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GROUP 60

WHEEL ALIGNMENT

In order for the vehicle to have good steering properties and minimum tyre wear, the front wheels must have certain, pre-determined settings which are generally known as wheel alignment. This includes caster, camber, king pin inclination, toe-out and toe-in.

CASTER

This refers to the longitudinal inclination of the king pin (forwards or backwards) (A, Fig. 1). This means easy steering since the wheels have a tendency to maintain the straight-forward position.

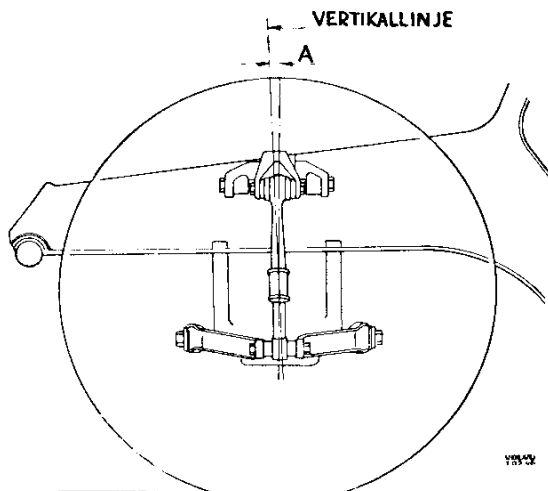


Fig. 1. Caster
Vertikallinje = Vertical line

CAMBER

This refers to the inwards or outward inclination of the wheel. Camber is reckoned to be positive if the wheel is inclined outwards and negative if it is inclined inwards. Positive camber is shown at C in Fig. 2. Faulty camber means uneven tyre wear.

KING PIN INCLINATION

This refers to the inward inclination of the king pin (B, Fig. 2). King pin inclination means that the centre lines of the king pin and the wheel approach each other towards ground level. The wheel is thus easier to turn. The king pin inclination also influences the tendency of the wheels to run straight ahead since the vehicle is lifted slightly when the steering wheel is turned.

TOE-OUT

When driving round a curve, the wheels have varying radii of rotation. In order to have the same turning centre with resulting minimum tyre wear, the front wheels must be turned to a varying extent. This relationship, the toe-out, is determined by the construction of the steering rods and steering arms. See Fig. 3.

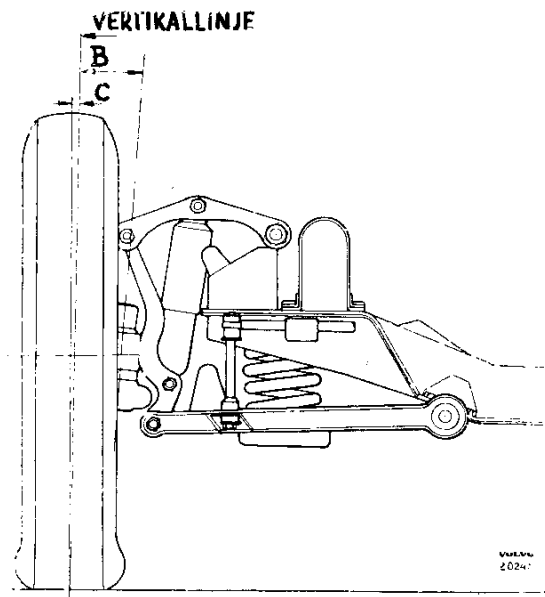


Fig. 2. Camber and king pin inclination
Vertikallinje = Vertical line

TOE-IN

The difference in the distances (E and G, Fig. 3) between the wheels measured at hub height at the rear and front of the tyres is called toe-in. The purpose of toe-in is to reduce tyre wear.

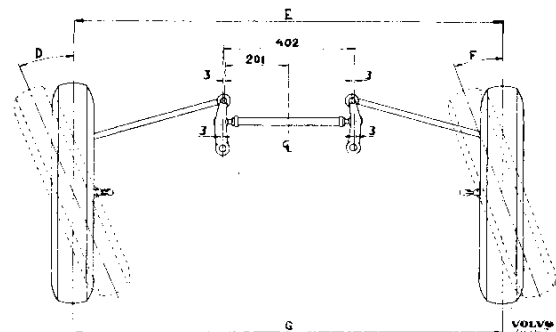


Fig. 3. Toe-out

MEASURING AND ADJUSTING WHEEL ALIGNMENT

Wheel alignment is measured by means of special instruments of which many different types are available. For this reason, no general instructions concerning the procedures to be adopted are given, with the exception of toe-out and toe-in. The principle of measurement is that camber is measured directly when the wheels are in the straight-forward position. Caster and king pin inclination cannot be measured directly. Instead, measurements of the angular difference are carried out on the instrument when the wheels are turned from 20° outwards to 20° inwards.

Most types of modern measuring tools for wheel alignment require that the wheels are locked by means of a pedal jack or similar device. This is not sufficient on vehicles equipped with Duo-Servo type brakes since the brake shoes in this system have a certain amount of reciprocating movement. On such vehicles, therefore, the brake drum should be locked mechanically to the brake backing plate when measuring. This can be done by applying welding pliers between the drum and brake backing plate on each front wheel (see Fig. 4), when it is not necessary to use a pedal jack.

When carrying out wheel alignment measurements, always follow the instructions given with the measuring instruments concerned.

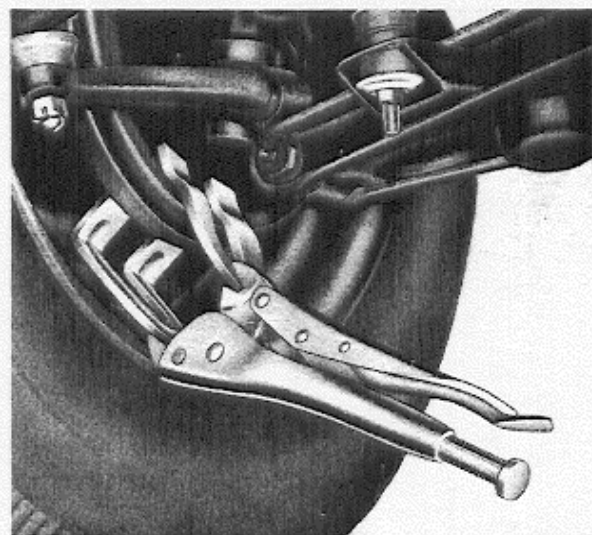
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Fig. 4. Locking the brake drum

Measures to be taken before adjusting wheel alignment

Before any adjustments are made, the following points must be checked and any faults corrected.

1. Check the tyre pressure on all wheels.
2. Check that the front wheel tyres are equally worn. If not, change around with a rear wheel or the spare wheel.
3. Check that the wheel warp and out-of-roundness do not exceed 2.5 mm (3/32"), and that the radial throw does not exceed 2.5 mm (3/32").
4. Check the front wheel bearings, king pin and bushes as well as the shock absorbers.
5. Check that the control arms are not damaged and that they are firmly attached to the front axle member. Check that the control arm bushes do not have excessive play.
6. Check that the springs are in good order and are not fatigued.
7. Check the play and adjustment of the steering mechanism. With the steering mechanism in the central position, the wheels should point straight forward.
8. Check the steering rods, steering arms and idler arm.
9. Check that the vehicle has normal equipment (oil, water, petrol and tools), but is otherwise unloaded.

Adjusting caster

Caster should be $-3/4^{\circ}$ - $+1/4^{\circ}$. This is adjusted by loosening the clamp bolt (1, Fig. 5) and then turning the eccentric bush (2). Use wrench SVO 1411 if the bush is early production with a width across flats of 28.5 mm (1 1/8") and wrench SVO 2201 if the bush is late production with width across flats of 34.3 mm (1 11/32"). One complete turn alters the angle by $1/2^{\circ}$.

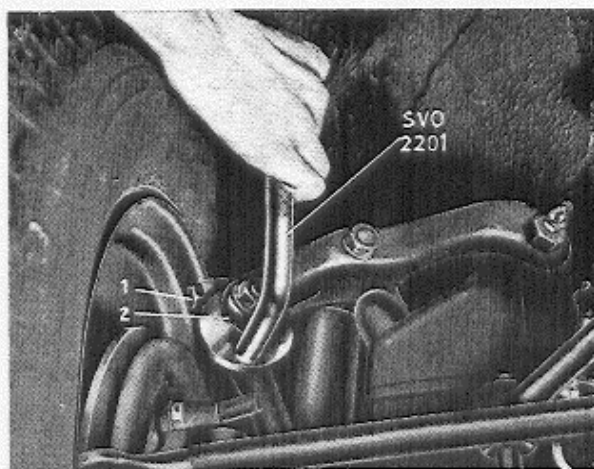
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Fig. 5. Adjusting caster and camber

1. Clamping screw
2. Eccentric bush

Note that if the wheel has the correct camber, one complete turn must be given, otherwise the camber will be altered. Tighten the clamp bolt before checking the caster.

Checking camber

After the caster has been checked, adjust the camber. This should be $-14^{\circ} - +1/2^{\circ}$. It is adjusted by loosening the clamp bolt and turning the eccentric with wrench SVO 1411 or SVO 2201, see Fig. 5. Altering the camber also means a slight alteration of the caster, but this is negligible.

