

CONTENTS

Description	1
Repair instructions	2
Work that can be carried out with the rear axle fitted	2
Repair instructions for Model I rear axle	4
Removing the rear axle	4
Disassembly of rear axle	4
Inspection	5
Assembly of rear axle gears	7
Fitting	8
Repair instructions for Model II rear axle	9
Removing the rear axle	9
Disassembly of rear axle	9
Inspection	10
Assembly	11
Fitting	16
Rear axle gear adjustments	17
Tracing faults	20
Specifications	21
Tools	22

DESCRIPTION

This Service Manual concerns rear axles with part numbers 86583, 87770, 88704, 88895, 88999, 89650, 655712 and 655713 for the PV 444 and rear axles with part numbers 88159, 89238 and 89686 for the PV 445.

Reference is made to the Spare Part Catalogue concerned which show the chassis numbers of the various vehicles and the rear axles fitted.

Early models PV 444 cars with chassis numbers up to 8377 were fitted with spiral bevel gears, the pinion being level with the centre of the crown wheel centre.

The rear axle on PV 444 cars from chassis number 8378 onwards and all PV 445 station wagons and vans are of the hypoid type, i.e. the pinion lies lower than the centre of the crown wheel and has enabled the use of a lower propeller shaft. One disadvantage of this is that there are greater stresses on the teeth of the pinion and crown wheel. Apart from the pressure normally exerted between the teeth, there is also a wiping action in hypoid gears. This makes great demands on the degree of adhesion of the oil used. That is why a special oil called hypoid oil must be used in hypoid gears since this oil has an excellent degree of adhesion to the gear teeth. The use of the wrong type of oil in hypoid gears can cause extremely rapid wear of the gears.

The rear axle can suitably be divided into three main units: the rear axle housing, the gears and the axle drive shafts.

Rear axles with part numbers 86583, 87770, 87869, 88159, 88704, 88895, 89238 and 655712 (see Illustration I) differ from part numbers 88999, 89650, 89686 and 655713 Model II (see Illustration II) mainly that the gears are fitted in a special housing — the rear axle gear housing — which is bolted to the rear axle housing.

Rear axle gears consist of the pinion, the crown wheel and the differential. There are slight differences between the rear axle gears in Model I rear axles and Model II rear axles. On Model I rear axles, there are adjusting nuts to assist the setting of the differential housing bearing and the backlash between the crown wheel and pinion. On Model II, however, these nuts are not fitted and adjustment is carried out by shims inside the differential housing bearings.

The differential housing and the crown wheel are journalled in the rear axle gear housing and the rear axle housing by two taper roller bearings.

The crown wheel is attached to the differential housing by bolts which are locked with tab washers.

The differential consists of two differential pinion gears on a short shaft and two larger side gears carrying the axle shafts by means of internal splines. By virtue of their journaling, these gears can rotate and permit the axle shafts to rotate at varying speeds when the vehicle is being driven round curves. There is a washer under each differential gear and the pinion is journalled in taper roller bearings. The axial position of the pinion relative to the crown wheel is adjusted by means of shims under the rear pinion bearing outer ring. Pinion bearing adjustment is carried out by means of shims under the front pinion bearing inner ring.

Each axle shaft is also journalled in a taper roller bearing which, on rear axle part number 89650, is fitted in the inward-extended cone for the wheel hub. Bearing clearance is adjusted by means of shims under the brake backing plate. On the inside of each axle shaft bearing, there is a seal ring which, together with a felt ring on the outside of the bearing, prevents the oil in the differential from reaching the brake linings.

The rear axle suspension consists of two inclined support arms. On early production vehicles the rear axle housing is bolted to the support arms directly. On late production models, the rear axle housing is journalled in two rubber bushings which are attached to the support arms. In order to prevent the rear axle housing from twisting relative to the longitudinal axis of the vehicle, there are two torque rods. These are rubber-journalled in attachments which are bolted to the upper side on the rear axle housing and the underside of the body. The rear axle suspension principle is shown in fig. 1.

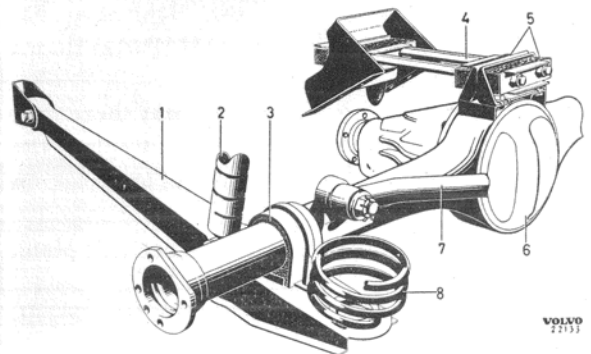


Fig. 1. Rear axle, late production.

- | | | |
|-------------------|----------------------|----------------|
| 1. Support arm | 4. Torque rod | 7. Track rod |
| 2. Chock absorber | 5. Rubber blocks | 8. Rear spring |
| 3. Rubber | 6. Rear axle housing | |

REPAIR INSTRUCTIONS

Work that can be carried out with the rear axle fitted

Replacement of axle shaft seal ring

1. Remove the wheel and pull off the wheel hub as shown in fig 2. Use puller SVO 1446 A for hubs with four wheel bolts and SVO 1791 for hubs with five bolts. Remove the brake backing plate after having placed a wooden block under the brake pedal and loosened the brake line from the backing plate.

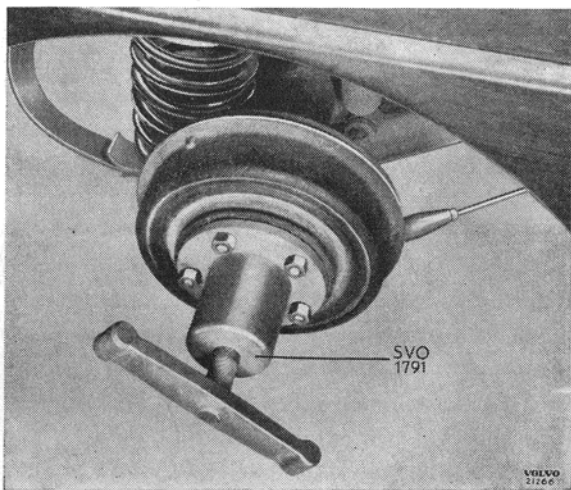


Fig. 2. Removing a wheel hub.

2. Pull out the axle shaft, fig. 3. Use puller SVO 2204 (SVO 1804 can be used on rear axles on which the gears can be removed.)
3. Pull out the seal ring by using tool SVO 4078 (fig. 4).
4. Drive in the new seal ring. Make sure that it lies correctly. Use tool SVO 1803 as shown in fig. 5.
5. Remove any oil and grease that there may be on the brake backing plate. Replace the brake linings if there is any oil or grease on them.
6. Fit the axle shaft and brake backing plate. Use a new felt washer.
7. Check the axle shaft end play. See the directions under the heading "Assembly".
8. Replace the cross key if it has been removed and then fit the hub and wheel.

9. Air-vent the brake lines and adjust the brakes. Follow the directions given in Part 7.
10. Check the oil level in the rear axle.

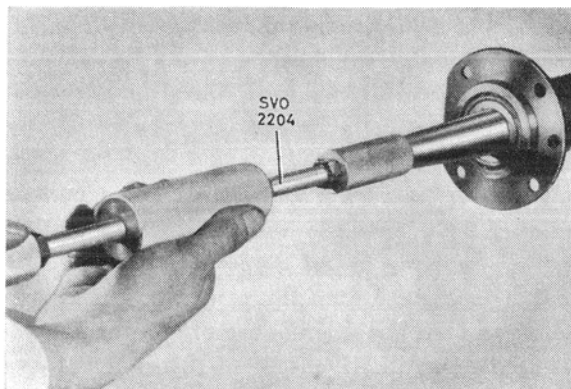


Fig. 3. Removing the axle shaft.

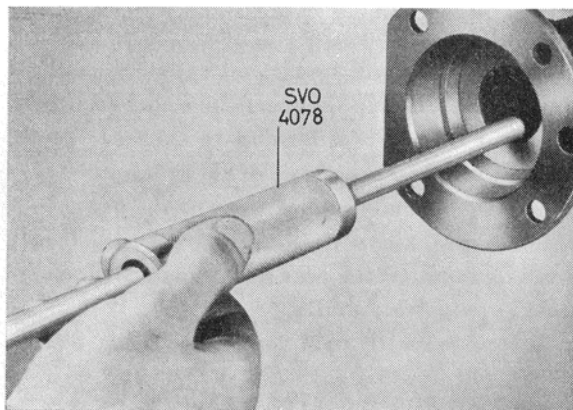


Fig. 4. Removing the seal ring.

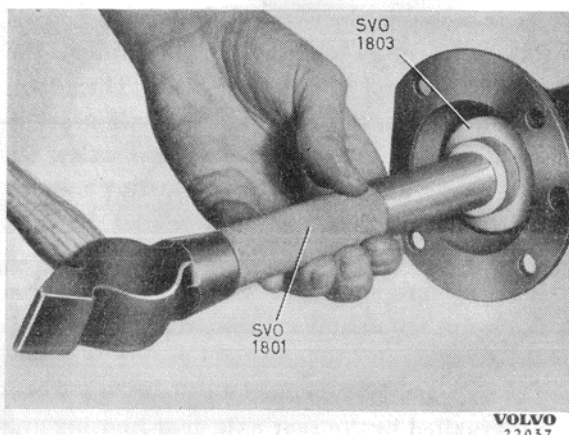


Fig. 5. Fitting the seal ring.

Replacement of pinion seal ring

1. Disconnect the rear section of the propeller shaft from the flange on the pinion. Check the looseness of the pinion in its bearings. If it is loose, this must be remedied before a new seal ring is fitted.
2. Remove the flange nut and pull this off with tool SVO 2261 (tool SVO 4068 A can be used). See fig. 6. Remove the oil seal ring by using tool SVO 4030 as shown in fig. 7.

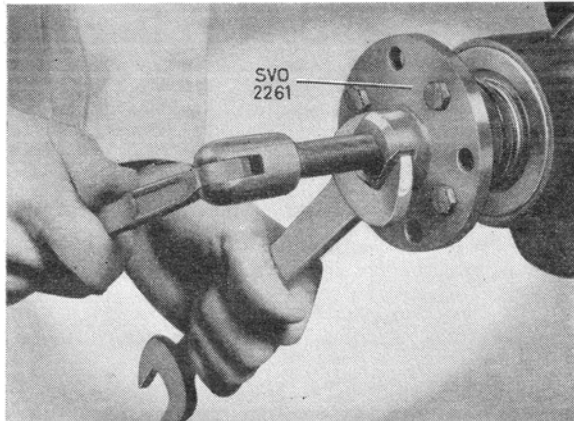


Fig. 6. Removing the flange.

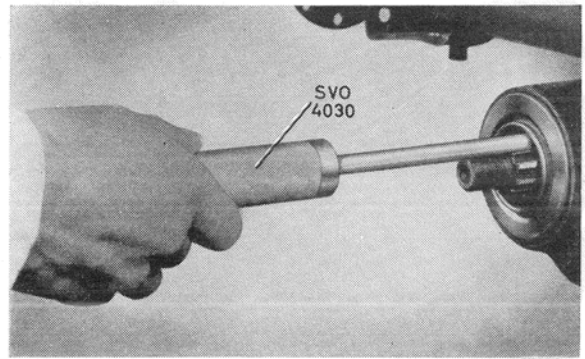


Fig. 7. Removal of seal ring.

