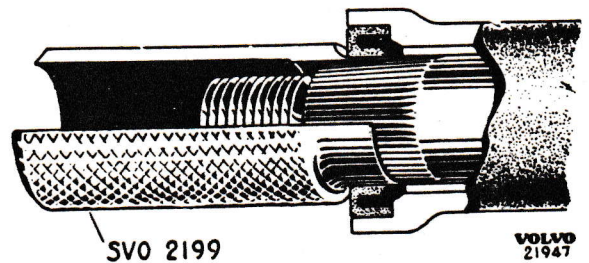


Fig. 34. Fitting pitman arm shaft

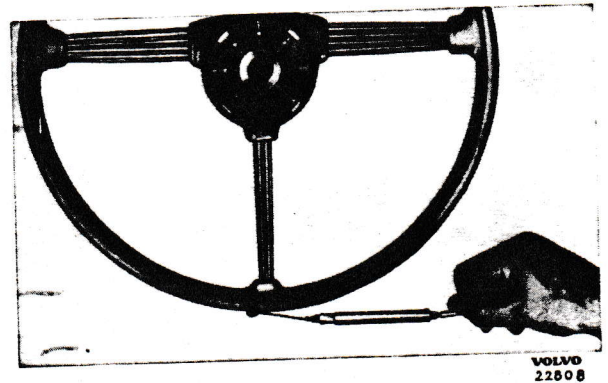


Fig. 35. Measuring steering wheel torque

not as a rule be filled in at once. First fill up as far as possible and then check the level after about 15 minutes, topping up as necessary.

To obtain the best steering properties, a new steering gear should be adjusted after the first 5 000—10 000 km (3 000—6 000 miles). Adjustment is carried out according to point 9 above and with the pitman arm removed.

### Fitting

1. Insert the jacket tube through the hole in the bulkhead (do not forget to fit the rubber seal). Place the steering box in position and bolt it onto the body (on P 210, to the frame).
2. Fit the support for the jacket tube but do not tighten the bolts.
3. Turn the steering column to the centre position (count the number of turns) and set the wheels to point straight forward. In this position fit the pitman arm onto the pitman arm shaft. On those types with a mark on the pitman arm, this should coincide with the mark on the pitman arm shaft. Fit the washer (certain types), nut and split pin (certain types). The nut should be tightened to a torque of 13.5—16.5 kgm (100—120 lb.ft.).
4. Fit the direction indicator switch housing if there is one.

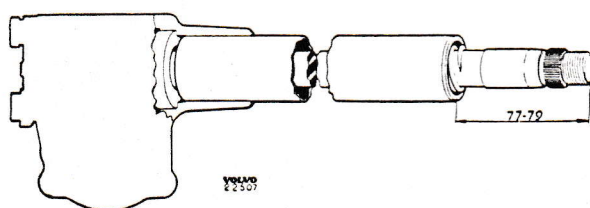


Fig. 33. Fitting jacket tube.

5. Place the washer and spring on the steering column. Fit the steering wheel so that the spokes come horizontally. Fit the lock washer (late production) and nut, which should be tightened to a torque of 3.5—5.0 kgm 25—35 lb.ft.).
6. On types without direction indicator switch housing, the jacket tube is now slid up under the steering wheel hub and the clamp tightened.
7. Tighten the bolts for the support under the instrument panel.
8. Move up the direction indicator switch housing so that a gap of 1—1.5 mm (0.04—0.06") is obtained between the upper edge of the housing and the steering wheel hub.
9. Fit the horn lead and horn ring with locking screws. Connect together the leads on the steering box. Fit the fuse.

### Checking pitman arm adjustment

On steering gears with a marked pitman arm and pitman arm shaft, check that the marks coincide with each other. On other steering gears the pitman arm adjustment is checked as follows.

Lift up the front end of the vehicle so that the wheels are free. Turn the steering column to the centre position (count the number of turns). Lower the vehicle. If the vehicle is correctly loaded, the wheels should now point straight forward. If the wheels do not come straight forward, remove the pitman arm from the pitman shaft. Use puller SVO 2370 (Fig. 28). Then set the left wheel straight forwards and re-fit the pitman arm. The steering column should be in the centre position. Tighten the nut to a torque of 13.5—16.5 kgm (100—120 lb.ft.).

