

CONTENTS

	Page
1. DESCRIPTION	3
1.1. General	3
1.2. Front axle	3
1.3. Front suspension	4
1.4. Rear axle	5
1.5. Rear suspension	5
1.6. Shock absorbers	5
2. TECHNICAL DATA	6
3. WORK ON CAR	6
3.1. Front wheel alignment	6
3.2. Checking and adjustment of front wheel alignment	7
3.3. Replacement of coil springs	10
3.3.1. Replacement of front spring and/or upper spring bomber	10
3.3.2. Replacement of rear spring and/or upper spring bomber	14
3.4. Replacement of spring arms, wheel bearings, bushings, etc.	14
3.4.1. Replacement of front upper spring arm	14
3.4.2. Replacement of front lower spring arm	15
3.4.3. Replacement of ball joint seal bellows	15
3.4.4. Adjustment of spring arm ball joints	16
3.4.5. Replacement of wheel bearings	17
3.4.6. Replacement of rubber bushings, front suspension	19
3.4.7. Replacement of rubber bushings, rear suspension	19
3.4.8. Replacement of shock absorbers	22
4. INSPECTION WORK	24
4.1. Front suspension	24
4.1.1. Removal	24
4.1.2. Inspection and adjustment of spring arm ball joints	24
4.1.3. Adjustment of spring arms	25
4.1.4. Installation	25
4.2. Rear suspension	26
4.2.1. Removal	26
4.2.2. Inspection and adjustment of rear axle	27
4.2.3. Installation	27

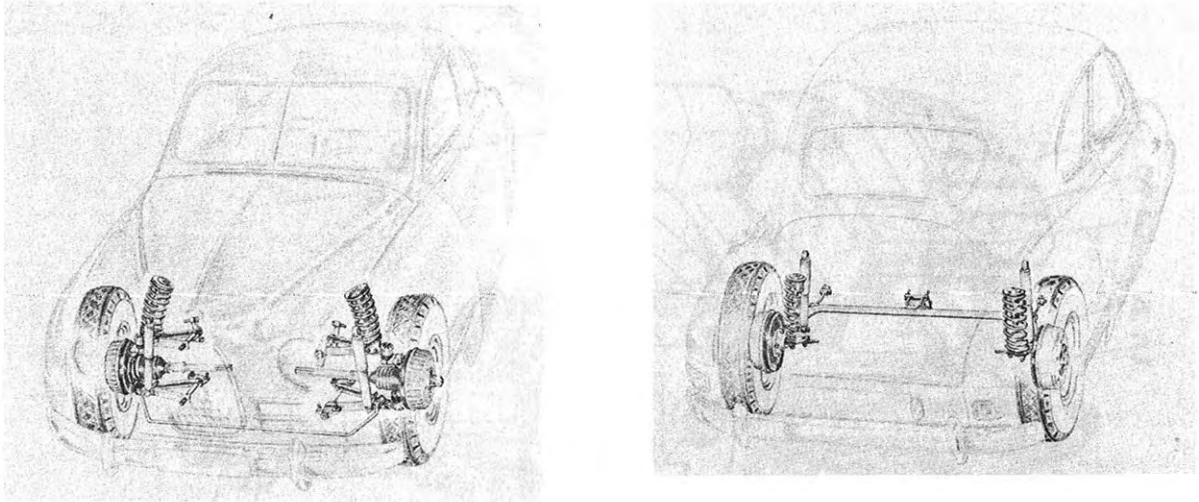


Fig. 1. Axles and suspension

1. DESCRIPTION

1.1. General

All four wheels of the Saab 93 have coil spring suspension. Each front wheel is attached to the steering knuckle housing which is suspended by ball joints in two V-shaped, transverse spring arms. The inner ends of each spring arm is carried in rubber bearings attached to the body, and the spring movements of the wheels are limited by rubber bumpers.

The rear wheels are mounted on axle shafts which are pressed into the swept-back ends of the transverse tube axle. This rigid axle is placed in a tunnel under the body and is attached by a rubber links which run forwards and are carried in rubber bearings at both axle and body attachments. Downward motions of the wheels are limited by stop straps and upward motions by rubber bumpers.

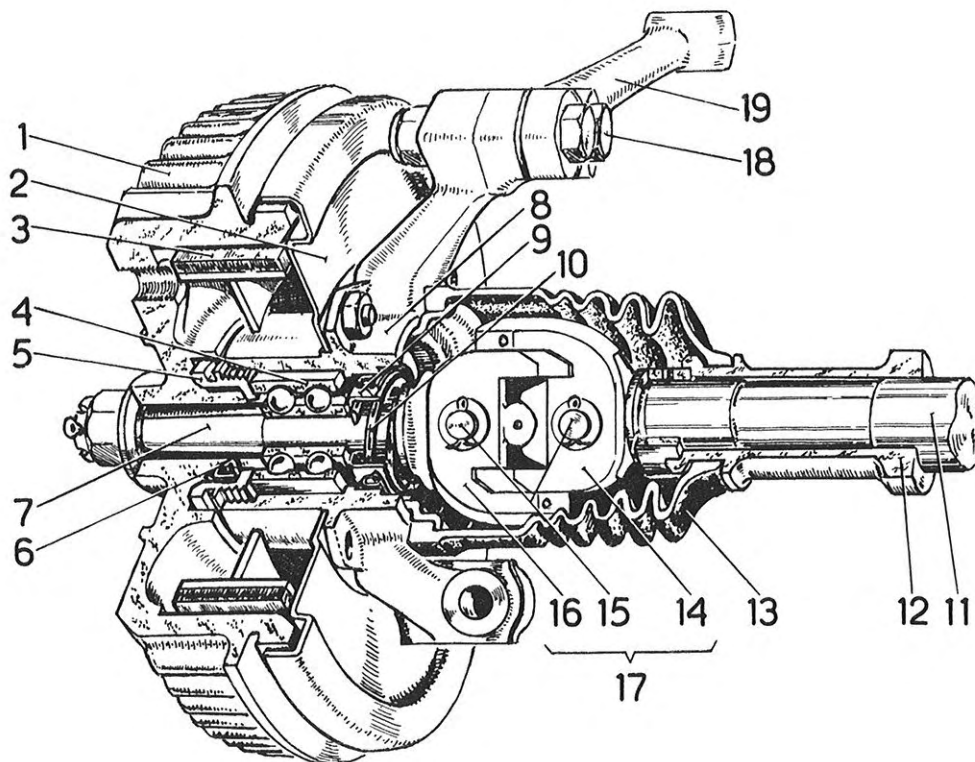
The return motion of the wheels after a spring deflection is damped by single-acting, hydraulic shock absorbers of telescopic type. The plunger ends are attached to the body and the other ends to the front lower spring arms and rear axle respectively.

The front and rear shock absorbers differ in length and hardness and must not be confused. The front and rear coil springs are also different and can be distinguished by their length and number of coils, see 2.1. Fig. 1 shows how axles, springs and shock absorbers are arranged.

1.2. Front axle

The front axle consists of a right-hand and left-hand unit. A large forging, the steering knuckle housing 8, Fig. 2, constitutes the body of the front axle. It consists essentially of a bearing housing with two arms, an upper and a lower one, pointing inwards. The outer drive shaft 7 is carried in the ball bearing 4 and the wheel hub with brake drum 1 is mounted on the outer end of this shaft. The brake shield 2 fitted with the front brake is attached to the outside of the steering knuckle housing.

The ball joint pivots are connected to the arms of the steering knuckle housing and the steering arm 19, to which the drag rod end is connected, is attached to the upper arm of the steering knuckle



- | | | |
|-----------------|-----------------------------|-----------------------------------|
| 1. Brake drum | 7. Outer drive shaft | 13. Rubber bellows |
| 2. Brake shield | 8. Steering knuckle housing | 14. Inner half of universal joint |
| 3. Brake shoe | 9. Spring cup | 15. Pins |
| 4. Ball bearing | 10. Spring | 16. Outer half of universal joint |
| 5. Nut | 11. Inner drive shaft | 17. Outer universal joint |
| 6. Shaft seal | 12. Seal sleeve | 18. Bolt |
| | | 19. Steering arm |

Fig. 2. Front axle unit, right-hand

housing. When turning the steering wheel, the steering knuckle housing with hub and wheel turns about a virtual axis, the "king pin" axis, which passes through the centers of the two ball joints and meets the ground near the center of the tread, see 3.1.1. The outer and inner drive shafts are connected by the outer universal joint 17, the rotation center of which lies on the above-mentioned "king pin" axis. The outer universal joints are protected from dirt by rubber bellows 13 which also contain the lubricant for the joint. The inner end of inner drive shaft is splined to the inner universal joint, which is attached to the differential output shaft.

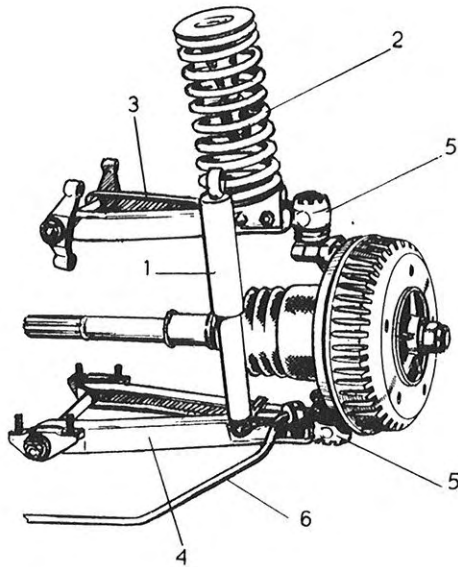
1.3. Front suspension

The front axle forms a separate unit on each side

and is suspended in the pivots of the ball joints 5, see Fig. 3, which are attached to the spring arms. On each side there are two spring arms, each one carried in two rubber bearing brackets attached to the body.

The upper spring arms have a seat for the coil springs, which are compressed between this seat and a similar seat in the body. The latter seat is provided with a rubber bumper, see Fig. 4, which serves as a bottoming stop and limits the upward spring deflection of the front axle. Downward motion of the wheel is limited by two rubber buffers attached to the body under the upper spring arms.

The two lower spring arms are interconnected by means of stabilizer, see Figs. 3 and 5, which is attached by two rubber bearings under the engine compartment floor.



1. Shock absorber
2. Coil spring
3. Upper spring arm
4. Lower spring arm
5. Ball joints
6. Stabilizer

Fig. 3. Front suspension

1.4. Rear axle

The rear axle is a unit, see Fig. 6, consisting of a tube 1 with swept-back ends fitted with end pieces 2 into which the axle shafts 3 are pressed. The wheel hubs with brake drums are carried in ball bearings on these axles, and the rear brake shields with the rear brakes are screwed to the outsides of the end-pieces.

The rear axle is attached to the body by a rubber bearing 4, on the middle and at the sides the axle

The rear axle is attached to the body by a rubber bearing 4, on the middle and at the sides the axle is braced to the body by longitudinal side links 6, which are also carried in rubber bearings at both body and axle attachments.

1.5. Rear suspension

The rubber bearings provide the rear axle with a three-point flexible connection to the body. The lower seats 5 for the coil springs are screwed to the extension of the axle shafts inside the end-pieces. The upper spring seats are attached to the body and are combined with rubber bumpers which limit the upward motion of the rear axle. The downward motion is limited by stop straps attached to the body by clamps. See Fig. 17.