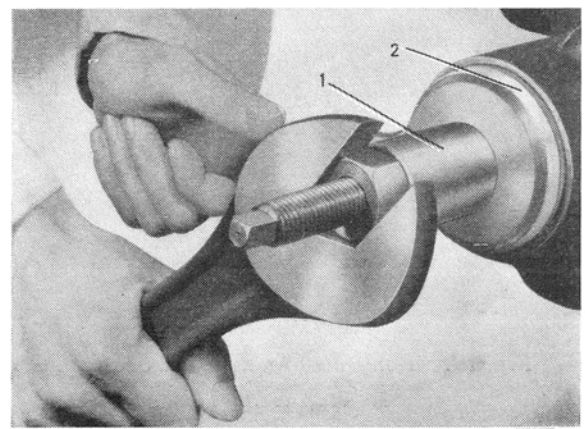


Fig. 8. Fitting of seal ring.

1. Press tool, see tool list.
2. Wrench, see tool list.

3. Insert a new paper washer and fit the new seal ring with an SVO tool as shown in fig. 8. (See page 20 for the SVO tools used on the various rear axles).
4. Press on the flange by using an SVO tool as shown in fig. 9.
5. Re-connect the propeller shaft.

Replacement of axle shaft and/or bearing

1. Remove the wheel and pull off the hub as shown in fig. 2. Use puller SVO 1446 A for hubs with four wheel bolts and SVO 1791 for hubs with five wheel bolts. Remove the brake backing plate after having placed a wooden block under the brake pedal and loosened the brake line from the backing plate.
2. Pull out the axle shaft as shown in fig. 3. Use tool SVO 2204 (SVO 1804 can be used on rear axles on which the gears can be removed). Check and replace the seal ring if necessary.
3. Press off the bearing as shown in fig. 10 and then fit the new (see the tool list on

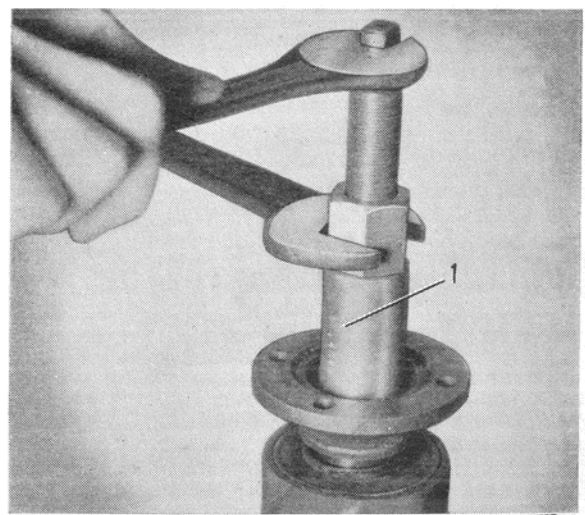


Fig. 9. Fitting the flange.

1. Press tool, see tool list.

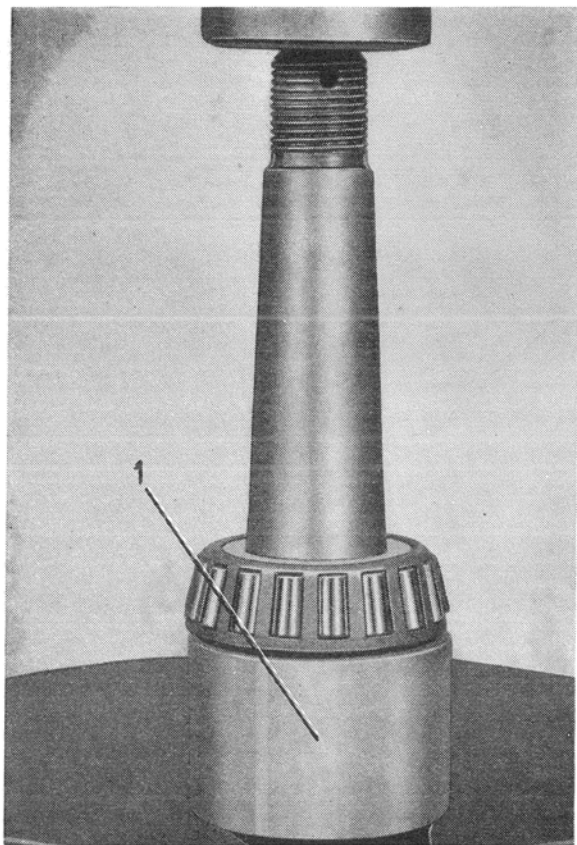


Fig. 10. Removal of axle shaft bearing.

1. Ring, see tool list.

page 22 concerning SVO tools for the various rear axles).

4. Fit the axle shaft, shims and brake backing plate.
5. Check the axle shaft end play and adjust if necessary. Follow the directions given under the heading "Assembly".
6. Fit the cross-key, hub and wheel.
7. Air-vent the brake lines and adjust the brakes. Follow the directions given in Part 7.
8. Check the oil level in the rear axle.

Repair instructions for the Model I rear axle

(Rear axles with part numbers 86583, 87770, 87869, 88159, 88704, 88895, 89238 and 655712, see Illustration I).

Removing the rear axle gears

(See pages 9 and 16 concerning the removal and fitting of the complete rear axle.)

1. Loosen the rear wheel nuts (7, Illustration I), jack up the car and then block it up so that the wheels are about 4" above the floor.
Screw out the oil drain plug on the underside of the gear housing and allow the oil to run out while the axle shafts are being removed.
2. Lift off the rear wheels and remove the rear axle nuts (2).
3. Pull off the rear wheel hubs together with the brake drums. Use puller SVO 1446 for hubs with four bolts and SVO 1791 for hubs with five bolts, fig. 2. (The handbrake should be released and the brake shoes backed up if necessary).
4. Disconnect the brake line at the brake backing plates (place a wooden block under the brake pedal to prevent it from being depressed by mistake).
5. Remove the four bolts (48) for the brake backing plates. Make sure that the shims are not lost or damaged.
6. Pull out the axle shafts (11) with tool SVO 2204 (SVO 1804 can be used for rear axles on which it is possible to remove the gears) and lift them clear. Fig. 3.
7. Disconnect the propeller shaft from the pinion flange (21).
8. Loosen the bolts (13) retaining the rear axle gear housing (14) and lift this off.

Disassembly of rear axle

1. Place the rear axle in fixture SVO 4110. Check that the cap (37) for the differential carrier is marked. If not, mark one side with a punch. Remove the cap bolts (44).
2. Remove the adjusting nuts (34) and the bearing rings. Lift out the differential and the crown wheel.
3. Loosen the nut (22) and pull off the flange (21) with tool SVO 2261, fig. 6. (SVO 4068 A can be used). Press out the pinion (18).
4. Pull out the seal ring (20) with puller SVO 4030 from the forward end of the pinion housing, fig. 7. Take out the paper washer, the metal washer (19) and the roller bearing (25).
5. Drive out the bearing outer rings, fig. 11. Use tool SVO 4063 for the forward and SVO

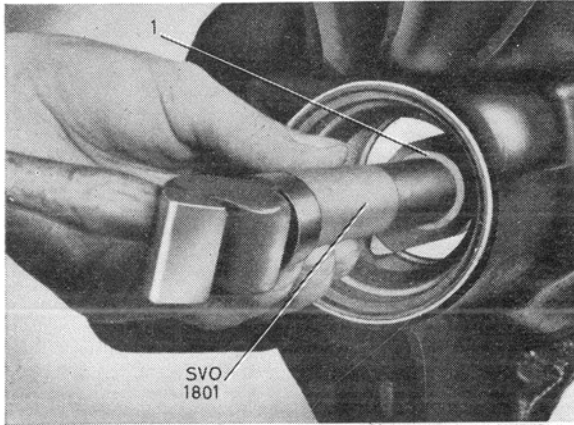


Fig. 11. Removing the bearing ring.

1. Drift, see tool list.

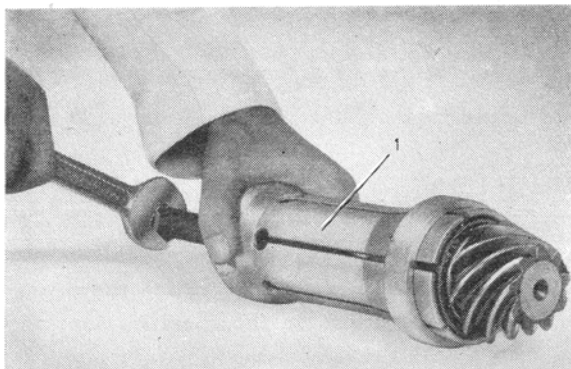


Fig. 12. Removing the rear pinion bearing.

4064 for the rear bearing ring together with the standard handle, SVO 1801. Be careful not to lose the shims (28).

6. If required, pull off the rear bearing (29) from the pinion, fig. 12. Use puller SVO 4191 or SVO 2231. See the table below. There are two different pinion bearings. Check to determine which of these is fitted. If the wrong puller is used, the bearing can be so damaged that it cannot be removed.

	Volvo Part No.	SKF Part No.	Tool
Early production	181221	32207 W	SVO 4091
Late production	181233	231508	SVO 2231

Disassembly of differential

1. Loosen the crown wheel bolts and remove the crown wheel (17).
2. Drive out the lock pin (30) for the differential pinion gear shaft (31), see fig. 13. Then drive out the shaft with a suitable drift and remove the spacer (32). The gears (38,41)

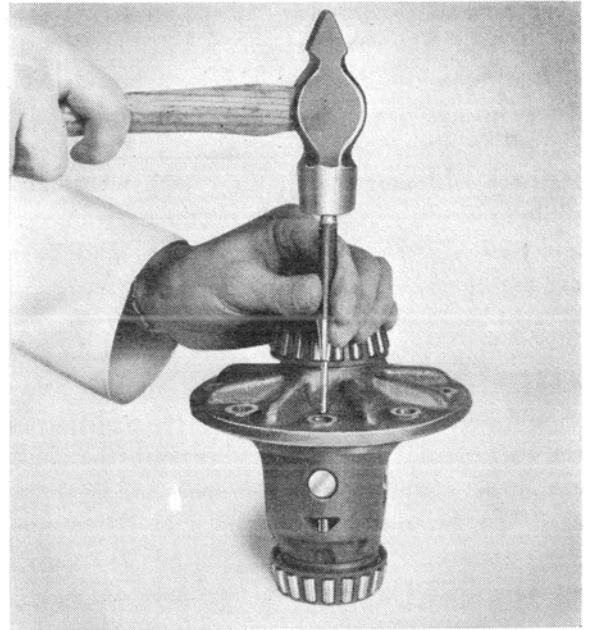


Fig. 13. Removing the lock pin.

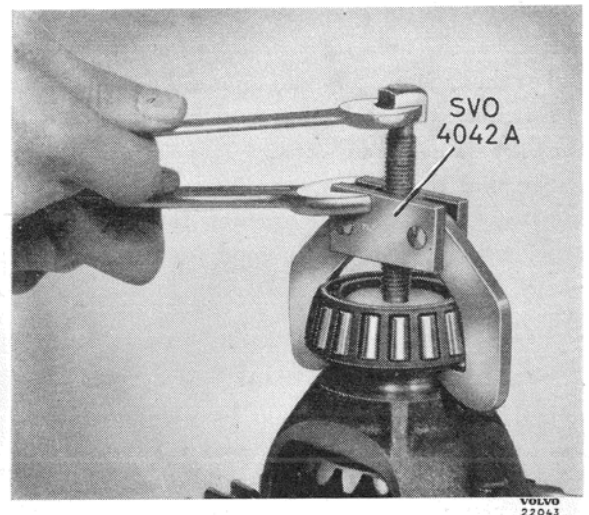


Fig. 14. Removing the differential carries bearing.

can then be removed together with the thrust washers (39,42).

