

Part 6

FRONT END  
AND  
STEERING GEAR

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# GROUP 60

## GENERAL

### TOOLS

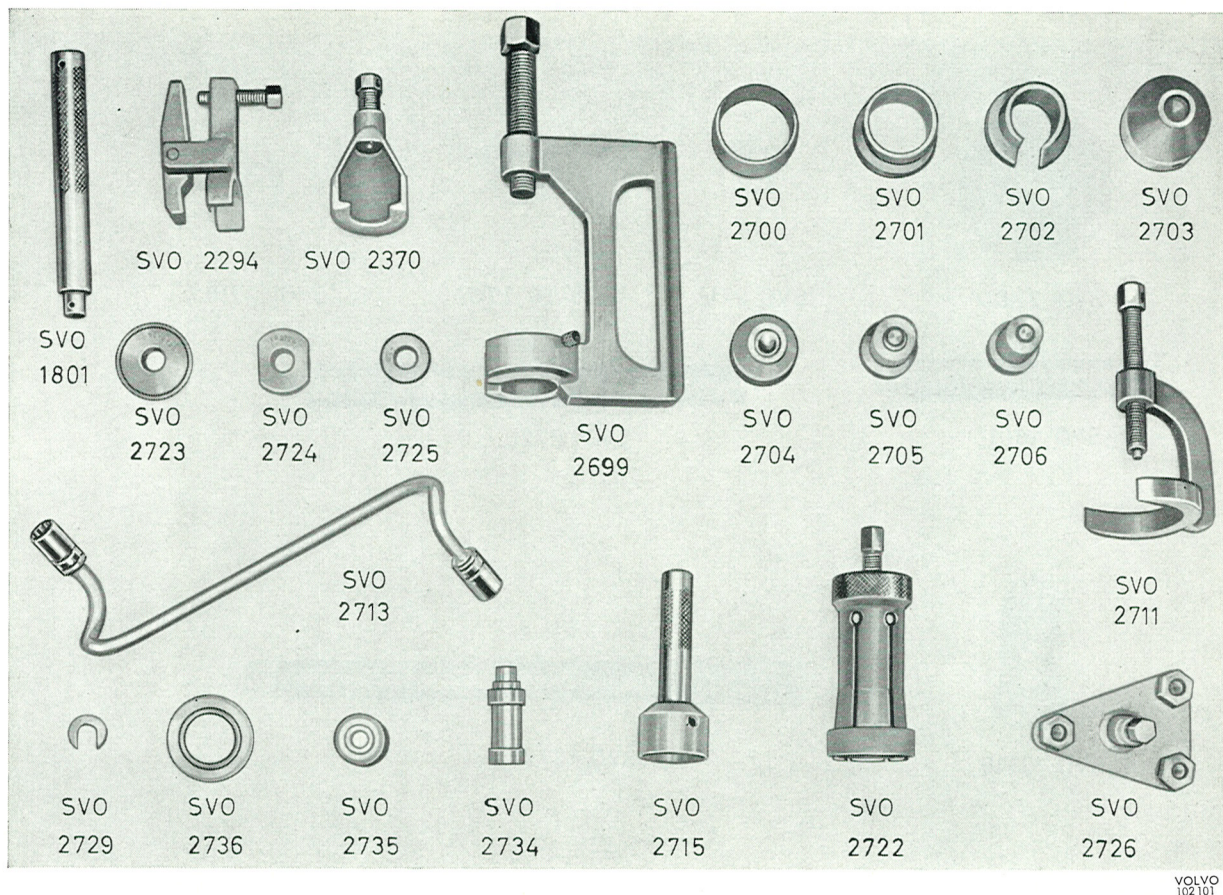
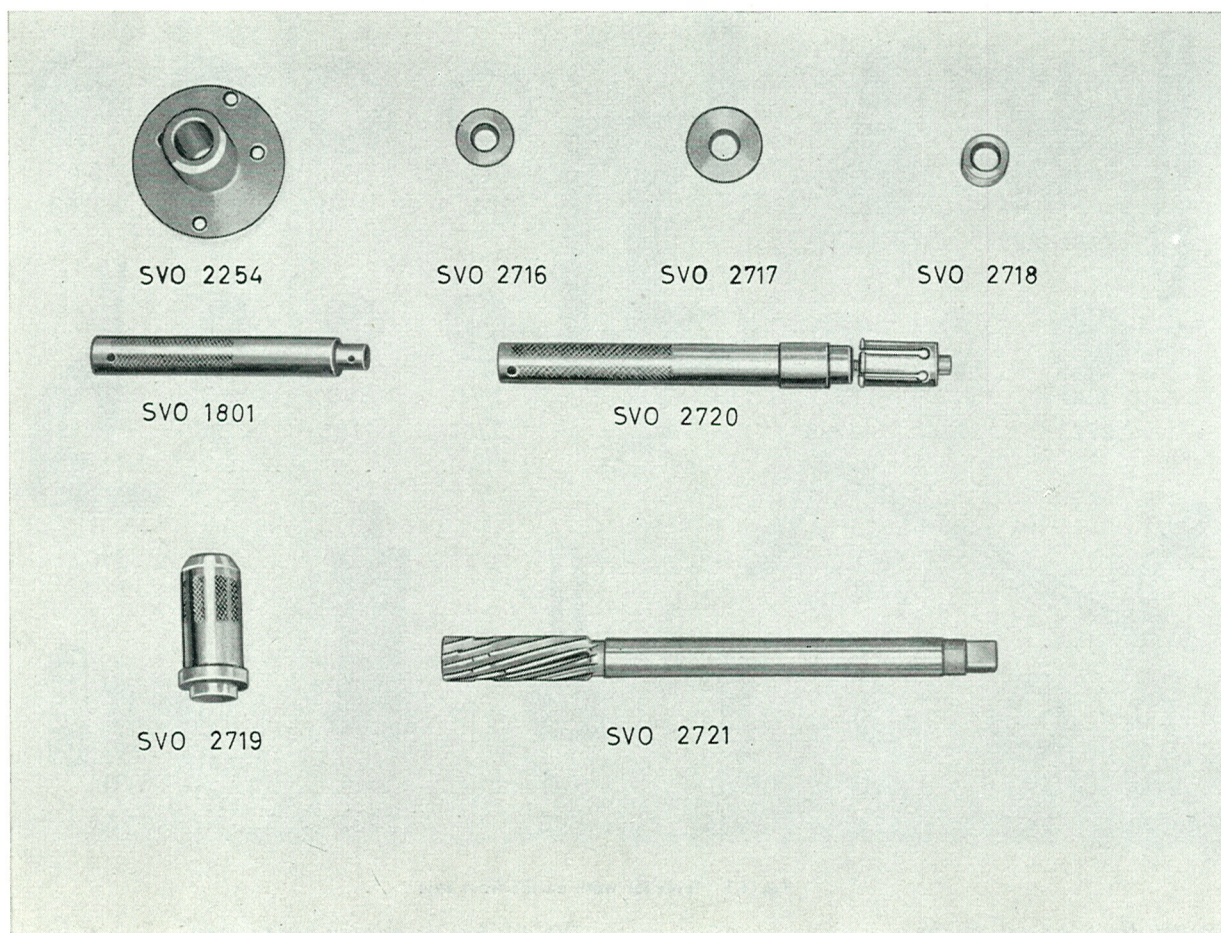


Fig. 6-1. Tools for work on the front axle

- |          |   |           |   |
|----------|---|-----------|---|
| SVO 1801 | Standard handle 18×200.   | SVO 2711  | Tool for removing steering wheel.   |
| SVO 2294 | Press tool, for removing the ball joints, tie-rod end.  | SVO 2713  | Spanner (5/8") for upper wishbone shaft bolt, wheel adjustment.   |
| SVO 2370 | Puiler, pitman arm.   | SVO 2715  | Drift, for removing and fitting grease cap in hub.  |
| SVO 2699 | Press tool, for removing and fitting ball joints and rubber bushes, wishbones.  | SVO 2722  | Puller, inner ring, inner front wheel bearing.  |
| SVO 2700 | Sleeve, for removing ball joint, lower wishbone.  | SVO 2723  | Drift, for fitting outer ring, inner front wheel bearing, and sealing ring in hub.                            |
| SVO 2701 | Sleeve, for removing and fitting ball joint, upper wishbone and rubber bush in lower wishbone, removing ball joint, lower wishbone. | SVO 2724  | Drift, for fitting outer ring, outer front wheel bearing, for removing outer race, inner front wheel bearing. |
| SVO 2702 | Sleeve, for removing and fitting rubber bush, upper wishbone.   | SVO 2725  | Drift, for removing outer ring, outer front wheel bearing.  |
| SVO 2703 | Drift, for fitting of ball joint bolt, lower wishbone.  | SVO 2726  | Puller, front wheel hub.  |
| SVO 2704 | Drift, for fitting of ball joint, upper wishbone.   | SVO 2729  | Washer, for removing shaft, upper wishbone.   |
| SVO 2705 | Drift, for removing and fitting rubber bush in lower wishbone.  | SVO 2734  | Drift, for removing relay arm bush.   |
| SVO 2706 | Drift, for removing and fitting rubber bush in upper wishbone.  | SVO 2736  | Tool, for removing relay arm bush.  |
|          |   | SVO 2520* | Stand for fixture for reconditioning the front axle.  |
|          |   | SVO 2560* | Fixture for front axle.   |

\* Not shown in the above figure.





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Fig. 6-2. Tools for work on the steering box

- SVO 1801 Standard handle 18×20
- SVO 2254 Guide for reamer SVO 2721.
- SVO 2716 Drift, for fitting bush, pitman arm shaft, incl. SVO 1801.
- SVO 2717 Drift, for fitting upper bearing race, steering cam, incl. SVO 1801.
- SVO 2718 Drift, for removing upper bearing race, steering cam, incl. SVO 1801.
- SVO 2719 Sleeve, for fitting oil seal, pitman arm shaft.
- SVO 2720 Removal tool for pitman arm shaft bush.
- SVO 2721 Reamer for pitman arm shaft bush, incl. SVO 2254.



# WHEEL ALIGNMENT

## WHEEL ANGLES

For the vehicle to have good steering properties and a minimum of tyre wear, the front wheels must have certain pre-determined settings, generally known as the wheel angles. The wheel angles refer to the caster, camber, king pin inclination, toe-out and toe-in.

### CASTER

Caster generally refers to the longitudinal inclination (forwards or backwards) of the king pin. As this vehicle does not have a king pin, the caster consists of the angle between a vertical line and a line through the centre of the ball joints (Fig. 6-3).

Caster has the effect of causing the wheels to run straight forwards thereby facilitating the steering.

### CAMBER

Camber is the inclination of the wheel itself outwards or inwards. It is positive if the wheel is inclined outwards (see C, Fig. 6-4) and negative if the wheel inclines inwards. Faulty camber causes uneven tyre wear.

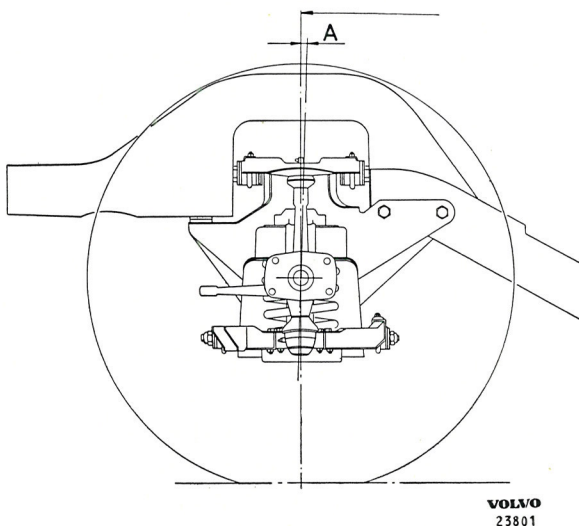


Fig. 6-3. Caster

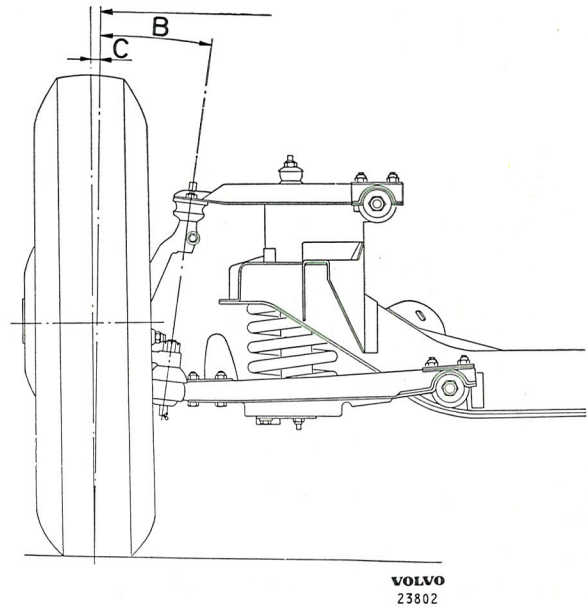


Fig. 6-4. Camber and king pin inclination

B = King pin inclination C = Camber

### KING PIN INCLINATION

King pin inclination means the inclination of the king pin inwards. Since this car does not have a king pin, the inclination is represented by an angle made between a vertical line and a line through the centre of the ball joints (B, Fig. 6-4).