1.6. Shock absorbers

The car is equipped with single-acting, hydraulic shock absorbers of telescopic type which damp the return motions after spring deflections. The plunger ends are attached to the body and the cylinder ends to the lower front spring arms and to the rear axle.

The hardness and stroke of the shock absorbers differ between front and rear, and the two types must not be confused. They are identical in appearance and can only be distinguished by their length and the marking on the protective cylinders, see 2.1. The front shock absorbers are harder than the rear ones and the strokes are five and six inches respectively.

The shock absorbers are correctly adjusted on delivery of the car and thus do not require any adjustment. They cannot be dismantled.

When a shock absorber is installed, be sure to use only original rubber components and washers at the upper and lower attachments. as faulty components can cause noisy operation. Before the shock absorber is installed, all air must be removed from it. Hold the shock absorber in the position it has in the car and pump up and down a few full strokes, then install it. If the shock absorber is laid down, air may get into it again.

2. TECHNICAL DATA

2.1. General data

Shock absorber length and marking:

Front, 10 in. (extended 15 in.)	5/152 or F
Rear, 11 in. (extended 17 in.)	6/163 or B

Shock absorber stroke, installed:

Front	85 mm. (3 1/2 in.)
Rear	125 mm. (5 in.)

Coil springs, number of coils and length:

Front, 11 coils (wire diam. 11.7 mm.)	380 mm. (15 in.)
Rear, 9 coils (wire diam. 11.0 mm.)	330 mm. (13 in.)

Max. spring deflection:

Front	140 mm. (5 1/2 in.)
Rear	180 mm. (7 in.)

Ground clearance, 2 occupants in front seats, approx. 190 mm. (7 1/2 in.)

Track 1.220 mm. (4 ft.)

Wheel base 2.488 mm. (8 ft. 2 in.)

2.2. Dimensions and tolerances

Front wheel alignment:

"King pin" inclination	$7^{\circ} \pm 1$
Caster	$2^{\circ} \pm 1/2$
Camber	$3/4^{\circ} \pm 1/4$
Toe-in measured on rim 2 mm.	± 1

Curve angle:

Cuter wheel	20°
Inner wheel	$22.1/2^{\circ} \pm 1.1/2^{\circ}$

Minimum turning radius 5.5 m (18 ft.)

Note. The above values for the front wheel alignment apply to the unloaded car (empty weight).

3. WORK ON CAR

3.1. Front wheel alignment

It is most important that the front wheel alignment should be properly adjusted, as incorrect alignment may cause:

1. Tiring driving conditions, due to deterioration of road-holding qualities.
2. Difficulty in keeping the car under control.
3. Increased tire and repair costs owing to abnormal wear of tires and steering mechanism.

If there is reason to suspect incorrect front wheel alignment, for instance after a collision or ditching, and when deterioration of the car's road-holding qualities is marked, the car must immediately be left to an approved workshop for checking and adjustment. Even if there is no definite reason for suspecting that the wheel alignment is incorrect, the car should be inspected at regular intervals and adjusted if necessary.

The angles and dimensions which are closely inter-related and directly affect the front wheel alignment are as follows:

"King pin" inclination
Caster
Camber
Toe-in
Steering geometry

3.1.1. "King-pin" inclination

As there is no actual "king pin", this is to be considered as the inclination of the virtual axis which passes through the centers of the two ball joint pivots and meets the ground near the center line of the tread. See Fig. 9.

3.1.2. Caster angle

Caster means the deviation of the "king pin" axis from the vertical as seen from the side and is usu-

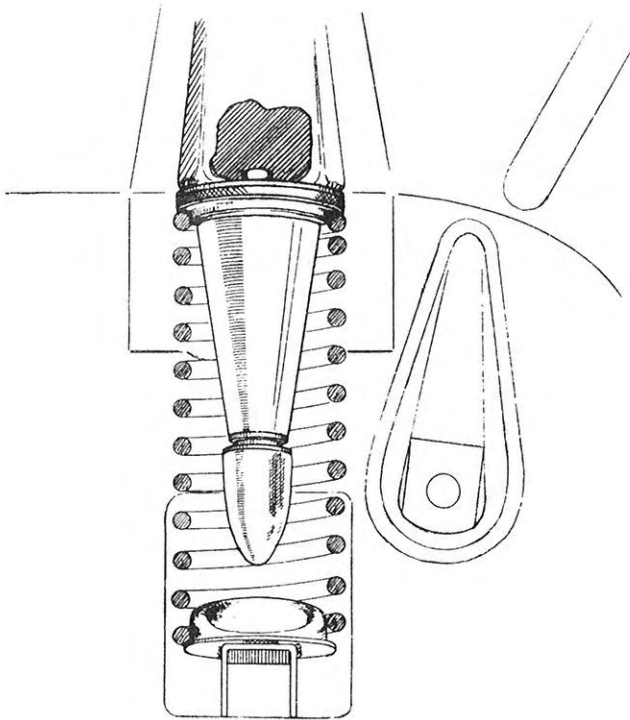


Fig. 4. Front spring seat and spring bumper

ally given in degrees. The caster angle varies greatly from one make of car to another. In most cases, the "king pin" is inclined backwards, as shown in Fig. 9 - the caster angle is then said to be positive (+), and if it is inclined forwards, the caster angle is negative (-). Finally, the "king pin" can be vertical, and the caster angle is then = 0° .

On the Saab 93 the caster angle is $2^{\circ} \pm 1/2$ positive.

3.1.3. *Camber angle*

Camber means the deviation of the wheel from the vertical, see Fig. 9. If the wheel leans outwards, the camber angle is positive (+), and if it leans inwards, then the camber angle is said to be negative (-). On the Saab 93 the camber angle is $3/4^{\circ} \pm 1/4$ positive.

3.1.4. *Toe-in*

The wheels must also have a certain alignment when seen from above; the dimensions A and B, measured on the edge of the rim at axle height, should have a certain relation, see Fig. 9.

If the dimension A is smaller than B, then the wheels are toed-in; if A is greater than B they are toed-out.

The amount of toe-in or toe-out is given in mm. and is the difference between A and B.

The toe-in is zero if the wheels are parallel and thus the two dimensions are equal.

On the Saab 93 the toe-in is 2 mm. (0.08 in.)

$B - A = 2 \text{ mm. } \pm 1 \text{ (0.08 in. } \pm 0.04)$. Dimension A must be 1-3 mm. (0.04 - 0.12 in.) less than dimension B.

3.1.5. *Steering geometry*

When the car is driven round a curve all four wheels should circle around a common center if the wheel alignment is correct and, as the rear wheels cannot be turned, this center must lie somewhere on the axis through the rear wheel centers, see Fig. 10. Thus the inner front wheel must be turned more than the outer one.

The steering geometry is mainly determined by the direction of the steering arms, though the direction and length of the drag rods also has a certain effect, especially when the springs are deflected, as is apparent from Fig. 11.

A detailed explanation of the reasons for choosing the various angles and dimensions of the wheel alignment should be too extensive but it should be mentioned that the calculated values quoted above give the car the best road-holding qualities and reduce wear on tires and bearings to a minimum. It is therefore important that the recommendations given for checking and adjusting the front wheel alignment should be followed.

3.2. Checking and adjustment of front wheel alignment

If there is reason to suspect that the front wheel alignment is incorrect, due to excessive tire wear, deterioration in steering or road-holding qualities, etc., the front wheel alignment should be checked and adjusted if necessary. Before making check measurements:

1. Check that the pressure is correct in all tires, and make sure that the front tires are not too unevenly worn.

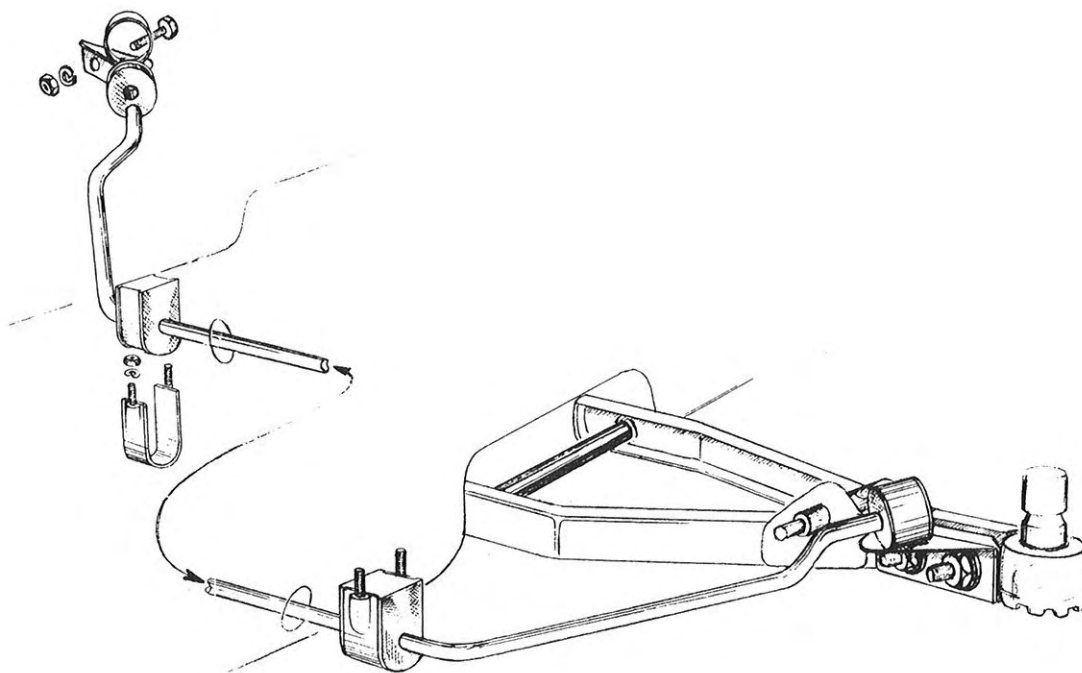


Fig. 5. Stabilizer

2. Inspect front wheel bearings, spring arm bearings, pivots and drag rod ends. Adjust or replace to eliminate faults due to worn or deformed parts.

3. Inspect the steering gear and adjust any faults. See Chapter 11, "Steering".

4. Check that the shock absorbers operate correctly and replace any damaged shock absorbers or rubber bushings.

5. If the car has been involved in a collision or has been ditched, the resulting damage must be repaired before check measurements are made. If the steering or spring arms are bent, they must be replaced. They must not be straightened.

When the measurements are made the car must be unloaded and stand on a flat, horizontal base. Otherwise the measurements will not be reliable.

For correct dimensions and angles, see 2.2.

3.2.1. Toe-in

1. Roll the car slowly forward on a flat floor and stop it without using the brakes. The car must not then be moved backwards.

2. Check the distances A and B, Fig. 9, applying the toe-in gauge, Saab 92-2, between the edges of the rims at axle height. Move the car forward and repeat the measurement at various points on the rim. The rim may be distorted and a single measurement would then be misleading.