3. If required, pull off the differential housing bearing (33). Use puller SVO 4042 A, see fig. 14.

Inspection

The various components must be thoroughly cleaned before inspection can be carried out. All bearing races and bearings must be thoroughly examined. All bearing races, rollers and retainers must be free from damage. Replace if damaged. The pinion gear and the crown wheel must be

examined thoroughly for damage on their teeth. Cracks in the teeth can result in pieces loosening while the vehicle is being driven. These pieces can come between the gears and can cause extensive damage in the rear axle gear. If there is damage, both the crown wheel and pinion must be replaced. These (the crown wheel and pinion) are sold in complete sets since they are matched in a special machine to ensure the correct backlash and silent operation.

Examine the differential gears for cracks and damage on the teeth. The differential gears should be fitted in a clean and dry condition in the differential carrier together with the shaft and thrust washers so that looseness and wear can easily be determined. If there is looseness, the parts concerned should be replaced. The thrust washers should be free from any unevenness.

Examine to determine if the flange cylindrical part, which goes in the seal ring, is worn or scratched. If this is the case, replace the flange together with the seal ring.

Inspect the axle shafts. Shafts that are distorted or damaged in any way should be replaced.

Examine the seal rings and replace them if they are damaged or worn.

See that there are no cracks on the rear axle housing. Check that the brackets for the support arms and track rod are in good condition.

Assembly

Assembly of differential

1. If the differential has been disassembled, the differential side gears (38) and the thrust washers (39) are fitted in the differential housing (43). Then "roll" in the differential pinion gears (41) (both simultaneously) with the recessed thrust washers (42), see fig. 15.
2. Insert the spacer block (32) and drive in the shaft (31).
3. Fit the differential carrier in a vice and fit one axle shaft in the differential side gear on one side. The differential should then run so stiffly that it can only be turned with difficulty by hand with this shaft. If it runs too easily, new thrust washers (39) are fitted. The plain washers are available in oversizes and thicknesses as shown in the specifications. Note that equally thick washers should be fitted under correspon-

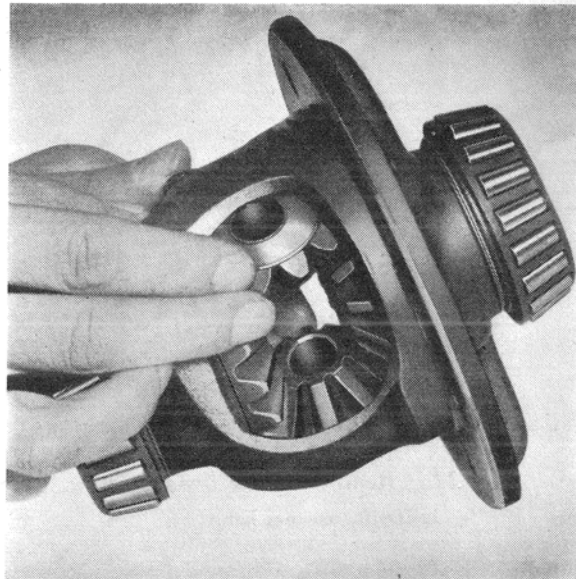


Fig. 15. Fitting the differential pinion gears.

ding gears. When this adjustment has been carried out, the lock pin (30) for the shaft is fitted.

4. Fit the crown wheel (17) and make sure that the contact surfaces are clean and even. Tighten the bolts (15) to the degree of torque shown in the specifications and lock with the tab washers (16).

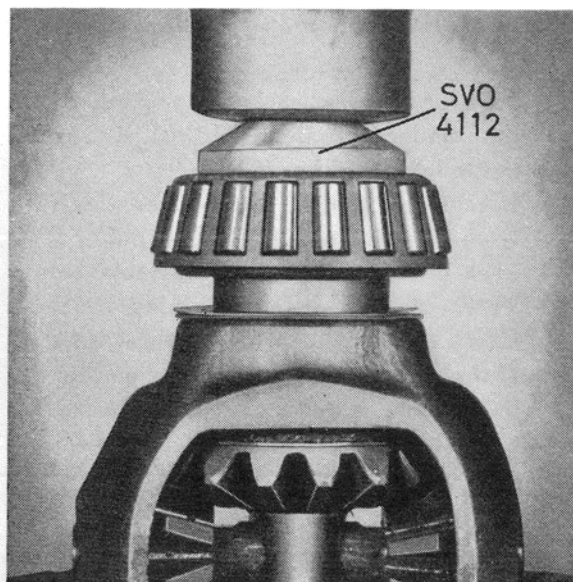
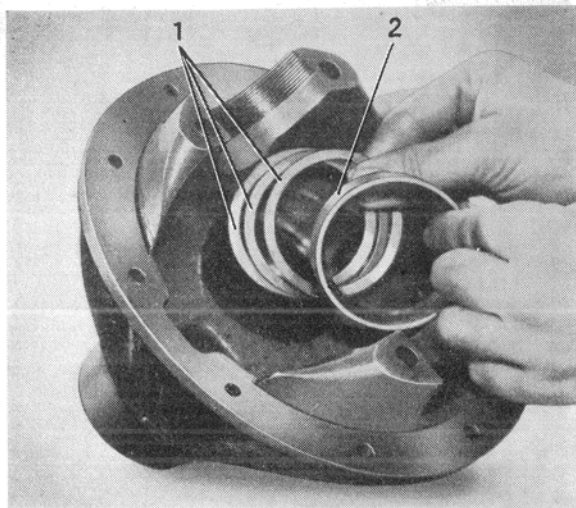


Fig. 16. Fitting the differential carrier bearing.

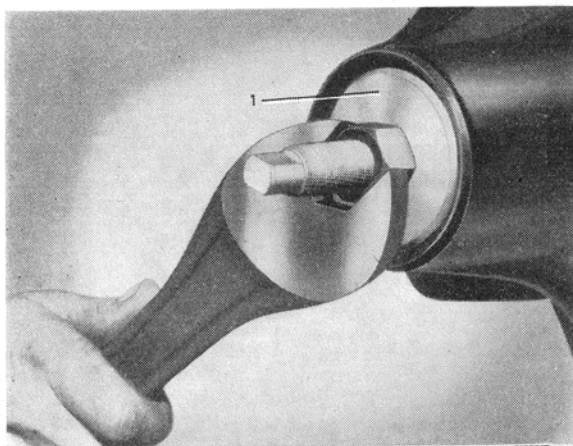
5. Press on the differential carrier bearings (33) as shown in fig. 16. Use tool SVO 4112 and the standard handle SVO 1801 for the bearings.



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Fig. 17. Fitting shims.

1. Shims. 2. Bearing ring.



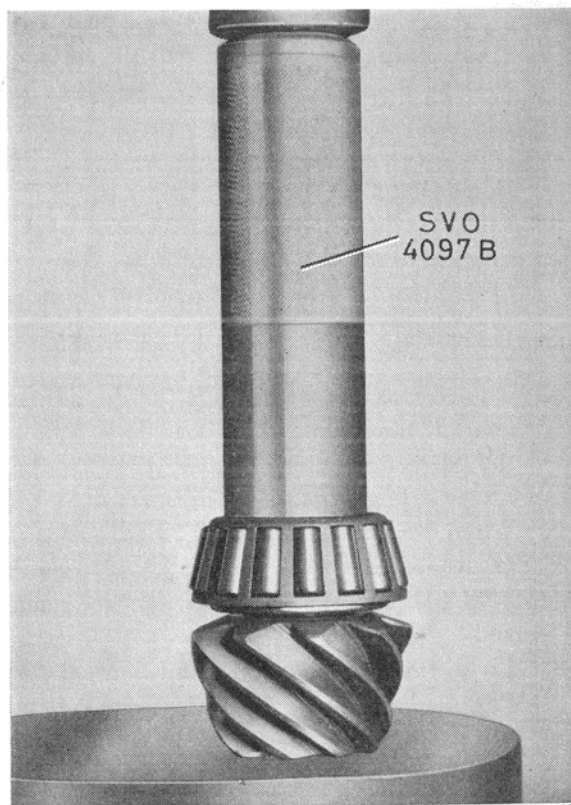
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Fig. 18. Fitting the bearing rings.

1. Press tool SVO 4047 B.

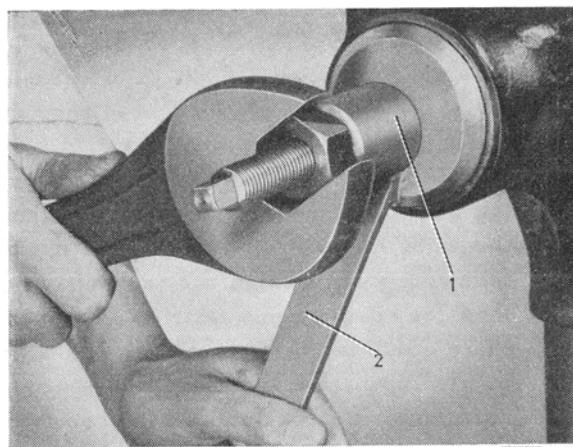
Assembly of rear axle gears

1. Replace the number of shims (28) which were under the pinion bearing outer ring when disassembling, see fig. 17. Then press in the front and rear outer rings with the press tool SVO 4047 A as shown in fig. 18. (SVO 4047 and SVO 4048 can be used for the rear and front rings respectively). Make sure that the rings do not chafe or lie at an angle in the housing.
2. Press the rear pinion bearing (29) onto the pinion (18). Use tool SVO 4097 B as shown in fig. 19.
3. Insert the pinion in the housing and then fit the spacer ring (27), the same number of shims (26) there were when disassembly



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Fig. 19. Fitting the rear pinion bearing.



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Fig. 20. Fitting the pinion.

1. Press tool SVO 4049. 2. Wrench SVO 4061.

was carried out and the front pinion bearing (25). Then place the spacer ring SVO 4069, the wrench SVO 4061 and the press tool SVO 4049 on the front end of the pinion, see fig. 20. Press in the pinion by using the press tool.

4. After the pinion has been fitted, check the pinion setting and adjust if necessary. The pinion should be relatively easy to turn

(1.7—3.5 lb.in.). There may be no looseness. If the pinion rotates too stiffly, the forward bearing should be removed by pressing out the pinion and fitting more shims. If there is looseness or the pinion rotates too easily, shims should be removed.

5. Fit the differential with crown wheel, bearing races, cap (37) and adjusting nuts (34). Do not tighten the cap bolts (44) more than that it is possible to turn the adjusting nuts.
6. The rear axle is now ready for the adjustment of tooth contact and backlash. Follow the direction given under the heading "Rear axle gear adjustment".
7. When adjustments have been carried out, in accordance with point 12, the wrench SVO 4061 and the ring SVO 4069 are removed.
8. Fit the metal washer (19) and the seal ring (20) with the washer. Use tool SVO 4061 for the seal ring as shown in fig. 8. Then press on the flange with the help of tool SVO 4049 as shown in fig. 9. Fit the washer (24) and the nut (22) which should be tightened to the torque shown in the specifications. Check the run-out and alignment tolerance of the flange. These should not exceed 0,075 mm (0.0030") and 0,09 mm (0.0035") respectively. If the flange is faulty, it should be replaced.
9. Carry out final adjustment of the differential housing bearing and secure the adjusting nuts. Adjustment is carried out in the following way: Tighten the cap bolts and then loosen them one quarter of a turn. Place a dial indicator against the back of the crown wheel. Tighten the adjusting nuts until looseness just disappears. Then tighten the adjusting nut on the tooth side of the crown wheel 1½—2 segments. Check the backlash which should be 0,1—0,2 mm (0.004—0.008").
10. After the adjusting nuts and the cap bolts have been secured, the rear axle gear can then be fitted onto the rear axle housing.