King pin inclination causes the centre lines of the ball joints and the wheel to approach each other towards the road surface. This makes the wheel easier to turn. The inclination also assists the tendency of the wheel to run straight forwards since the car is lifted very slightly when the wheels are turned.

### TOE-OUT

When driving round a bend, the wheels roll at different radii. For them to have the same pivoting centre, and consequently minimum tyre wear, the front wheels must be turned to different extents. This relationship is determined by the shape of the steering rod and steering arms, see Fig. 6-7.

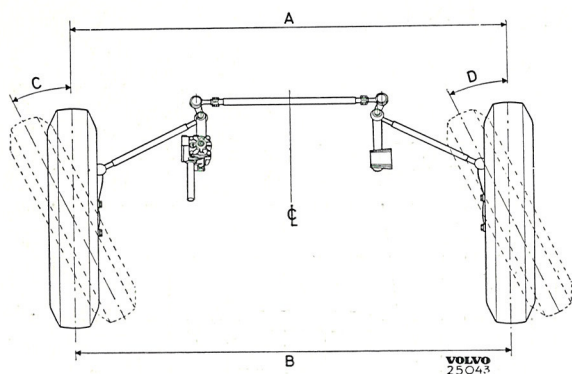


Fig. 6-5. Toe-out and toe-in  
Rozbieżność i zbieżność

### TOE-IN

The difference in the distances (A and B, Fig. 6-5) between the wheels measured at hub height at the front and rear of the tyres is known as toe-in. The purpose of toe-in is to reduce tyre wear.

### PROCEDURE BEFORE WHEEL ADJUSTING

Before any measuring and possible adjusting are carried out, the following points should be checked and any defects remedied:

1. Check the air pressure in all the tyres.
2. Check that the front wheel tyres are evenly worn. If not, change them with the rear wheels or the spare wheel.
3. Check that the wheels are not warped more than 2.5 mm (0.1") and that the radial throw does not exceed 2.5 mm (0.1").
4. Check the front wheel bearings and shock absorbers.
5. Check that the wishbones are undamaged and firmly attached to the front axle member. Check that there is no excessive play in the wishbone bushes.
6. Check that the springs are undamaged and are not fatigued.
7. Check the clearance and adjustment of the steering box. With the steering box in the centre position, the wheels should point straight forwards.
8. Check the steering rods, steering arms, relay arm and tie-rod.
9. Make sure that the car has normal equipment (oil, water, petrol and tools) but is otherwise unloaded.

### MEASURING THE WHEEL ANGLES

The wheel angles are measured with special measuring instruments of which there are many different types. No general description can, therefore, be given as to how measuring should be carried out except in the case of the steering geometry. The measuring principle is that camber is measured directly with the wheels pointing straight forwards. Caster and king pin inclination cannot be measured directly. Instead, the angular alteration which occurs when the wheel is turned from 20° outwards to 20° inwards is measured on the instrument.

Most types of modern wheel alignment measuring instruments require that the wheels are locked with, for example, the help of a pedal jack.

When measuring the wheel angles, follow the instructions for the measuring instruments concerned.

### CHECKING THE KING PIN INCLINATION

The king pin inclination, which on this vehicle is represented by the inclination of the centre line of the ball joints, should be 7.5° at a camber of 0°. This cannot be adjusted and is difficult to measure exactly due to the tension and resilience in the parts, so that the angle read off on the instruments will not be the exact king pin inclination but can serve as a guide.

### CHECKING THE TOE-OUT

1. Place the vehicle front wheels on turntables and make sure that the wheels point straight forwards. Before the car is placed on them, the turntables must be set to zero and locked.
2. Turn the wheels to the left until the right wheel has turned 20° inwards. The scale on the left turntable should then read  $22.5 \pm 1^\circ$ .
3. Check the position of the right wheel in the same manner by turning the wheels to the right until the left wheel has turned 20° inwards, when the right turntable scale should give the same reading as previously indicated on the left. Both measurements should thus lie within the above-mentioned tolerances, otherwise it means that the steering gear or front end is distorted.
4. There are no adjusting possibilities, but if the toe-out is incorrect, the steering arms and steering rods should be checked. Replace any parts that are damaged.



## ADJUSTING THE WHEEL ANGLES

**N.B.** The front wheel angles are always adjusted in the following order:

1. Caster
2. Camber
3. Toe-in

### ADJUSTING THE CASTER

**NOTE:** The upper wishbone shaft is fixed with a special bolt with a nylon plug.

The caster should be  $0^\circ \pm 1^\circ$  and the adjustment made by means of shims inserted at the upper wishbone shaft (see Fig. 6-6). When adjusting, loosen the bolts with tool SVO 2713, one end of which is used for the front bolt and the other for the rear bolt. After the bolts have been slackened several turns, shims can either be removed or additional ones fitted. Shims are stocked in thickness of 0.15—0.05—1.0—3.0 and 6.0 mm (0.006—0.020—0.039—0.12 and 0.24"). The extent to which these alter the caster is shown in the diagram, Fig. 6-7.

The same alteration is obtained either by:

1. Removing a shim from one of the attaching bolts
2. Adding a shim to the other attaching bolt
3. Moving over half of the requisite shim thickness from one bolt to the other.

The caster is adjusted towards the **positive** side either by **inserting** shims at the **rear** attaching bolt or by **removing** shims from the **front** attaching bolt.

For correct camber, the caster should be adjusted by moving over half the shim thickness according to the diagram from one bolt to the other or simply by moving at one of the attaching screws the thickness obtained from the diagram.

After adjustment has been carried out, the bolts can be tightened to a torque of 4.8—5.5 kgm (35—40 lb.ft.).

### ADJUSTING THE CAMBER

The camber should be  $0^\circ$  to  $+1/2^\circ$  and is adjusted by means of shims (A, Fig. 6-6) at the upper wishbone shaft.

For a left-hand steered vehicle in right-hand traffic, as well as a right-hand steered vehicle in left-hand traffic, the vehicle can be suitably provided with the same camber on both sides. For a right-hand steered vehicle, intended for right-hand traffic, it may be suitable for the left-hand side to have a camber which is a  $1/4^\circ$  greater than that for the right-hand side (e.g.  $0^\circ$  and  $+1/4^\circ$  resp.). This will eliminate the influence of the road surface inclination which would pull the vehicle in a certain direction. Also the location of the driver in the vehicle (left-hand steered/right-hand steered) has a certain influence due to the

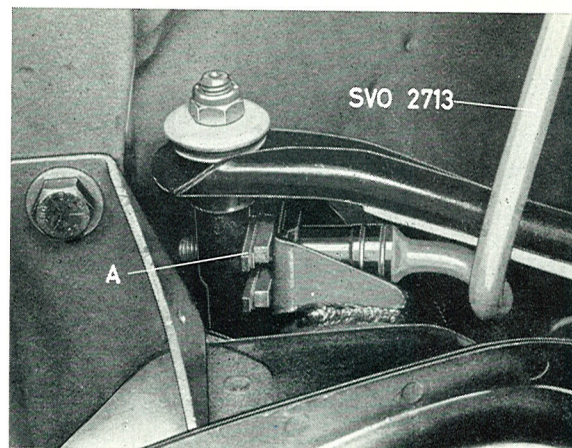


Fig. 6-6. Adjusting the caster and camber  
A = Shims

fact that the vehicles are mostly driven when occupied by only one person.

When adjusting the camber, the bolts are slackened a couple of turns with tool SVO 2713, one end of which is used for the front and the other end for the rear attaching bolts (see Fig. 6-6). Therefore the number of shims is increased or decreased equally at both the bolts. The camber is adjusted to a greater positive angle by removing the shims, and to a negative angle by adding shims. The diagram in Fig. 6-7 shows the thickness of the shims corresponding to a certain alteration in the angle. After adjustment, the bolts are tightened to a torque of 4.8—5.5 kgm (35—40 lb.ft.) and the camber is checked once again.

**NOTE:** An equal number of shims must either be removed or added to both the bolts otherwise the camber will be altered.

If it is understood how the camber and caster should be altered, these alterations can be carried out at the same time by, for example, removing or adding shims for the camber and at the same time carrying out similar shim alterations for the caster. (If, for example, the camber is increased  $0.6^\circ$  and the caster  $1/4^\circ$ , 2.5 mm [1"] is first removed at the bolts and 0.3 mm [0.012"] is transferred from the front to the rear bolt.)

### ADJUSTING THE TOE-IN

The toe-in should be 0—4 mm (0—0.16"). Incorrect toe-in is adjusted by slackening the clamping screw or locknuts respectively on the tie rod, after which the rod is turned in the required direction. The distance between the tyres at the front is reduced, that is to say, toe-in is increased by turning the tie-rod in the normal direction of rotation of the wheels. Tighten the locknut after adjustment to a torque of 7.5—9.0 kgm (55—65 lb.ft.).