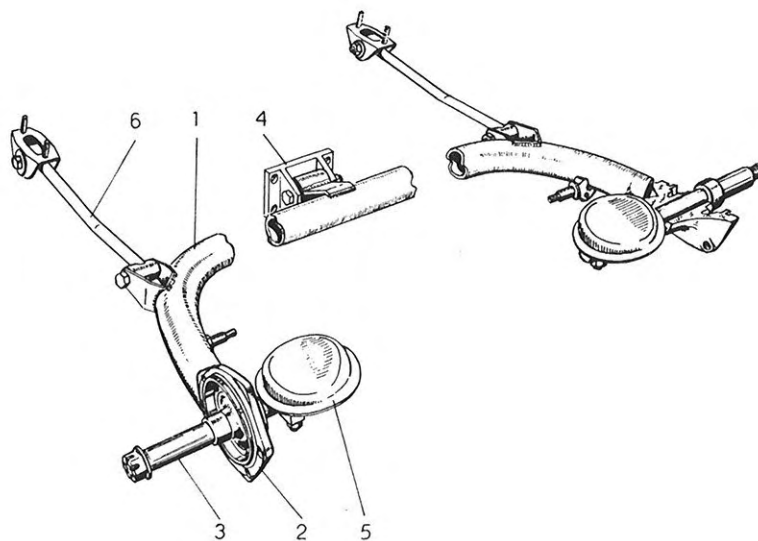
Any necessary adjustments are made by altering the lengths of the drag rods:

3. Loosen the lock nut inside the drag rod end, see Fig. 12

4. Grip the flats on the steering rod and turn it to the left or right until further checks show that the toe-in is correct. Note: If the clamp for the rubber bellows is so tight that the bellows twists, the clip must first be loosened.

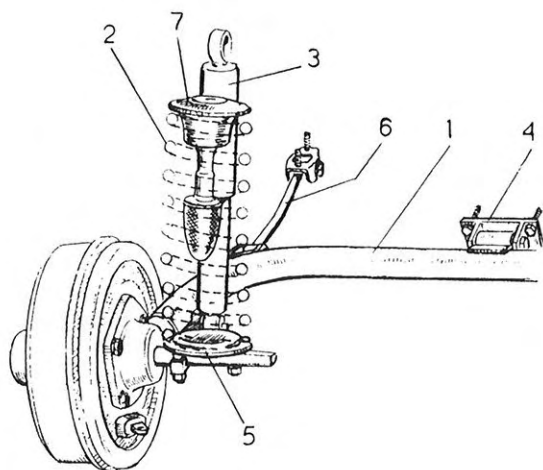
When toe-in is correct, the two drag rods should be of equal length - or matched so that both front wheels have the same clearance to fenders and wheel housings when the steering wheel is turned left or right. See also Fig. 13. Check that the steering wheel spokes are horizontal when driving straight ahead.

Don't forget to tighten the lock nut and the clamp for the rubber bellows after adjustment.



- | | |
|--------------|-------------------|
| 1. Rear axle | 4. Middle bearing |
| 2. End piece | 5. Spring seat |
| 3. Axle | 6. Side link |

Fig. 6. Rear axle unit



- | |
|-----------------------|
| 1. Rear axle |
| 2. Coil spring |
| 3. Shock absorber |
| 4. Middle bearing |
| 5. Spring seat, lower |
| 6. Side link |
| 7. Spring seat, upper |

Fig. 7. Rear suspension

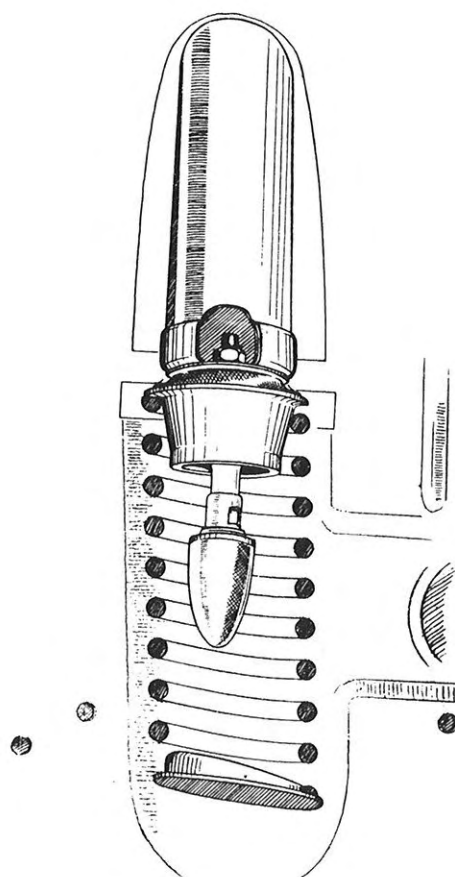


Fig. 8. Rear spring seats and spring bumper

3.2.2. *Camber, caster and "king-pin" inclination*

These angles can be checked by means of various standard tools which are fitted to the rim or directly to the drive shaft. Refer to the appropriate instructions for their use.

Note: When measuring tools for attachment to the drive shaft are used on front wheel driven cars, the wheels must be placed on turntables or the like, and be locked with the brakes while measurements are made.

Incorrect wheel angles may be caused by worn or distorted parts. Damaged parts should be replaced with new ones, if they cannot be adjusted.

The "king pin" inclination and thus also the camber angle can be adjusted by means of shims under the bearing brackets for the upper spring arms. The desired result can be obtained by increasing or decreasing the number of shims. If the thickness of the shims under each bracket is increased by 2.5 mm. (0.1 in.), the camber angle decreases by about 0.5° , while the "king pin" inclination is equally increased. If, on the other hand, shims of 2.5 mm. (0.1 in.) are removed from under each bracket, the camber angle will increase and the "king pin" inclination decrease about 0.5° .

The caster angle can also be adjusted by means of shims. If shims to a thickness of 0.5 mm. (0.02 in.) are removed from under the front bearing bracket and placed under the rear one, the caster angle increases by about 0.5° . Note that if shims of a certain thickness are removed from under one bracket, then shims of the same thickness must be placed under the other bracket, otherwise the camber and "king pin" inclination will also be altered.

NOTE

The dimension A must on no account exceed 40 mm. (1.6 in.) after adjustment of toe-in. The difference between dimensions A of the two drag rods must not exceed ± 2 mm. (0.08 in.)

All adjustments with shims must be kept within reasonable limits, however. If there is any distortion owing to collision, etc., the body must be properly straightened. Deformed spring and steering arms must be replaced with new ones.

3.2.3. *Steering geometry*

The toe-in must be correctly adjusted before the steering geometry is checked. Two graduated turntables of standard type are used for this measurement, see Fig. 14. The centre of turntables must be placed as close to the "king pin" axis as possible.

Turn the steering wheel to the left until the scale for the right-hand wheel shows a deflection of 20° . If the steering geometry is correct, the other scale should read $22.5^\circ \pm 1.5$.

Make a similar measurement with the steering wheel turned in the other direction. If the measurements show that the steering geometry is faulty, then one or both of the steering arms is deformed and should be replaced.

3.3. Replacement of coil springs

As already mentioned, all four wheels have coil spring suspension. The springs at front and rear are different and must on no account be confused, as those at the rear are shorter and considerably softer than those at the front. The springs can most easily be distinguished by means of their length. See 2.1., "General data".

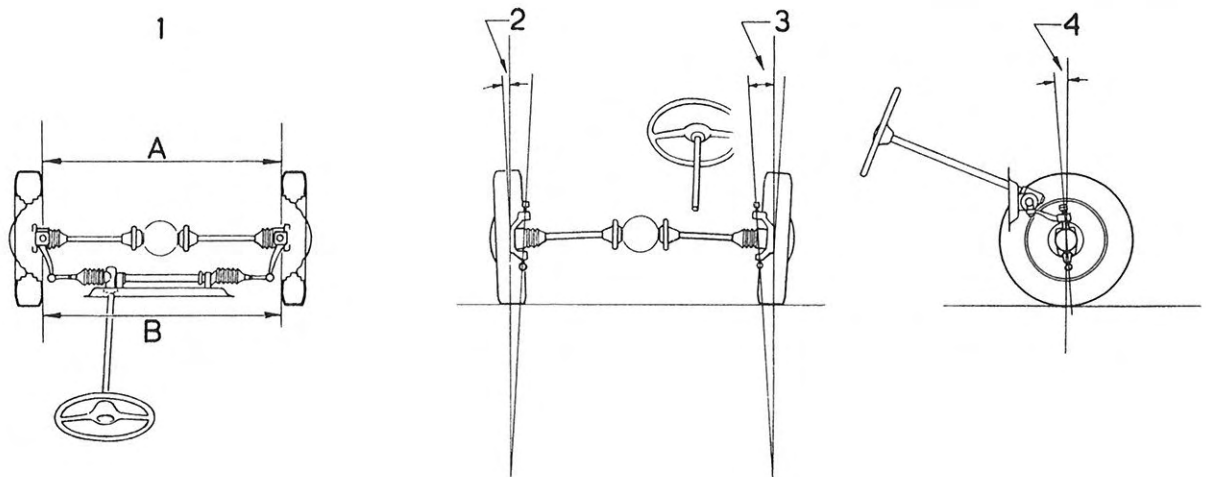
The springs are treated against rusting and if the finish has worn off, it should be touched up before the spring is installed.

3.3.1. *Replacement of front spring and/or upper spring bumper*

3.3.1.1. Removal.

Alternative I Serial numbers to 27740.

1. Jack up front end of car and remove wheel.
2. Compress spring by means of spring clamp, Saab 93-133.
3. Loosen attachment of upper spring bumper, which is in the wheel housing wall which is accessible from the engine compartment. See Fig. 15.
4. Remove the tool with compressed spring and the detached spring bumper.



- | | |
|-----------|---------------------------|
| 1. Toe-in | 3. "King pin" inclination |
| 2. Camber | 4. Caster |