Fitting

1. Lift the rear axle gear into position onto the rear axle housing. Make sure that the gasket is not damaged and that the sealing

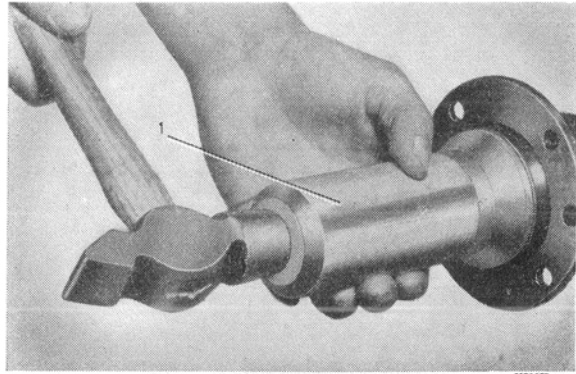


Fig. 21. Fitting the bearing ring.
1. Sleeve, SVO 4157.

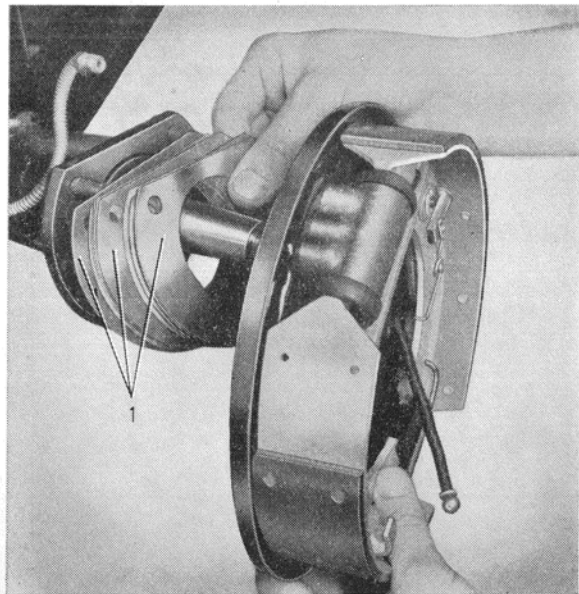


Fig. 22. Fitting the brake backing plate.
1. Shims.

- surfaces are undamaged and clean. Tighten the bolts evenly all the way around.
2. Connect the propeller shaft to the pinion flange. Replace the lock tab if it is damaged.
3. Pack ball bearing grease into the rear axle bearings and insert the axle shafts (11). Drive in the outer bearing rings with the sleeve SVO 4157 as shown in fig. 21.
4. Fit the brake backing plates as shown in fig. 22 at the same time as the shims (49) which were removed earlier are re-fitted and the felt washers (8) on both sides and tighten the bolts (48) finally. Examine the rubber sleeve where the handbrake cable passes through the brake backing plate. Replace the sleeve if necessary. Strike the ends of the axle shafts with a mallet so that

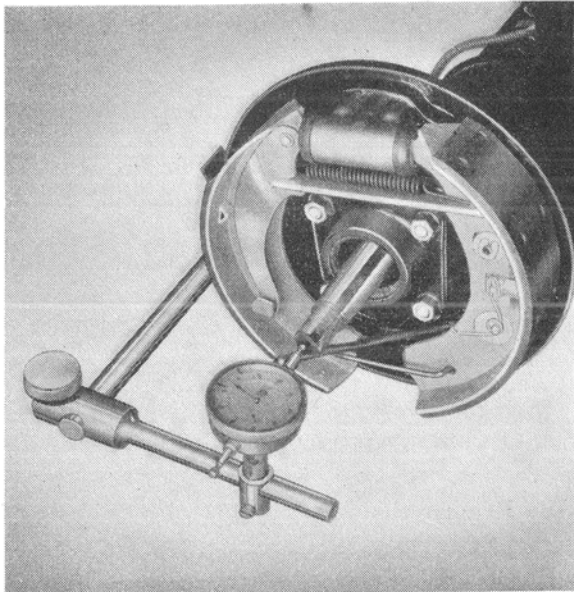


Fig. 23. Measuring axle shaft end play.

the bearing outer rings come into their correct position.

5. On late production models, the shims on the right-hand side have been replaced by a 1,5 mm (0.059") thick washer. Adjustment must, therefore, be carried out on the left-hand side. Fit a dial indicator on this side using attachments SVO 4054 and SVO 4149—3 which are fitted on the brake backing plate. Place the point of the indicator on the axle shaft end and zero the indicator. See fig. 23.
6. Pull the shaft out and in several times and read off the indicator. The reading should be between 0,02 mm (0.0008") and 0,12 mm (0.0047"). If the reading obtained is higher or lower than these figures, shims are used (49). These are available in thicknesses of 1,0 mm, 0,35 mm and 0,1 mm.
7. When the axle shaft end play has been adjusted, the brake line and the handbrake cable are fitted on both sides. The hub (6) with drum is fitted on each side and the wheels are fitted. The brakes should be air-vented and adjusted according to the directions given in Part 7.
8. Fill the rear axle with oil.

Use only hypoid oil

Repair instructions for the Model II rear axle

(Rear axles with part numbers 88999, 89560, 89686 and 655713, see Illustration II).

Removing the rear axle

If any work is to be carried out on the rear axle gears, it is usually best to remove the complete rear axle. The instructions given below are intended mainly for the PV 444 but can also be used for the PV 445, where they apply.

1. Loosen the rear wheel nuts (1, Illustration II) and nuts (3) on the axle shafts (11). Jack up the rear end of the car fairly high by means of a jack under the rear axle. Put chocks in front of the front wheels. Fit stands under the body in front of the rear wheels (under the frame on the PV 445). Remove the rear wheels.
2. Disconnect the rear section of the propeller shaft from the flange (20) on the pinion (16) and disconnect the brake line from the master cylinder to the rear axle at a point level with the rear universal joint (place a wooden block under the brake pedal).
3. Loosen the track rod, the shock absorbers, the shock absorber bands and the support arms from the rear axle as well as the handbrake cable from the body. Disconnect also the torque arms on late production PV 444 cars.
4. Lower the jack and disconnect the springs from the rear axle. Roll the rear axle clear of the car.
5. Clean the rear axle thoroughly externally and drain off the oil.

Disassembly of rear axle

1. Place the rear axle in a stand or a couple of V-blocks at a suitable working height. Pull off the rear wheel hubs with puller SVO 1791 as shown in fig. 2.
2. Disconnect the brake lines on the rear axle from the brake backing plates. Remove the brake backing plates from the rear axle housing. Be careful not to lose the shims.
3. Remove the axle shafts (11). Use puller SVO 2204 as shown in fig. 3. Press the roller bearing (9) off the axle shafts if required. Use ring SVO 1806 as shown in fig. 10.

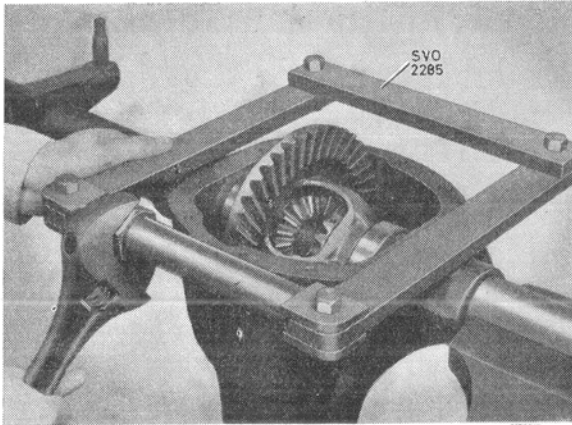


Fig. 24. Removing the differential.

4. Remove the seal rings (10) with the help of puller SVO 4078 as shown in fig. 4.
5. Remove the inspection cover (42) from the rear axle housing.
6. Check the marking of the caps (32,41) and the housing. If there are no markings or they are difficult to see, mark one side with a punch. Remove the caps.
7. Fit the tool SVO 2285 in the hole in the rear axle housing as shown in fig. 24. Unscrew the tension nut by hand as far as possible and then use a wrench on it until the differential carrier can be lifted out relatively easily. Do not tighten the nut too much since the housing may be deformed. Lift out the differential carrier with the crown wheel.
8. Remove the nut (21) for the flange (20) and pull this off with puller SVO 2261 as shown in fig. 6. Press out the pinion (16).

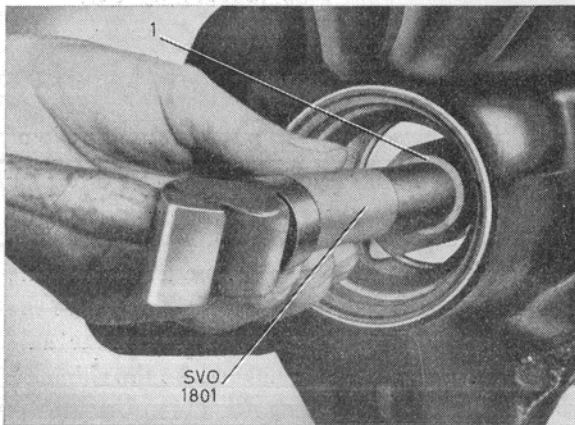


Fig. 25. Removing the bearing ring.

1. Drift, see text.

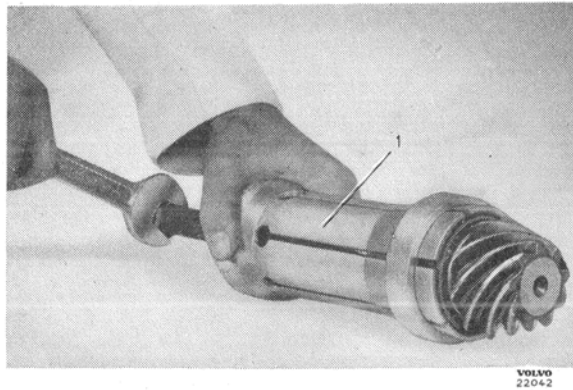


Fig. 26. Removing the rear pinion bearing.

1. Puller SVO 2164.

9. Remove the seal ring (18) with the help of SVO 4030 as shown in fig. 7. Then remove the washer (17), the forward pinion bearing (23) and the shims (24).
10. Drive out the bearing outer rings if required, see fig. 25. Use the standard handle SVO 1801 and the drift SVO 4064 for the forward ring and SVO 2207 for the rear ring. Be careful not to lose the shims (25) under the rear ring.
11. Pull the rear bearing (26) from the pinion (16) if required, using puller SVO 2164, see fig. 26.

Disassembly of differential

1. Loosen the bolts (38) and remove the crown wheel (15).
2. Drive out the lock pin (27), see fig. 27 and then the differential gear shaft (28). Take out the spacer block (29). Remove the gears (33, 36) and the thrust washers (34, 37).
3. Pull off the differential housing bearings (13, 31) with puller SVO 4042 A, see fig. 28. Do not lose the shims (14, 30).