Adjusting toe-in

The toe-in should be 0—3 mm (0—0.12 ins.). This is adjusted by slackening the clamping bolts or locknuts respectively and turning the tie-rod in the required direction. By turning in the normal direction of rotation of the wheels, the distance between the tyres at the front is reduced, that is to say, the toe-in increases. Thus a 1/4 turn of the tie-rod represents a toe-in of about 3 mm (0.12"). When the correct toe-in has been obtained, the clamping bolts are tightened to a torque of 1.1—

1.4 kgm (8—10 lb.ft.). In the case of the late production tie-rods, the locknuts can be tightened to a torque of 7.5—9 kgm (55—65 lb.ft.).

Checking king pin inclination

As a precautionary measure, the king pin inclination should also be checked. This should be 5° when the camber is 0° .

Checking toe-out

1. Place the front wheels on turntables and ensure that they are pointing straight forward. When the vehicle is placed on them, the turntables should be set to zero and locked.
2. Turn one of the wheels 20° inwards and read off the turning angle of the other wheel. This should be $22 \pm 1^{\circ}$.
3. Turn the wheel in the other direction and read off the angle of turn on the other wheel in the same way.
3. There is no possibility of adjusting the toe-out. If it should be faulty, check the steering arms and steering rods and replace any damaged parts.

GROUP 61

FRONT AXLE

DESCRIPTION

The PV 544 and P 210 have independent front wheel suspension. There is thus no front axle as such, this being replaced by a robust box-section front axle member. This member is bolted to the front part of the integral body (on P 210, to the frame). The front engine mounting rests on the centre part of the member. The wheel suspension and springs are fitted on the ends of the member. The whole construction of the front axle is illustrated in Figs. 6—9.

The inner ends of the upper and lower control arms (2 and 8, Fig. 6) are pivoted on the front axle

member (6) by means of pins and bolts. At the outer end the control arms are attached to the steering knuckle (1) by means of bolts and threaded bushes. The upper bush is eccentric for adjusting camber.

The stub axle (6, Fig. 7) is carried by the king pin (18) on which the steering knuckle is pivoted. The axial thrust of the steering knuckle support is taken up by a ball bearing (39).

The stabilizer bars (4, Fig. 6) are attached to the lower control arms and to the body (on P 210, to the frame).

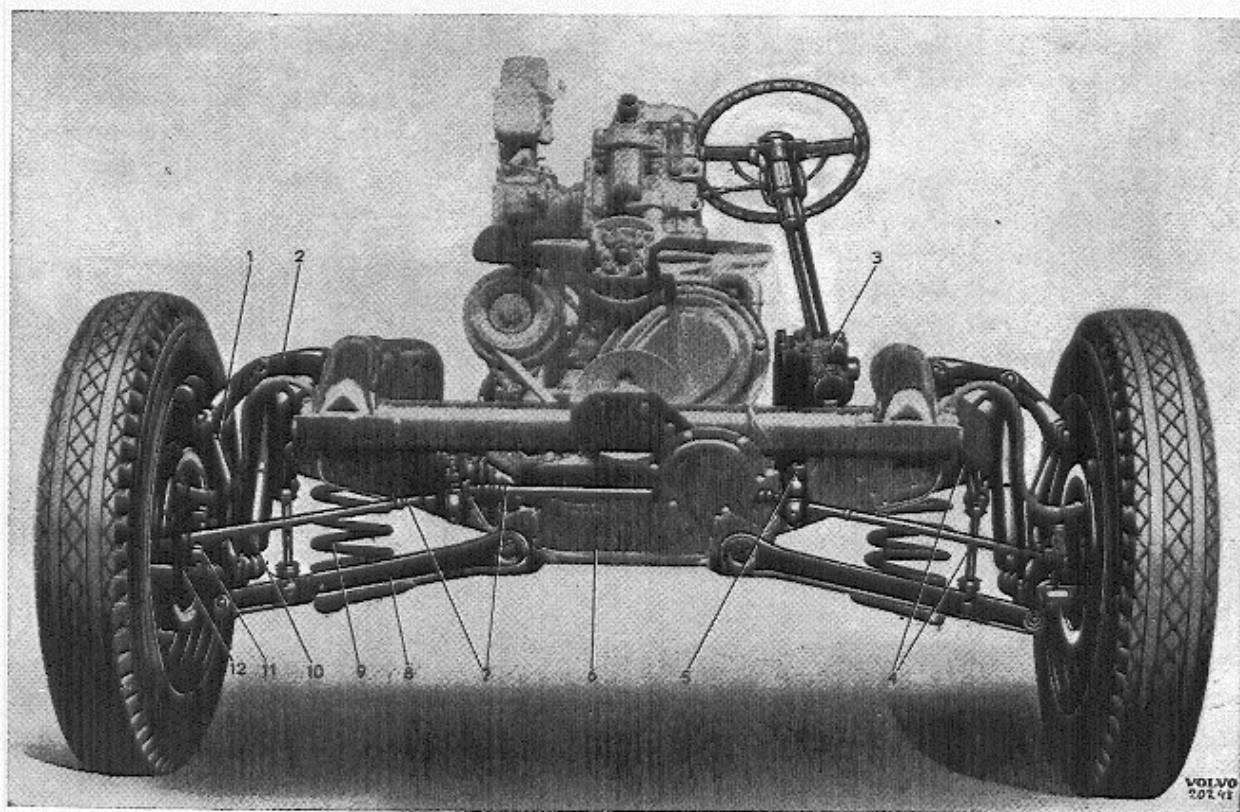


Fig. 6. Front axle and steering gear

- | | |
|----------------------|-----------------------------|
| 1. Steering knuckle | 7. Steering rod and tie rod |
| 2. Upper control arm | 8. Lower control arm |
| 3. Steering box | 9. Spring |
| 4. Stabilizer | 10. Shock absorber |
| 5. Pitman arm | 11. Stub axle |
| 6. Front axle member | 12. Steering arm |

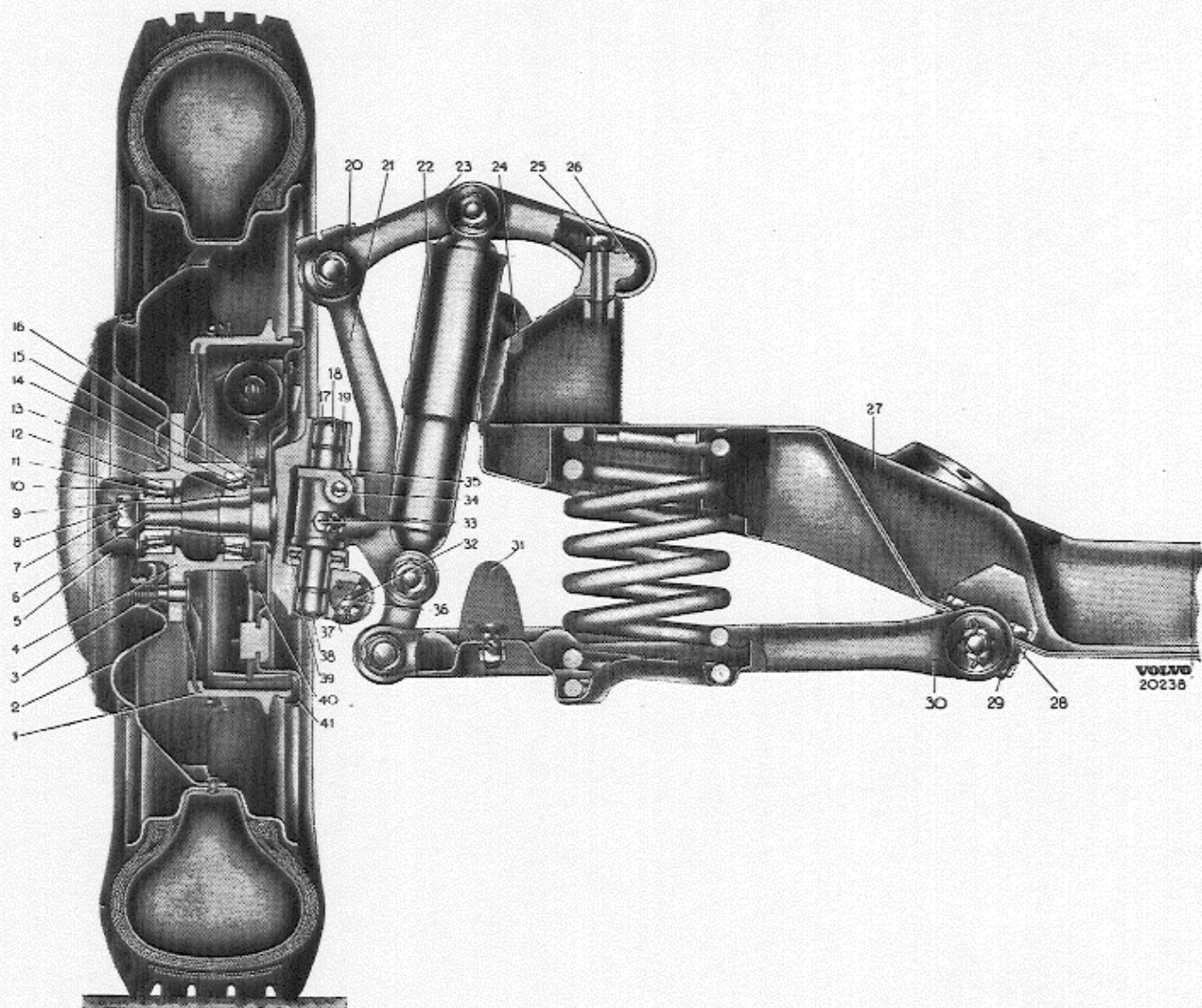


Fig. 7. Front axle

- | | | |
|-------------------------------|-------------------------------|-------------------------|
| 1. Brake drum | 15. Outer ring, inner bearing | 29. Bolt |
| 2. Wheel | 16. Sealing ring | 30. Lower control arm |
| 3. Wheel nut | 17. Sealing washer | 31. Rubber buffer |
| 4. Hub | 18. King pin | 32. Stop screw |
| 5. Grease cap | 19. King pin bushing | 33. Stop screw |
| 6. Stub axle | 20. Clamping screw | 34. King pin stop key |
| 7. Split pin | 21. Steering knuckle | 35. Adjusting shim |
| 8. Castle nut | 22. Shock absorber | 36. Steering arm |
| 9. Inner ring, outer bearing | 23. Upper control arm | 37. King pin bushing |
| 10. Washer | 24. Rubber buffer | 38. Sealing washer |
| 11. Roller bearing | 25. Bolt | 39. Roller bearings |
| 12. Outer ring, outer bearing | 26. Pin for upper control arm | 40. Splash guard |
| 13. Inner ring, inner bearing | 27. Front axle member | 41. Brake backing plate |
| 14. Roller bearing | 28. Pin for lower control arm | |