Fig. 9. Front wheel alignment

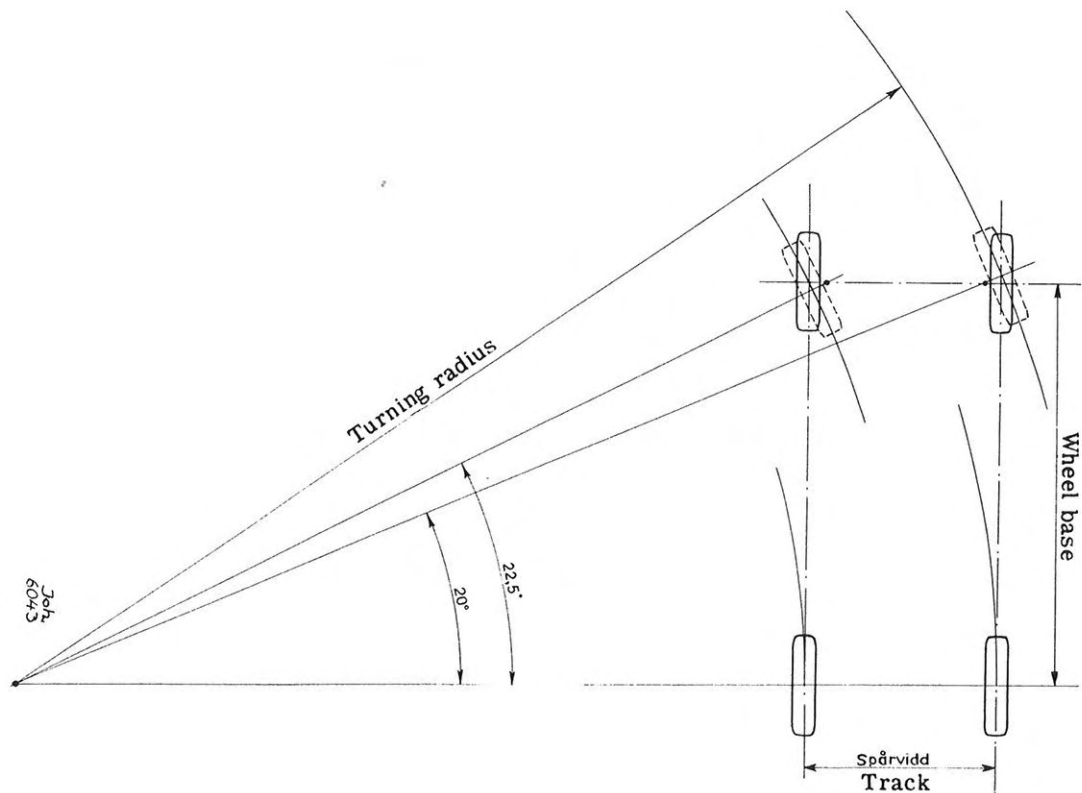


Fig. 10. Steering geometry

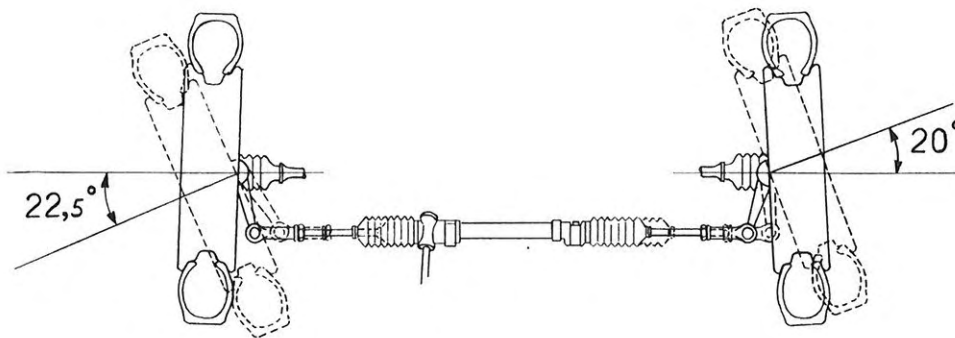


Fig. 11. Wheel angles in curves

5. If the rubber buffer is to be replaced, screw it off the cone with a pipe wrench or the like. Grip around the steel washer at the upper end of the buffer.

6. Inspect and, if necessary, replace the ring-shaped rubber insulation of the upper spring attachment.

7. Inspect the two rubber buffers under the upper spring arm which form the lower spring bumper, and replace them if necessary.

Alternative II Serial numbers from 27741.

1. Jack up front end of car and remove wheel.
2. Insert a suitable wrench, Polygrip or the like, into the spring and unscrew the spring bumper inside the spring.

See also note below.

3. Remove shock absorber.
4. Compress spring by means of spring clamp, tool 93-133.
5. Loosen and remove the two screws which hold the ball joint to the upper spring arm, and remove the lower spring seat. See Fig. 18.
6. Remove the compressed spring.
7. Inspect and, if necessary, replace the rubber ring at the upper spring seat.

8. Inspect the two rubber buffers under the upper spring arm which form the lower spring bumper and replace them if necessary.

Note: If the upper spring bumper is binding and thus cannot be detached the spring can be removed after cutting off the lower rubber buffers so that the spring arm comes down against the supporting plates.

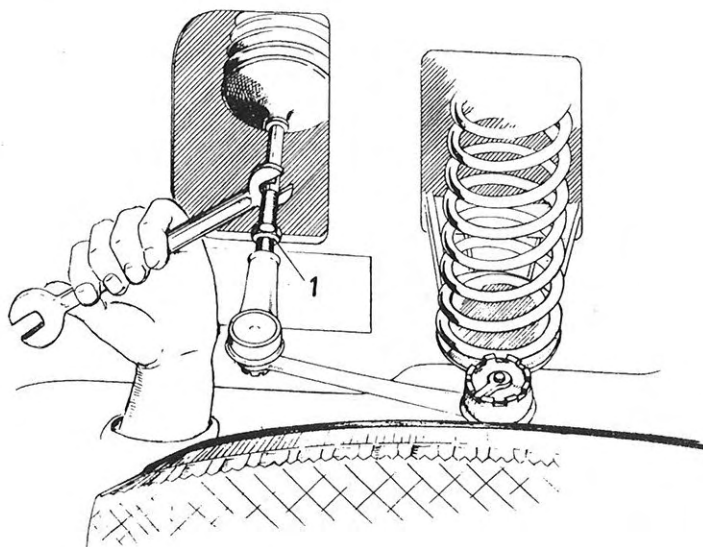
3.3.1.2. Installation.

Alternative I

1. Compress coil spring in spring press 93-132, see Fig. 16.
2. Fit spring clamp, 93-133, to spring and remove it from press.
3. Put compressed spring, spring seat with rubber insulation and bottoming stop in position, and attach the spring seat to the wheel housing wall.
4. Loosen the nuts of the spring clamp gradually until the clamp can be removed.
5. Fit the wheel and lower the car.

Alternative II

1. Compress coil spring in spring press, tool 93-132, see Fig. 16.
2. Fit spring clamp 93-133 to spring and remove it from press.



1. Lock nut
2. Clamp

Fig. 12. Adjustment of toe-in

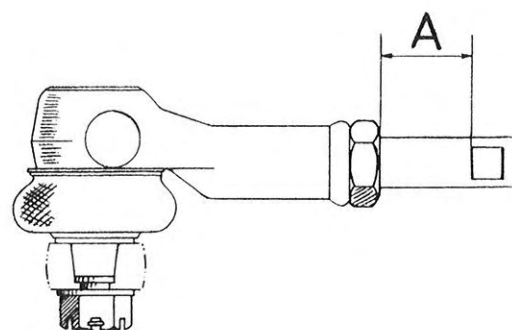


Fig. 13. Checking of drag rod length

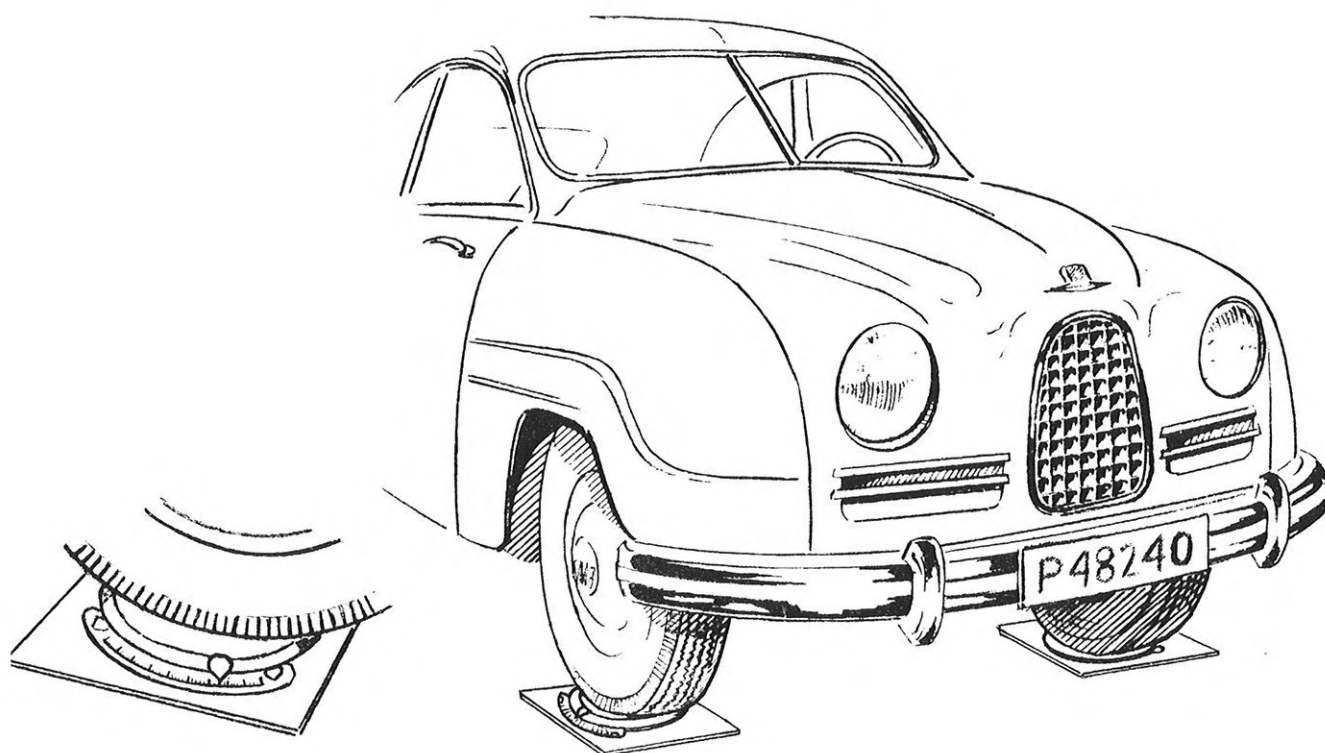


Fig. 14. Turntables for checking steering geometry

3. Check that the rubber ring and metal washer at the upper spring seat and the spring bumper under the upper spring arms are fitted.

4. Place the spring against its upper seat, and insert the upper spring bumper into the spring. Attach lower spring seat and ball joint to spring arm.

5. Loosen the screws of the spring clamp gradually until the tool can be removed.

6. Screw on the upper spring bumper.

7. Install the shock absorber.

8. Fit the wheel and lower the car.

3.3.2. Replacement of rear spring and/or upper spring bumper

3.3.2.1. Removal.

1. Jack up one side of car. Place jack under rear end of door sill.

2. Remove wheel.

3. Disconnect stop strap at its rear attachment and let axle drop down. The spring can then be removed without tools.

4. If the spring bumper has to be replaced, it can be unscrewed with a suitable wrench. Grip around the steel washer at the thick end of the buffer.

5. Check whether the stop strap requires replacement.

3.3.2.2. Installation.

1. If the spring bumper has been removed, screw it into place. Don't forget the lock washer.

2. Fit spring into place.

3. If stop strap has been removed, attach it at front end. Note that the end of the strap must lie 15 mm. (0.6 in.) outside the attachment, see Fig. 17.

4. Fit the wheel and lower the car.

5. Attach the stop strap at the rear end. Note that the end of the strap must lie outside the attachment, see Fig. 17.

3.4. Replacement of spring arms, wheel bearings, bushings, etc.

3.4.1. Replacement of front upper spring arm

3.4.1.1. Removal.

Alternative I Serial numbers to 27740.

1. Remove coil spring as described in 3.3.1.1., alt. I.

2. Loosen and remove the two screws which hold the ball joint to the spring arm. This also loosens the lower spring seat, see Fig. 18.

3. Loosen the screws which hold the two bearing brackets to the body.

4. Remove spring arm and bearing brackets. Collect any shims from under brackets.

5. Loosen and remove the two nuts for the spring-arm bearing. The brackets and bushings can then be removed, see Fig. 19.

Alternative II Serial numbers from 27741.