Inspection

All component parts must be thoroughly cleaned before inspection is carried out. Examine all bearing races and bearings. There should be no signs of damage on the races, the rollers or the retainers. Replace bearings if there is any sign of damage. Examine the pinion and the crown wheel for damage on the teeth. Damage in the teeth surfaces can result in small pieces loosening while the car is being driven. These

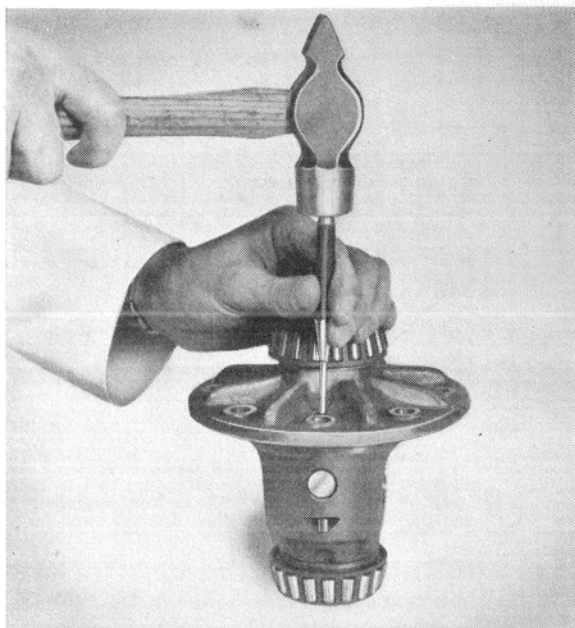
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Fig. 27. Removing the lock pin.

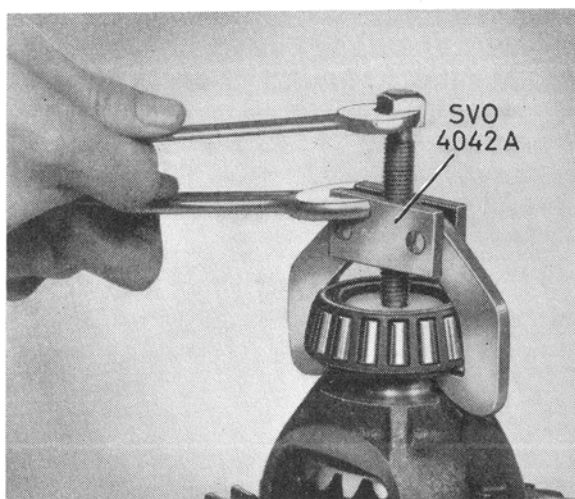
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Fig. 28. Removing the differential carrier bearing.

pieces can come between the gears and cause extensive damage. If there is any sign of damage, both the crown wheel and the pinion should be replaced. The crown wheel and pinion are available only in complete sets since they have been matched in a special machine to obtain the correct tooth contact and silent operation.

Examine the differential gears for cracks and damage on the teeth. The gears are cleaned and dried and are fitted into the differential carrier together with the shaft and the thrust washers

so that looseness and wear can be determined more easily. If there is looseness, the components concerned are replaced. The thrust washers should be free from any unevenness.

Examine the cylindrical part of the flange which goes in the seal ring for wear and scratches. If there is any signs of these defects, the flange together with the seal ring should be replaced.

Inspect the axle shafts. Deformed or damaged shafts should be replaced.

Examine the seal rings and replace them if they are damaged or worn.

Make sure that the rear axle housing is free from cracks.

Check that the brackets for the support arms and the track rod are free from damage.

Assembly

Assembly of differential

1. Insert the differential side gears (33) with the thrust washers (34) in the differential carrier (40). Then "roll" in the differential pinion gears (36) together with the recessed thrust washers (37) (both gears simultaneously), see fig. 29.
2. Lay in the spacer block (29) and then drive in the shaft (28).
3. Check the differential. If there is looseness, new thrust washers must be fitted, oversize if required. After the washers



Fig. 29. Assembling the differential gears.

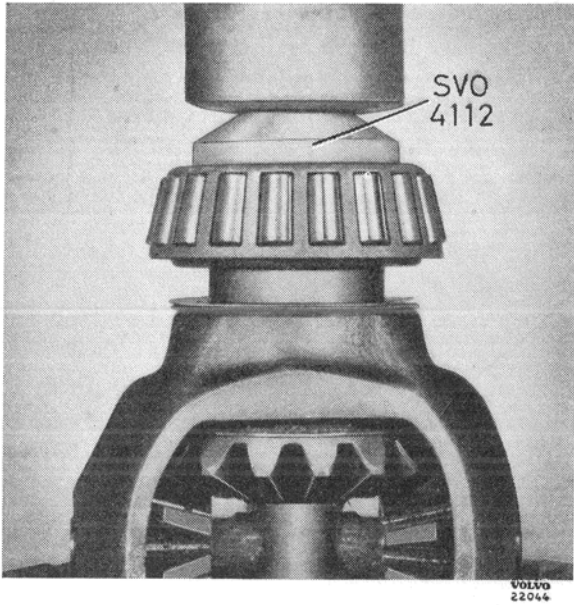


Fig. 30. Fitting the differential carrier bearing.

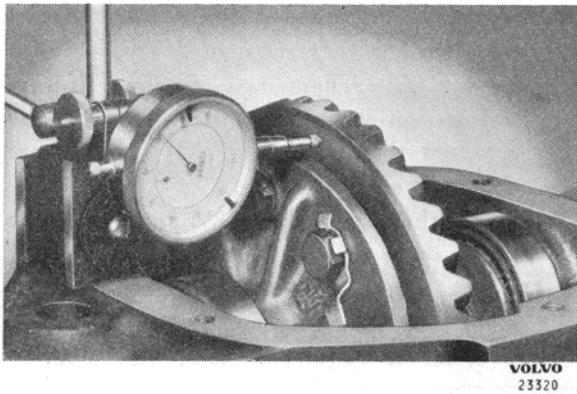


Fig. 31. Measuring the differential end play.

have been checked and replaced if necessary, the lock pin (27) is fitted.

4. Fit the crown wheel (15). Make sure that the contact surfaces are clean and free from burr. Tighten the bolts (38) to the degree of torque shown in the specifications and secure with the tab washers (39).

Assembling the rear axle gears

1. Press in the differential carrier bearings (13, 31) without shims. Use SVO 4112, see fig. 30. Place the differential carrier with the crown wheel and roller bearing in the housing. Measure the end play. This can be done in two ways either by using a micrometer or a feeler gauge. Whichever method is used

measuring must be carried out accurately in order to obtain the correct result. If a dial indicator is used, it is placed against the back side of the crown wheel, 5e, fig. 31. The differential (notice also the outer rings for the bearings) is pushed first in one direction and then in the other after which the indicator is set to zero. The differential is then pushed in the other direction and the end play measured. If the feeler gauge method is to be used, two gauges are required. These are stuck down between the outer ring and the bearing position in the carrier. Add 0,2 mm (0.0080") to the reading obtained to give the total thickness of the shims to be used when assembling.

2. Press the rear bearing (26) onto the pinion (16). Use tool SVO 4097 B, see fig. 32.
3. Replace the same number of shims (25) for the rear pinion bearing outer ring as were there when disassembly was carried out into the housing and then press in the outer rings using press tool SVO 2206 as shown in fig. 33. Make sure that the rings do not chafe or are not at an angle in the housing.

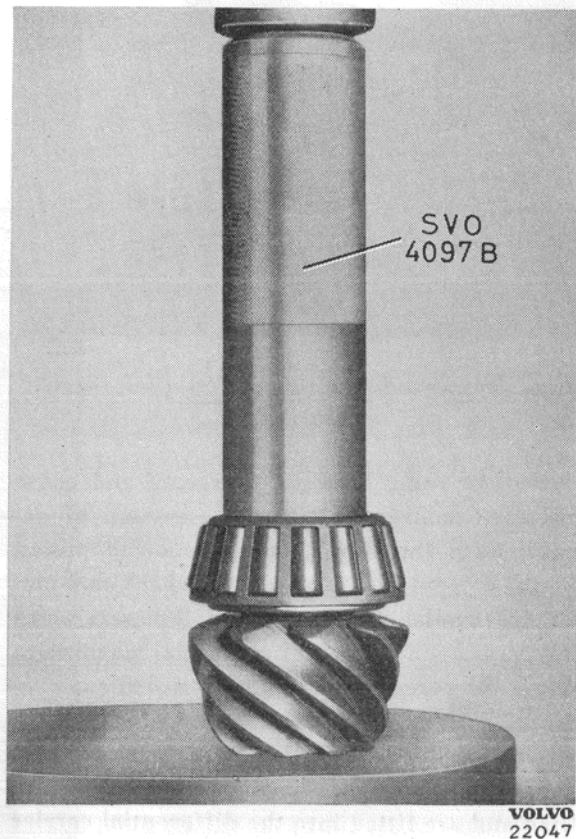


Fig. 32. Fitting the rear pinion bearing.

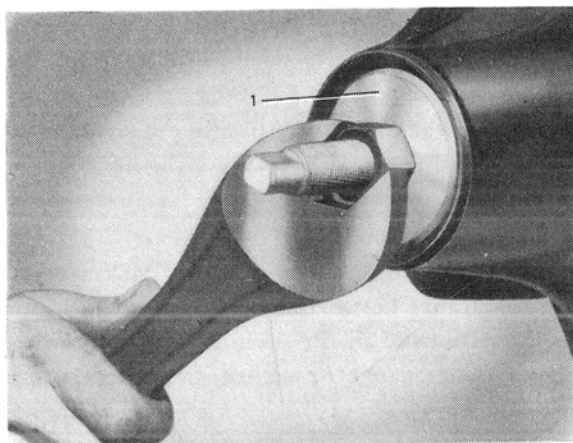


Fig. 33. Fitting the bearing rings.

1. Press tool SVO 2206.

4. Insert the pinion into the housing and fit on the spacer tube (this concerns only the gear-box with part number 89686), the same number of shims (24) there were when disassembly was carried out, the forward pinion bearing (23) and the washer (17). Fit the wrench SVO 2208 and the press tool SVO 1845 on the forward end of the pinion and tighten the pinion as shown in fig. 34.

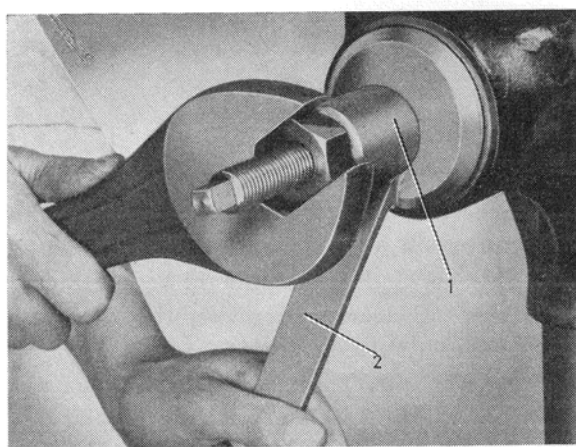


Fig. 34. Fitting the pinion.

1. Press tool SVO 1845. 2. Wrench SVO 2208.

5. Check the bearing adjustment. The pinion should be relatively easy to turn 9—14 kgcm = 8—12 lb.in). There may be no looseness. Adjustment may be carried out by means of the shims (24) on the forward pinion bearing.
6. The pinion should have a certain nominal measurement (A, fig. 35) to the crown wheel centre line. Due to tolerances in

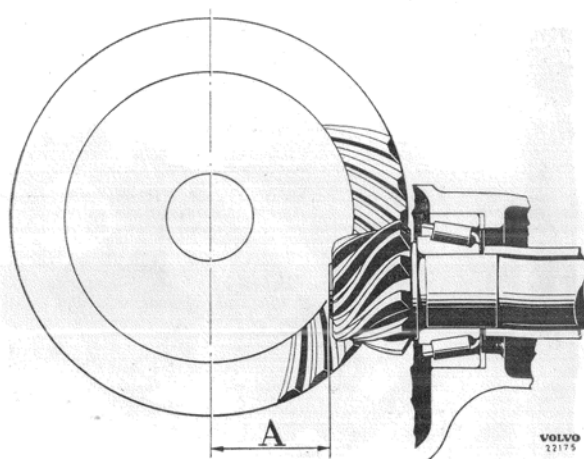


Fig. 35. Pinion position.