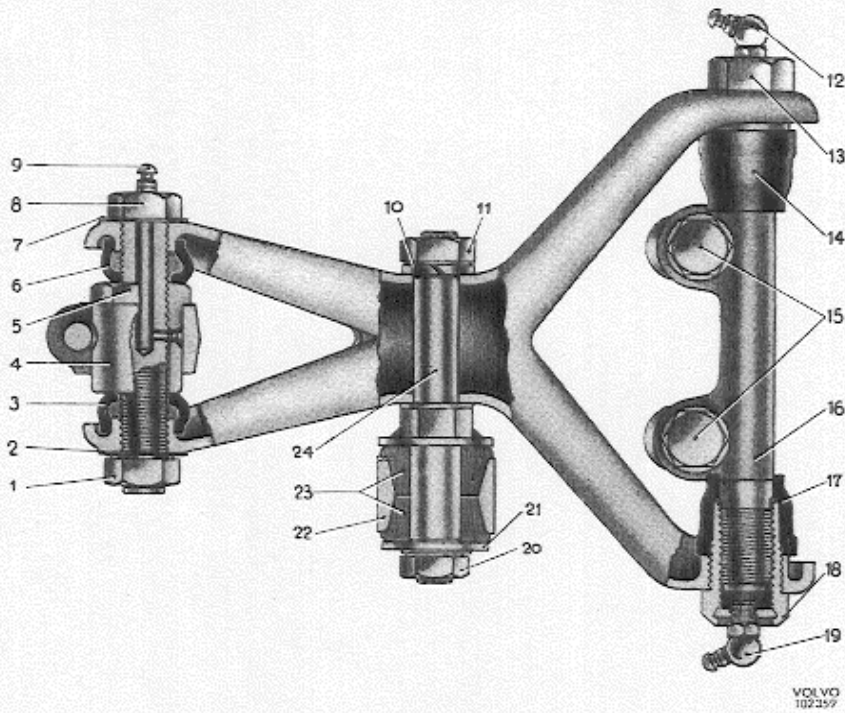


Fig. 8. Upper control arm

- | | | | |
|---------------------|-------------------|-----------------|--------------------|
| 1. Nut | 7. Lock washer | 13. Bush | 19. Grease nipple |
| 2. Locking washer | 8. Bolt | 14. Rubber seal | 20. Nut |
| 3. Rubber seal | 9. Grease nipple | 15. Bolt | 21. Washer |
| 4. Steering knuckle | 10. Spring washer | 16. Pin | 22. Shock absorber |
| 5. Eccentric bush | 11. Nut | 17. Rubber seal | 23. Rubber bush |
| 6. Rubber seal | 12. Grease nipple | 18. Bush | 24. Bolt |

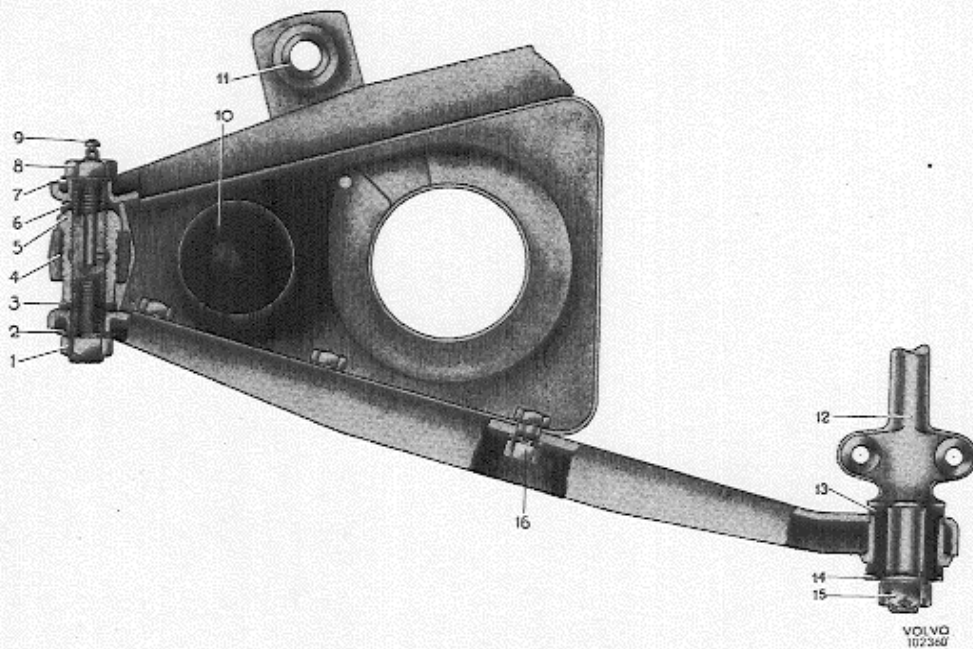


Fig. 9. Lower control arm

- | | | |
|---------------------|---------------------------|---|
| 1. Nut | 6. Rubber insert | 12. Pin |
| 2. Lock washer | 7. Lock washer | 13. Rubber bushing |
| 3. Rubber insert | 8. Bolt | 14. Washer |
| 4. Steering knuckle | 9. Grease nipple | 15. Nut (in late production
Nyloc nut) |
| 5. Bush | 10. Rubber buffer | 16. Bolt with washer and nut |
| | 11. Stabilizer attachment | |

REPAIR INSTRUCTIONS

REMOVING COMPLETE FRONT WHEEL SUSPENSION

1. Remove the hub caps and slacken the wheel nuts slightly.
2. Place a jack under the front axle member and lift up the front end of the vehicle so that the wheels are free. Place blocks under the body (for P 210 the frame) behind the front axle member.
3. Remove the wheel nuts and lift off the wheels.
4. Disconnect the stabilizers from the lower control arms.
5. Pull off the pitman arm. Use tool SVO 2370 as shown in Fig. 28.
6. Put a wooden block under the brake pedal. Disconnect the front wheel brake line at the master cylinder. Plug the connections to prevent dirt from entering the brake system.
7. Screw off the nuts at the front engine mountings. Remove the front engine guard plate. Place a wooden block (1, Fig. 10, size about $62 \times 6 \times 6$ cm = $24 \frac{1}{2} \times 2 \frac{1}{2} \times 2 \frac{1}{2}$ ") above the support members but under the fan hub (3). Insert the wooden block from below. In addition, on P 210 two blocks (2, size $4 \times 6 \times 6$ cm = $1 \frac{1}{2} \times 2 \frac{1}{2} \times 2 \frac{1}{2}$ ") should be placed between the frame and the above-mentioned wooden block. On late production models a recess must be made in the block. If the vehicle is not to be moved and an overhead hoist is available, the engine can be suspended in this instead.
8. Unscrew the four bolts on each side which hold the front axle member to the body (on P 210, to the frame).
9. Lower the jack carefully. (Sometimes it is necessary to slacken one of the upper control

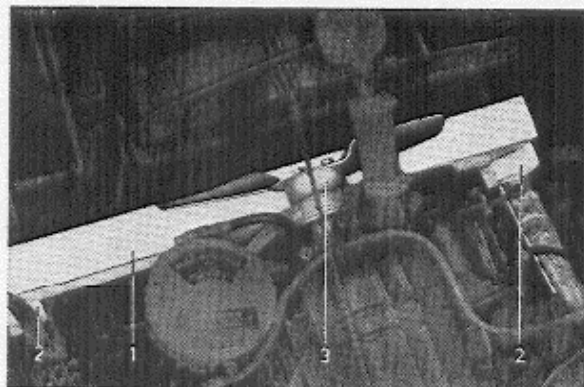


Fig. 10. Engine support

1. Wooden block 2. Wooden block 3. Fan hub

arm inner attachments at the front axle member in order that the front suspension unit can be lowered.) When the brake backing plates have reached the floor, the jack and front wheel suspension unit are pulled out.

When about to carry out work on the front axle member, place it in fixture SVO 2560 and stand SVO 2520, see Fig. 11.

FITTING COMPLETE FRONT WHEEL SUSPENSION

1. Lift up the front wheel suspension unit on a hydraulic jack and move it under the vehicle.
2. Place two guide pins into the body (the frame on P 210). Raise the jack so that the front axle member comes into position and bolt in on.
3. Remove the wooden block for supporting the engine and tighten the engine down onto the front engine mountings. Connect the brake lines.
4. Fit the pitman arm (see instructions under "Steering gear").
5. Fit the stabilizers.
6. Air-vent the front wheel brake system. See Part 5.
7. Lift on the wheels after having cleaned the contact surfaces between wheel and hub free from sand and dirt, and tighten the nuts sufficiently so that the wheel cannot be disturbed on the hub. Lower the vehicle and tighten the wheel nuts. Tighten every other nut a little at a time until all are tightened to a torque of 10—14 kgm (72—101 lb.ft.). Fit the hub caps.
8. Check the wheel alignment. (See under the heading "Wheel Alignment", page 1.)