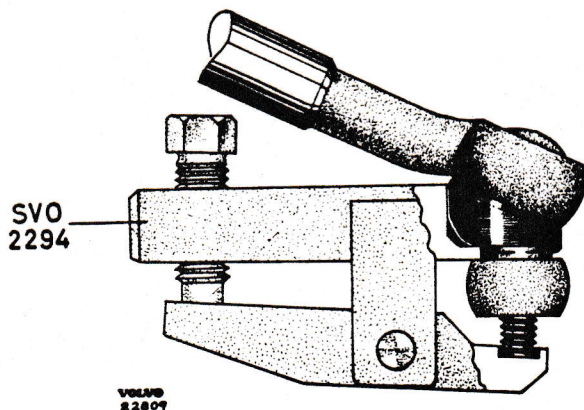


Fig. 36. Removing steering rod

If the steering wheel spokes do not come horizontally, adjust as described under "Replacing the steering wheel".

### RECONDITIONING STEERING ROD AND TIE-ROD

The steering rod and tie-rod must not be straightened, but any parts which are bent or otherwise damaged must be replaced.

### Replacing ball joints

The ball joints cannot be dismantled or adjusted, so that when worn or damaged, they must be replaced.

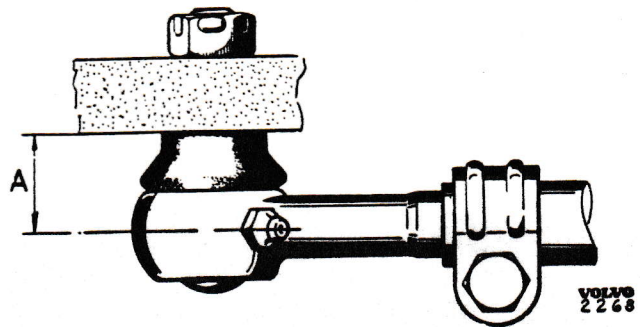


Fig. 37. Ball joint for tie-rod

The steering rod ball joints are made integrally with the steering rods so that the complete rod must be replaced. If the steering rod is to be removed with the wheel in position, the ball joint on the pitman arm and idler arm respectively should first be removed as shown in Fig. 15, see point 5, page 9. The steering rod is then turned forwards and upwards and the tool placed on the ball joint as shown in Fig. 36.

The tie-rod ball joints can be replaced individually. When doing so, first disconnect the ball joint from the pitman arm or the idler arm respectively (see point 5, Page 9). The clamping bolt or locknut respectively on the tie-rod is then slackened and the ball joint screwed out. The new ball joint should be screwed in an equal number of turns so as to facilitate adjusting the toe-in. The nut for the clamp (early production) is tightened to a torque of 1.1—1.4 kgm (8—10 lb.ft.). On types with a locknut on the ball joint, this nut is tightened to a torque of 7.5—9 kgm (55—65 lb.ft.).

If late production ball joints (A, Fig. 37=14 mm) are fitted onto an early production tie-rod (A=21 mm), the ball joints on both sides should be replaced with late production ones.

When fitting, the ball joint is turned so that the split pin hole comes across the longitudinal direction of the rod. Tighten the castle nut for the ball joint to a torque of 3.2—3.8 kgm (23—27 lb.ft.). Lubricate the ball joints if they are of the type with grease nipples. After fitting new parts, check the toe-in, see under the heading "Wheel Alignment".

## RECONDITIONING IDLER ARM MOUNTING

### Early production

1. Remove the split pin and nut for both the ball joints on the idler arm. Screw back the tensioning screw on tool SVO 2294 and place the tool on the ball joint as shown in Fig. 15. Press in the tool properly and ensure that the thread of the ball joints fits into the countersink of the tool. Screw in the tensioning screw until the ball joint releases.
2. Pull over the dust cover (9, Fig. 24) inwards and remove the bolt (7). Pull out the idler arm.
3. Screw out the grease nipple. Press out both bushings with tool SVO 4025 and backing ring SVO 4089, (see Fig. 38).
4. Press in the new bushes in the same way. The bushes should be flush with the outer side, see Fig. 24.
5. Ream the bushes to a light push fit compared with a new spacing sleeve (6).
6. Fit the grease nipple. Place the idler arm with spacing sleeve in position and fit the bolt, washer and nut, see Fig. 24. Check that the idler arm turns easily. Pull the dust cover back on again.
7. Re-fit the ball joints. Tighten the castle nuts to a torque of 3.2—3.8 kgm (23—27 lb.ft.). Lubricate the bushes and ball joints with chassis grease

