

CONTENTS

	Page
1. DESCRIPTION	3
3. WORK ON THE CAR	4
3.1. Checking and adjustment of drag rods	4
3.1.1. Replacement of drag rod ends	5
3.2. Checking and adjustment of steering gear	5
3.2.1. Adjustment of pinion end float	6
3.2.2. Adjustment of play between rack and pinion	6
3.2.3. Replacement of rubber bellows, steering gear	7
3.3. Checking and adjustment of gear shift device	7
3.3.1. Removal and installation of universal coupling	7
4. INSPECTION WORK	9
4.1. Steering wheel and steering column	9
4.2. Steering gear	11

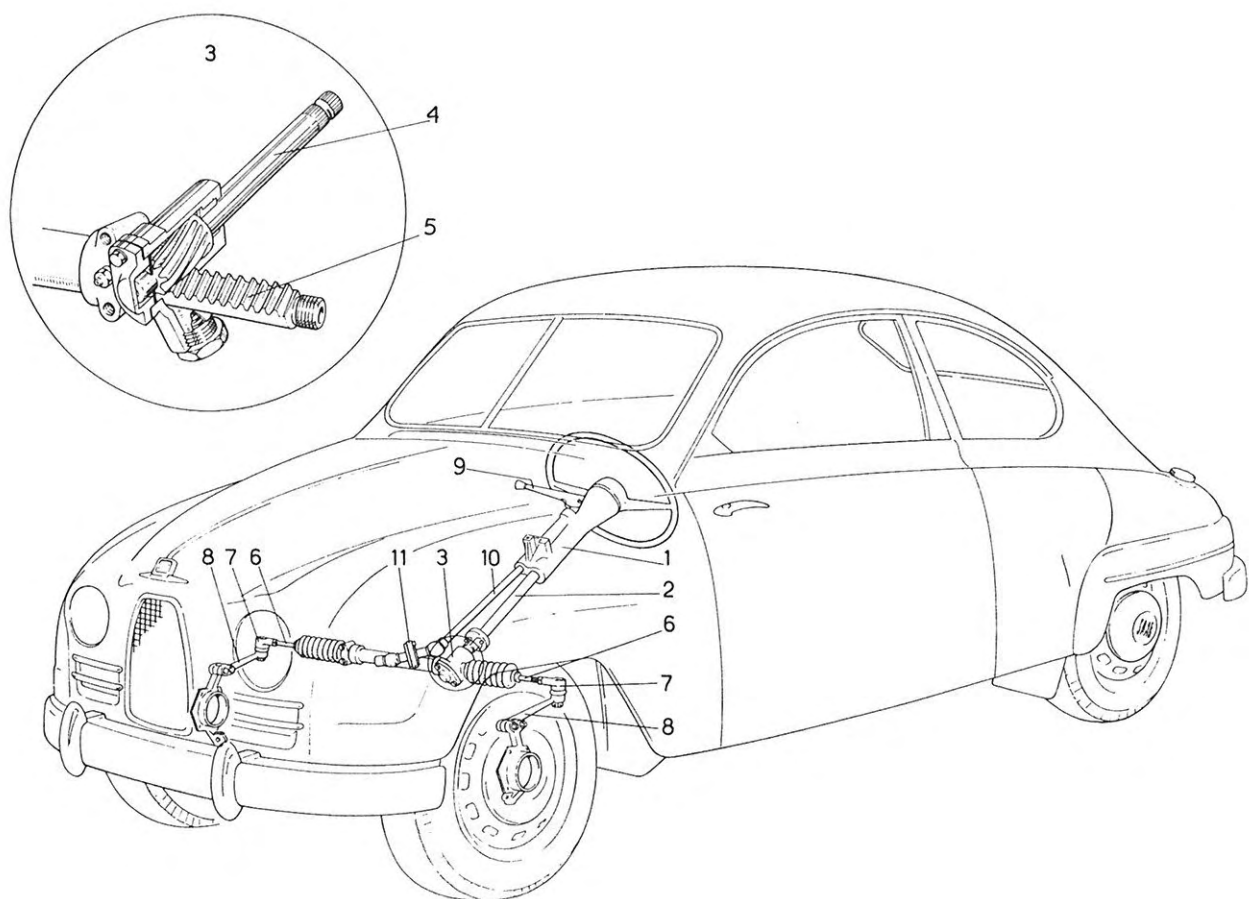
1. DESCRIPTION

The steering gear is of rack and pinion type and consists essentially of a helical pinion which works against oblique teeth on a rack. The steering gear is built into a housing which consists of a tube fitted with a cast-iron bracket at each end. Pinion and rack are carried in these end brackets.

The steering wheel is splined to the steering column and its movements are transmitted through the steering column via a rubber joint to the pinion, which generates a to and fro movement of the rack 5, Fig. 1. The two drag rods 6, which are attached

to the ends of the rack by the inner ball joints, transmit the movement to the arms of the steering knuckle housings 8. These arms are connected to the drag rods by means of the outer ball joints 7.

The Saab 93 has a steering column gear shift device of which the gear shift rod is connected to the transmission shift lever by a universal joint coupling. This coupling consists of a short shaft, of which the middle part is a rubber disc connected by universal joints to the gear shift rod and the transmission shift lever. See Fig. 7.