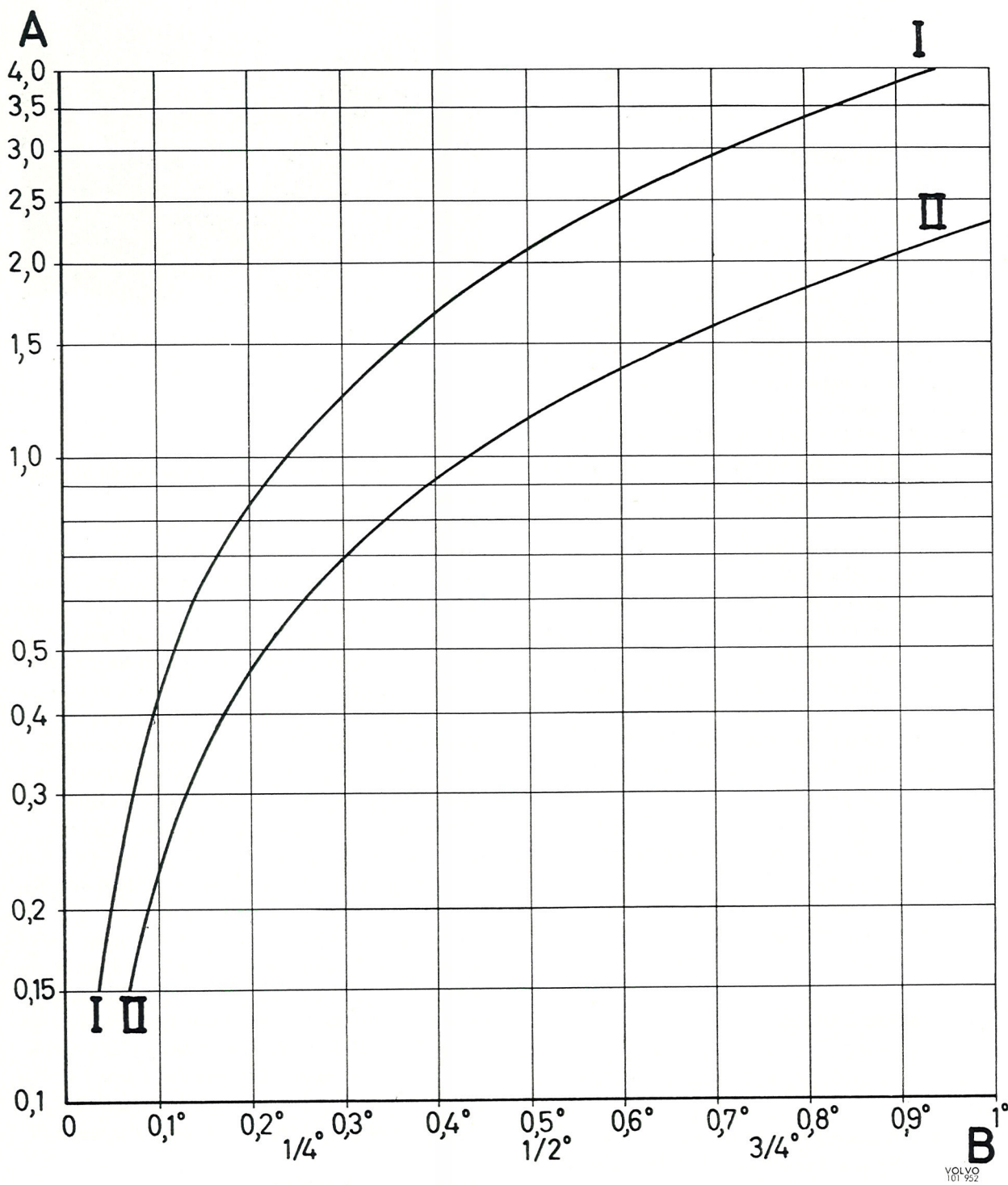


Fig. 6-7. Diagram for alteration of caster and camber

I = Camber  
 II = Caster  
 A = Shims (mm)  
 B = Alteration of angle



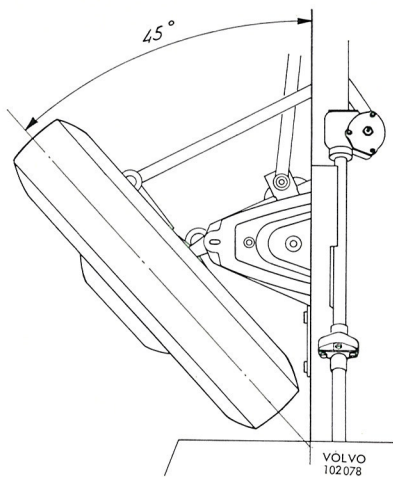


Fig. 6-8. Adjusting the max. wheel lock

### ADJUSTING THE STEERING LIMITS

Turning of the wheels is limited by stop screws, at the pitman arm for left-hand driving and at the relay arm for right-hand driving, see Fig. 6-9.

Adjusting is done as follows:

1. Turn the left wheel for a left-hand turn as far as it goes. Check that the lock angle of the

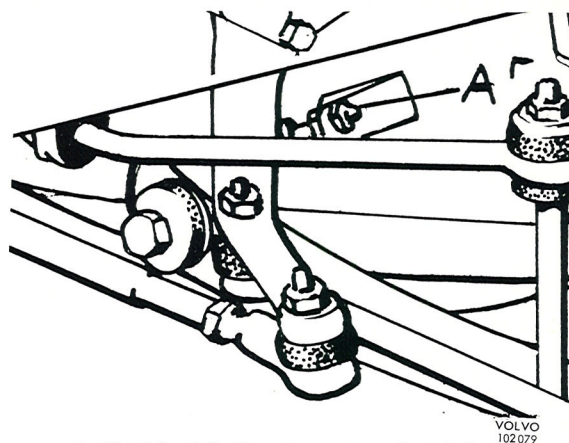


Fig. 6-9. Adjusting screw, max. wheel lock

wheels is 45°. If it is not, then adjust to this value with the stop screw (Fig. 6-9) at the pitman arm.

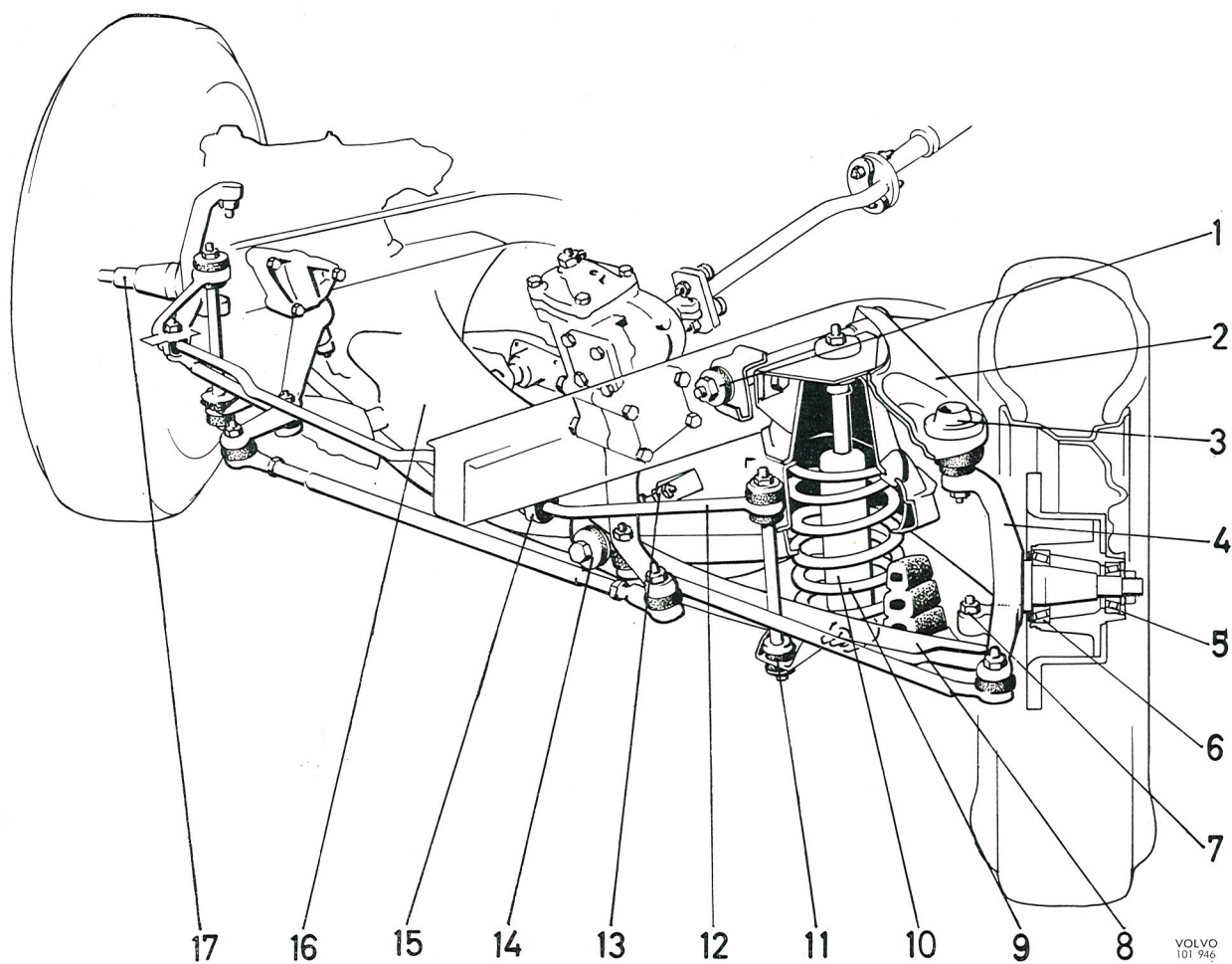
2. Repeat this procedure with the right wheel and the stop screw on the relay arm.

**N. B.** Check that brake hoses are clear at full wheel lock.

GROUP 62

# FRONT AXLE

## DESCRIPTION



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Fig. 6-10. Front axle

- |                              |                                     |
|------------------------------|-------------------------------------|
| 1. Upper wishbone bush       | 10. Shock absorber                  |
| 2. Upper wishbone            | 11. Stabilizer attachment           |
| 3. Upper wishbone ball joint | 12. Stabilizer                      |
| 4. Steering knuckle          | 13. Stop screw, max. wheel lock     |
| 5. Outer wheel bearing       | 14. Lower wishbone bush             |
| 6. Inner wheel bearing       | 15. Frame attachment for stabilizer |
| 7. Lower wishbone ball joint | 16. Front axle member               |
| 8. Lower wishbone            | 17. Stub axle                       |
| 9. Coil spring               |                                     |



The vehicle has independent front wheel suspension. This means that there is no actual front axle, this being replaced by a robust box-section front axle member. This member is bolted to the self-supporting body and the front wheel suspension and springs are fitted at the ends of the member. The construction is illustrated in Fig. 6-10.

The steering knuckle is pivoted on the upper and lower wishbones by means of ball joints (3 and 7) which are pressed into the wishbones. The wishbone shafts are carried in rubber bushes (1 and 14, Fig. 6-10) which are journalled in the wishbones. Camber and caster are adjusted by means of shims between the upper wishbone shaft and its attachment in the front axle member (see Fig. 6-6).

The front wheels are carried in taper roller bearings (5 and 6, Fig. 6-10). The front spring assembly consists of coil springs (9) inside which telescopic shock absorbers (10) are fitted. In order to increase its anti-rolling properties, the car is equipped with a stabilizer (12) which is attached partly to the lower wishbones (11) and partly to the body (15).

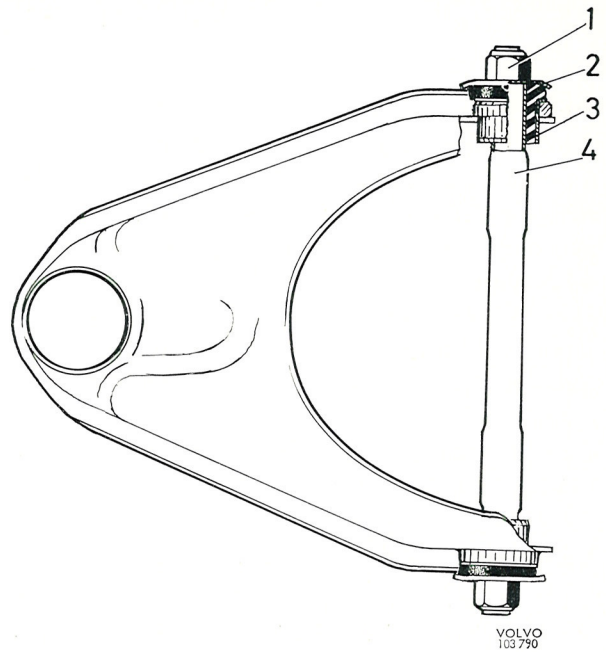


Fig. 6-11. Upper wishbone

1. Nut 2. Washer 3. Bush 4. Wishbone shaft

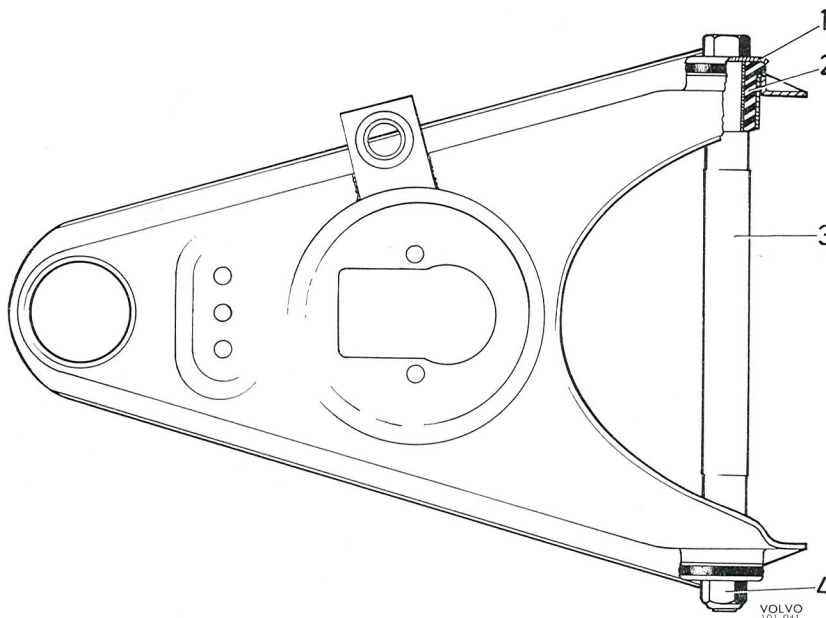


Fig. 6-12. Lower wishbone

1. Washer 2. Bush 3. Wishbone shaft 4. Nut

# REPAIR INSTRUCTIONS

## GENERAL

The ball joints require no lubrication and are therefore not fitted with lubricating nipples. However, the rubber seal should be inspected once a year and if necessary replaced when topping up with grease takes place.

The wishbones may only be straightened to a minor extent and then only in a cold condition. If the old part deviates to any great extent when compared to a new one, it should be replaced.

No straightening whatsoever is permitted for stub axles with steering knuckles.