### Late production

#### REMOVING

Remove the split pin and nut for both the ball joints on the idler arm. Screw back the tensioning screw on tool SVO 2294 and place the tool on the ball joint as shown in Fig. 15. Press in the tool properly and make sure that the thread on the ball joint fits into the countersink on the tool. Screw in

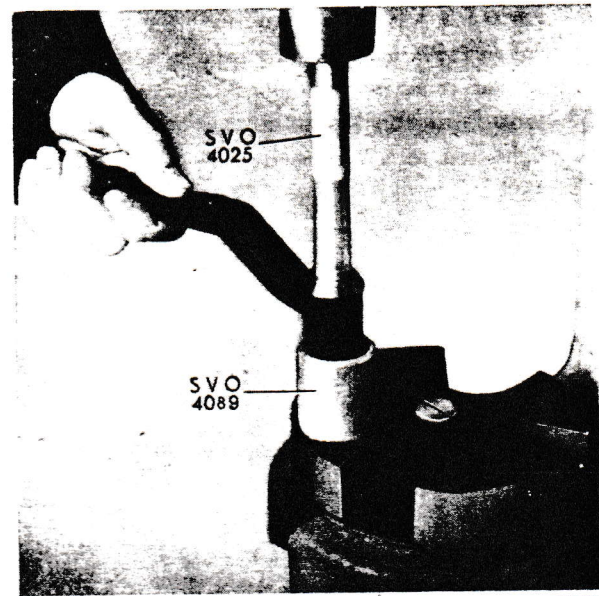


Fig. 38. Removing bushings in idler arm, early production

the tensioning screw until the ball joint releases. Remove the three attaching bolts of the bracket and lift off the bracket with idler arm.

#### DISMANTLING

Remove the locking ring (9, Fig. 25) and nut (8). On an early production pin the nut is locked with a washer. Pull out the idler arm (2) with pin (5) and remove the washers. Press out the bushes with the help of drift SVO 2498. If the pin is to be separated from the idler arm, it is pressed out.

#### INSPECTING

Clean all parts and inspect them. Any damaged parts or those which show signs of wear should be replaced.

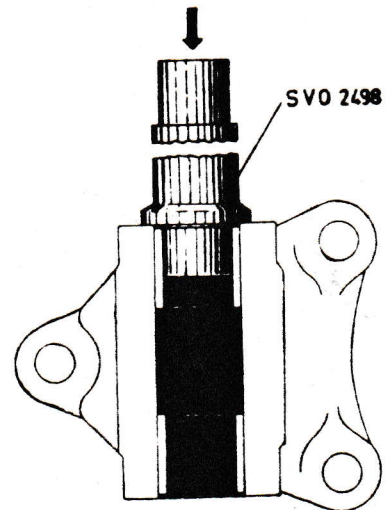
#### ASSEMBLING

1. Press in the new bushings 0.3—0.5 mm (0.012—0.02") inside the outer face with the help of drift SVO 2498, see Fig. 39. Ream the bushes with reamer SVO 4153. Clean the bracket and check the fit of the pin in the bushes. The pin should move easily but without any noticeable play.
2. Press the pin (5, Fig. 25) into the idler arm (2). Coat the washer (3) with a thin coating of chassis grease and place it on the pin. Fit the pin into the bracket. Fit the adjusting shims (11), the greased washer (10) and the washer (7). Fit the nut (8) and locking ring (9) or locking washer respectively. Tighten the nut to a torque of 7 kgm (50 lb.ft.).

3. After assembling there must be no play in the mounting. When correctly adjusted, a turning torque of  $15 \pm 5$  kgcm ( $13 \pm 4.33$  lb.ft.) is required. This means that when pulled at right-angles by means of a spring balance attached to the tie rod hole (1) in the idler arm, a reading of 0.7—1.3 kg (1.54—2.87 lb.) should be obtained. If this check does not give this result, the mounting should be dismantled and adjusted by means of shims of suitable thickness.