- | | |
|--------------------------|---------------------------------------|
| 1. Steering column stand | 7. Outer ball joint |
| 2. Steering column | 8. Steering arm |
| 3. Steering gear | 9. Gear lever |
| 4. Pinion | 10. Gear shift rod |
| 5. Rack | 11. Universal coupling gear shift rod |
| 6. Drag rods | |

Fig. 1. Steering mechanism and gear shift device

3. WORK ON CAR

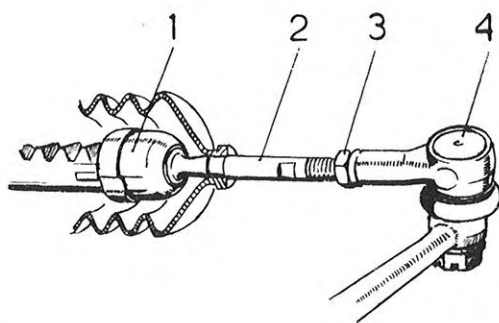
3.1. Checking and adjustment of drag rods

The drag rod 2, Fig. 2, is of the same type on both sides. Its inner end which is connected to the rack is provided with double spheres, and the outer end is threaded for connection to the outer ball joint 4. The outer ball joint is screwed onto the drag rod and locked with a nut 3. If the lock nut is loosened and the drag rod, which is provided with wrench flats, turned to the left or right, the total length of the drag rod can be decreased or increased respectively. This is necessary for adjustment of the toe-in. See further Chapter 7, "Axles and suspension".

The outer ball joints cannot be dismantled. They are self-adjusting for moderate wear and need therefore seldom be replaced.

However, damage caused by collisions etc. may necessitate replacement of the drag rods and their ends. In the interests of safety, damaged drag rod ends should be replaced as soon as possible.

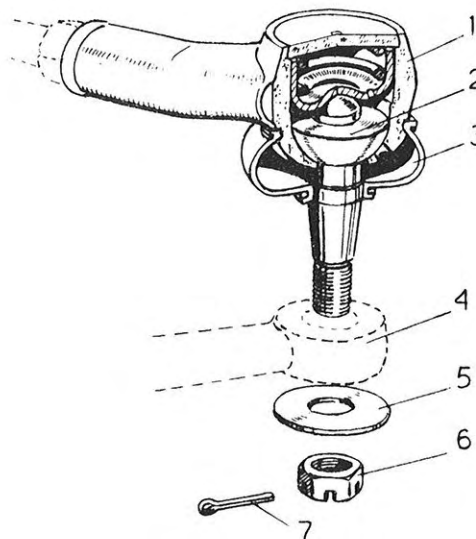
The drag rods are connected to the arms of the steering knuckle housings by means of the tapered pivots 2, Fig. 3, of the ball joints, which fit into corresponding tapered holes in the steering arms.



1. Inner ball joint
2. Drag rod
3. Lock nut
4. Outer ball joint. (Drag rod end)

Fig. 2. Drag rod

The pivot is locked with a crown nut and cotter pin and each ball joint is protected by a rubber seal 3, Fig. 3. If this seal is damaged so that it no longer seals effectively, it must be replaced by a new one. The appropriate procedure is as follows:



1. Body
2. Pivot
3. Rubber seal
4. Steering arm
5. Washer
6. Crown nut
7. Cotter pin

Fig. 3. Outer ball joint. (Drag rod end)

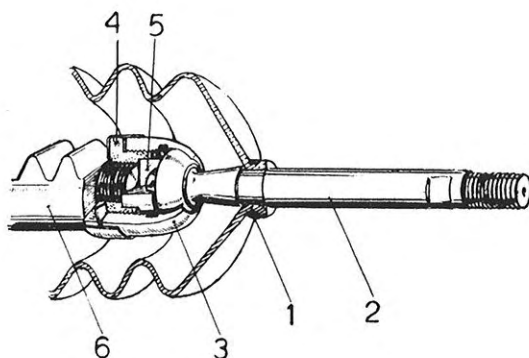
1. Jack up the car and remove the wheel.
2. Remove cotter pin 7, crown nut 6 and washer 5, Fig. 3.
3. Apply extractor, tool Saab 92-5, and pull the pivot free from the steering arm, see Fig. 5.
4. Remove the damaged rubber seal from the pivot and fit a new seal.

5. Insert the pivot into the steering arm, fit the washer and tighten the crown nut with a wrench torque of 3.5 - 5 kgm (25 - 36 lb.-ft.) and lock with a new cotter pin.

6. Fit the wheel and lower the car.

Do not try to knock the pivot free, as the pivot and other parts may be damaged. Always use the extractor.

The drag rod is connected to the rack by means of the outer socket 3, nut 4 and inner socket 5, Fig. 4, which, together with the spherical end 2 of the drag rod, comprise the inner ball joint. Slack in this ball joint can be taken up, but in order to do so the entire steering gear must be removed from the car, see 4.2.