## REMOVING THE FRONT END COMPLETE

1. Install the lifting tool SVO 2727 according to Fig. 6-13. Fix the plate with the upper screw (no flat washer) for the timing gear casing. Raise the engine until the weight is taken off the front engine mountings. Remove the hub caps and loosen a couple of turns the nuts for the front wheels.
2. Jack up the vehicle under the front jack attachment. Remove the front wheels.
3. Disconnect the steering rods from the steering arms with tool SVO 2294 according to Fig. 6-17.
4. Remove the brake hose clamps from the stabilizer screws and remove the screws.
5. Loosen the brake hoses from the bracket at the support member.
6. Remove the lower nuts for the front engine mountings.

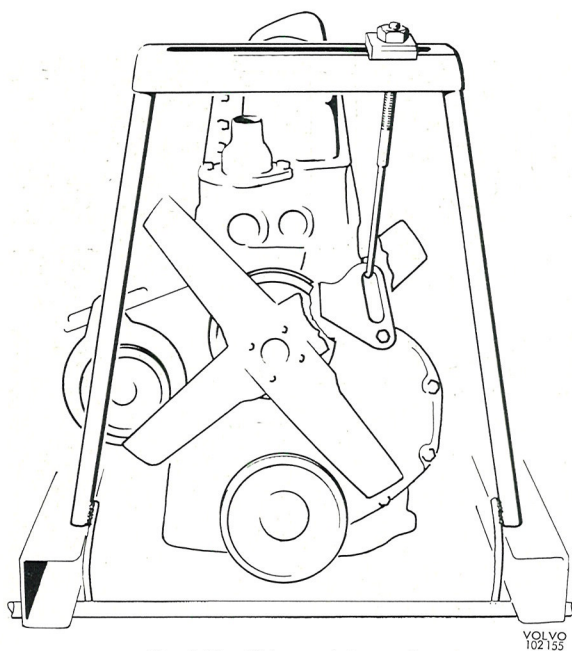


Fig. 6-13. Lifting tool for engine

7. Remove the front axle member attaching screws, lower and remove the front end.

## DISMANTLING THE FRONT END

With regards to the removal of the various components, see the particular section in question.

## FITTING THE FRONT END COMPLETE

1. Fit the guide pins in the front holes for the front axle member.
2. Place a jack under the front end and raise the front end so that it comes into position. Apply some drops of lock fluid, part No. 277916, on the rear screws and fit them. Remove the guide pins and fit the front screws (also lubricate these with the same lock fluid as above).
3. Tighten the engine mountings.
4. Fit the brake hoses according to Fig. 5-15 (Part 5). Fit the bolts for the stabilizer. Firmly secure the brake hoses. N.B. Check the location of the brake hoses according to Fig. 5-15 (Part 5).
5. Fit the steering rods and front wheels.
6. Vent the brakes according to the instructions given in Part 5.
7. Lower the vehicle and remove the lifting device. Then fit the timing gear casing screw with the flat washer.

## STUB AXLE

### REMOVING

1. Remove the front wheel brake unit according to Part 5, "Removing the front wheel brake unit", points 1—4.

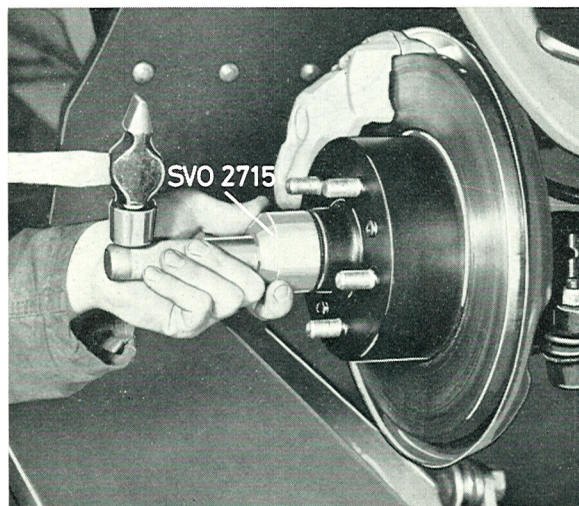


Fig. 6-14. Removing the grease cap



2. Remove the grease cap with tool SVO 2715, see Fig. 6-14. Remove the split pin and castle nut. Pull off the hub with puller SVO 2726, see Fig. 6-15. Pull off the inner bearing for the stub axle with tool SVO 2722, see Fig. 6-16.
3. Remove the steering rod from the steering arm with tool SVO 2294, see Fig. 6-17.
4. Slacken but do not remove the nuts for the ball joints and knock on the axle with a hammer until the ball joint pins loosen. Raise the lower wishbone a little with the jack. Remove the nuts for the ball joints and then the stub axle.

### EXAMINING THE BEARING COMPONENTS

Clean the hub and grease cap thoroughly. Make sure that all the old grease, even inside the hub, is removed. Compressed air can suitably be used for a comprehensive cleaning of the bearings. Then wash the bearing components in white spirit and allow them to dry. Drying by means of compressed air should be avoided since the air often contains water and dust particles. Accessible bearing components are dried with cotton or cloth rags (but not waste). A new bearing taken directly from its packing container should not be cleaned.

After the cleaning, inspect the parts. If the bearing races or rollers are damaged, rusted or are blued, replace the bearing. If the outer or inner ring is loose in its seating, try a new ring. If the play does not disappear, then the hub or shaft must be replaced. The sealing rings should be replaced if they are worn or damaged.

For lubrication of the wheel bearings, use only a high-class, durable grease for wheel bearings. A lubricating unit should be used for effective greasing of the wheel bearings. The instructions of the manufacturer of the unit should then be followed. If a lubricating unit is not available, pack the bearings

manually with as much grease as possible between the roller retainers and the inner race. Grease also on the outside of the rollers and container. The intermediate spaces in the hub between the outer and inner bearing should be filled with grease, see Groups 46 and 77. Before being fitted, the wheel hub felt rings should be oiled generously with, for example, light engine oil.

### FITTING

1. Place the inner bearing in position in the hub and press in the sealing ring with tool SVO 2723 and standard handle SVO 1801. See Fig. 6-18.
2. Place the stub axle in position and tighten the ball joint nuts. (If the ball joint twists, hold it firmly in

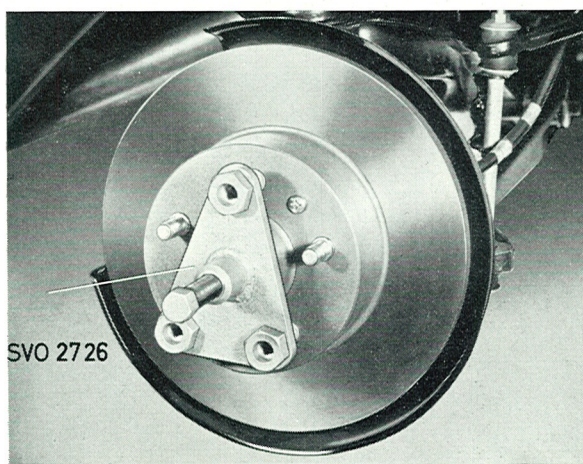


Fig. 6-15. Removing the front wheel hub



Fig. 6-16. Removing the inner bearing

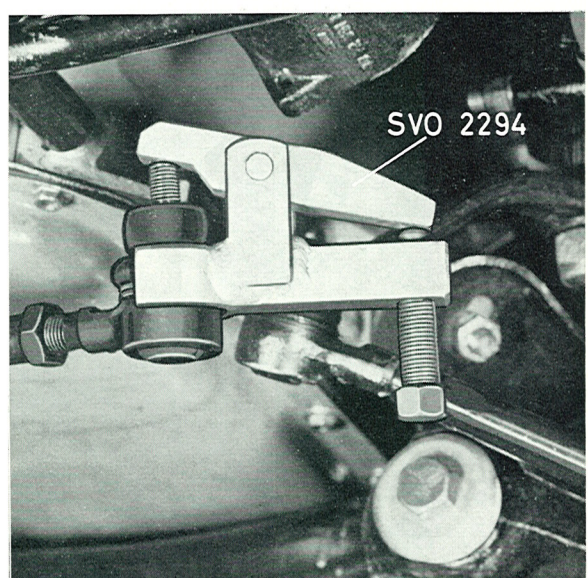


Fig. 6-17. Removing the steering rod



position with a screw vise, (see Fig. 6-22). Fit the steering rod on to the steering arm.

3. Place the hub on the axle, fit the outer bearing, washer and castle nut.
4. Adjust the front wheel bearings by tightening the nut with a torque wrench to a torque of 7 kgm (50 lb.ft.). Then slacken the nut one third of a turn. If the slot in the nut does not coincide with the split pin hole in the stub axle, slacken the nut further until the split pin can be fitted. Check that the wheel rotates easily but without any play.
5. Fill the grease cap half full of grease and fit it with tool SVO 2715.