#### FITTING

Fit the bracket into place and tighten the attaching bolt well. Fit the ball joints and tighten their castle nuts to a torque of 3.2—3.7 kgm (23—27 lb. ft.) and lock them with split pins.



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Fig. 39 Fitting bushes in idler arm, late production

# FAULT TRACING

REASON	REMEDY
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## THE VEHICLE WANDERS

<p>Incorrect caster. Excessive or insufficient play in the steering mechanism. The steering rod ball joints worn or binding. Incorrect toe-in. Control arm system stiff. Tyres too soft. Play in rear suspension of vehicle.</p>	<p>Check and adjust caster. Adjust the steering mechanism.</p> <p>Check the ball joints and replace any that are worn. Check and adjust toe-in. Lubricate thoroughly. Replace any damaged parts. Change the tyres. Replace the necessary parts.</p>
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## THE VEHICLE PULLS TO ONE SIDE

<p>Uneven tyre pressure. The front springs are fatigued or have different heights. One of the roller bearings too stiff.</p> <p>Faulty tracking.</p> <p>Dragging brake. Bent steering rod. Incorrect camber.</p>	<p>Adjust the tyre pressure. Remove and check the springs.</p> <p>Check the bearings. Replace any damaged bearings and adjust in accordance with the instructions on pages 4—5. Check-measure the body (the frame on PV 445) and straighten if necessary. Adjust brake. Replace a damaged rod. Check and adjust the camber.</p>
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## HARD OR STIFF STEERING

<p>Tyre pressure too low. Front end insufficiently lubricated. Excessive caster. Steering mechanism adjusted too tightly. Insufficient or unsuitable lubricant in the steering box. Damaged bearing in steering box or jacket tube. Damaged thrust bearing in steering knuckles. Damaged front axle member or body.</p>	<p>Adjust the tyre pressure. Lubricate the front end. Adjust the caster. Adjust the steering mechanism. Top up or change the oil.</p> <p>Replace any damaged bearing. Replace any damaged bearing. Straighten or replace any damaged parts.</p>
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## FRONT WHEEL SHIMMY

<p>Wheels out-of-balance or warped. One of the brake drums worn out-of-round. Insufficient tyre pressure. Damaged steering rod. Loose or worn front wheel bearings.</p> <p>Incorrect wheel alignment.</p>	<p>Balance the wheels and align if necessary. See part 5. Adjust the tyre pressure. Replace damaged rod. Remove the wheel and hub. Examine the bearing races. If any parts is damaged, the complete bearing must be replaced. Adjust the wheel alignment.</p>
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**SHOCKS AND JARRING IN THE STEERING WHEEL**

Excessive play in steering mechanism.

Unsuitable or insufficient lubricant in the steering box.

Front wheel bearings loose.

Steering rod ball joints loose.

Pitman arm incorrectly fitted.

Wheels out-of-balance or warped.

Steering wheel or steering box loose.

Idler arm loose.

Bushes in shock absorber anchorages worn or anchorages loose.

Shock absorbers not functioning.

Adjust or if necessary recondition the steering mechanism.

Check the oil. Concerning oil grades, see "Specifications".

See under the heading "Front wheel bearings"

Replace loose ball joints.

See page 19.