A. Nominal measurement = 2.25".

manufacture, however, there are variations from the nominal measurement. This is shown on the ground surface on the pinion by means of a figure with a + or — sign. If there is a + sign then the nominal measurement must be increased but if there is a — sign then the nominal measurement is decreased. The figure on the pinion shows the deviation in thousandths of an inch.

The pinion position is checked by using a dial indicator, an indicator retainer SVO 2284 and the measuring tool SVO 2283 which consists of two parts: a pinion calibrator and a gauge.

The procedure is as follows:

Place the pinion calibrator on the ground surface and the gauge in the differential bearing positions as shown in fig. 36. Place the dial indicator retainer on the housing and zero the indicator against the gauge, fig. 37. Then move over the indicator retainer so that the indicator is against the pinion calibrator, see fig. 38. If the pinion is marked 0 then the gauge and the calibrator should be on the same level. If the pinion is marked — then the pinion gauge should be higher than the jig and if it is marked + then the pinion calibrator should be lower than the gauge if the setting is correct. Adjustment is carried out by adding or removing shims under the rear pinion bearing outer ring. If the pinion bearing has the correct adjustment an equal number of shims must be added or removed at the same time under the forward pinion bearing.

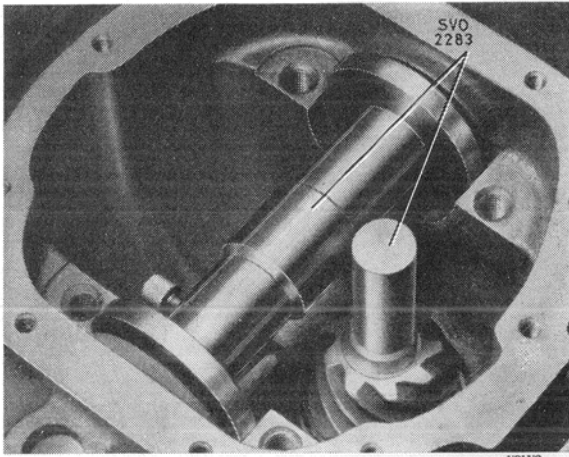


Fig. 36. Placing the measuring tool.

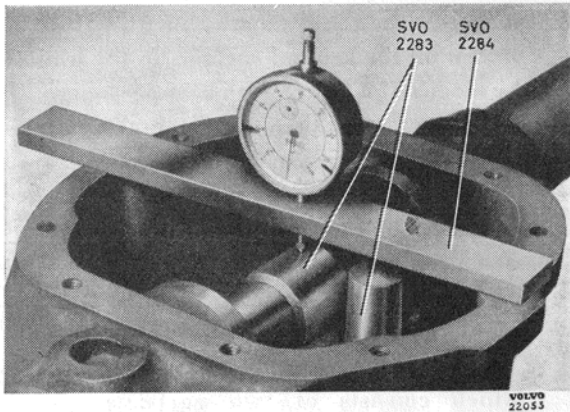


Fig. 37. Zero-setting the indicator.

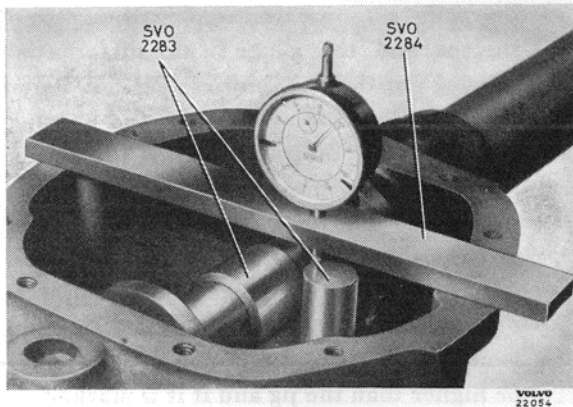


Fig. 38. Measuring the pinion position.

An example: The pinion is marked + 2. The pinion calibrator should then be 0.002" below the adjuster gauge. Measurement shows that, in point of fact, the pinion calibrator on the pinion is 0.006" above the gauge. The pinion must be lowered 0.006" + 0.002" = 0.008" so shims corresponding

to this thickness (measured with a micro-meter) should be removed from under the rear pinion bearing outer ring.

7. After the pinion position has been checked and adjusted if necessary, the tension on the pinion bearings is once again checked.
8. Place the differential (without shims for the bearings) in the housing. Measure the clearance between the pinion and the outer positions of the differential either by using a feeler gauge or with a dial indicator on the back side of the crown wheel as shown in fig. 31. See under the heading "Assembly of differential", point 1 on page 11. Note the clearance obtained.

Conversion table, inches to millimetres	
inches	millimetres
0.001	0,025
0.002	0,051
0.003	0,076
0.004	0,102
0.005	0,127
0.006	0,152
0.007	0,178
0.008	0,203
0.009	0,229

9. In certain cases, the backlash is stamped on the crown wheel (for example B/L 0.004). This backlash figure should be subtracted from the clearance figure noted in point 8 above.

An example. The crown wheel is marked B/L 0.004 (0,10 mm). Shims required in accordance with point 1 are:

Clearance noted 1,5 mm + tension 0,2 mm = 1,7 mm.

Clearance noted in point 8 = 1 mm.

Shim thickness on crown wheel side 1 mm — 0.004" (0,10 mm) = 0,9 mm.

Shim thickness on opposite side 1,7 — 0,9 = 0,8 mm.

If the backlash is not stamped on the crown wheel, use the average value for the backlash = 0,15 mm as a guide.

An example. Clearance obtained 1,4 mm + tension 0,2 = 1,6 mm.

The clearance noted in point 8 = 0,8 mm.
 The thickness of the shims in the crown wheel side = 0,80—0,15 mm = 0,65 mm.
 The thickness of the shims on the opposite side = 1,60—0,65 mm = 0,95 mm.

10. Pull off the differential carrier bearings with puller SVO 4042 A. Fit shims with the thickness calculated under the bearings and then press them into position.
11. Fit tool SVO 2285 and an indicator dial on the rear axle housing as shown in fig. 39. Tighten the tension nut so that the rear axle housing is tensioned out not more than 0,3 mm. Remove the dial indicator. Lay in the differential and bearings. Then remove tool SVO 2285.

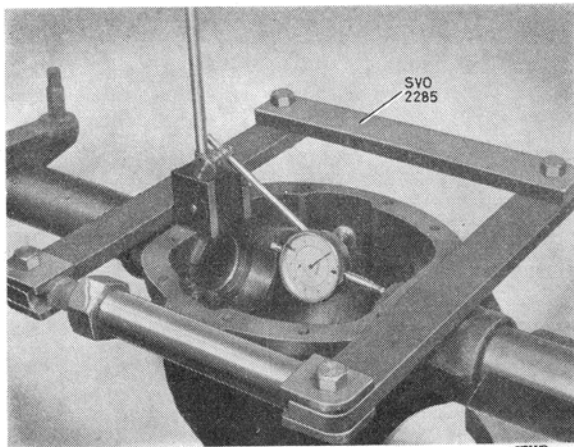


Fig. 39. Tensioning out the rear axle housing.

12. Fit the caps (32, 41) with their bolts and tighten the bolts. Fit a dial indicator against the back side of the crown wheel as shown in fig. 40. Rotate the crown wheel and check the run-out. This may not exceed 0,008 mm (0,003").
13. Check the backlash as shown in fig. 41. This should agree with the value given in the specifications or the value stamped on the crown wheel. Backlash should be at least 0,0040" (0,1 mm).
14. Check the setting by painting some of the crown wheel teeth and noting the tooth contact in accordance with the instructions given under "Adjustment of rear axle gears" on page 17.
15. After final adjustment, remove the wrench SVO 2208.
16. Fit the metal washer (17) and the seal ring

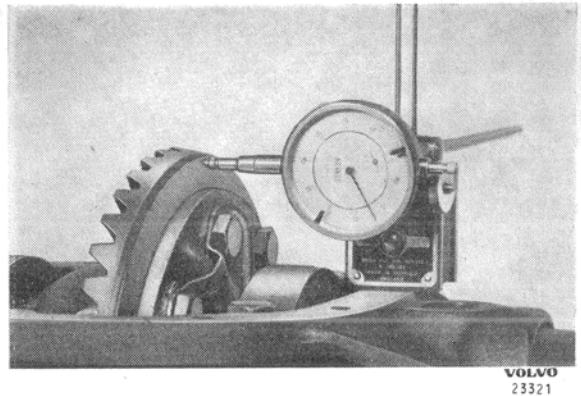


Fig. 40. Measuring the crown wheel run-out.

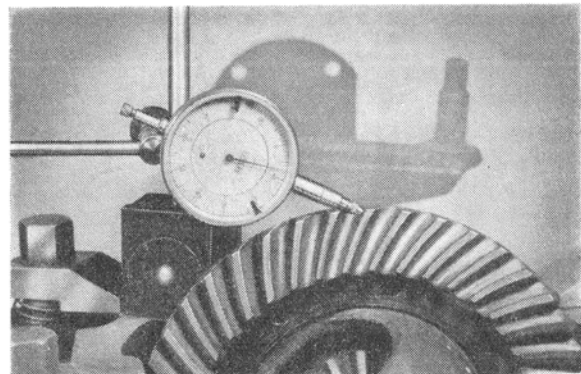
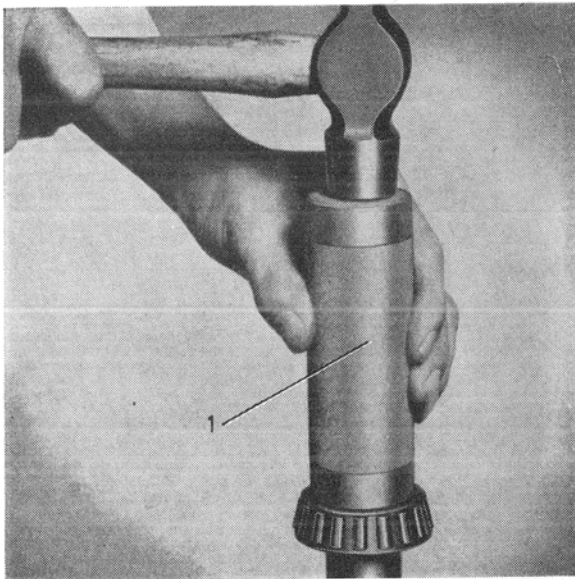


Fig. 41. Measuring the crown wheel backlash.

(18) together with the paper washer. Use press tool SVO 1845 and wrench SVO 2208 for the seal ring. Then press on the flange (20) with the help of SVO 1845.

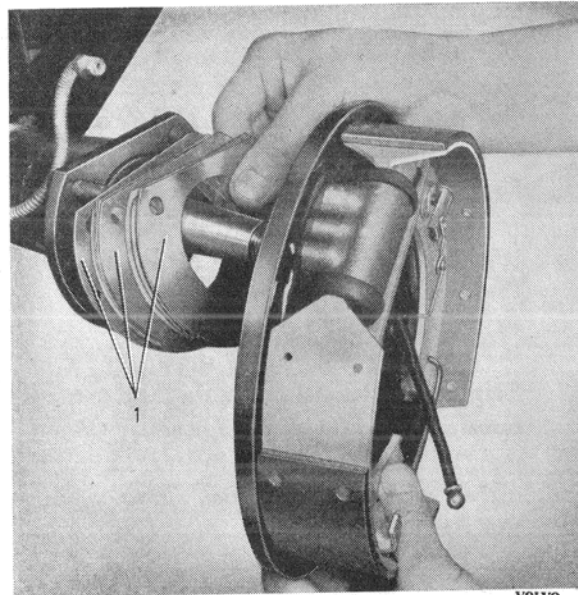
Fit the washer (22) and the nut (21). Tighten the nut to the torque shown in the specifications. Check the radial throw of the flange and check for distortion. These figures may not exceed 0,0030" (0,075 mm) and 0,0035" (0,09 mm) respectively.