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

2. Remove shock absorber.

3. Compress coil spring by means of spring clamp, tool 93-133.

4. Loosen and remove the two screws which hold the ball joint and lower spring seat to the spring arm. See Fig. 18.

5. Loosen the screws which hold the two bearing brackets to the body.

6. Remove the compressed coil spring.

7. Remove spring arm and bearing brackets. Collect shims from under brackets.

8. Loosen the two bearing nuts. Brackets and bushings can then be removed from spring arm, see Fig. 19.

3.4.1.2. Installation.

Clean all parts thoroughly before installation, and replace worn or damaged parts with new ones. Note that oil or grease must on no account be used in connection with installation of the rubber bushings.

Alternative I

1. Attach the rubber-suspended brackets to the

spring arm. When the two nuts are tightened and locked, the angle between spring arm and brackets should be 80° , see Fig. 20,

2. Install spring arm by attaching the brackets to the body.
3. Attach the ball joint and the spring seat to the spring arm.
4. Install coil spring as described in 3.3.1.2.
5. Drive the car a short distance with normal spring deflections and without hard cornering.
6. Check and, if necessary, adjust wheel as described in 3.2. The correct wheel angles are given in 2.2.

Alternative II

1. Attach the rubber-bushed brackets to the spring arm. When the two nuts are tightened and locked, the angle between spring arm and brackets should be 80° , see Fig. 20.
2. Fit spring arm in position, but do not insert screws in brackets.
3. Check that rubber ring and metal washer at upper spring seat and rubber bushings under spring arm are installed.
4. Fit the compressed coil spring into position and attach ball joint and spring seat.
5. Attach spring arm brackets to body.
6. Loosen spring clamp gradually until the tool can be removed.
7. Install shock absorber.
8. Road-test the car. Check wheel alignment and, if necessary, adjust them as described in 3.2. The correct wheel angles are given in part 2.2.

3.4.2. Replacement of front lower spring arm

3.4.2.1. Removal.

1. Jack up car and remove wheel.
2. Disconnect lower shock absorber attachment.
3. Loosen and remove the two screws which hold the ball joint and stabilizer attachment to the spring arm. See Fig. 21.
4. Unscrew the nuts inside the engine compartment which hold the bearing brackets to the floor plate. The spring arm and brackets can then be removed.

5. Unscrew the two nuts for the spring arm bearing and remove brackets and bushings. See Fig. 19.

3.4.2.2. Installation.

Clean all parts thoroughly before installing, and replace worn or damaged parts with new ones.

Note that oil or grease must on no account be used in connection with the installation of the rubber bushings.

1. Attach rubber bushings and brackets to spring arm. When the two nuts are tightened and locked, the angle between spring arm and bracket contact face against chassis should be 17° , see Fig. 20.
2. Install spring arm by screwing its bearing brackets to the body.
3. Attach ball joint and stabilizer attachment to spring arm. Don't forget reinforcing washer on rear side of arm.
4. Install lower shock absorber attachment.
5. Fit wheel.

6. Test-drive car a short distance without hard cornering with normal spring deflections.

7. Check and, if necessary, adjust wheel alignment as described in 3.2. The correct wheel angles are given in part 2.2.

3.4.3. Replacement of ball joint seal bellows

The ball joints are fitted with rubber bellows in order to protect them from wear caused by dirt. These bellows must therefore be replaced if damaged.

3.4.3.1. Removal

1. Remove wheel.
2. Clean ball joint and adjacent parts.
3. Disconnect pivot from steering knuckle housing. The upper one is held in place by two screws and the lower one by one screw. See Fig. 21.
4. Remove the wire with which the bellows is clamped to the ball joint body.
5. Remove bellows.
6. Lubricate ball joint generously through the lubricator and wipe off superfluous grease.

Generous lubrication of the ball joint presses out any dirt that may have entered the bearing through the damaged bellows.

It is convenient to inspect and, if necessary, adjust the play of the pivot when replacing a rubber bellows, see point 3.4.4.

3.4.3.2. Installation.

1. Fit a new seal bellows.
2. Wind two turns of galvanized 1 mm. (0.04 in.) iron wire round the bellows and lock it with pliers.
3. Attach the pivot to steering knuckle housing.
4. Lubricate ball joint.
5. Fit wheel.

3.4.4. Adjustment of spring-arm ball joints

If play has developed in the ball joints, they must be adjusted as it may otherwise impair the steering qualities and cause noise.

1. Remove the wheel. Clean ball joint and adjoining parts.

2. Disconnect pivot from steering knuckle housing. The upper one has two screws and the lower pivot one screw. See Fig. 21.

3. Remove screw 6 with spring washer and lock bar 5 from top or underside of ball joint.

4. Tighten nut 4 with a hook wrench, tool 93-130, until the pivot is slightly stiff to move.

Note that the pivot must not bind so hard in any position that it cannot be fairly easily loosened by hand.

5. Place lock bar 5 in the suitable groove after adjustment, and tighten screw. Don't forget the spring washer.

6. Fit pivot to steering knuckle housing.

7. Fit wheel.



Fig. 15. Removal or installation of front spring using the tool 93-133.

3.4.5. Replacement of wheel bearings

After a long period of service the wheel bearings may be so worn that play appears, especially if the lubrication has not been satisfactory. As this seriously affects the steering qualities, the wheel bearings must be replaced. The wheel bearings can easily be checked for play as follows: Jack up the car, grasp the tire at top and underside and try to rock the wheel. If the play measured at the edge of the rim is greater than 2 mm. (0.08 in.), the wheel bearings must be replaced.

Note that a press tool must be used in addition to the other tools mentioned for removal and installation of wheel bearings. The wheel bearings must on no account be struck, as they are easily damaged by blows.

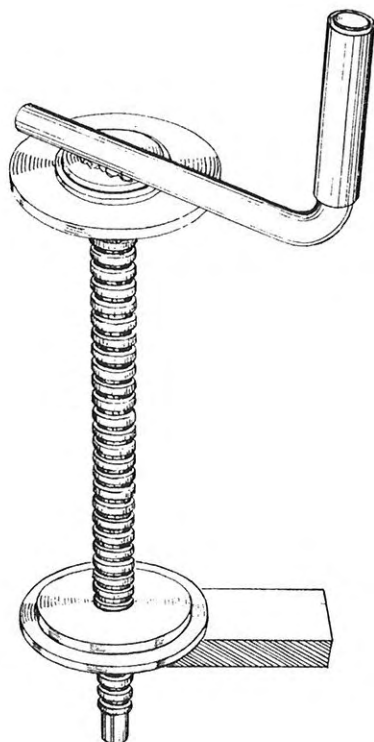


Fig. 16. Spring press Saab tool 93-132

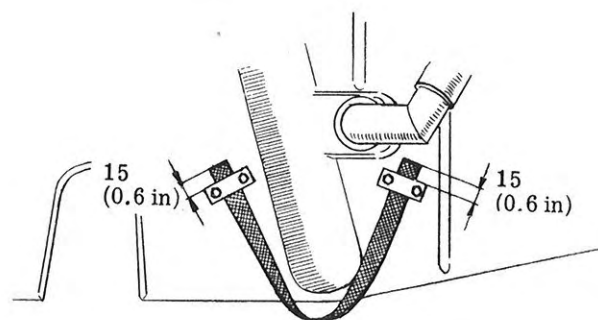


Fig. 17. Installation of rear axle stop straps

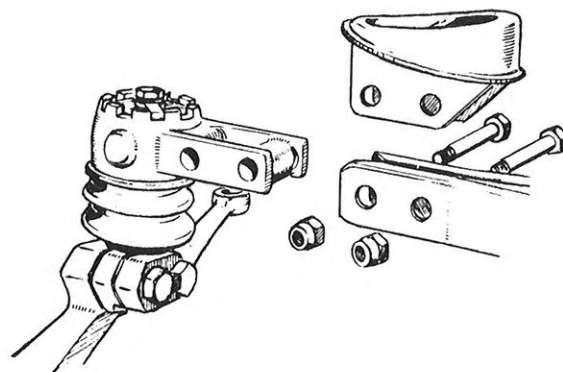


Fig. 18. Removal of upper ball joint and lower spring seat.

3.4.5.1 Replacement of ball bearing in front wheel hub.

DISMANTLING

1. Remove the wheel.
2. Remove cotter pin and crown nut.
3. Remove brake drum with puller 92-3, see Fig. 22.
4. Disconnect brake hose at body. However, the brake hose should preferably not be disconnected, and this is avoided if the brake shield with brake cylinders is detached from the steering knuckle housing and placed, or preferably suspended, nearby.
5. Loosen the stop nuts and remove the two screws which hold the steering arm and upper ball joint to the steering knuckle housing

In cars with serial numbers from 28015: Unfold lock washer and loosen the two attachment bolts.

6. Loosen the clamp screw which holds the lower pivot to the steering knuckle housing.

7. Pull the drive shaft loose from the inner universal joint and remove the entire front axle unit, which should then be thoroughly cleaned.

8. Loosen hose clip and push aside rubber bellows 13, Fig. 23. Remove cotter pin, washer and pin 25 at universal joint 17; remove inner drive shaft with universal joint and rubber bellows.

9. Remove nut 5 with shaft seal. Use hook wrench 92-21. First unlock nut with a drift or the like.

10. Collect woodruff keys, if they are still in place.

11. Remove outer drive shaft 7 by pressing on its threaded end. This releases spring 10 and cup 9.

12. Press bearing out of steering knuckle housing.

13. Remove the two seal rings from their seats in steering knuckle housing and nut if they should be replaced.

ASSEMBLY

Clean all parts thoroughly and replace worn or damaged ones. Pay special attention to seal rings and rubber bellows 13.

1. If seal ring in steering knuckle housing has been removed, press in a new one.

2. Pack ball bearing with ball bearing grease, see Chapter 15, "Lubrication".

3. Press ball bearing into steering knuckle housing with the mark X on inner race facing outwards, see Fig. 24.

4. Screw on nut 5, Fig. 23, with seal ring 6 and lock the nut.

5. Place spring 10 and cup washer 9 on outer drive shaft.

6. Press in shaft until distance from the outside of the ball bearing to outer end of shaft is 66 mm. (2.6 in), see Fig. 24.

7. Insert pin 15, Fig. 23, with washer, and lock with cotter pin.

8. Pack outer universal joint with chassis or universal grease.

9. Connect rubber bellows to steering knuckle housing with a hose clip.

10. Lubricate splines on inner drive shaft with graphite grease or chassis grease and push shaft into inner universal joint.

11. Attach steering knuckle housing to steering arm and pivots.

12. Fit brake shield and brake drum. When pushing on brake drum, make sure that the woodruff keys are not displaced and that the sliding surface against the seal ring is not damaged. If the surface is damaged, it must be adjusted and polished with very fine emery cloth, see Chapter 8, "Wheels and hubs" 3.3.2. Grease the sliding surface with some ball bearing grease.

13. Tighten the crown nut with a torque of 17-20 kgm. (125-145 lb-ft.) and lock with a cotter pin.

14. Fit wheel and lower the car.

15. Adjust brake shoes, see Chapter 9, "Brake system" 3.1.1.

3.4.5.2. Replacement of ball bearings in rear wheel hub

DISMANTLING

1. Jack up car and take off wheel.

2. Remove dust cap 15, Fig. 25, with a screwdriver.

3. Remove cotter pin 1, crown nut 2 and washer 3.

4. Make sure that handbrake is fully released.

5. Pull off brake drum with tool 92-3, see Fig. 22.

6. Remove nut 7 with seal ring 8, Fig. 25. Use hook wrench 92-10. First unlock nut with a drift or the like.

7. Press out the two bearings towards inside of brake drum. Use tool 92-34, see Fig. 26.

ASSEMBLY

Clean all parts thoroughly and replace worn or damaged ones. Pay special attention to shaft seal 8 in nut 7, Fig. 25.