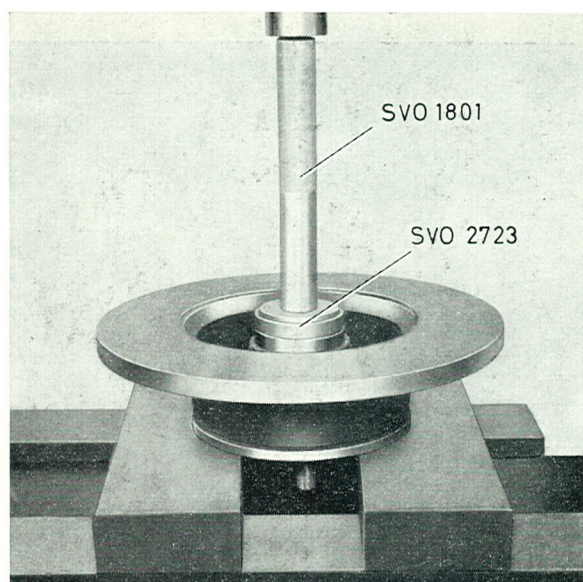


Fig. 6-18. Fitting the sealing ring

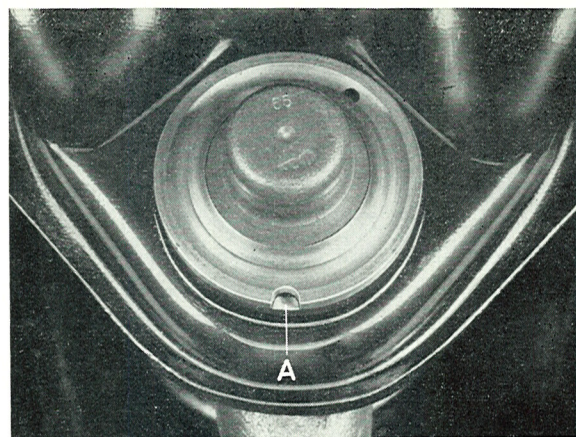


Fig. 6-20. Location of ball joint in upper wishbone  
A = Slot

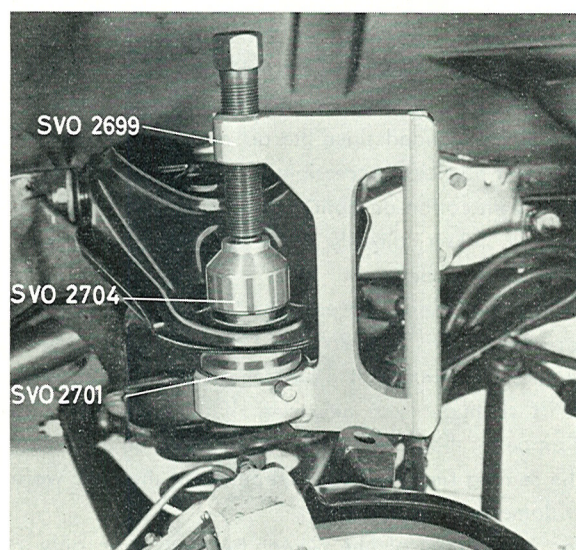


Fig. 6-21. Fitting the ball joint, upper wishbone

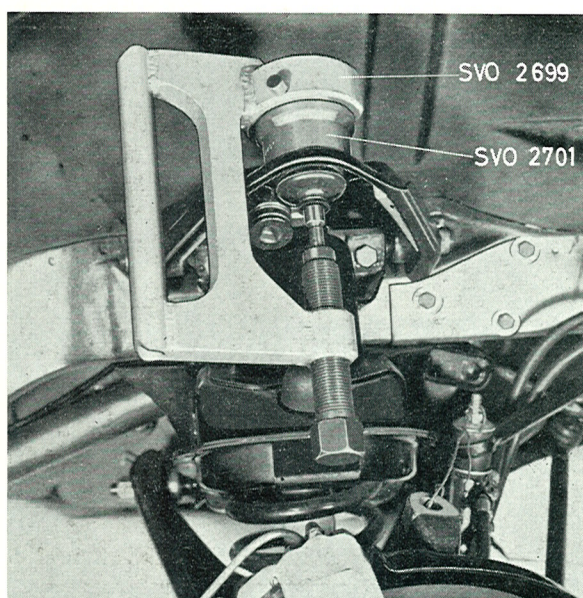


Fig. 6-19. Removing the ball joint, upper wishbone

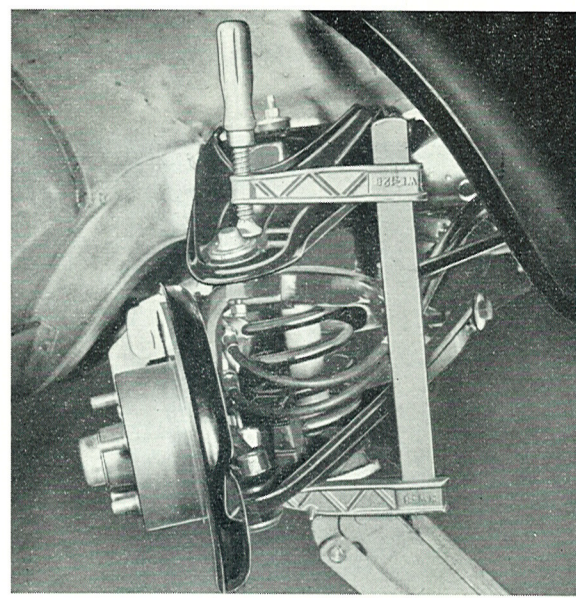


Fig. 6-22. Upper ball joint securely held by vise



6. Fit the front wheel brake unit and wheel according to Part 5 "Fitting the front wheel brake unit".

## REPLACING THE BALL JOINT, UPPER WISHBONE

1. Remove the hub cap and slacken the wheel nuts slightly.
2. Jack up the front end of the vehicle under the front jack attachments. Remove the wheel.
3. Slacken but do not remove the nut for the upper ball joint. Knock with a hammer on the stub axle round the ball joint pin until it loosens from the axle. Remove the nut and suspend the upper end of the axle with a wire to avoid straining the brake hoses. See Fig. 6-19.
4. Loosen the nuts for the wishbone shaft a 1/2 turn. Lift up the wishbone slightly and press out the ball joint with press tool SVO 2699 and sleeve SVO 2701, see Fig. 6-19.
5. Before fitting the ball joint, check that the rubber cover is filled with grease. Bend the pin end over the slot, see Fig. 6-20. Check that the grease forces its way out. If necessary top up with multi-purpose grease.
6. Press the ball joint into the wishbone with press tool SVO 2699, sleeve 2701 and drift 2704, see Fig. 6-21. Make sure that the slot in the ball joint coincides with the longitudinal shaft of the wishbone either externally or internally, see Fig. 6-20, as the pin has maximum movement in the direction of this line. Should the ball joint be incorrectly fitted when being pressed in, turn the tool SVO 2699 half a turn and then press the ball joint into the correct position. Turn down the wishbone and tighten the nuts for the wishbone shaft. Tighten the ball joint against the stub axle. If the pin rotates, hold it firmly with a screw vise, see Fig. 6-22.
7. Fit the wheel and wheel nuts. Lower the vehicle and tighten the wheel nuts to a torque of 10–14 kgm (70–100 ft. lb.). Fit the hub cap.

## REPLACING THE BALL JOINT, LOWER WISHBONE

1. Remove the hub cap and slacken the wheel nuts slightly.
2. Jack up the vehicle under the front jack attachment. Remove the wheel.  
Disconnect the steering rod from the steering arm with tool SVO 2294, see Fig. 6-17, and disconnect the brake lines from the stabilizer bolt.
3. Loosen the nuts for the upper and lower ball joints, but do not remove them. With a hammer knock until the ball joints loosen from the axle.

Raise the lower wishbone with the jack. Remove the nuts.

4. Remove the steering knuckle with hub and the front wheel brake unit, and place them on a stand or similar.
5. Press the ball joint out of the lower wishbone with press tool SVO 2699 and sleeve SVO 2700, see Fig. 6-23.
6. Check that the rubber cover is filled with grease by breaking the pin to the side so that grease is forced out. If this does not happen, then fill the rubber cover with grease.
7. Press the ball joints in the wishbone with tools SVO 2699 + 2701 + 2703, see Fig. 6-24. Should the

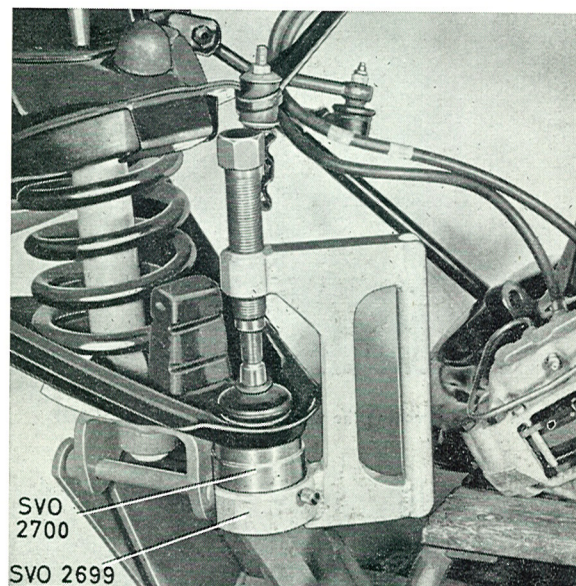


Fig. 6-23. Removing the ball joint, lower wishbone

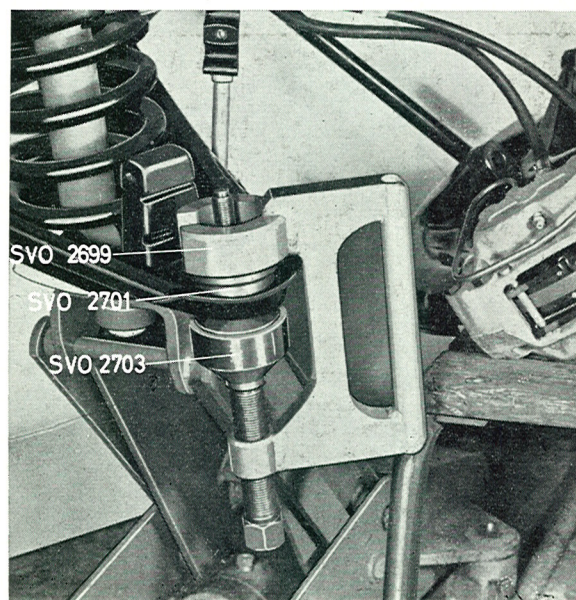


Fig. 6-24. Fitting the ball joint, lower wishbone



ball joint not fit correctly, turn the tool 180° and tighten finally with the tool in this position.

8. Fit the steering knuckle and tighten the nuts of the upper and lower ball joints. If the pins rotate, fix them securely with a screw vice, see Fig. 6-22. Fit the steering rod and lower the jack in order to take the load off the wishbones. Point the wheels straight forwards and fasten the brake hoses to the stabilizer screw.
9. Fit the wheel. Lower the vehicle and tighten the wheel nuts. Fit the hub cap.

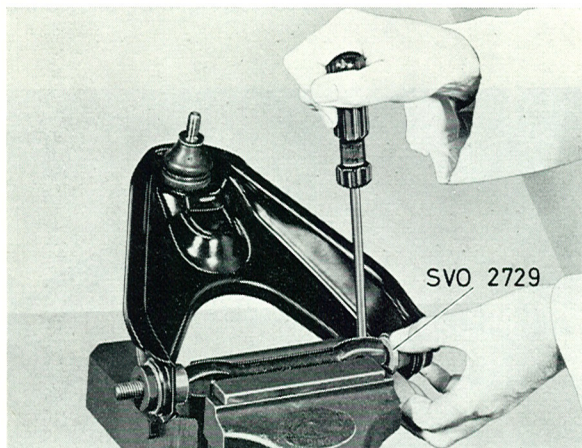


Fig. 6-25. Removing the wishbone shaft. 1. Fit tool 2729

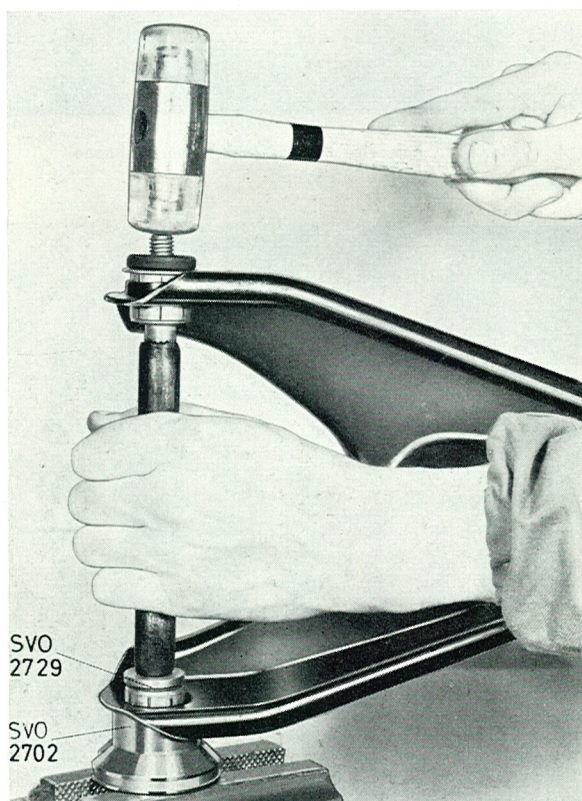


Fig. 6-26. Removing the wishbone shaft. 2. Drive out the shaft

## UPPER WISHBONE

### REMOVING

1. Carry out operations 1—3 described in "Replacing the ball joint, upper wishbone".
  2. Remove the screws for the wishbone shaft with tool SVO 2713, see Fig. 6-6.
- N.B. Keep the shims in a safe place. Lift off the wishbone.

### REPLACING THE UPPER WISHBONE BUSHES

1. Remove the nuts (1, Fig. 6-11) and the washers (2) for the wishbone shaft.
2. Fix the wishbone shaft securely in a vise. Carefully bend out the wishbone ends so that tool SVO 2729 can be fitted, see Fig. 6-25. Drive out one of the bushes with a fiber club and tool SVO 2702, see Fig. 6-26. Turn the wishbone, move tool SVO 2729 over to the other side and drive out the other bush in the same way as for the first one.

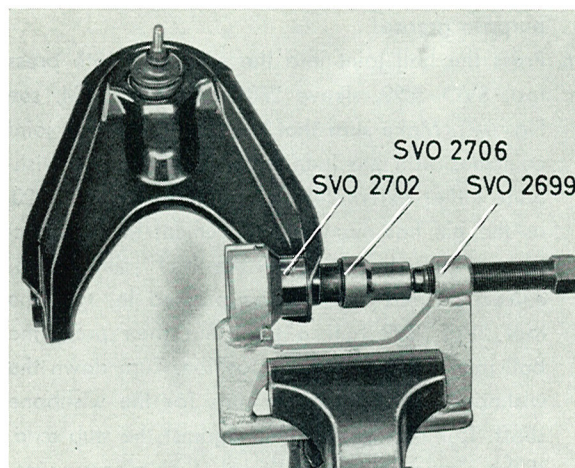


Fig. 6-27. Fitting the first rubber bush, upper wishbone

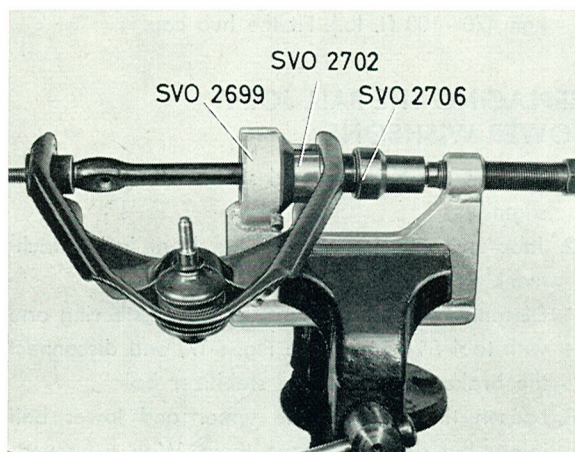


Fig. 6-28. Fitting the second rubber bush, upper wishbone



3. Hold press tool SVO 2699 firmly in a vise. Press in one of the bushes with tool SVO 2702 and tool SVO 2706, see Fig. 6-27.
4. Fit the wishbone shaft and press in the other bush with the sleeve SVO 2702 + drift SVO 2706, see Fig. 6-28. Make sure that the shaft fits the recess of the tool SVO 2702.
5. Fit the washers (2) and the nuts (1). Tighten the nuts when the wishbone is fitted.