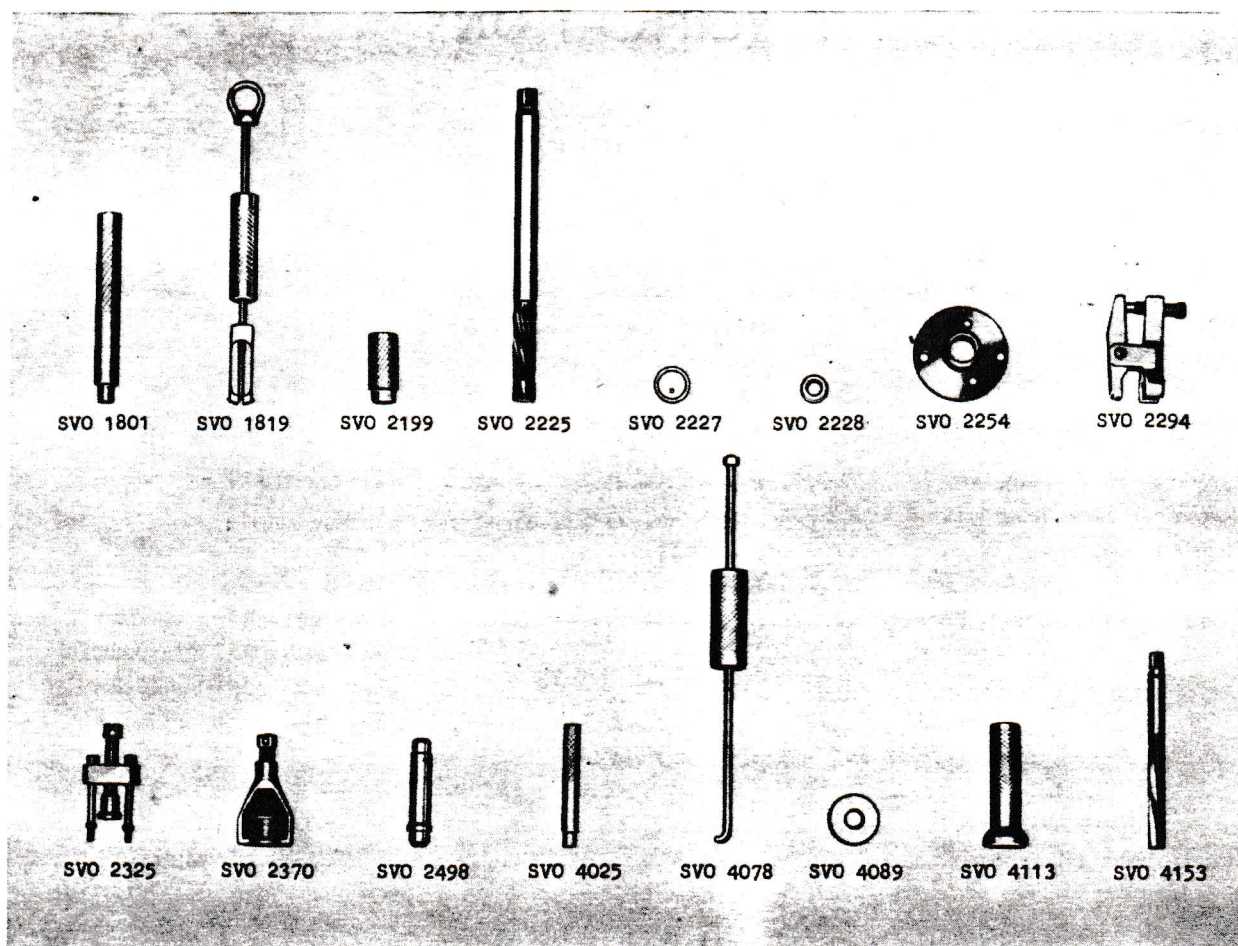
Balance and align the wheels if necessary.

Tighten the steering wheel or steering box respectively.

Tighten or if necessary replace the bushings.

Replace any necessary parts.

Replace the shock absorbers.



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### STEERING GEAR

- |          |   |          |  |
|----------|---|----------|--|
| SVO 1801 | Standard handle   | SVO 2370 | Puller for pitman arm                                      |
| SVO 1819 | Puller for upper bearing outer ring and pitman arm shaft bush | SVO 2498 | Drift for removing and fitting bushes in relay arm bracket |
| SVO 2199 | Protecting sleeve for seal when fitting pitman arm shaft      | SVO 4025 | Drift for removing and fitting relay arm bush              |
| SVO 2225 | Reamer for pitman arm shaft bushes                            | SVO 4078 | Puller for bearing in jacket tube                          |
| SVO 2227 | Fitting drift for seal  | SVO 4089 | Cushion ring for removing relay arm bush                   |
| SVO 2228 | Drift for fitting of pitman arm shaft bush                    | SVO 4113 | Drift for fitting upper bearing outer ring                 |
| SVO 2254 | Guide for reamer SVO 2225                                     | SVO 4153 | Reamer for bush in relay arm bracket                       |
| SVO 2294 | Removal tool for ball joint                                   |          |  |
| SVO 2325 | Steering wheel puller   |          |  |