1. Pack ball bearings with ball bearing grease, see Chapter 15, "Lubrication".

2. Press in the larger bearing with tool 92-33, see Fig. 27.

3. Screw on nut 7 with seal ring 8 and lock the nut, see Fig. 25.

4. Put ball bearing grease into the brake drum until the space between the bearings is half-filled.

Note that the space between the bearings must be only half-filled with grease otherwise it may penetrate to the brake linings.

5. Insert spacer 5, Fig. 25, and press in the smaller bearing 4. Use tool 92-34, see Fig. 26.

6. Check that the sliding surface against the seal ring is undamaged. If damaged, it must be adjusted and polished with very fine emery cloth. Grease the sliding surface with some ball bearing grease.

7. Install the brake drum and tighten the crown nut with a torque of 10 kgm. (73 lb-ft.) and lock with a cotter pin. Then fit dust cap 15 with tool 92-37.

8. Fit wheel.

3.4.6. *Replacement of rubber bushings, front suspension*

3.4.6.1. Upper spring arm bearings.

1. Remove upper spring arm and take bearing apart as described in 3.4.1.1.

2. Replace worn bushings in bearing brackets.

3. Attach brackets to spring arm. Note that when the two end nuts are tightened and locked the angle between spring arm and brackets should be 80° , see Fig. 20.

4. Install spring arm as described in 3.4.1.2.

3.4.6.2. Lower spring arm bearings.

1. Remove lower spring arm and take bearing apart. See point 3.4.2.1.

2. Replace worn bushings in bearing brackets.

3. Attach brackets to spring arm. Note that when the two end nuts are tightened and locked the angle between spring arm and brackets should be 17° , see Fig. 20.

4. Install spring arm as described in 3.4.2.2.

3.4.6.3 Stabilizer bearings.

1. Block up front end of car and remove both front wheels.

2. Loosen and remove the two screws on each side which hold the ball joint and stabilizer attachment on to the lower spring arm.

3. Disconnect stabilizer attachments from spring arms.

4. Bend down the stabilizer and remove its two end

attachments into which the rubber bushings are pressed.

5. Loosen and remove one of the body attachments of the stabilizer. The nuts are accessible inside the engine compartment.

6. Replace rubber bushing in body attachment and reinstall it.

7. Repeat procedure 5 and 6 with the other body attachment.

8. Replace rubber bushings in the two end attachments. Note that oil or grease must on no account be used when installing the rubber bushings.

9. Fit the two end attachments to the stabilizer.

10. Connect stabilizer and ball joints to the lower spring arms, and tighten screws.

11. Fit wheels and lower the car.

3.4.7. *Replacement of rubber bushings, rear suspension*

3.4.7.1. Side link bushings.

1. Block up rear end of car and remove rear wheels.

2. Disconnect side link body attachment. The nuts are accessible inside the car under the rear seat, see fig. 28.

3. Disconnect link at rear axle attachment.

4. Remove body attachment bracket from link.

5. Replace bushings at both ends of links. Use tool 93-135 for pressing the bushings out and in, see Fig. 29.

6. Attach body attachment bracket to link. Note that when this bearing is tightened, the angle between link and bracket should be 4° , see Fig. 30.

7. Attach link to rear axle but do not tighten the nut. This must never be tightened until the car is resting on its wheels. Insert the bolt from the outside towards the middle bearing.

8. Fit body attachment and tighten nuts, see Fig. 28. Don't forget the spring washers.

9. Fit wheels and lower the car.

10. Tighten the nut at the side link attachment to rear axle. Check the stop nuts for locking power and replace if necessary.

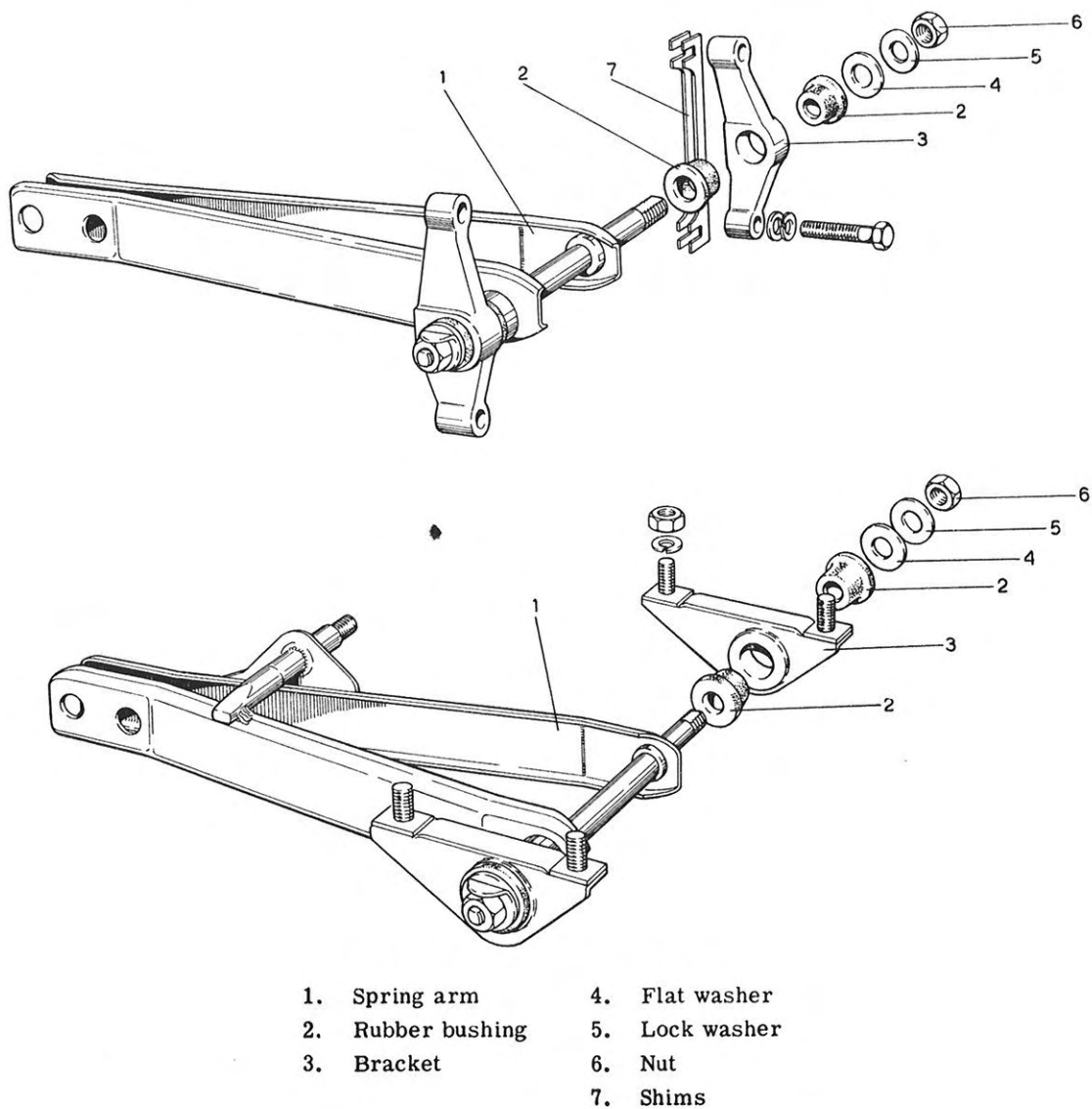


Fig. 19. Upper and lower spring arms, front suspension

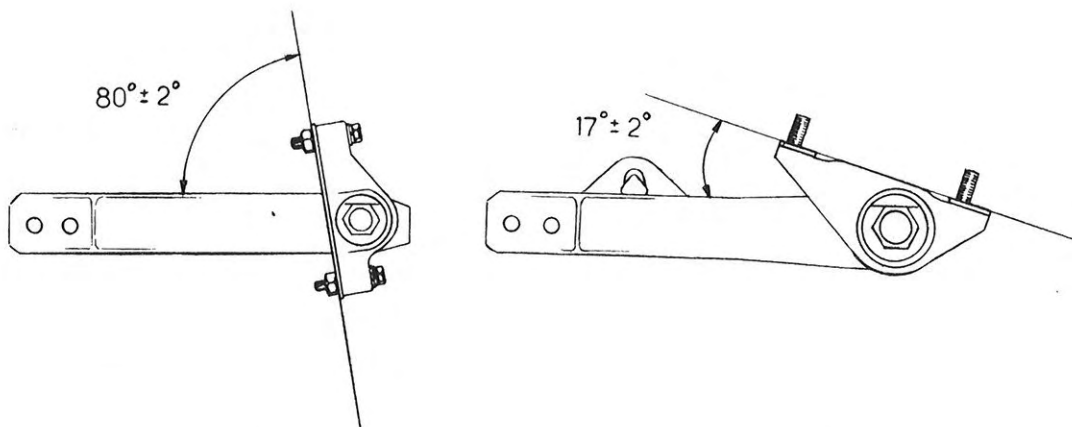


Fig. 20. Angles between upper and lower spring arms and their brackets

3.4.7.2 Rubber bushing in rear axle bearing.

If the bushing in the rear axle bearing is to be replaced, this should preferably be done in connection with some other work when the rear axle is removed. It is possible, however, to replace the bushing without removal of the axle.

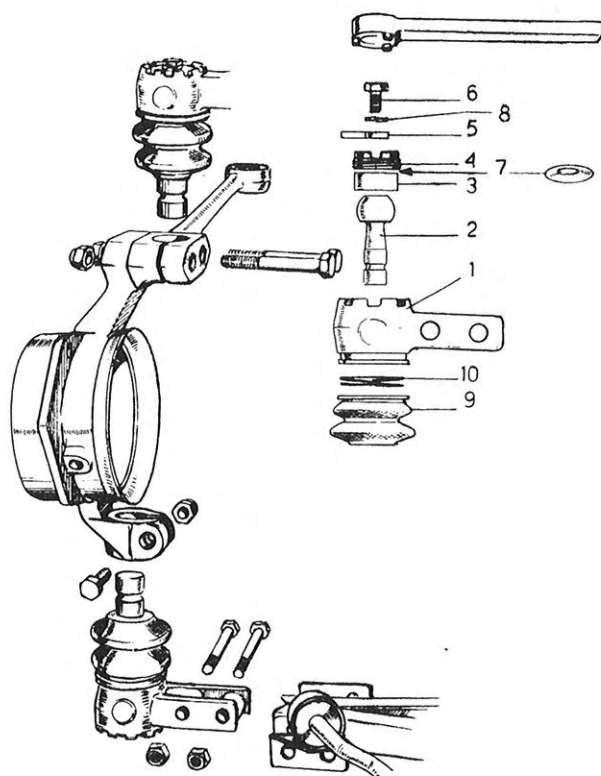


Fig. 21. Attachment of steering knuckle housing and dismantled ball joint

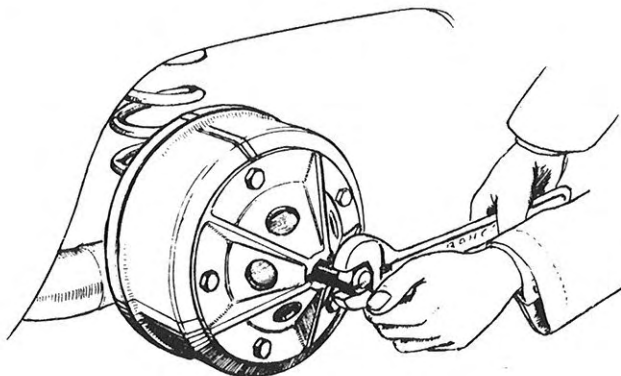


Fig. 22. Wheel puller

Alternative I

Replacement without removing rear axle.