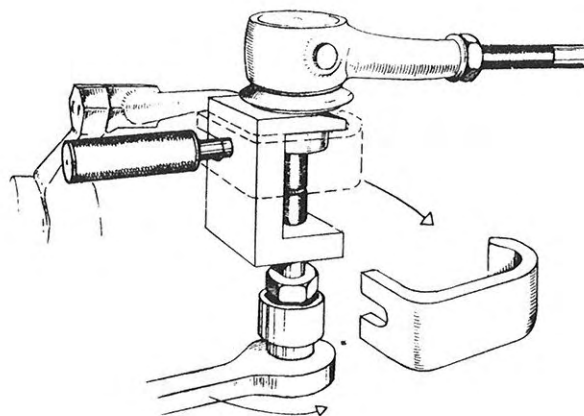
1. Clamp
2. Drag rod
3. Outer socket
4. Nut
5. Inner socket
6. Rack

Fig. 4. Inner ball joint

3.1.1. Replacement of drag rod ends

As mentioned above, the drag rod ends cannot be taken apart, and they must therefore be replaced if excessive wear occurs in them.

1. Jack up the front end of the car and remove the wheel.



Tool 92-5

Fig. 5. Detachment of drag rod end

2. Remove cotter pin 7, crown nut 6 and washer 5, Fig. 3.
3. Apply extractor, tool Saab 92-5, and pull the pivot free from the steering arm, see Fig. 5.
4. Loosen the nut which locks the drag rod end.
5. Unscrew the drag rod end.
6. Screw on a new end to the drag rod, but do not lock it by tightening the lock nut.
7. Connect the pivot to the steering arm. Don't forget to lock the crown nut with a new cotter pin.
8. Fit the wheel and lower the car.
9. Check and adjust the toe-in as described in Chapter 7, points 3.2. and 3.2.1.

After adjustments, don't forget to tighten the lock nuts for the drag rod ends.

3.2. Checking and adjustment of steering gear

The steering gear is accurately adjusted when the car is delivered and should not be taken apart for re-adjustment without due cause. The shims 9 and 12, Fig. 6, are used to eliminate unavoidable

manufacturing tolerances and permit adjustment of play between pinion and rack and pinion end float which is caused by wear or replacement of parts.

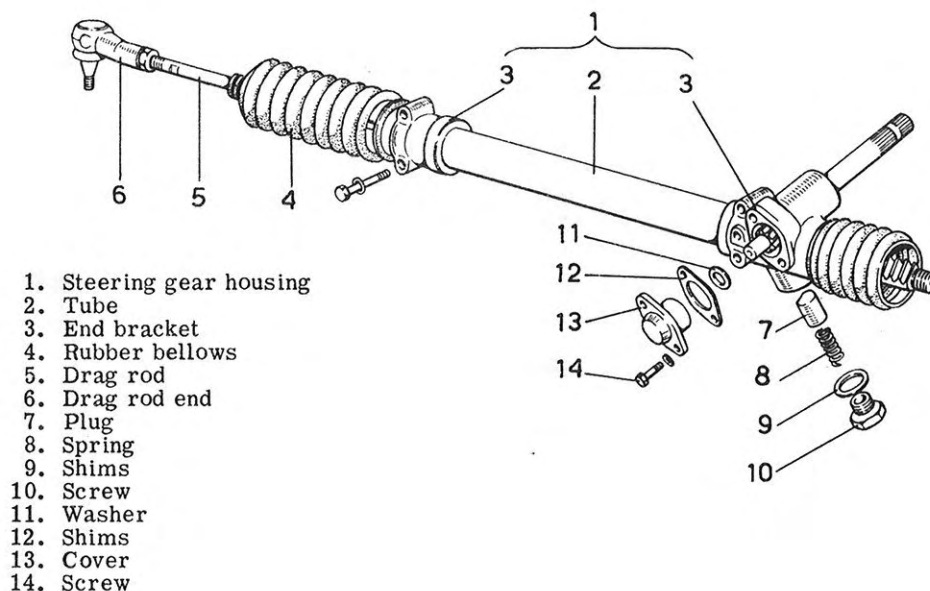


Fig. 6. Steering gear

3.2.1. Adjustment of pinion end float

If the steering mechanism becomes noisy or inert, it is advisable to check whether any axial or radial play has occurred at the pinion.

End float of the pinion is adjusted by means of the shims 12, Fig. 6. The normal wear is very small and therefore it is seldom necessary to make adjustments for play due to this cause, provided that the steering gear has been properly lubricated.

1. Jack up the front end of the car so that the wheels are clear of the ground.
2. Remove screw 10 and parts 7, 8 and 9, see Fig. 6.
3. Unscrew the two screws 14.
4. Remove the cover 13 and collect the shims.
5. Remove the required number of shims, of which there are two thicknesses, 0.1 and 0.3 mm (0.004 and 0.012 in.).

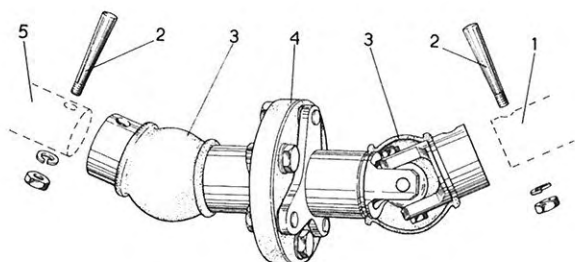
6. Check that the washer 11 is still in place and grease around the pinion with some universal or chassis grease. Replace the cover and the remaining shims, screw in and tighten the screws. Don't forget the spring washers 15.