17. a) On rear axle 89650:
 Loosen the cap bolts. Then smear the bolts threads and taps with sealing compound — Permatex 3 — Form — A — Gasket or corresponding compound of another make. In this way the through holes are sealed and the bolts are secured. Then tighten the bolts to the torque shown in the specifications.
- b) On rear axles 88999 and 89686:
 Lock the cap bolts with internally toothed lock washers. Tighten the bolts to the torque shown in the specifications.
18. Fit the inspection cover and gasket.



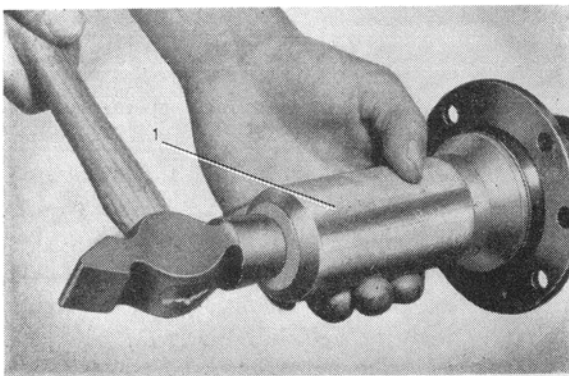
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Fig. 42. Fitting the axle shaft bearings.
1. Sleeve SVO 1805.



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Fig. 44. Fitting the brake backing plates.
1. Shims.



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Fig. 43. Fitting the bearing rings.
1. Sleeve SVO 2205.

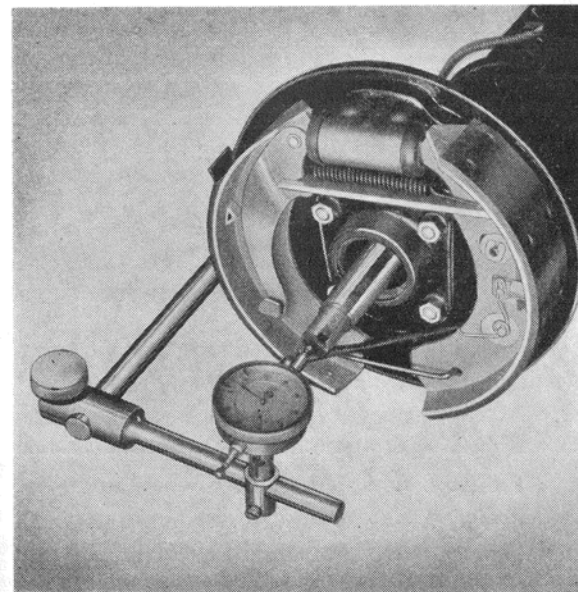


Fig. 45. Measuring the axle shaft end play.

Assembly of rear axle

1. Drive in the seal rings (10) for the axle shafts (11) with drift 1803 as shown in fig. 5.
2. Drive the bearings (9) onto the axle shafts if they have been removed. Use SVO 1805 as shown in fig. 42.
3. Pack in the bearings with heat-resistant grease.
Insert the axle shafts into the rear axle housing. Drive in the bearing outer rings with the sleeve, SVO 2205 as shown in fig. 43.
4. Fit the brake backing plates, shims (48), retainer (8) and felt seal. See fig. 44.

5. Check axle shaft end play and adjust if necessary. See fig. 45. See the specifications for the permissible end play.
5. Connect the brake line on the brake backing plate and then fit the hubs and brake drums.

Fitting

The directions given below concern mainly the PV 444 but can also be used, where they apply, for the PV 445.

1. Roll in the rear axle under the car and raise it slightly with a jack.
2. Bolt the support arms and track rod in position. On late production PV 444 cars, bolt the torque rods in position.
3. Bolt springs, shock absorber bands and shock absorbers in position.
4. Connect the propeller shaft to the flange on the pinion and connect the brake line and handbrake cable.
5. Air-vent the brake system, fill oil, fit the wheels and lower the car. Tighten the wheel nuts (1) and the nuts (3) on the axle shafts. Fit the cotter pins (4).

Use only hypoid oil

Rear axle gear adjustments

When the rear axle gears are assembled, it is extremely important to ensure that the crown wheel and pinion are correctly fitted relative to one another. This concerns not only backlash but also tooth contact. When the tooth contact is correct, the stresses that the teeth are subjected to when the car is driven are distributed over the greater part of the teeth surfaces. In this way, tooth breakage and abnormally great gear wear are avoided and the gears run quietly. The instructions given below can serve as a guide when this work is being carried out. First check the crown wheel run-out with a dial indicator. The run-out may not exceed the value given in the specifications.

In order to describe tooth contact in a simple way, the various parts of the gear teeth have been given special names. See fig. 46 which shows one of the teeth on the crown wheel. *Note.* Adjustment is carried out on the basis of the contact obtained on the crown wheel teeth.

The driving side is the side subjected to pressure from the pinion when the car is driven forwards.

The reverse side is the side which is subjected to pressure when the car is reversed and when the engine is used to brake the car in forward travel.

The narrowest and the broadest ends of the tooth are called the toe and the heel respectively. The toe lies nearest the centre while the heel is furthest out on the crown wheel.

In order to obtain a clear picture of tooth contact, the crown wheel teeth on both sides are

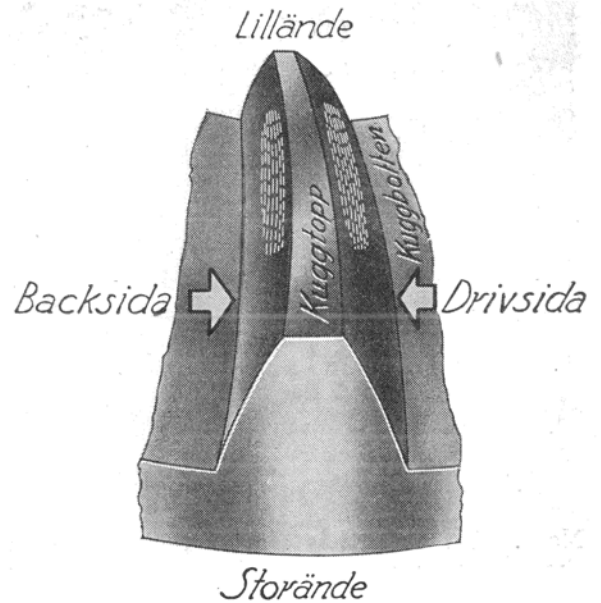


Fig. 46. Correct tooth contact.

Lillände = Toe. Storände = heel.
 Baksida = reverse side. Drivsida = driving side.
 Kuggtopp = tooth top. Kuggbotten = tooth root.

coated with marking paint consisting of red lead mixed with engine oil. This marking paint must not be too thin since this can cause faulty impressions of tooth contact. All the teeth are coated with marking paint as shown in fig. 47. The pinion is then rotated 10—12 turns in each direction at the same time as the crown wheel is braked hard by using a wooden wedge or similar device as shown in fig. 48. The marking paint on the crown wheel teeth is thus removed where the pinion teeth contact it so that a clear picture of the tooth contact extent and position is obtained. The correct tooth contact is shown in fig. 46.

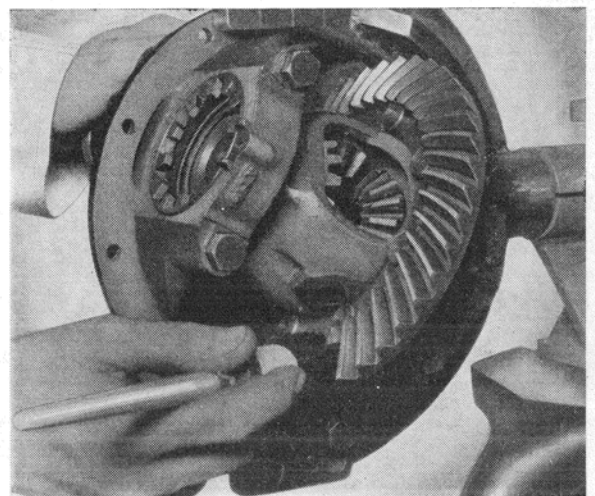


Fig. 47. Coating the teeth with marking paint.

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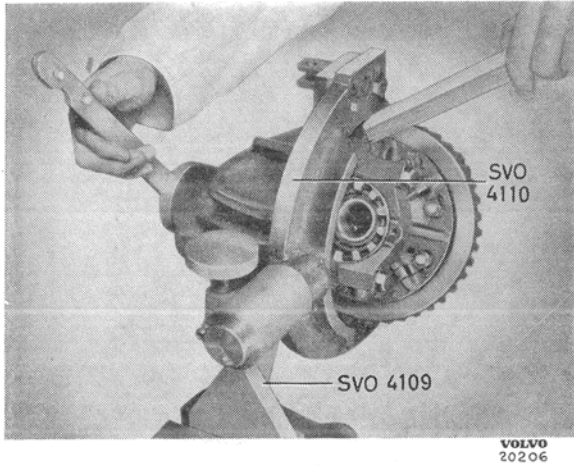


Fig. 48. Rotating the rear axle gears.

Note. The pattern is almost rectangular in shape and is, on the driving side, half-way up the tooth but nearer the toe than the heel. On the reverse side it is rather higher than on the driving side but otherwise similar.

Tooth contact adjustment is carried out by altering the position of the pinion relative to the crown wheel. This is done by adding or removing shims at the rear pinion bearing outer ring. At the same time, however, an equal number of shims must be added or removed at the forward bearing so that the pinion bearing adjustment is not altered.

Every time the pinion position is altered, the backlash must be checked and adjusted. See fig. 49.

The movement of the tooth contact pattern is somewhat different on spiral bevel gears (as fitted on the very first series of PV 444 cars produced) and hypoid gears so both types have been treated separately.

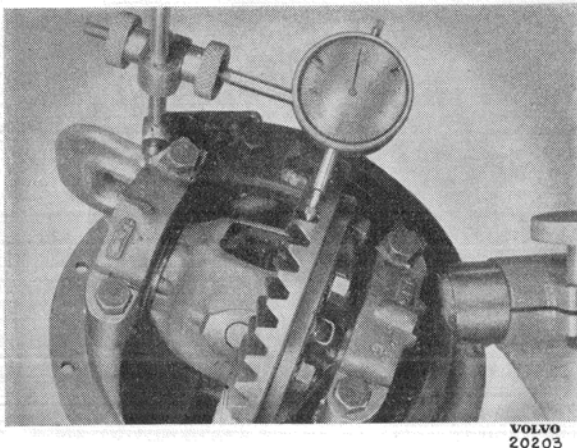


Fig. 49. Measuring backlash.

Adjustment of spiral bevel gears

On this type of rear axle, the tooth contact pattern moves in the same direction on both the driving and the reverse sides.

If the pinion is moved inwards, the contact pattern moves from a high position (fig. 50) to a low position (fig. 51) on the tooth.

Should the pattern lie too high on the tooth, the pinion should be moved inwards and if it lies too low then the pinion should be moved outwards.

When the pinion is moved from its correct position, the pattern gradually assumes the shape of a narrow mark. It is thus easy to see when the gear is correctly adjusted since the tooth contact pattern has then the correct position on the teeth and the largest possible lateral width.

Adjustment of hypoid gears

On a hypoid gear, the tooth contact pattern moves diagonally over the teeth and in different directions on the driving and reverse sides.