1. Block up rear end of car.
2. Loosen rear muffler and exhaust pipe attachments at wheel housing and floor.
3. Loosen and remove bolt through bearing.
4. Pull down rear axle and place an iron bar across the tunnel on each side of the bearing.
5. Apply tool 93-134 and remove rubber bushing, see Fig. 31.
6. Press in a new bushing with the same tool. Note position of bushing. The bushing should be in the middle of the bearing, and any "ridge" in the end of the bushing should lie on the center line of the axle, see Fig. 33.
7. Fit the bearing but do not tighten the nut until the car is resting on its wheels.
8. Fit the rear muffler and exhaust pipe attachments to wheel housing and floor.
9. Lower the car.
10. Tighten nut of rear axle bearing.

Alternative II

Removal and installation of rear axle for replacement of bushing.

1. Remove rear seat, block up rear end of car and remove wheels.
2. Remove dust caps with a screwdriver, remove cotter pins, crown nuts and washers, then pull off brake drums with tool 92-3.
3. Loosen and lower rear muffler and exhaust pipe from wheel housing and floor.
4. Loosen shock absorbers from rear axle.
5. Loosen and remove the screws which hold brake shields on to rear axle ends, and loosen clamps on rear axle for hand brake cables.
6. Remove brake shields from axle and place shields so as not to damage brake hoses.
7. Disconnect the two rear axle stop straps at their rear attachments and remove the coil springs.
8. Disconnect side link body attachments, see Fig. 28.
9. Disconnect bearing from body and remove rear axle, see Fig. 32.
10. Remove bearing bracket from axle.
11. Replace bearing bushing using the tool 93-134, see Fig. 31. Make sure that the bushing is pressed in to the middle of the bracket, and any "ridge" in the end of the bushing should be placed as shown in Fig. 33.
12. Fit bearing bracket, but do not tighten the nut yet.
13. Lift rear axle into position and attach the bearing bracket to body. It may be convenient to attach the stop straps temporarily and let the axle rest in them while the bearing bracket is screwed into place.
14. Inspect the side link rubber bushings. If they have to be replaced, see 3.4.7.1., points 4 - 6. Attach side links to rear axle. Insert bolts from outside towards middle bearing.

Note: Do not tighten the nuts. Attach side link brackets to body and tighten nuts. Don't forget the spring washers.

15. Install coil springs after disconnecting stop straps, if the latter were connected for installation of the rear axle.

16. Fit the shock absorbers.

17. Install brake shields and clamp handbrake cables to axle.

18. Fit wheel hubs. Tighten crown nuts with a torque.

19. Fit wheels.

20. Lower the car. Block up under the wheels so as to leave enough space for getting under car.

21. Tighten the nut at the rear axle bearing.

22. Tighten nuts at the two side link bearings if they were loosened.

23. Connect stop straps at their rear attachments and tighten screws.

Note that the ends of the stop straps should come 15 mm. (0.6 in.) outside the attachment, see Fig. 17.

3.4.8. Replacement of shock absorbers

Faulty shock absorbers must be replaced. This is most important, as they are an essential contribution to the road-holding and steering qualities of the car.

Note that the front and rear shock absorbers have different hardnesses and lengths of stroke. The protective cylinders are therefore marked 5/152 and 6/163 or F and B respectively. See also part 2.2.

3.4.8.1. Removal.

1. Jack up car and remove wheel.
2. Disconnect shock absorber at upper and lower attachments.
3. Remove shock absorber and collect washers and rubber parts.

3.4.7.2. Installation.

When installing, make sure that any faulty rubber parts are replaced with new ones. These must, however, be original Saab products, otherwise noise may develop in the bearings. Before installing bleed the shock absorber, as described in point 1.6.

1. Fit rubber bushings and washers and install shock absorber. Grease threads on pins before screwing on nuts. The nuts should be tightened down to the stops.

2. Fit the wheel and lower the car.

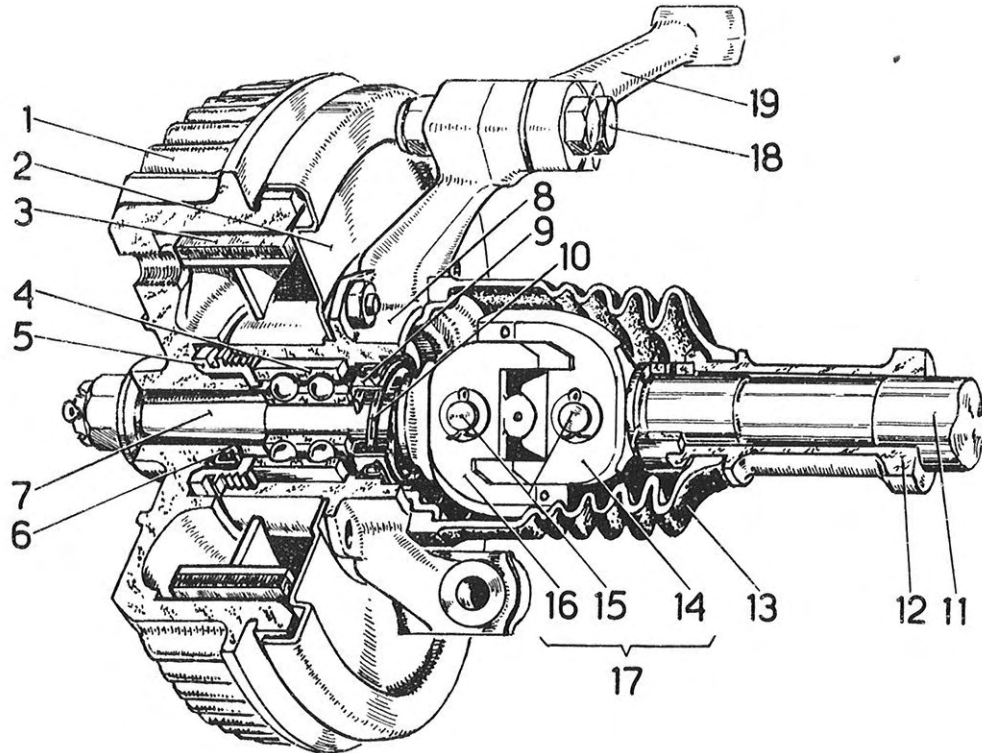


Fig. 23. Front axle unit. For explanation of numbering, see this chapter, Fig. 2.

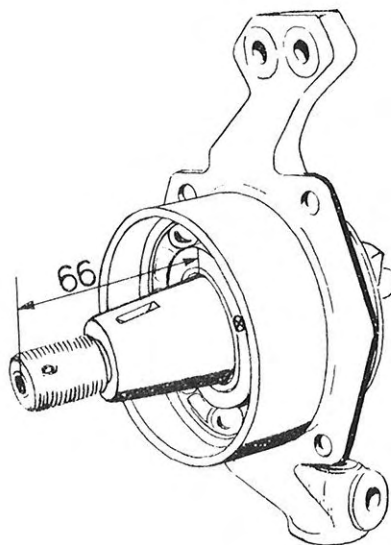


Fig. 24. Pressing in outer drive shaft, and marking off ball bearing.

4. INSPECTION WORK

4.1. Front suspension

4.1.1. Removal

1. Block up front end of car and remove front wheels.
2. Remove shock absorbers.
3. Disconnect drag rod ends from steering arms with tool 92-5.
4. Remove both front axle units as described in 3.4.5.1., points 1 - 7.
5. Remove coil springs and upper spring arms as described in 3.4.1.1.
6. Remove the lower spring arms as described in 3.4.2.1.

7. Remove the stabilizer by disconnecting its bearings from the body. The nuts are accessible from inside the engine compartment. Remove both body and end bearings from stabilizer and pull it out to the right.

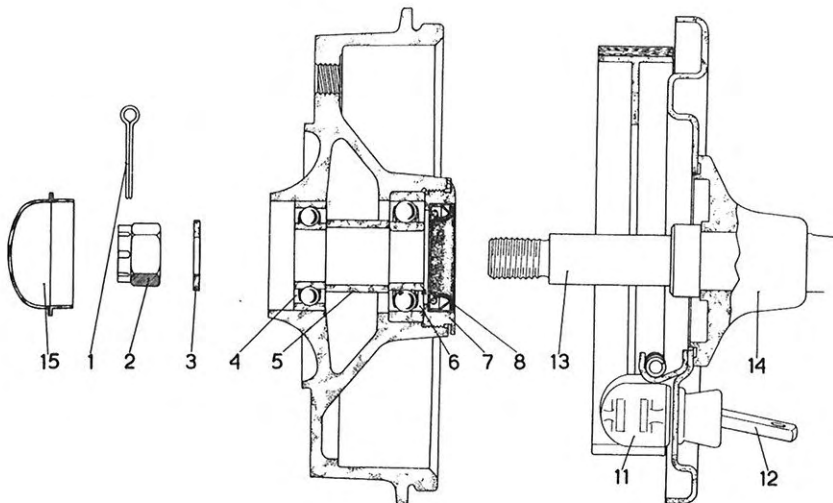
8. Remove steering gear, see Chapter 11, "Steering".

9. Remove lower springs bumpers.

4.1.2. Inspection and adjustment of spring arm

ball joints

After a period of service, the bearing cups are broken in with the pivots and they should not be moved in relation to each other. The ball joints should therefore not be dismantled unnecessarily. Play should be adjusted as described in 3.4.4.



- | | | |
|-----------------|------------------|--------------------|
| 1. Cotter pin | 6. Ball bearing | 11. Brake cylinder |
| 2. Crown nut | 7. Nut | 12. Brake lever |
| 3. Washer | 8. Seal ring | 13. Axle shaft |
| 4. Ball bearing | 9. Brake shoe | 14. Rear axle |
| 5. Spacer | 10. Brake shield | 15. Dust cap |

Fig. 25. Rear wheel hub

4.1.2.1. Dismantling of ball joints.

1. After disconnecting ball joint from spring arm and steering knuckle housing, remove rubber bellows 9, see Fig. 21.
2. Remove screw 6 and lock bar 5.
3. Remove cover 4 with tool 93-130.
4. Remove spring washer 7 (only in lower ball joints) bearing cup 3 and pivot 2 from the ball joint body.

4.1.2.2. Assembly of ball joint.

Inspect all parts and replace worn or damaged ones. Pay special attention to the pivot, particularly if it has been subjected to severe stresses due to collision or ditching. If it is cracked or deformed in the least, then it must be replaced.