## FITTING

N.B. The wishbone is fixed with a special screw containing a nylon plug.

1. Place the wishbone in position and fit the screws by hand. Fit the shims in position they occupied previously. Tighten the screws with tool SVO 2713. Tighten the nuts for the wishbone shaft.
2. Fit the upper ball joint in the steering knuckle and tighten the nut.
3. Fit the wheel and wheel nuts. Lower the vehicle and tighten the wheel nuts to a torque of 10–14 kgm (70–100 lb. ft.). Fit the hub cap.

## LOWER WISHBONE REMOVING

1. Remove the hub cap and loosen the wheel nuts a couple of turns.
2. Jack up the vehicle at the front jack attachments. Remove the wheel.
3. Remove the shock absorber, see Part 7, "Removing the shock absorber".
4. Disconnect the steering rod from the steering arm with tool SVO 2294, see Fig. 6-17. Loosen the clamp for the brake hoses. Remove the screw for the stabilizer.

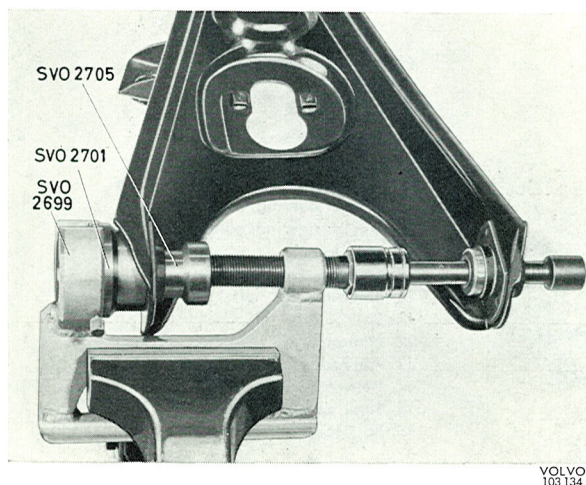


Fig. 6-29. Removing the rubber bush, lower wishbone

5. Place the jack under the lower wishbone. Loosen the nuts for the ball joints, and knock with a hammer until the ball joints loosen from the steering knuckle. Remove the nuts and lower the jack. Remove the steering knuckle with the front brake wheel unit and place them on a stand or such-like.
6. Then lower the jack and remove the spring.
7. Remove the nut from the wishbone shaft and take off the latter. Turn the relay arm with the tie rod so that the wishbone shaft is free and thus can be removed. Take off the wishbone.

## REPLACING THE LOWER WISHBONE BUSHES

1. Tension the press tool SVO 2699 in the vise. Press out the bushes with drift SVO 2705 and tool SVO 2701, see Fig. 6-29.
2. Turn the wishbone and press out the other bush in the same way.
3. Press in the bushes with drift SVO 2705 (turned in the opposite direction) and the tool SVO 2701 and press tool SVO 2699, see Fig. 6-30.

## FITTING

1. Place the wishbone into position. Fit the wishbone shaft. Keep the wishbone fairly horizontal and tighten the nut for the wishbone shaft.
2. Fit the spring. Raise the jack and fit the steering knuckle according to point 8 in "Replacing the ball joint, lower wishbone".
3. Fit the shock absorber according to Part 7, "Fitting the shock absorber".
4. Fit the wheel. Lower the vehicle. Tighten the wheel nuts. Fit the hub cap.

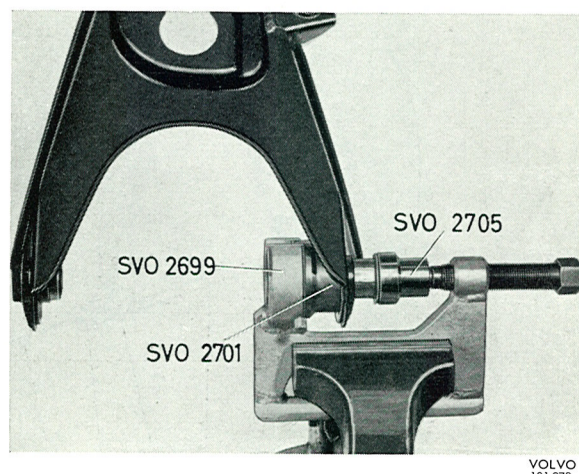


Fig. 6-30. Fitting the rubber bush, lower wishbone



# STEERING GEAR

## DESCRIPTION

The design of the steering gear is shown in Fig. 6-31. The movement of the steering wheel is transmitted to the wheels via the divided column (7 and 5), the steering box (3) the pitman arm (12), the tie rod (13), the steering rods (10) and (15) as well the steering knuckles (1) and (9). The steering gear is of the "cam and roller" type. The steering cam is carried in two ball bearings and the pitman arm shaft in three bushes.

The relay arm (Fig. 6-49) is supported on a pin in the bracket by means of a bush. The bush consists of three parts, a rubber bush with an outer sleeve of sheet-metal and an inside one consisting of a spacing sleeve. The outer sleeve has a press fit in the hole of the relay arm. When the relay arm is turned, movement takes place between the outer sleeve and the rubber bush, the intervening space of which has been lubricated for life. The bearing thus requires no lubrication.

The steering column is divided. Its upper and lower sections are jointed by means of a flange (6). Should a frontal collision involving the indentation of the front end occur, the flange of the lower part of the steering column is broken off from the upper steering column part and travels upwards. The upper steering column part retains its position, thus eliminating the risk of the steering column being forced backwards and upwards. The upper part of the steering column is carried in two ball bearings located in the jacket tube. The lower steering column part is connected to the steering cam by means of the flange (4).

The ends of the tie rod are plastic-lined which means that they require no lubricating.

The car has a turning circle of about 10 m (33 ft.) and the number of steering wheel turns from lock to lock is  $4\frac{1}{4}$ .

### STEERING WHEEL LOCK

The engine of the vehicle has been made tamper-proof by the installation of a steering wheel lock (Fig. 6-34) which is integrally built with the ignition switch. The ignition switch has four positions, 0-I-II-III. Removing the ignition key, which can only take place when it is in position "0", releases a catch and lock pin (A) is pressed forwards by a spring. When the steering wheel is turned, so that a slot coincides with the lock pin, the lock pin enters the slot and locks the steering column so that the wheels cannot be turned. When the ignition key is inserted and switched to position "I", the lock pin is pulled back and this releases the steering column which is secured in a withdrawn position. At position "I" the vehicle can be moved with the ignition not on.

At position "II" the ignition is connected up and in position "III" the starter motor can be engaged. The ignition switch and steering wheel lock can only be replaced as a single unit.

The steering wheel lock is mounted on the column by means of two shear-off bolts, and to the dashboard with two screws.

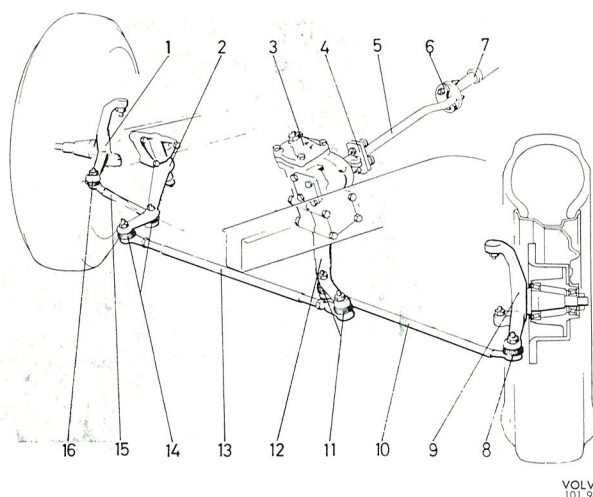


Fig. 6-31. Steering gear

1. Steering knuckle, right
2. Relay arm
3. Steering box
4. Lower steering column flange
5. Lower steering column section
6. Upper steering column flange
7. Upper steering column section
8. Ball joint
9. Steering knuckle, left
10. Steering rod, left
11. Ball joint
12. Pitman arm
13. Tie rod
14. Ball joint
15. Steering rod, right
16. Ball joint

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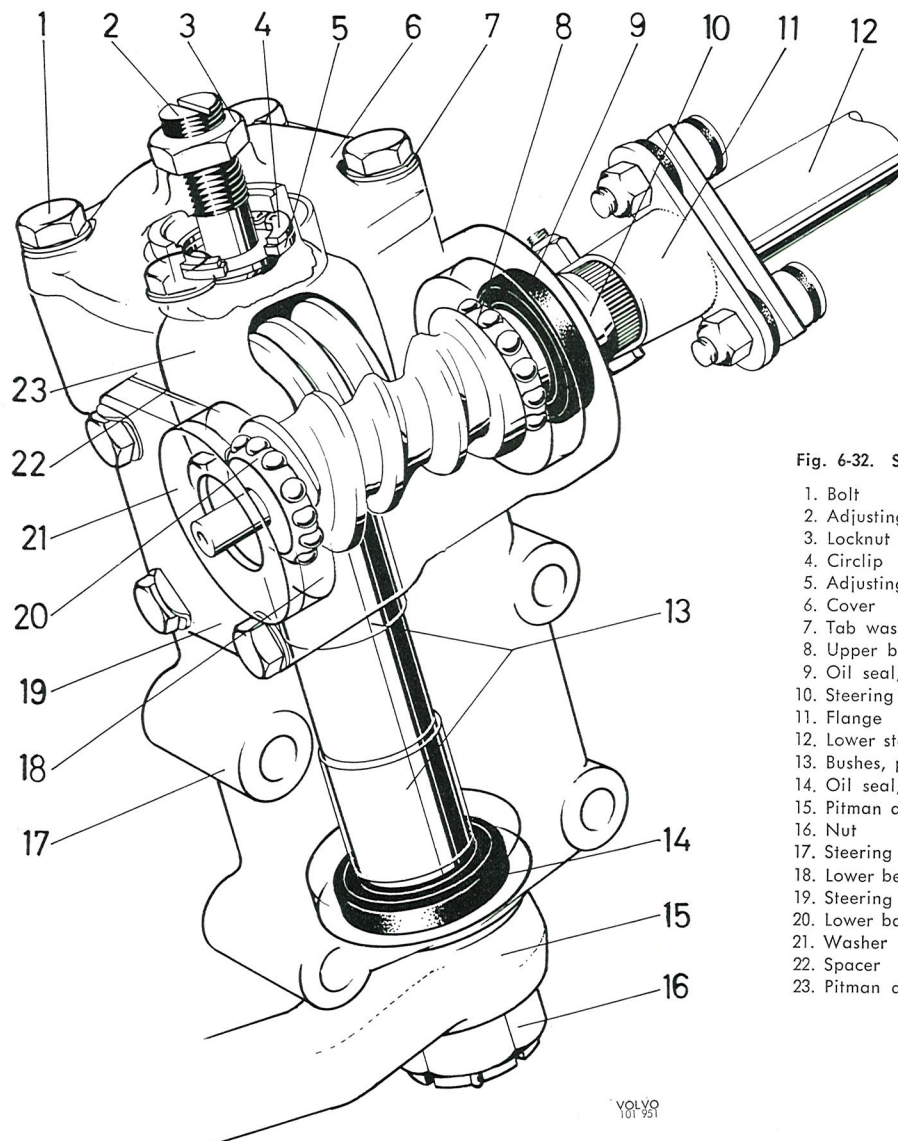


Fig. 6-32. Steering box

1. Bolt
2. Adjusting screw, pitman arm shaft
3. Locknut
4. Circlip
5. Adjusting washer
6. Cover
7. Tab washer
8. Upper ball bearing, steering cam
9. Oil seal, steering cam
10. Steering cam
11. Flange
12. Lower steering column section
13. Bushes, pitman arm shaft
14. Oil seal, pitman arm shaft
15. Pitman arm
16. Nut
17. Steering box
18. Lower bearing race, steering cam
19. Steering cam cover
20. Lower ball bearing, steering cam
21. Washer
22. Spacer
23. Pitman arm shaft

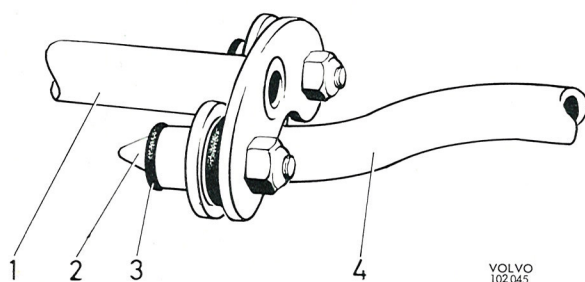


Fig. 6-33. Upper flange, steering column

1. Upper steering column section
2. Pin
3. Rubber bush
4. Lower steering column section

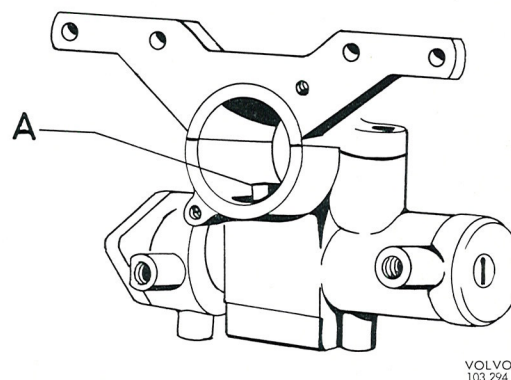


Fig. 6-34. Steering wheel lock

A = Lock pin

# REPAIR INSTRUCTIONS

## REPLACING THE STEERING WHEEL

1. Remove the screws for the directional indicator switch housing and lift off the housing. Remove the screws (2 and 3, Fig. 6-35), lift up the horn ring, disconnect the ground cable and remove the horn ring, see Figs. 6-35 and 6-36.
2. Remove the steering wheel nut.
3. Point the wheels straight forwards. Fit the steering wheel puller tool SVO 2711, see Fig. 6-37, and remove the steering wheel.
4. Make sure that the wheels point straight forwards. Fit on the steering wheel and the steering wheel nut. Tighten the steering wheel nut to a torque of 3.5–5.0 kgm (25–35 lb. ft.).