7. Check that the pinion is easily turned after the adjustment. If not, too many shims have been removed.

8. Screw in and tighten the screw 10 together with plug, spring and shims, and lower the car.

3.2.2. Adjustment of play between rack and pinion

Concerning the rack radial play, the distance between plug 7, Fig. 7, and the screw 10 should be less than 0.3 mm (0.012 in.). This distance is adjusted by means of the shims 9, which have the following thicknesses: 1.0, 0.3 and 0.1 mm (0.04, 0.012 and 0.004 in.).



1. Gear shift rod
2. Tapered pin with lock nut
3. Rubber bellows
4. Rubber disk
5. Transmission shift lever

Fig. 7. Universal coupling, gear shift rod

1. Jack up the front end of the car so that the wheels are clear of the ground.
2. Turn the steering wheel to full lock in both directions and check that it is not hard to turn in any position.
3. Remove screw 10, shims 9, spring 8 and plug 7.
4. Remove or add one shim at a time. Replace the spring in the screw and place the plug on top. Insert the screw and tighten it firmly.
5. Test by turning the steering wheel to full lock in both directions; it should turn easily and must not chatter or bind in any position. Note that the screw 10 must be properly tightened when testing.

3.2.3. Replacement of rubber bellows on steering gear

If the rubber bellows for the steering gear are damaged they should be replaced immediately, otherwise dirt may get into the steering gear and cause binding.

1. Jack the front end of the car and remove the wheel.
2. Remove the drag rod end as described in 3.1.1.

3. Loosen the clamp for the rubber bellows at steering gear housing and drag rod, and remove the bellows.
4. Slide on a new rubber bellows and clamp it into position.
5. Fit the drag rod end and connect it to the steering arm, see 3.1.1.
6. Fit the wheel and lower the car.
7. Adjust the toe-in as described in Chapter 7, points 3.2. and 3.2.1., then tighten the lock nut.

3.3. Checking and adjustment of gear shift device

3.3.1. Removal and installation of universal coupling

The joints of the universal coupling can be greased without being removed.

1. Open the engine hood and remove the sheet of cardboard behind the radiator.
2. Remove the lock nut and press out the tapered pin 2, Fig. 7.
3. Detach the universal coupling from the transmission shift lever.
4. Remove the lock nut and press out tapered pin
5. Pull the universal coupling off the transmission shift lever.

Inspect the universal joints for play and binding. If new rubber cuffs are fitted, the old grease must be removed. Pack the joints with universal or chassis grease before fitting the new rubber cuffs.

6. Fit the universal coupling to the shift lever and press in the tapered pin. Make sure that the lock pin taper of the coupling matches that of the shift lever.
7. Push the universal coupling up onto the gear shift rod and press in the tapered pin.
8. Lock the tapered pins
9. Replace the sheet of cardboard behind the radiator.

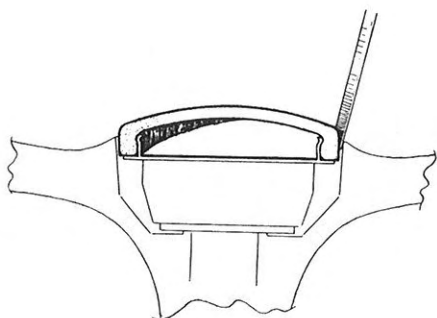
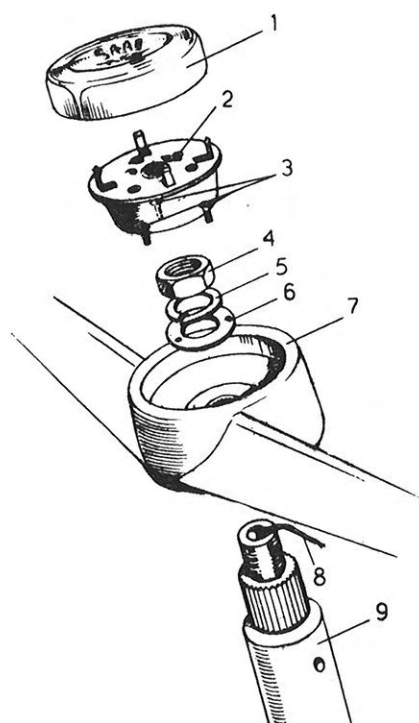


Fig. 8. Removal of horn button



- | | |
|------------------|-----------------------|
| 1. Horn button | 6. Fixing washer |
| 2. Soldering lug | 7. Steering wheel hub |
| 3. Screw | 8. Horn cable |
| 4. Nut | 9. Steering column |
| 5. Spring washer | |

Fig. 9. Removal of steering wheel and horn switch

4. INSPECTION WORK

4.1. Steering wheel and steering column

4.1.1. Removal of horn switch and steering wheel

1. Break the horn circuit at the connector, see Fig. 19, Chapter 15, "Electric system and instruments". The connector is accessible under the instrument panel to the right of the steering column.
2. Remove the horn button with a thin screwdriver or a knife, inserting the blade into the slit between button and steering-wheel hub. Lever carefully so as to loosen the button, see Fig. 8.
3. Disconnect the horn wire 8, Fig. 9, by opening the soldered connection 2 on the contact plate under the horn button.
4. Remove the horn switch by unscrewing the three screws 3 which hold it onto the fixing washer. The screws can be reached with a thin screwdriver through the three holes in the contact plate. When unscrewed, the screws remain in the base plate and can therefore easily be screwed in when the switch is being fitted.
5. Screw off nut 4, remove spring washer 5 and fixing washer 6.
6. Remove the steering wheel.