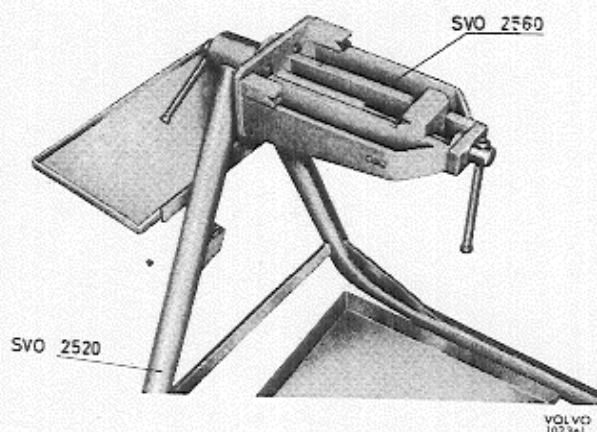


Fig. 11. Fixture for front axle member

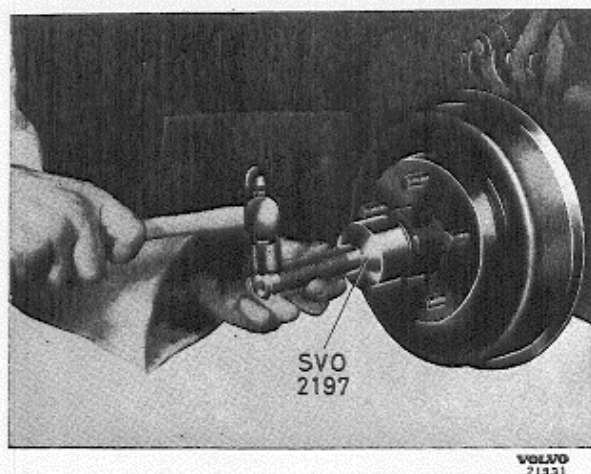


Fig. 12. Removing grease cap

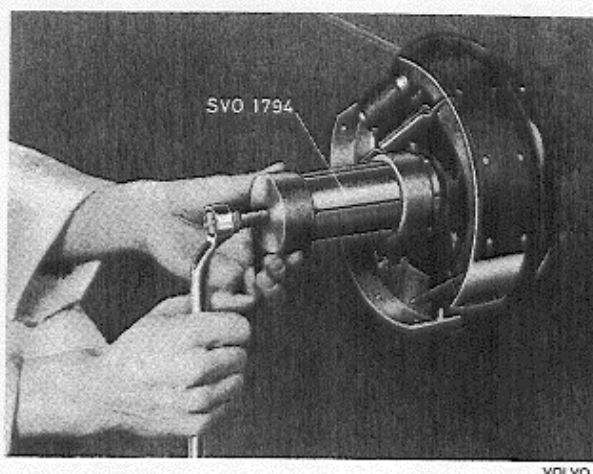


Fig. 14. Removing inner bearing

REPLACING KING PIN AND OUTER CONTROL ARM BOLTS WITH BUSHES

The clearance in the threaded bushes should normally be 0.3—0.6 mm (0.012—0.023"). The maximum permissible clearance is 0.8 mm (0.032"). The radial clearance of the king pin should not exceed 0.3 mm (0.012").

Removing

1. Remove the hub caps and slacken the wheel nuts slightly.
2. Lift up the front end of the vehicle so that the wheels are free and place frestles under the lower control arms. Remove the wheel.
3. Remove the grease cap with tool SVO 2197 (see Fig. 12). Remove the split pin and castle nut. Pull off the front hub with puller SVO

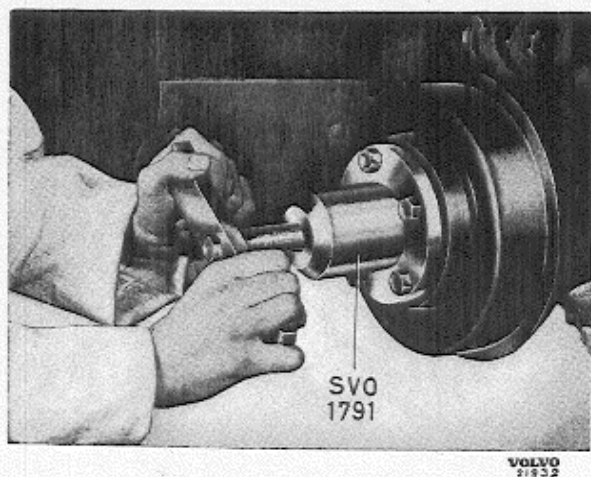


Fig. 13. Removing hub

1791 as shown in Fig. 13. Pull of the inner bearing ring, if necessary (see Fig. 14) with SVO 1794.

4. Remove the four bolts which hold the brake backing plate in place (41, Fig. 7) and splash guard (40) to the stub axle (6). Lift off the brake backing plate, after which it should be tied up with a piece of wire or similar so that the brake hose is not damaged.
5. Remove the split pin and nut for the steering rod ball joint. 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 joint enters the countersink in the tool. Screw in the tensioning screw until the ball joint releases.
6. Slacken the nut and screw out the upper control arm bolt. Take off the clamping bolt and remove the eccentric bush.
7. (Only when replacing control arm bolts with bushes.) Slacken the nut and screw out the lower control arm bolt. Disconnect the shock absorber at the bottom. Lift off the steering knuckle support. Screw out the lower bush.

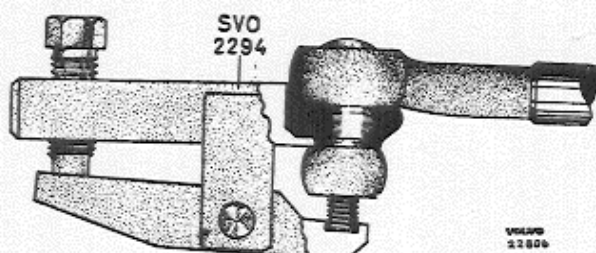
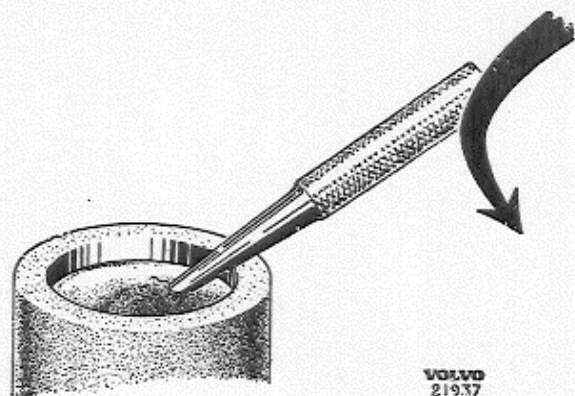


Fig. 15. Removing ball joint



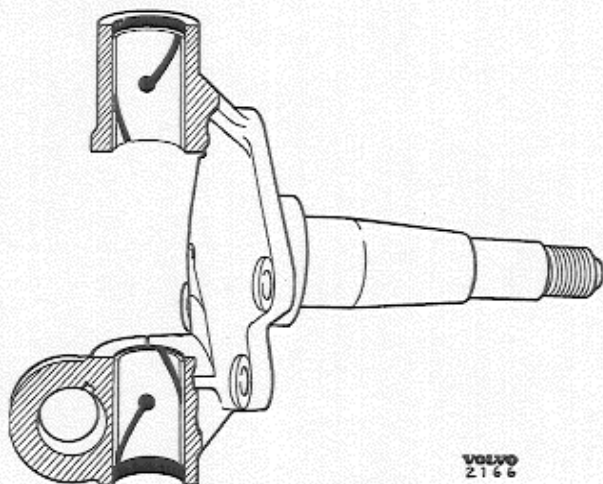
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Fig. 16. Removing the sealing washer

8. Drive out the stop key with a drift. Remove the sealing washer with a pointed punch as shown in Fig. 16. Drive out the king pin downwards with tool SVO 2224 as shown in Fig. 17. Place in the extensions as required. If the king pin fits very tightly it should first be knocked up a little with the help of a straight, thick drift.
9. Remove the grease nipples. Drive out the king pin bushes with drift SVO 1442.

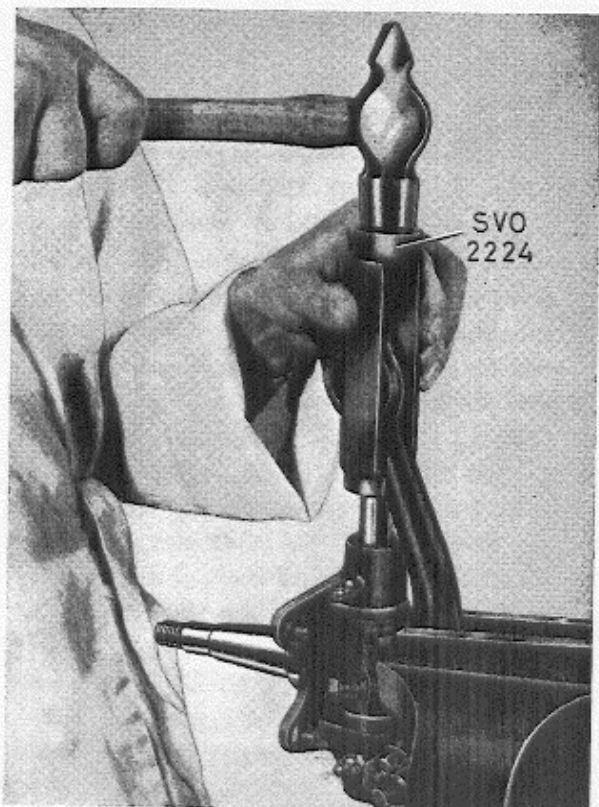
Fitting

1. Clean the steering knuckle. Clean off any burr at the bush positions. Press in the new bushes with drift SVO 1442. Make sure that the lubricating hole comes opposite the grease nipple and that the short lubricating groove faces the sealing washer, see Fig. 18.