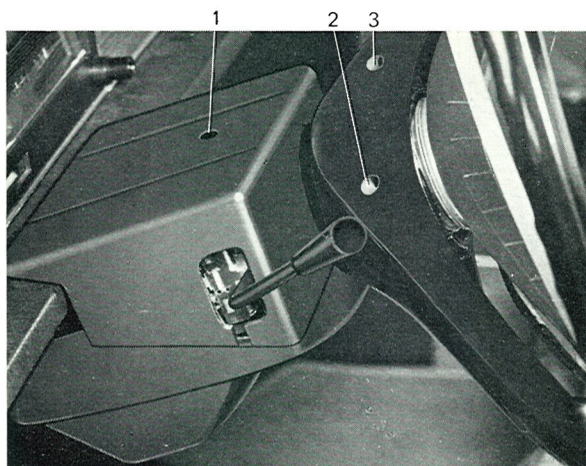


Fig. 6-35. Directional indicator switch housing, upper part

1. Screw for housing, upper part
2. and 3. Screws for horn ring

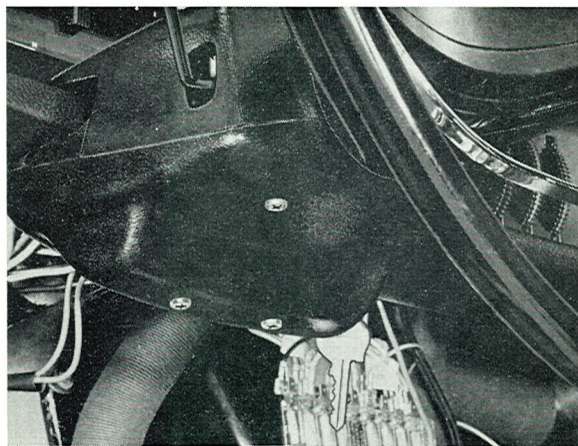


Fig. 6-36. Directional indicator switch housing, lower part

5. Connect up the ground cable, fit the horn ring check its function.
6. Fit first the lower then the upper part of the direction switch housing.

## REMOVING THE STEERING BOX

1. Jack up the vehicle at the front end.
2. Loosen the bolt (B, Fig. 6-38) at the lower steering column shaft flange. Remove the nuts (A) and move the lower part of the flange as far down as possible on the steering cam.
3. Remove the lock nut for the pitman arm. Pull of the pitman arm with tool SVO 2370. After fitting the tool, turn the wheels to the left (see Fig. 6-39).
4. Remove the nuts and bolts and lift out the steering box.

## REPLACING THE BUSHES IN THE STEERING BOX

1. Make guide marks on the flange and steering cam. Remove the flange.
2. Remove the cover (19, Fig. 6-32). Take care of the shims (22).
3. Drive out the lower bearing race and bearing (18 and 20) by carefully knocking the steering cam (10) downwards with a plastic hammer. Remove the steering cam and bearing.
4. Remove the oil seals (9 and 14) for the steering cam and pitman arm shaft with a screwdriver.

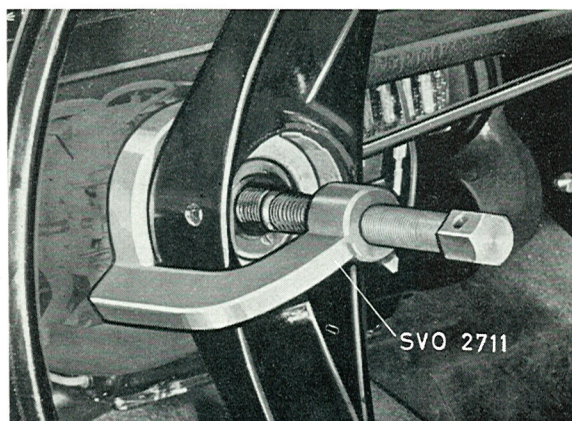


Fig. 6-37. Removing the steering wheel



5. Remove the outer bearing race for the upper steering cam bearing with tools SVO 2718 + SVO 1801.
6. Remove the bushes for the pitman arm shaft with tool SVO 2720 according to the following:  
Insert tool SVO 2720 with expander sleeve loose (Fig. 6-40). Move tool SVO 2720 into the housing until the expander fits into position in the bush. Press out the bush, see Fig. 6-41. Press out the other bush in the same way.
7. Remove the cover (6) with the pitman arm shaft (23). Screw the adjusting screw (2) in through the cover and thus separate the cover from the pitman arm shaft. Remove the circlip (4) and also the adjusting screw.

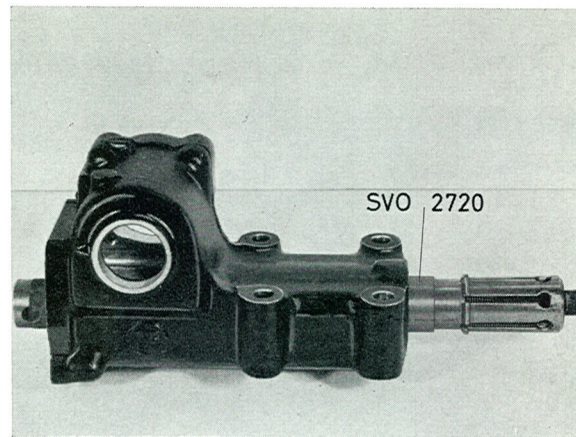


Fig. 6-40. Removing the bushes, pitman arm shaft, I  
Puller inserted

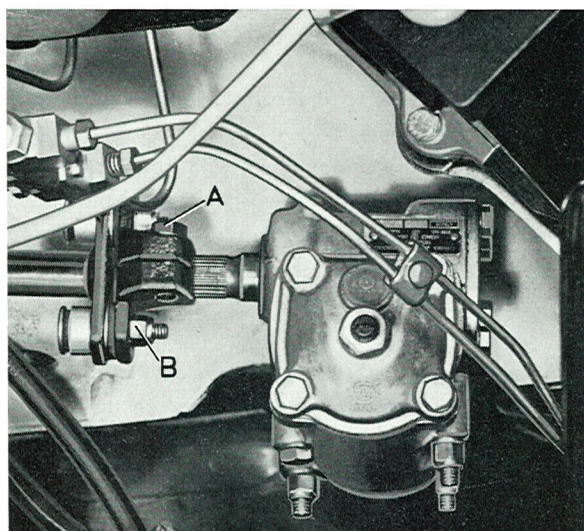


Fig. 6-38. Steering box

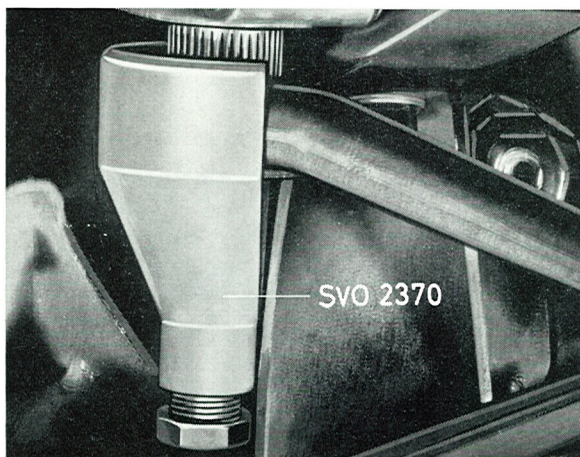


Fig. 6-39. Removing the pitman arm

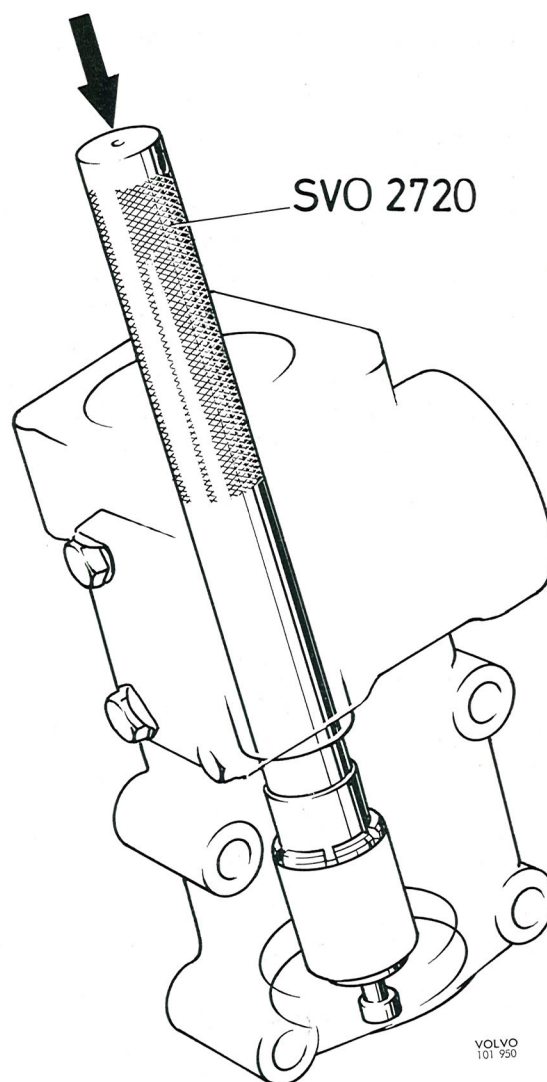


Fig. 6-41. Removing the bushes, pitman arm shaft, II



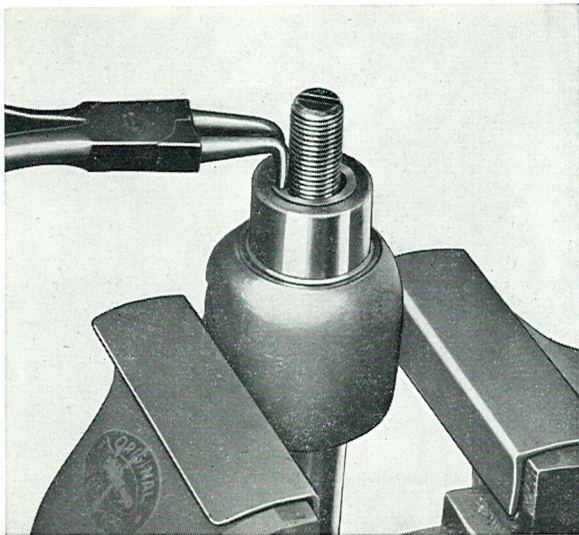


Fig. 6-42. Removing the adjusting screw

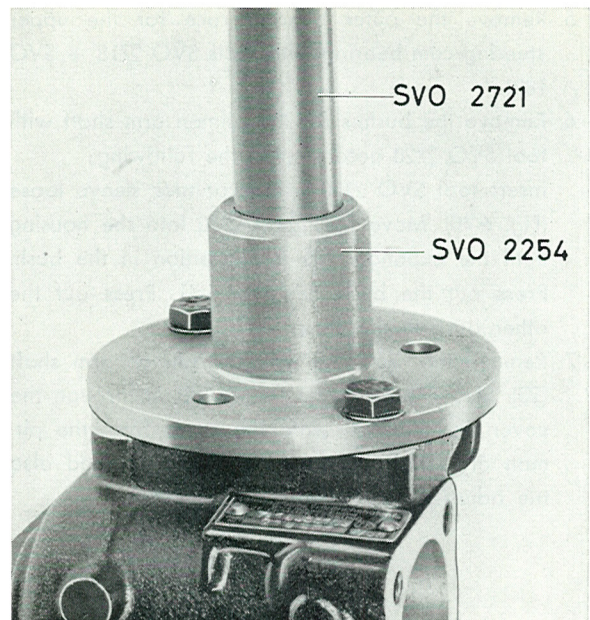


Fig. 6-44. Reaming the pitman arm shaft bush

8. Clean and check all the parts. Replace those that are damaged.
9. Press in new bushes with tools SVO 2716 + SVO 1801, see Fig. 6-43.
10. Fit guide SVO 2254 and ream the bushes with reamer SVO 2721, see Fig. 6-44.
11. Press in the outer bearing race for the upper bearing with tools SVO 2717 + SVO 1801. Fit the oil seal (9) for the steering cam.
12. Insert the steering cam with bearing and outer race (18) and washer (21). Fit the shims (22) and cover (19). Place the pitman arm shaft in a vice in such a way that the steering cam is horizontal. Tighten the cover and check the tension on the bearing. For correct tensioning, a torque of 1—25 kg/cm (6—14 lb.in.) is required to turn the steer-

ing cam. Adjust to the correct tension by adding or removing shims (22).