4.1.2. Fitting of horn switch and steering wheel

1. Fit steering wheel on the steering column. When the front wheels point straight ahead, the steering wheel should be pushed on the steering column so that the spokes are horizontal.
2. Insert the horn switch fixing washer 6, Fig. 9, and lock washer 5. Place the washer so that the emblem on the horn button will come right when fitted. Screw on and tighten nut 4.
3. Insert the horn cable 8 through the horn switch and solder it to the lug 2.
4. Place the horn switch in position and tighten the retaining screws 3.
5. Fit the horn button 1 so that the four catches on the horn switch enter the recesses on the underside of the button.
6. Connect the horn cable at the connector.

4.1.3. Removal of steering wheel and gear shift device

1. Remove horn switch and steering wheel as described in 4.1.1.
2. Remove the tapered pin 19 in the universal coupling, see Fig. 10.
3. Disconnect the electric cables at the connector under the instrument panel.
4. Loosen the two screws 23 for the steering column stand 5.

NOTE. The upper and lower rubber bushings are of different sizes, and as both bushings are tapered, they must be fitted in accordance with the marking on the guide stud.

5. Pull the steering column stand off the steering column together with gear lever and gear shift rod.
6. If also the steering column is to be removed, loosen the clamp screw 16 at the connection between steering column and pinion in steering gear 15.

4.1.4. Dismantling of steering column stand and gear shift device

When the steering column stand and gear shift device have been removed, the unit can be taken apart.

1. Remove the direction-indicator switch by loosening the two screws that hold it to the steering column stand and then disconnecting the cables.
2. Loosen the nut or screw and remove bolt 28 and the gear lever 30.
3. Pull the gear shift rod 22 out of the steering column stand 5.
4. Screw out the clevis nut 27, remove washer 26 and spring 25.
5. Take the felt bushing 24 out of the stand.
6. Remove the two rubber bushings 4 with the steering column bushings 7.
7. Pull out sleeve 6 and the cables for the direction-indicator switch.