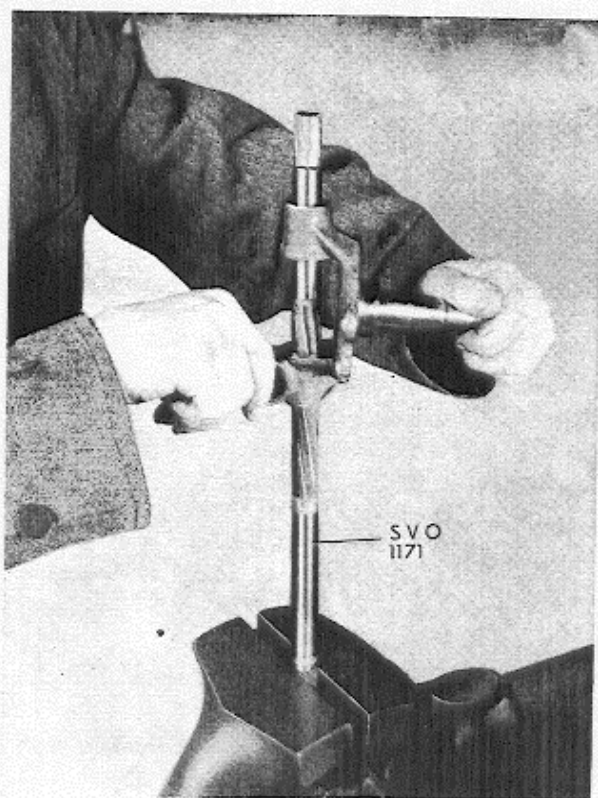
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Fig. 18. King pin bushes



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Fig. 17. Removing king pin



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Fig. 19. Reaming king pin bushes

2. Ream the bushes with reamer SVO 1171 as shown in Fig. 19. With a new king pin the play should then correspond to a running fit. Fit the grease nipples. Coat the bushes with chassis grease.
3. Place the stub axle, thrust bearing and adjusting shims in position and place the centring mandrel SVO 4005 in the upper bushing. Change the shims until the bearing take-up corresponds to a friction torque of 5—65 kg/cm (4.33—56.3 lb.in.) when turning the spindle. A spring balance attached to the split pin hole of the spindle should then give a reading 0.3—4.3 kg (0.66—9.46 lb.) when pulled at right-angles to the spindle, see Fig. 20. Then drive in the king pin ensuring that it comes in the correct position. Fit the stop key. Check that the steering knuckle turns easily. Fit the sealing washers by placing them in position with the dished side outwards and then knocking them flat with a hammer and drift.

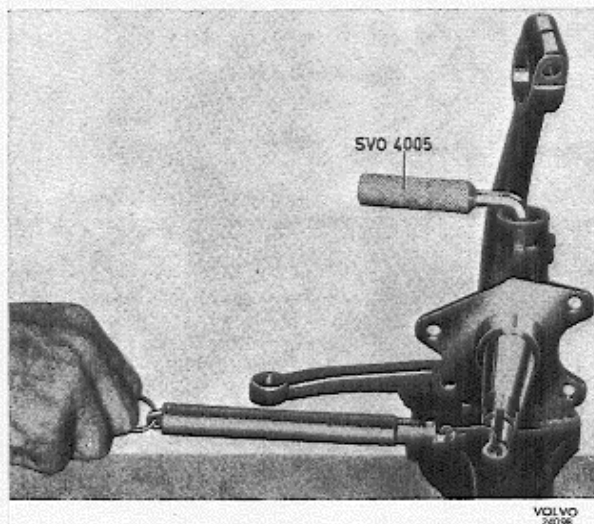


Fig. 20. Measuring friction torque

4. Fit the steering knuckle with bushes, guard plate and bolts. Fit the steering rod to the steering arm. Then turn the ball joint so that the split pin hole comes across the longitudinal direction of the rod. Tighten the castle nut to a torque of 3.2—3.8 kgm (23—27 lb.ft.).
5. Fit the brake backing plate and splash plate on the stub axle.
6. Fit the hub and wheel in accordance with points 8—12 under "Replacing and adjusting front wheel bearings", Part. 7.
7. Check the front wheel alignment.

RECONDITIONING THE CONTROL ARM SYSTEM

Straightening of damaged control arms may only be carried out to a minor extent, and then only in a cold condition. If an old part differs considerably when compared with a new one, it should be replaced.

Upper control arm

REMOVING

1. Slacken the wheel nuts slightly.
2. Lift up the front end of the vehicle so that the wheel is free and place a trestle under the lower control arm.
3. Unscrew the wheel nut and lift off the wheel.
4. Disconnect the shock absorber attachment at the upper control arm bolt (24, Fig. 8).
5. Unscrew the nut (1), after which the bolt (8) is screwed out.
6. Unscrew the bolts (15) which hold the pin (16) to the front axle member, after which the control arm is lifted out.

REPLACING PIN

1. The pin (16) is removed from the control arm by screwing out the grease nipples (12 and 19) and then the threaded bushes (13 and 18) at the ends of the pin.
2. Secure fixture SVO 2300 in a vice ensuring that the top edge of the plate is clear.
3. Fit the rubber protector on the new pin and insert this into the control arm. Screw the bushes onto the pin about two turns. It should then be possible to move the pin axially, if not the bush must be screwed back slightly.
4. Place the control arm in the fixture so that the peg on the cap fits into the U-profile on the control arm and the holes in the shoulders of the pin fit on both the guide pins. Move the cap towards the control arm, tighten the wing nut slightly, screw in the stop screw and tighten up the wing nut. See Fig. 21.
5. Lubricate the bushes externally and screw them in until the hexagon comes against the control arm. Place the rubber protector in position on the bushes and fit the grease nipples.
6. Slacken the wing nut and stop screw and lift off the control arm.

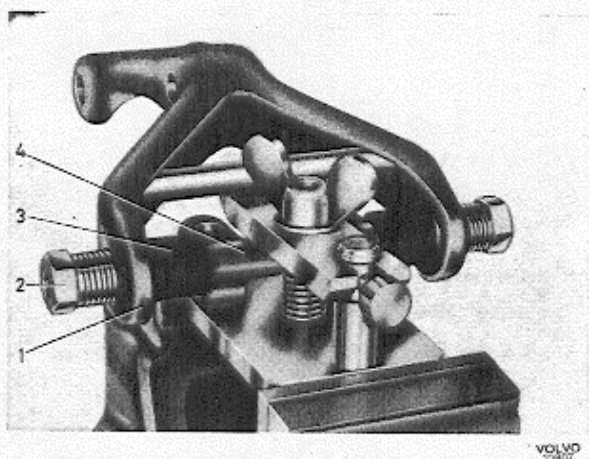


Fig. 21. Fitting pin in upper control arm

1. Control arm
2. Bush
3. Rubber protector
4. Pin

FITTING

1. Place the control arm in the correct position after which the bolts (15, Fig. 8) which hold the pin (16) to the front axle member are fitted. Tighten the bolts to a torque of 5.5—6.2 kgm (40—45 lb.ft.).
2. Fit new rubber seals (3 and 6), and then the bolt (8) (hexagon flat forward) with the nut (1). Do not forget the locking washers (2 and 7). Check that there is clearance. This should normally be 0.3—0.6 mm (0.012—0.023").
3. Lubricate the king pin and bushings and check that the grease penetrates through to all the lubricating points.
4. Fit the shock absorber and wheel. Lower the vehicle. Tighten the wheel nuts to a torque of 10—14 kgm (72—101 lb.ft.).
5. Check the wheel alignment, see under the heading "Wheel alignment".

Lower control arm

REMOVING

1. Slacken the wheel nuts slightly.
2. Lift up the front end of the vehicle so that the wheels are free and place trestles under the front axle member.
3. Remove the wheel. Disconnect the stabilizer from the attachment (11, Fig. 9).
4. Place a jack under the control arm pin. Remove the nuts for the attachment in the front axle

member and lower the jack, see Fig. 21. Remove the spring. Screw off the nut (1, Fig. 9) and bolt (8) and lift off the control arm to the front.

REPLACING PIN OR BUSHINGS

Remove the nuts (15, Fig. 9) and washers (14). Remove the two inner bolts (16) which hold both parts of the control arm together and slacken the outer one slightly. Turn both the parts of the control arm away from each other and remove the pin and bushes. Fitting is done in the reverse order and is facilitated if the rubber bushes are coated with soap solution.