13. Lubricate the steering cam with some drops of oil and fit the cam, the washer (5) and the circlip (4). Check that the steering cam can be turned easily without play. If play occurs, replace the washer (5) with a thicker one.
14. Lubricate and fit the pitman arm shaft. Put on the cover (6) with gasket. Screw out the adjusting screw (2) far enough for the roller on the pitman arm shaft to run free of the steering cam when the bolts (1) for the cover are tightened. Fit and tighten the bolts (1).
15. Lubricate the oil seal (14) and fit it with tool SVO 2719, see Fig. 6-46.
16. Adjust the take-up according to Fig. 6-47. The spring-balance should give a reading of 0.4—0.7 kg (1—1.5 lb.) at the correct turn past the centre position. Here the steering cam should be vertical.

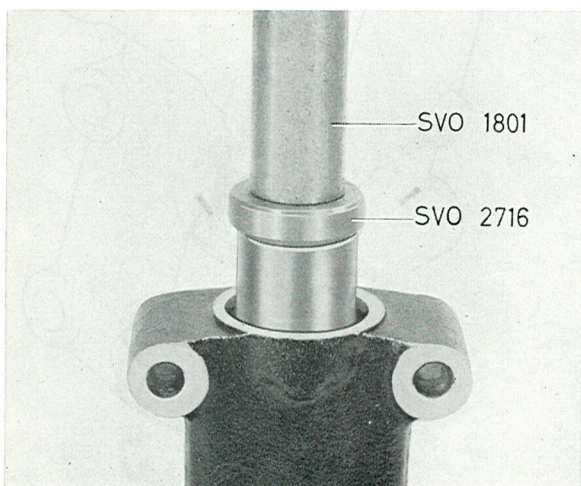


Fig. 6-43. Fitting the pitman arm bush

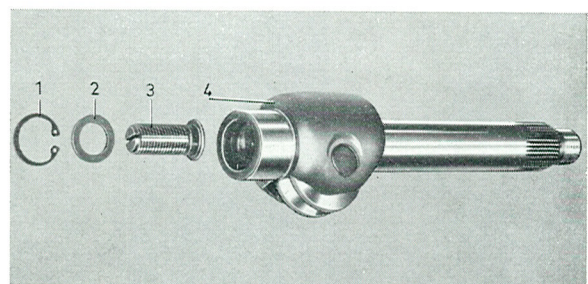


Fig. 6-45. Pitman arm shaft



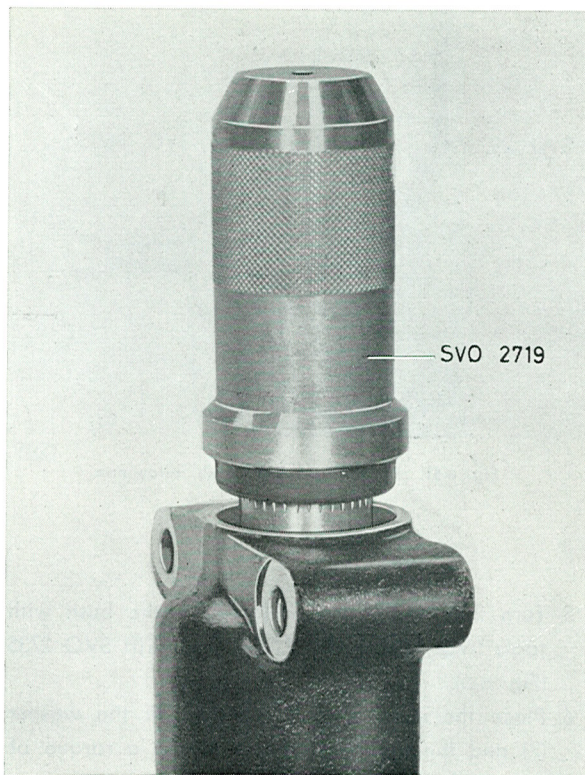


Fig. 6-46. Fitting the oil seal, pitman arm shaft

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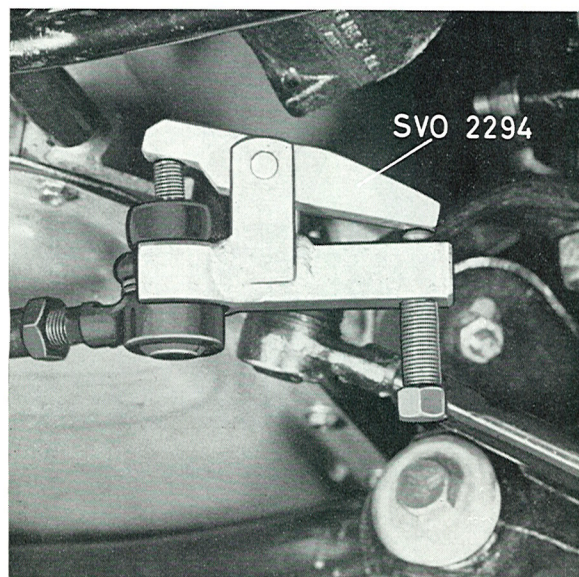


Fig. 6-48. Removing the ball joint

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After adjustment to the correct take-up, lock the adjusting screw lock nut (1).

17. Fit the washer so that its line-mark coincides with the mark on the steering cam. Top up with oil (approx. 0.25 litre = 3/4 US pint) hypoid oil SAE 80.

## FITTING THE STEERING BOX

1. Place the steering box into position and tighten up the bolts.
2. Place the pitman arm according to the marking and tighten the nut to a torque of 19 kgm (135 lb. ft.).
3. Manoeuvre the steering wheel so that the wheels point straight forwards and tighten both halves of the steering column shaft flange.
4. Lower the vehicle.

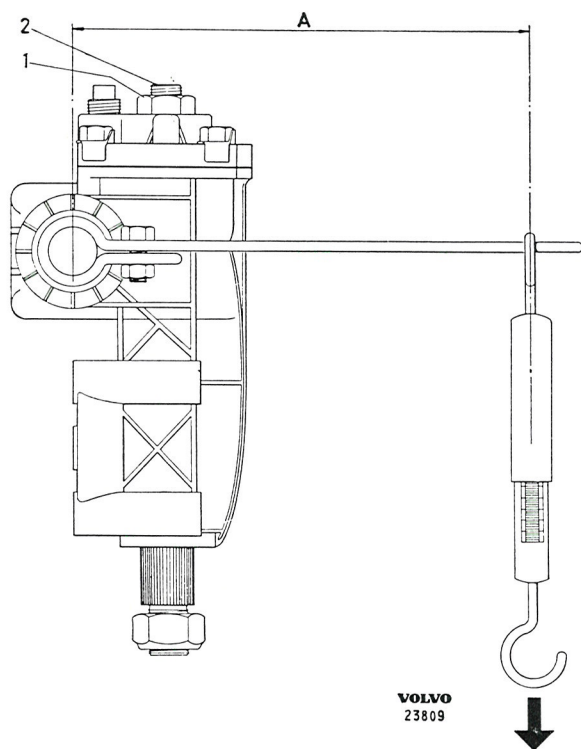


Fig. 6-47. Checking the take-up between cam and roller

A = 210 mm (approx. 8 1/4")

1. Lock nut
2. Adjusting screw

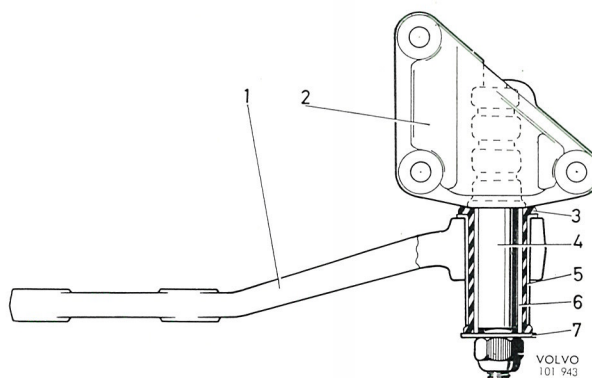


Fig. 6-49. Relay arm bearing

1. Relay arm
2. Bracket
3. Rubber bush
4. Bearing pin
5. Sleeve
6. Sleeve
7. Washer



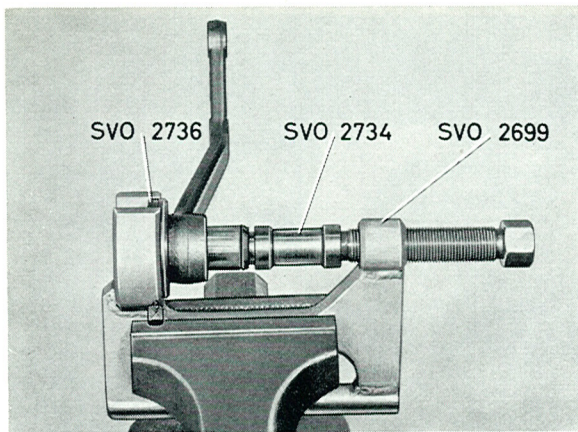


Fig. 6-50. Removing the rubber bush, relay arm

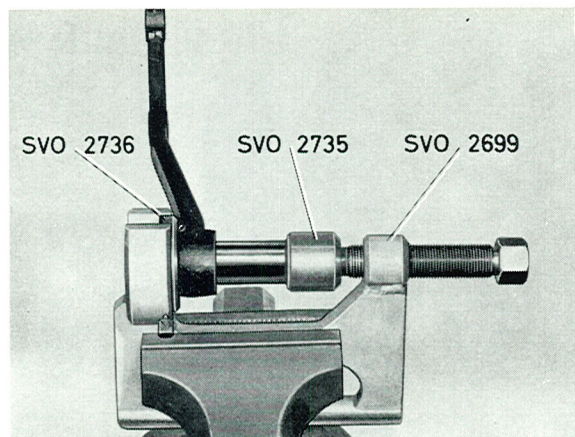


Fig. 6-51. Fitting the rubber bush, relay arm

## REPLACING THE RELAY ARM BUSH

1. Jack up the vehicle at the front end.
2. Disconnect the ball joints for the steering rod and tie rod from the relay arm with puller SVO 2294, see Fig. 6-48.
3. Remove the nut and washer (7, Fig. 6-49) and take down the relay arm (1).
4. Place press SVO 2699 in a vice and press out the bush with tool SVO 2736 and drift SVO 2734 (Fig. 6-50).
5. Turn the relay arm and press in the bush with tools SVO 2699 + SVO 2736 and drift SVO 2735 (Fig. 6-51).
6. Place the relay arm in position, fit the washer (7) and the nut. Tighten the nut to a torque of 7.0—8.5 kgm (50—60 ft. lb.).
7. Fit the steering rod (in the inner hole on the relay arm) and the tie rod. Tighten the Nyloc nuts to a torque of 3.5—4.1 kgm (20—30 ft. lb.).
8. Lower the vehicle.