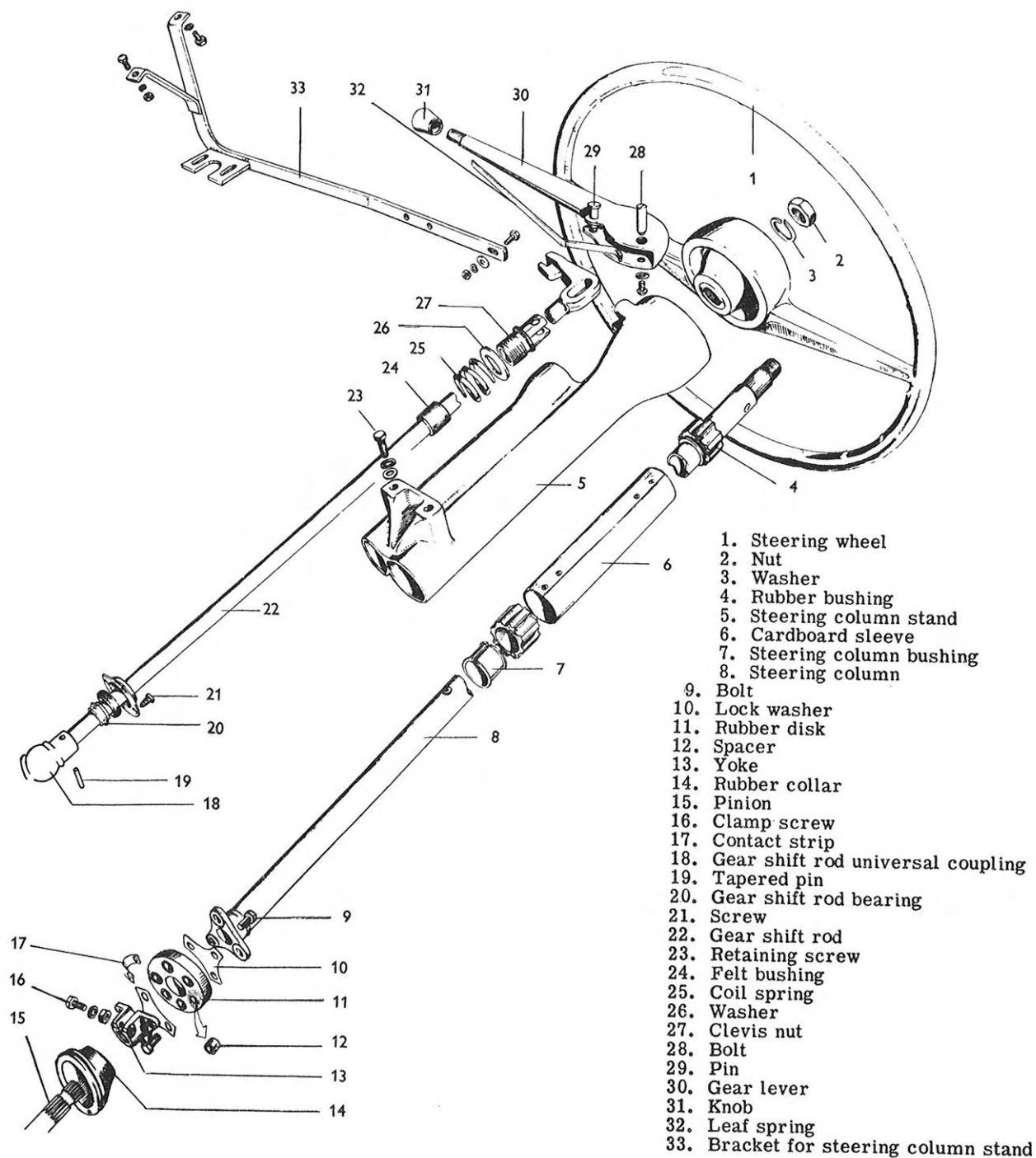


Fig. 10. Steering column and gear shift device

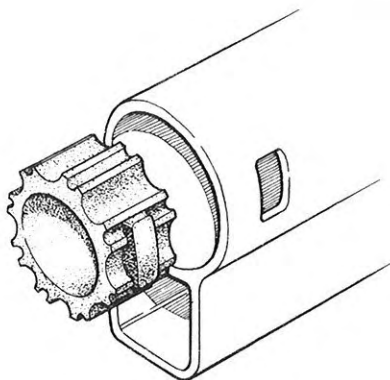


Fig. 11. Bushings, steering column stand

4.1.5. Assembly of steering column stand and gear shift device

1. Insert sleeve 6, Fig. 10, together with the cables to the direction-indicator switch into the steering column stand 5.
 2. Place the two rubber bushings 4 with the steering column bushings 7 in the stand. Note that the bushings must be fitted as shown in Fig. 11.
 3. Insert a new felt bushing 24, Fig. 10, in the stand 5. The bushing should be thoroughly impregnated with paraffin wax or tallow and all superfluous grease should be removed before the installation.
 4. Fit spring 25 and washer 26.
 5. Screw in clevis nut 27.
- The clevis nut should not be screwed in completely, but a clearance of about 1 mm (0.04 in.) should be left between the clevis flange and the stand.
6. Push the gear shift rod into the bearing and fit the gear lever. Make sure that the spring 32 is correctly positioned.
 7. Insert bolt 28 through the gear lever and the oblong hole in the gear shift rod 22, and lock it with screw or nut.
 8. Connect the cables to the direction-indicator switch and fit the switch to the steering column stand.

4.1.6. Installation of steering wheel and gear shift device

If the steering column has been removed, attach it to the steering gear pinion with clamp screw 16, Fig. 10.

1. Slide the steering column stand and gear shift device over the steering column and insert the gear shift rod through its bearing in the firewall.
2. Screw the steering column stand to the bracket 33 under the instrument panel.
3. Fit steering wheel and horn switch as described in 4.1.2.
4. Fit the gear shift rod universal coupling to the gear shift rod with pin 19 and lock the pin.
5. Connect the electric cables under the instrument panel.

4.2. Steering gear

For taking up play in the inner ball joints or for replacement of parts the steering gear must be removed. It is also advisable to check and, if necessary, adjust the pinion shimming while the steering gear is removed from the car. See 3.2.1. and 3.2.2.

4.2.1. Removal of steering gear

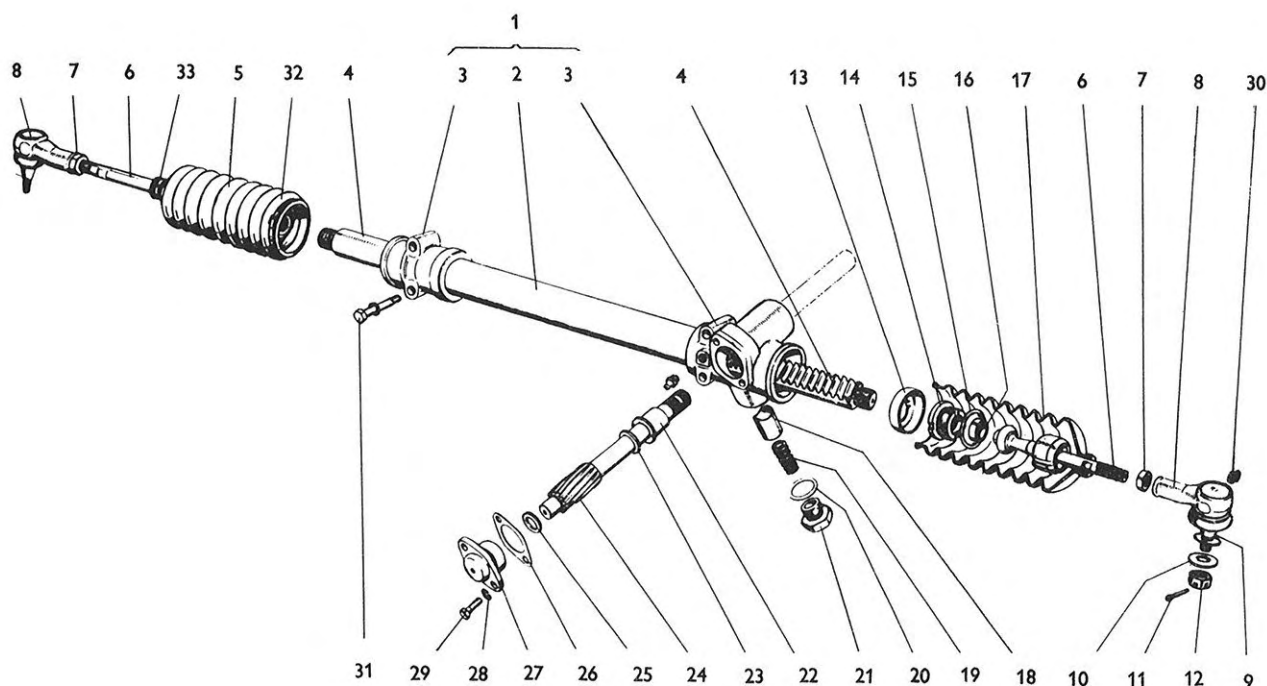
1. Remove engine hood.