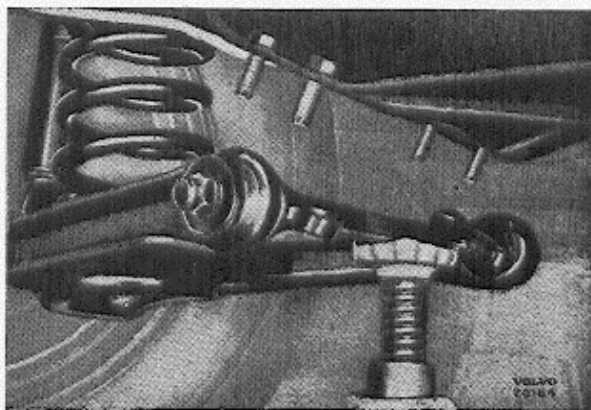


Fig. 22. Removing lower control arm

FITTING

1. Fit new rubber seals (3 and 6, Fig. 9) and then the bolt (8) (hexagon flat forward) with locking washer (7). Place on the washer (2) and tighten the nut (1). Check that there is a clearance of 0.3—0.6 mm (0.012—0.023") in the bush.
2. Place the spring in position with the straight end downwards. Move up the control arm pin into position with the help of a jack, see Fig. 22. Secure the pin and lock with split pins.
3. Lubricate the bolt and check that grease penetrates through the bush.
4. Fit the stabilizer and wheel. Lower the vehicle. Tighten the wheel nuts to a torque of 10—14 kgm (72—101 lb.ft.). Check the wheel alignment.

Replacing outer control arm bolts with bushes

1. Slacken the wheel nuts slightly. Lift up the front end of the vehicle and place a trestle under the lower control arm centrally below the spring. Remove the wheel.
2. Slacken the nut (1, Figs. 8 and 9) and screw out the bolt (8). The upper bush can be replaced after the clamping bolt has been removed. The lower bush is screwed out.
3. Fit the new bushes. Place the steering knuckle and new rubber seals in position and screw in the control arm bolt with lock washer, (see Figs. 3 and 4). Place on the lock washer (2) and tighten the nut (1). Check that there is a clearance of 0.3—0.6 mm (0.012—0.023") in the bush.
4. Lubricate the bolts and check that grease penetrates through the bush.
5. Fit the wheel. Lower the vehicle. Tighten the wheel nuts to a torque of 10—14 kgm (72—101 lb.ft.). Check the wheel alignment.

GROUP 64

STEERING GEAR
DESCRIPTION

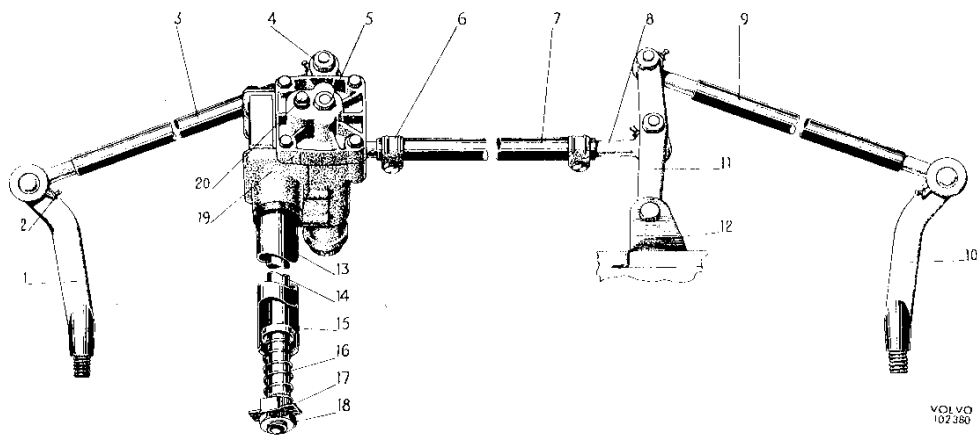


Fig. 23. Steering gear

- | | | |
|--|--|--------------------|
| 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).

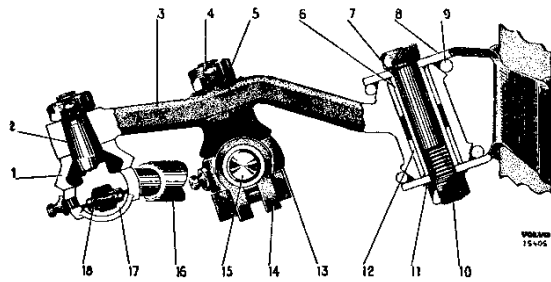


Fig. 24. Idler arm mounting, early production

- | | | |
|-----------------------|----------------------|----------------------------------|
| 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 |

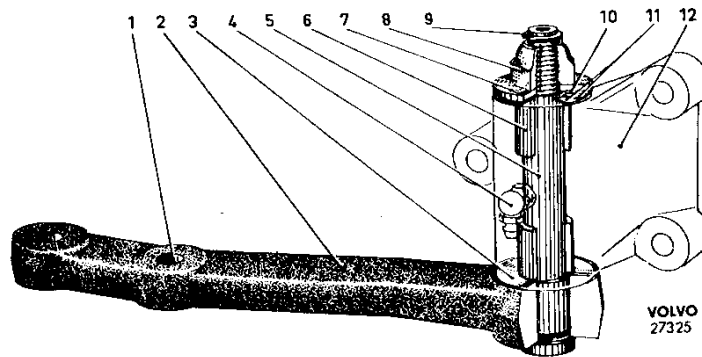
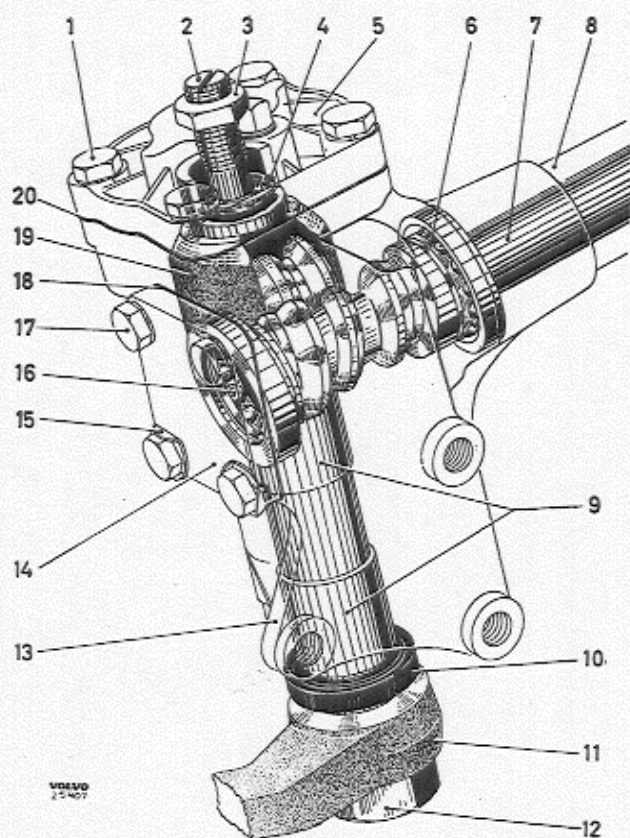


Fig. 25. Idler arm mounting, late production

- | | |
|----------------------------|-----------------------------|
| 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.

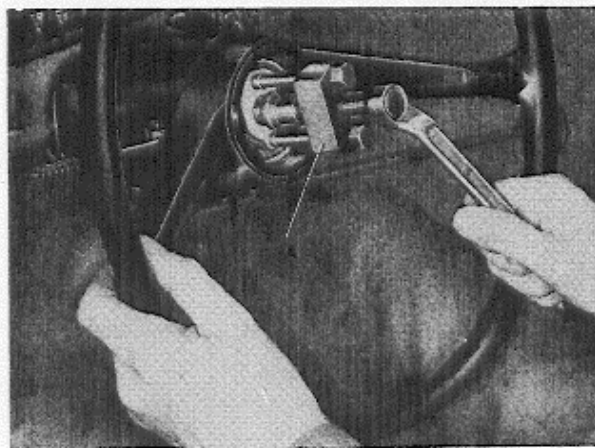


Fig. 27. Removing the steering wheel

A=SVO 2325



Fig. 28. Removing pitman arm

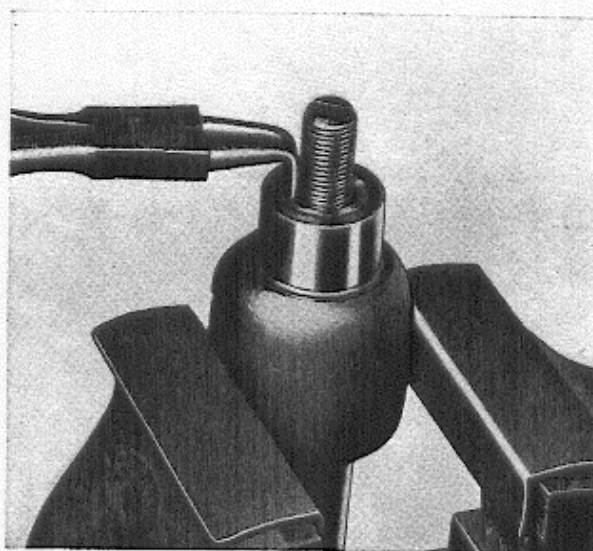


Fig. 29. Removing adjusting screw

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.

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.