1. Lubricate cups and pivot with chassis or universal grease.
2. Place pivot 2, cup 3 and spring washer 7 (the latter only in lower ball joints) in the ball joint body 1., Fig. 21.
3. Tighten nut 4 with a hook wrench, tool 93-130, until the pivot is slightly stiff to move. Note that the pivot must not bind so hard in any position that it cannot easily be loosened by hand.
4. Place the lock bar 5 in the suitable groove after adjusting, and tighten the screw. Don't forget the spring washer.
5. Fit rubber bellows 9. Damaged bellows must always be replaced. Use 1 mm. (0.04 in.) galvanized iron wire; wind two turns around the rubber bellows and lock with pliers.

4.1.3. Adjustment of spring arms

If the spring arms have been heavily stressed in a collision or the like, they should be carefully inspected for cracks or deformation. If the arms are deformed, they must be replaced.

4.1.4. Installation of front suspension

Clean all parts thoroughly, inspect carefully and replace worn or damaged parts, unless they can be adjusted as described. Adjust steering gear as described in Chapter 11 "Steering".

1. Attach stabilizer to body.
2. Install steering gear, see Chapter 11, "Steering".

3. Install upper spring arms and coil springs, see 3.4.1.2., points 1 - 4 or 1 - 6.

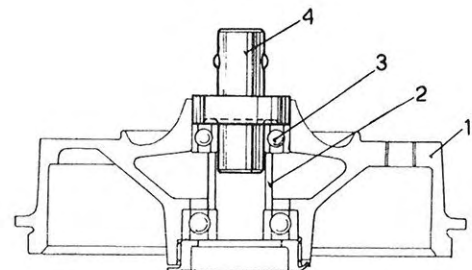
4. Install lower spring arms, see 3.4.2.2., points 1 - 3.

5. Install front axle units, fit brake shields and brake drums. See 3.4.5.1.

6. Install shock absorbers.

7. Fit wheels, lower the car, and adjust the brake shoes.

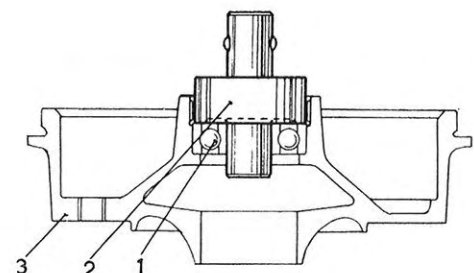
8. Road-test car. Check and, if necessary, adjust front wheel alignment, see 3.2.



1. Brake drum
2. Spacer
3. Outer ball bearing
4. Tool 92-34

Fig. 26. Pressing out both bearings or pressing in outer bearing.

Note: Handles 92-30 or 92-31 may be used to both tools. See Chapter 16, "Tools".



1. Ball bearing
2. Tool 92-33
3. Brake drum

Fig. 27. Pressing in inner ball bearing

7 AXLES AND SUSPENSION

4.2. Rear suspension

4.2.1. Removal

Alternative I

1. Remove rear axle as described in 3.4.6.2. alt. II, points 1 - 9.
2. Remove shock absorbers.
3. Remove upper spring seat with spring bumper and rubber insulation. The bumper can be removed separately with a suitable wrench. The rubber buffer is screwed to the pin.
4. Remove stop straps.

Alternative II

1. Remove rear seat.
2. Block up rear end of car and remove wheels.
3. Disconnect exhaust pipe and rear muffler at floor and wheel housing.
4. Disconnect brake hoses at their connections to the body.
5. Disconnect stop-strap at their rear attachments and remove coil springs.
6. Suspend the axle temporarily in stop straps.

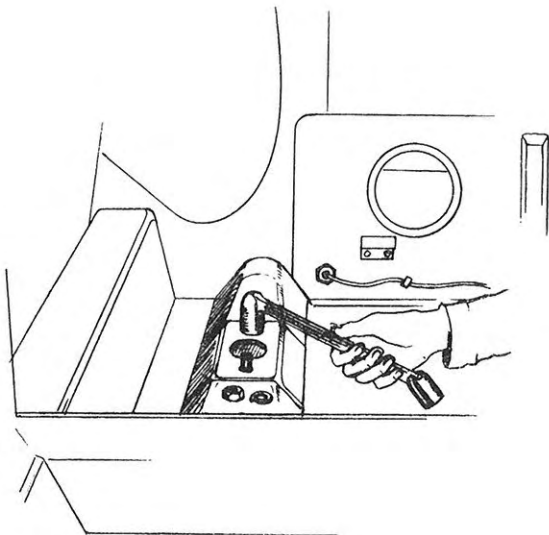


Fig. 28. Side link body attachment

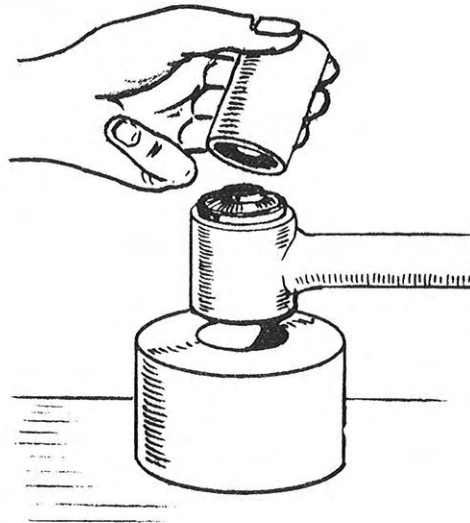


Fig. 29. Pressing out side link rubber bushing

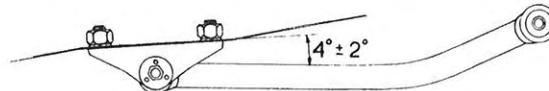


Fig. 30. Angle between side link and body attachment bracket

7. Loosen upper shock absorber attachments.
8. Loosen clamps for brake cables on axle and disconnect cables from the brake levers inside brake shields.
9. Detach rear axle bearing bracket from body, see Fig. 32.
10. Disconnect side link attachment from body. The nuts are accessible inside the car under the rear seat. See Fig. 28.
11. Disconnect the stop straps again and remove the entire rear axle unit.
12. Remove brake drums, brake shields, side links and rear axle bearing.
13. When pressing out the rubber bushings, use tools 93-134 and 93-135, see Fig. 29 and 31. The bracket must be removed before pressing out the front bushings from the side links.

14. If necessary, the axle shafts can be pressed out. Press it out inwards and collect the spacer outside the axle end.

4.2.2. Inspection and adjustment of rear axle

If the rear axle has been subjected to abnormal stresses in a collision or the like, it must be carefully checked for cracks and deformation. If the axle is slightly deformed, it can be straightened, preferably cold. After straightening and inspection, the axle should be left for about 8 hours and then inspected once more. The axle shafts should also be carefully inspected and if they are deformed, they must be replaced.

When inspecting the rear axle, pay particular attention to the sealing surface "A", Fig. 25. The tongue of the seal ring slides against this surface. If the surface is scratched or otherwise damaged, it must be adjusted and polished with very fine emery cloth, see Chapter 8, "Wheels and hubs".

4.2.3. Installation

Clean all parts thoroughly, inspect carefully and replace all worn or damaged parts.

Install in reverse order. Note that the rubber bushings must be installed correctly so that no stresses remain, that is, the rear axle bearings

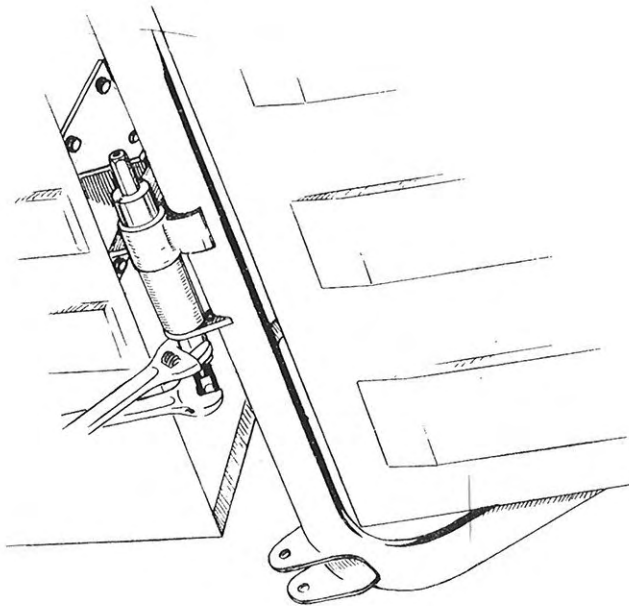


Fig. 31. Pressing rubber bushing out or in without removing rear axle unit

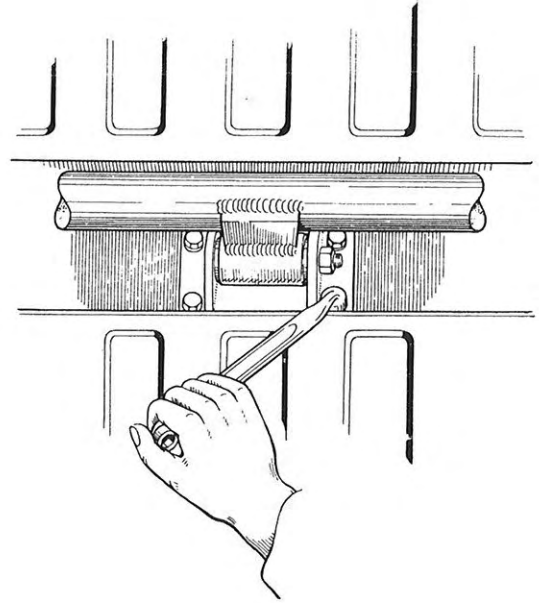


Fig. 32. Detachment of rear axle bearing bracket

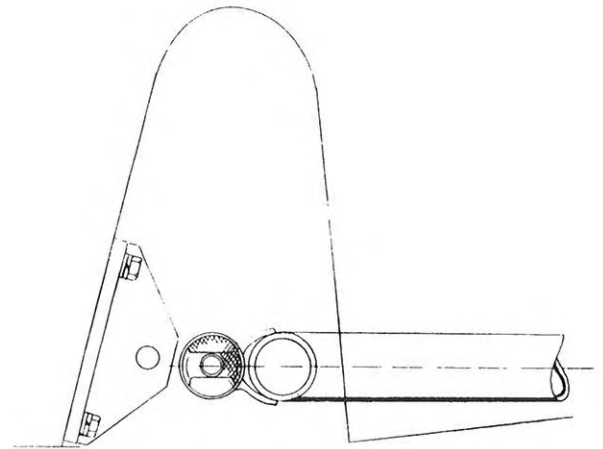


Fig. 33. Installation of rubber bushing in rear axle bearing

to body and side links should be locked when the car rests on its wheels and is unloaded. See further 3.4.7.1., points 6 - 10 and 3.4.7.2., alt. II, points 11 and 19 - 23.

NOTE

1. Be sure to protect the rubber bushings from rubber solvents such as grease gasoline, etc.

2. If a rubber bushing is stuck in place owing to rust it must be destroyed. However, it must be re-

moved very carefully so as not to damage axle, arms or links. This applies in particular to the bushings in the spring arm bearings. After removing the bushing, clean the bearing surfaces with very fine emery cloth.

3. Elastic stop nuts which lose their locking power after repeated removals must be replaced.