After disconnecting the electric cables and hood stoppers the hood can be lifted off.

2. Loosen the steering column clamp screw 16, Fig. 10, under the rubber disk, which is reached under the rubber disk.
3. Disconnect the speedometer cable at the transmission and remove the cardboard sheet behind radiator.
4. Loosen and remove screw 21, Fig. 12, spring 19 and plug 18. Don't lose the shims 20.
5. Loosen screws 29, remove cover 27, shims 26 and washer 25.
6. Pull out the pinion through the engine compartment and collect the washer 23. Insert a clean rag in the steering gear to prevent dirt from entering.
7. Jack up the front end of the car, remove both front wheels and disconnect the drag rod ends from the steering arms as described in 3.1.1. Use tool Saab 92-5, see Fig. 5.
8. Loosen and remove the four bolts 31 which hold the steering gear to the firewall, and pull out the steering gear through the opening in the left-hand wheel housing wall, see Fig. 13.

Cleanliness is of the utmost importance, otherwise dirt may get into the steering gear and damage bearings and ball joints.

11 STEERING



- | | |
|--------------------------|-----------------------------|
| 1. Steering gear housing | 17. Outer socket |
| 2. Tube | 18. Plug |
| 3. End bracket | 19. Coil spring |
| 4. Rack | 20. Shims |
| 5. Rubber bellows | 21. Screw |
| 6. Drag rod | 22. Bushing |
| 7. Lock nut | 23. Washer |
| 8. Drag rod end | 24. Pinion |
| 9. Pivot | 25. Washer |
| 10. Washer | 26. Shims |
| 11. Split pin | 27. Cover |
| 12. Nut | 28. Spring washer |
| 13. Lock washer | 29. Screw |
| 14. Nut | 30. Grease nipple |
| 15. Shims | 31. Bolt with spring washer |
| 16. Inner socket | 32. Clamp |
| | 33. Clamp |

Fig. 12. Steering gear, dismantled

4.2.2. Dismantling of steering gear

1. Loosen lock nuts 7, Fig. 12, and screw off drag rod ends 8.
2. Loosen clamps 33 and 34 and remove rubber bellows 5.
3. Unfold lock washers 13.
4. Insert the pinion into the steering gear housing.
5. Remove the drag rods by disconnecting the inner ball joints with tool Saab 93-131.
6. Unscrew the two nuts 14 with tool Saab 93-131 and remove the pinion.
7. Take the ball joints apart and take care of the shims 15 and the inner sockets 16.
8. Pull out the rack 4.
9. Press out the pinion bushing 22 if it should be replaced.

4.2.3. Inspection of steering gear components

Clean all components thoroughly and inspect them. Replace worn or damaged parts.

After a large mileage, especially if lubrication has not been satisfactory, uneven wear may occur. If this wear is appreciable on the cylindrical part of the rack, the rack should be replaced. Inspect the rack bearings in the end brackets of the housing as well, which is best done with the aid of a new rack. If a large amount of wear is found, the end bracket 3, Fig. 12, should be replaced. The brackets are attached to the tube 2 by press fit.

Check the teeth on rack and pinion for wear which does not appear uniformly. The teeth which are engaged when driving straight ahead wear most, but the actual amount of wear is very small if the lubrication is satisfactory. Should the rack teeth be appreciably worn, the steering gear will not function properly and adjustments become difficult. In such a case, the rack should be replaced.

If the pinion, on the other hand, has suffered a moderate amount of wear, it can be rotated half a turn so that the least worn teeth are in mesh with the rack when driving straight ahead. However, it is preferable to replace the pinion as well.

Inspect the inner ball joints of the drag rod ends. The drag rod ends are self-adjusting for moderate wear, and if excessive play occurs, the whole drag rod end must be replaced.

The inner ball joints and their components wear only very slightly, if properly lubricated. However, if noticeable wear has occurred, then the worn parts should be replaced.