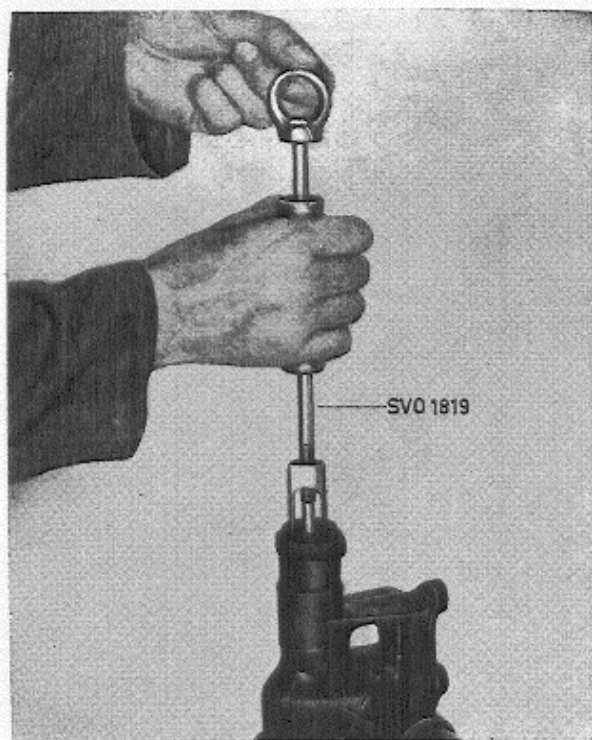


Fig. 30. Removing pitman arm shaft bush and sealing ring

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.

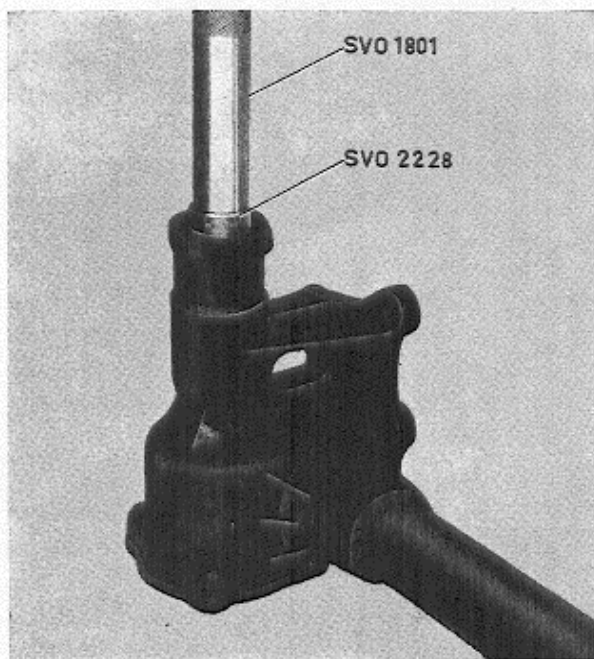


Fig. 31. Fitting bush

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

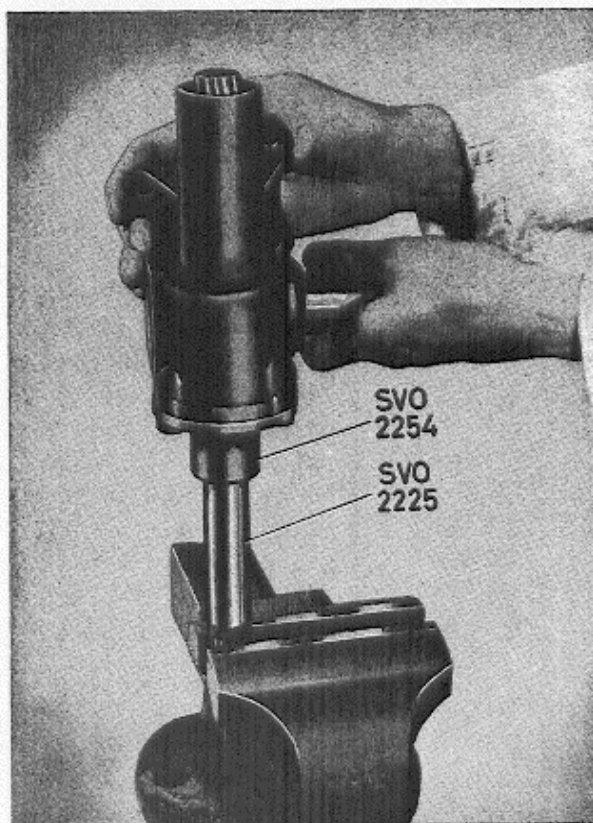


Fig. 32. Reaming bushes

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-

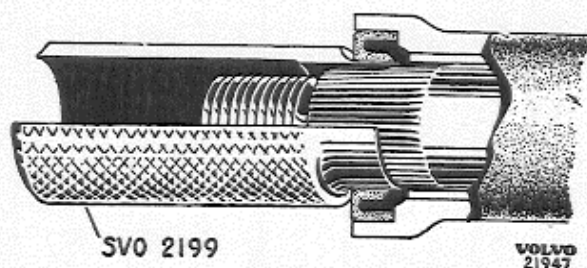


Fig. 34. Fitting pitman arm shaft

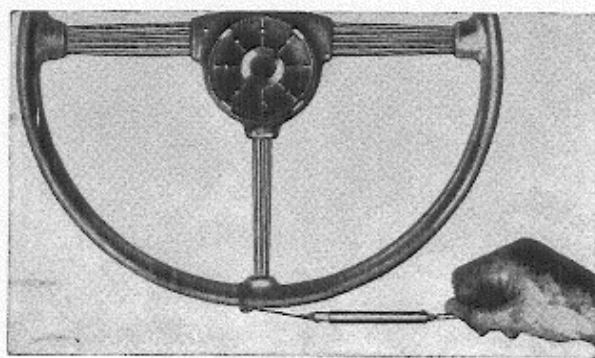


Fig. 35. Measuring steering wheel torque

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.

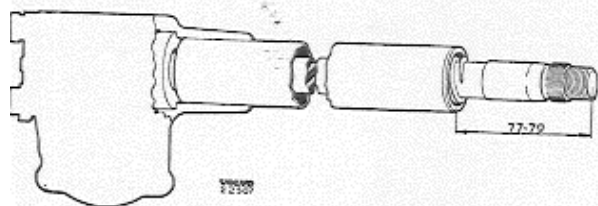


Fig. 33. Fitting jacket tube.

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.).

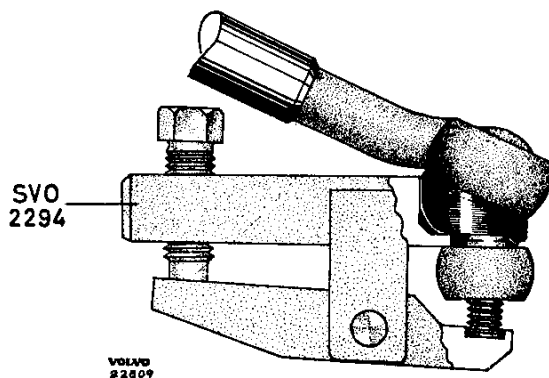


Fig. 36. Removing steering rod

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.

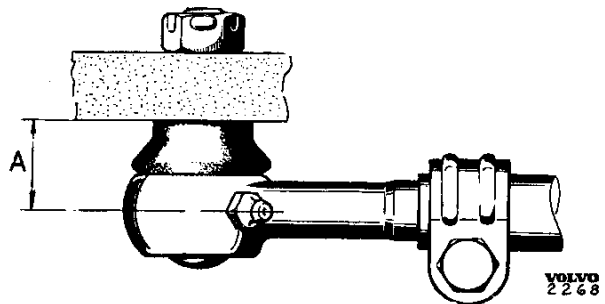


Fig. 37. Ball joint for tie-rod

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

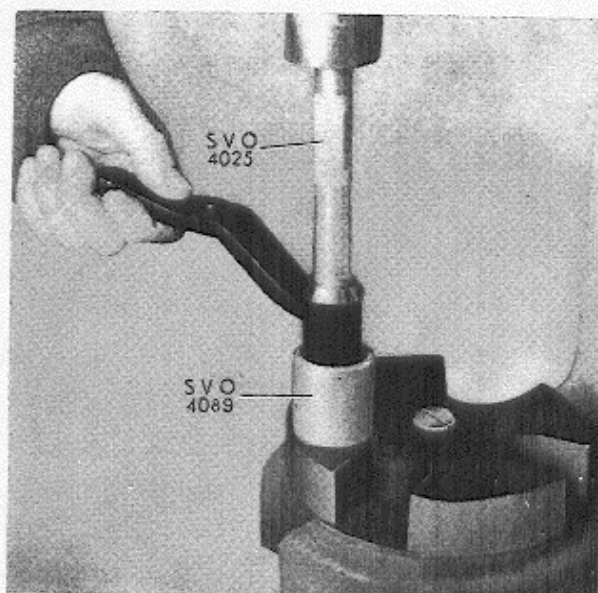


Fig. 38. Removing bushings in idler arm, early production

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 ± 5 kgcm (13 ± 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.

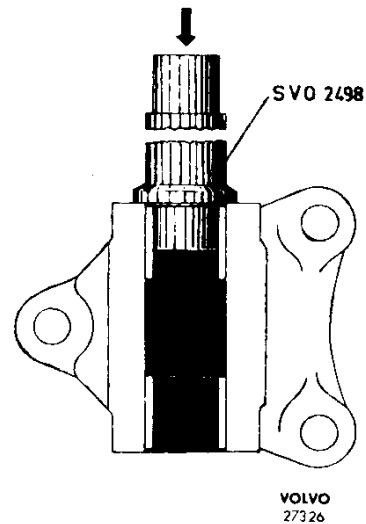


Fig. 39 Fitting bushes in idler arm, late production

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

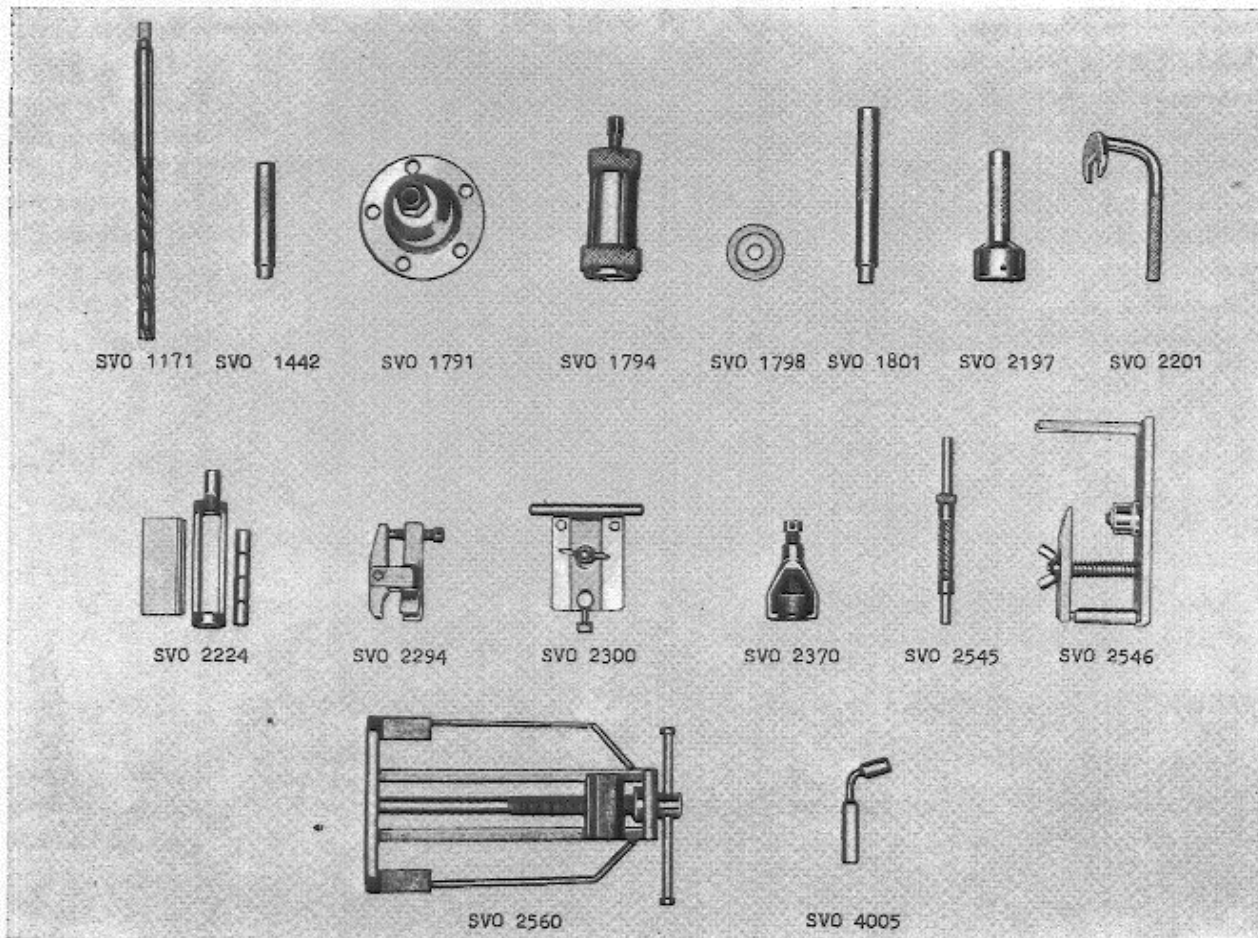
<p>Wheels out-of-balance or warped. One of the brake drums worn out-of-round. Insufficient tyre pressure. Damaged steering rod. Loose or worn front wheel bearings.</p> <p>Incorrect wheel alignment.</p>	<p>Balance the wheels and align if necessary. See part 5. Adjust the tyre pressure. Replace damaged 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.	Adjust or if necessary recondition the steering mechanism.
Unsuitable or insufficient lubricant in the steering box.	Check the oil. Concerning oil grades, see "Specifications".
Front wheel bearings loose.	See under the heading "Front wheel bearings"
Steering rod ball joints loose.	Replace loose ball joints.
Pitman arm incorrectly fitted.	See page 19.
Wheels out-of-balance or warped.	Balance and align the wheels if necessary.
Steering wheel or steering box loose.	Tighten the steering wheel or steering box respectively.
Idler arm loose.	Tighten or if necessary replace the bushings.
Bushes in shock absorber anchorages worn or anchorages loose.	Replace any necessary parts.
Shock absorbers not functioning.	Replace the shock absorbers.

TOOLS

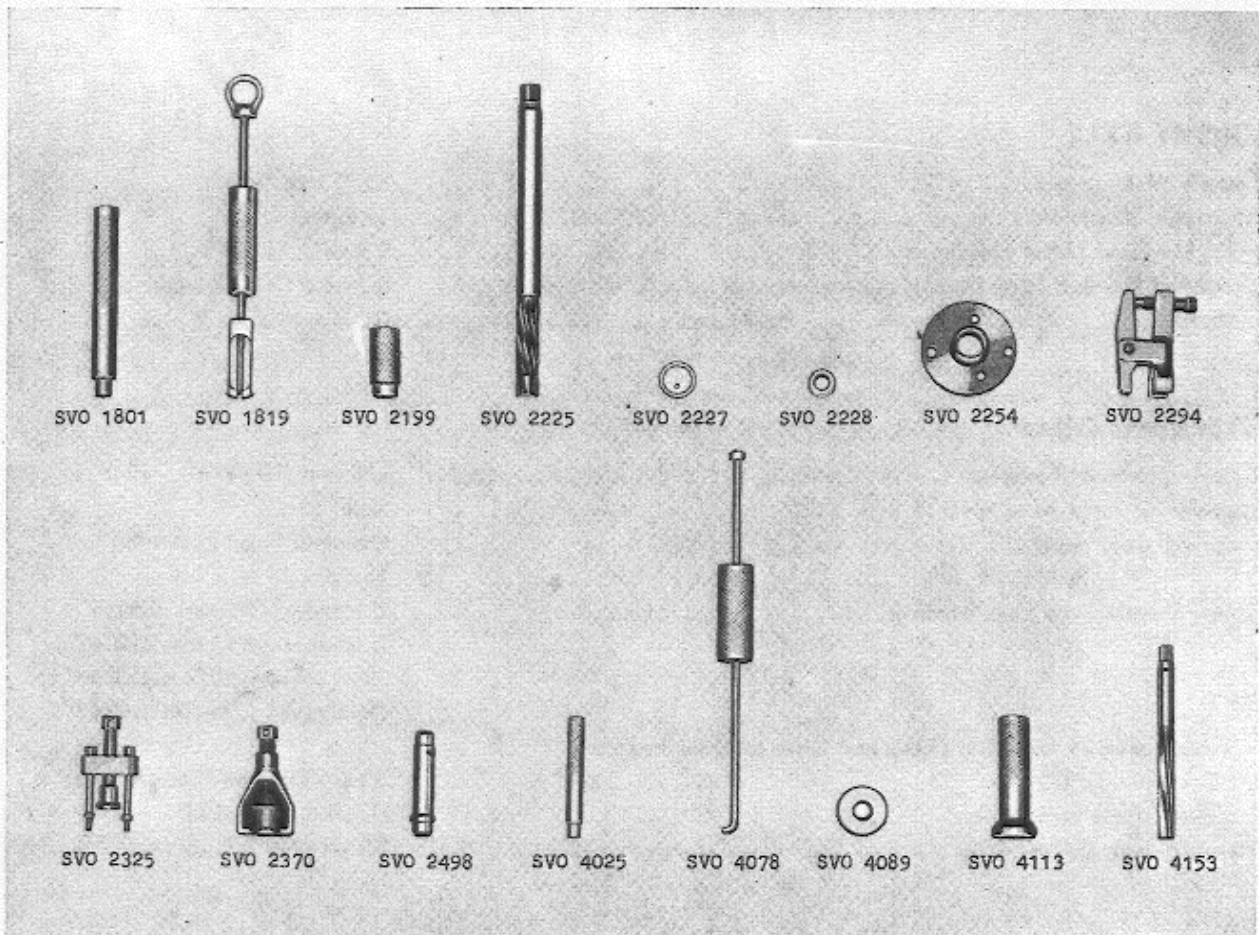
The following special tools are used for repair work on the front axle and the steering gear.



VOLVO
102357

FRONT AXLE

- | | | | |
|----------|---|----------|--|
| SVO 1171 | Reamer for steering knuckle | SVO 2201 | Spanner for eccentric bush |
| SVO 1442 | Drift for removing and fitting king pin bush | SVO 2224 | Removal tool for king pin |
| SVO 1791 | Puller for front wheel hubs | SVO 2294 | Removal tool for ball joint |
| SVO 1794 | Puller for inner ring of inner bearing on front wheel stub axle | SVO 2300 | Fixture for upper control arm |
| SVO 1798 | Fitting drift for sealing ring in front wheel hub | SVO 2370 | Puller for pitman arm |
| SVO 1801 | Standard handle | SVO 2545 | Machine reamer alternative to SVO 1171 |
| SVO 2197 | Drift for removing and fitting grease cap | SVO 2546 | Stand for machine reamer |
| | | SVO 2560 | Fixture for front axle member. Use together with stand SVO 2520. |
| | | SVO 4005 | Centring drift for king pin |

VOLVO
102358

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 | | |