4.2.4. Assembly of steering gear

Cleanliness is essential during assembly. Teeth, bearings and other sliding surfaces should be lubricated thoroughly with universal or chassis grease.

1. Press the pinion bushing 22, Fig. 12, into the end bracket of the steering gear.
2. Place lock washer 13 at the cylindrical end of the rack 4 (the toothed end is fitted later) and screw on nut 14. Use tool Saab 93-131.
3. Place shims 15 on nut 14 and insert the inner socket 16 in the nut.
4. Insert the rack and pinion into the steering gear housing.

5. Slide the outer socket 17 onto the drag rod 6 and tighten the socket with the special tool.

6. If the ball joint is correctly shimmed, it should be completely free from play, but on the other hand it should not bind in any position. If the rack is held horizontal, the ball joint should be at least so tightly adjusted that the drag rod can be put in any position without falling from its own weight.

If the shimming is not correct, then the outer socket must be loosened again and the number of shims increased or reduced.

7. Peen the lock washer down into the grooves of the outer socket, see Fig. 14.

8. Fit the other ball joint and adjust it in the same way.

9. Adjust the clearances at plug 18 and cover 27. Begin with the cover, see 3.2.1.

The correct clearance between pinion and cover should be 0.1 - 0.2 mm (0.004 - 0.008 in.). Shims are available in thicknesses of 0.1 and 0.3 mm (0.004 - 0.012 in.).

Proceed in the same way with the plug, see 3.2.2. When correctly adjusted, the clearance should be less than 0.3 mm (0.012 in.). Shims are available in thicknesses of 0.1, 0.3 and 1 mm (0.004, 0.012 and 0.04 in.).

10. Remove and take care of the parts 18 - 29, with the exception of bushing 22, when the adjustment is correct and the gear is to be installed.

11. Slide on the rubber bellows 5, Fig. 12, and clamp them to the steering gear housing and drag rods, but not so firmly that the drag rod cannot be turned.

12. Screw lock nuts 7 and drag rod ends 8 onto the drag rods.

4.2.5. Installation of steering gear

1. Insert the steering gear through the hole in the left-hand wheel housing wall, see Fig. 13, and mount the steering gear on the firewall with the four screws 31. Don't forget the spring washers.
2. Slide washer 23 onto the pinion and insert the pinion in the steering gear.
3. Place washer 25 on pinion and fit the cover with the previously selected shims.

11 STEERING

4. Place the previously selected shims 20 on screw 21.
 5. Insert spring 19 into screw 21 and place plug 18 on the spring. Insert these parts into the steering gear and tighten the screw firmly.
 6. Connect the speedometer cable to the transmission.
 7. Connect the steering column to the pinion by tightening the clamp screw 16, see Fig. 10.
- The steering wheel spokes should be horizontal when the front wheels point straight ahead.
8. Connect the drag rod ends to the steering

arms, fit the washer and tighten the nuts with a wrench torque of 3.5 - 5 kgm (25 - 36 lb.-ft.). Lock with new cotter pins.

9. Fit the wheels and lower the car.
 10. Adjust the toe-in as described in Chapter 7, "Axles and suspension", points 3.2. and 3.2.1.
- Don't forget to tighten the lock nuts for the drag rod ends after adjusting.
11. Tighten the clamps for the rubber bellows round the drag rod.
 12. Mount the engine hood and place the cardboard sheet behind radiator.

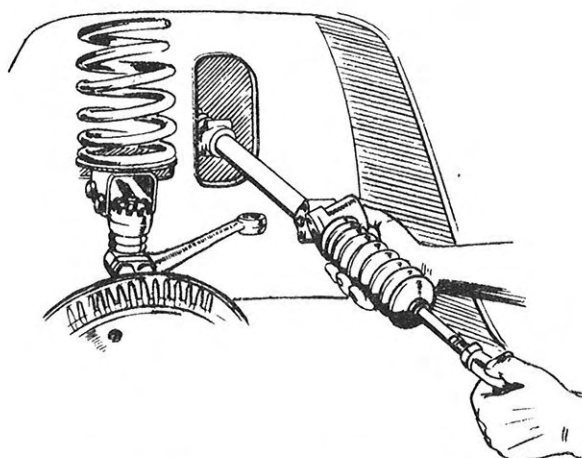


Fig. 13 Removal of steering gear

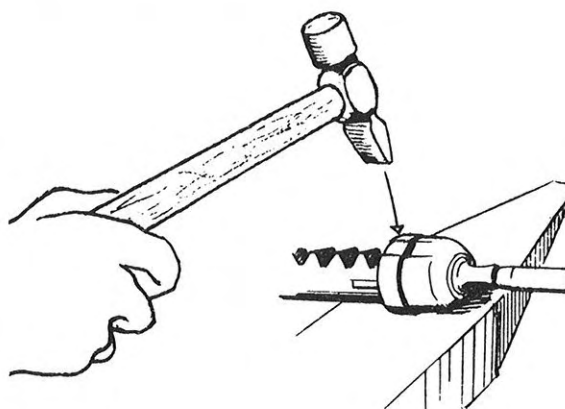


Fig. 14 Locking of inner ball joint