If the pinion is moved inwards, the contact pattern moves from a high at the heel on the driving side, fig. 52, to a low position at the toe, fig. 53. On the reverse side the pattern moves at the same time from a high position at the toe, fig. 52, to a low position at the heel, fig. 53.

The tooth contact pattern on the driving side moves thus in the same direction as the pinion. If the pattern lies too near the heel, the pinion is moved inwards and if it lies too near the toe, then the pinion is moved outwards.

When the pattern has come into the correct position on the driving side, the pattern on the reverse side is noted. If the gear is correctly adjusted then the two patterns lie opposite each other.

The adjustment procedure is carried out as follows:

1. Adjust the backlash to the value stated in the specifications.
2. Cover the teeth with marking paint and rotate the pinion while the crown wheel is being braked.
3. Note the position of the tooth contact pattern and adjust as described above. Every time the position of the pinion is altered, checking should be carried out and the backlash adjusted.

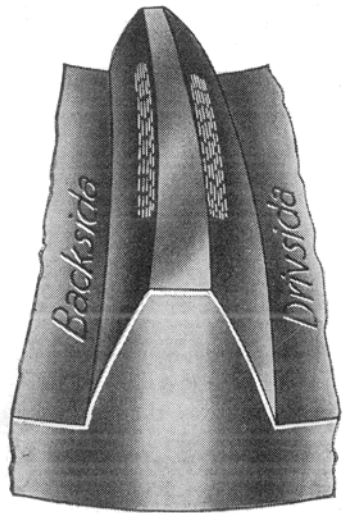


Fig. 50. Spiral bevel gear pattern.

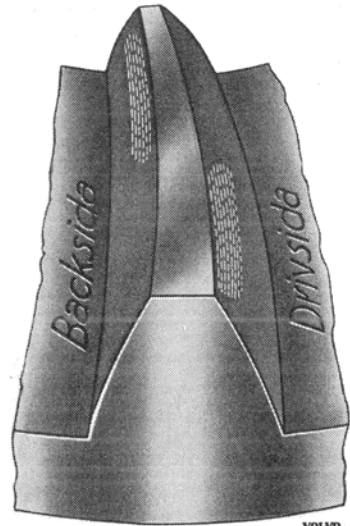


Fig. 52. Hypoid gear pattern.

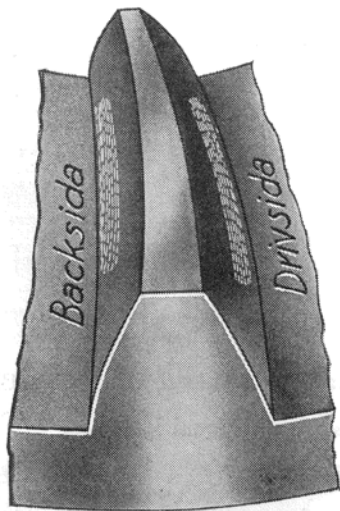


Fig. 51. Spiral bevel gear pattern.

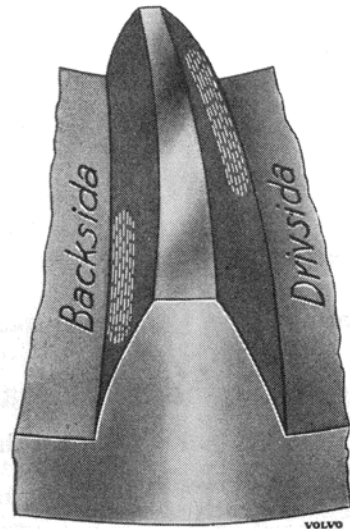


Fig. 53. Hypoid gear pattern.

Baksida = reverse side.
Drivsida = driving side.

TRACING FAULTS

The faults occurring in a rear axle become apparent as noisiness, overheating, leakage or axle shaft breakage. The noisiness to be encountered is usually in the form of a growling or whining sound.

FAULT	
CAUSE	REMEDY

Noisiness possibly accompanied by a high temperature

The wrong type of oil used.	Drain off the oil. Inspect the rear axle gears. Fill with hypoid oil.
Low oil level.	Top-up with oil.
Excessive bearing tension on gears or axle shafts.	Remove the gears (axle shaft) and adjust the bearings.
Faulty backlash. Faulty tooth contact.	Remove the gears, adjust the backlash and tooth contact according to the instructions given.
Worn bearings.	Remove the rear axle gears and replace worn bearings.
Distorted rear axle housing.	Replace.
Distorted rear axle.	Replace.

A thumping sound in the rear axle gears when accelerating or decelerating

Examine first to ensure that this is not caused by worn universal bearings.

Worn washers on differential gears.	Fit new recessed washers and oversize plain washers.
Worn differential gears or differential shaft.	Replace worn parts.
One of the drive gears is loose on its hub.	Tighten loose nuts.
Worn splines on shafts or in the drive.	Replace worn parts.

Leakage

If leakage occurs, check first that the ventilation hole in the rear axle housing is not blocked.

Leakage at axle shafts (oil on brake linings).	Replace the seal ring inside the bearing and the felt washer.
Leakage at the pinion.	Replace the seal ring and the paper washer. Adjust or replace the pinion bearings if necessary.
Leakage between the rear axle housing and the rear axle gear housing.	Check that the sealing surfaces are clean and even, replace the gasket.

SPECIFICATIONS

Rear axle, type	Semi-floating
Track, PV 444 and PV 445, early production	51 ¹¹ / ₆₄ " (1300 mm)
Track, PV 444 and PV 445, late production	51 ⁴⁹ / ₆₄ " (1315 mm)
End play for axle shafts, Model I rear axle	0.008"—0.0047" (0,02 mm—0,12 mm)
End play for axle shafts, Model II rear axle	0.003"—0.008" (0,07 mm—0,2 mm)

Rear axle gears

PV 444, very early production

Type	Spiral bevel gears
Ratios	4.57: 1 (⁷ / ₃₂) or 4.63: 1 (⁸ / ₃₇)
Runout, crown wheel	max. 0.003" (0,08 mm)
Backlash	0.004"—0.008" (0,10—0,20 mm)
Pinion bearing bearing tension	1.75—3.5 lb. in. (2—4 kg cm)
Lubricant	Hypoid oil
Lubricant viscosity	SAE 80
Oil capacity	2 ³ / ₄ US pints (1,3 litres)

PV 444, late production and PV 445

Type	Hypoid bevel gears
Ratio, PV 444	4.56: 1 (9/41)
Ratio, PV 445 early production	5.43: 1 (7/38)
Ratio, PV 445, late production	5.63: 1 (8/45)
Runout, crown wheel	max. 0.003" (0,08 mm)
Backlash	0.004"—0.008" (0,10—0,20 mm)
Pinion bearing tension, Model I rear axle	1.75—3.5 lb. in. (2—4 kg. cm.)
Pinion bearing tension, Model II rear axle	8—12 lb. in. (9—14 kg. cm.)
Lubricant	Hypoid oil
Lubricant viscosity	SAE 80
Oil capacity, Model I	2 US pints (0.9 litres)
Oil capacity, Model II	2 ³ / ₄ US pints (1,3 litres)

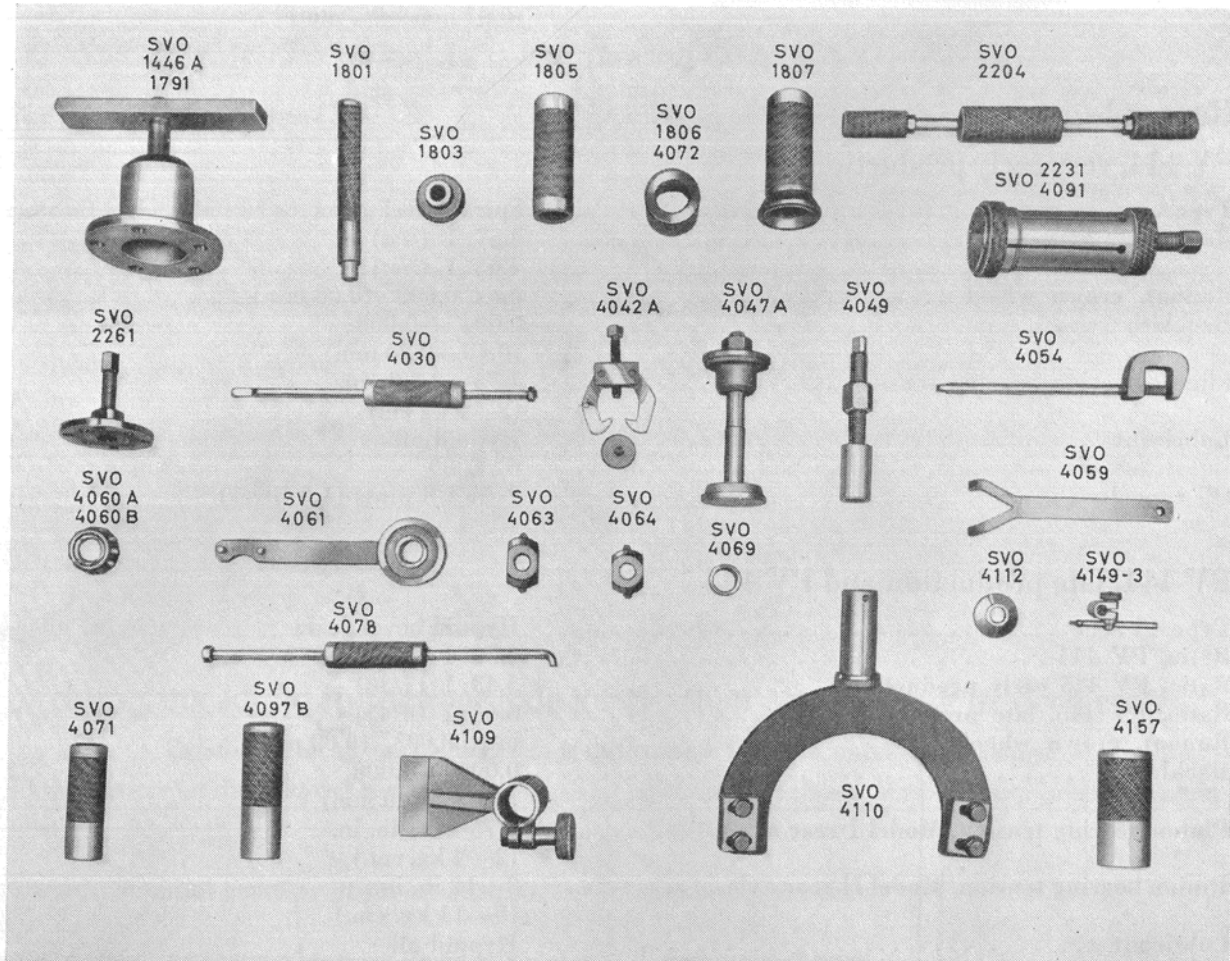
Tightening torques

	kgm	lb. ft.
Flange (18×1,5 mm thread)	max. 20	Max. 150
Flange (³ / ₄ "—16 thread)	28—30	200—220
Caps (11×1,5 mm thread)	5,5—6	40— 45
Caps (¹ / ₂ "—13 thread)	8,5—10	60— 70
Crown wheel (10×1 mm thread)	5,5—6	40— 45
Crown wheel (10×1,25 mm thread)	5,0—5,5	36— 40
Crown wheel (³ / ₈ "—24 thread)	5,5—7	40— 50
Crown wheel (⁷ / ₁₆ "—20 thread)	7—8,5	50— 60

TOOLS

The following tools are required when carrying out repair work on the rear axle.

Tools for Model I rear axle

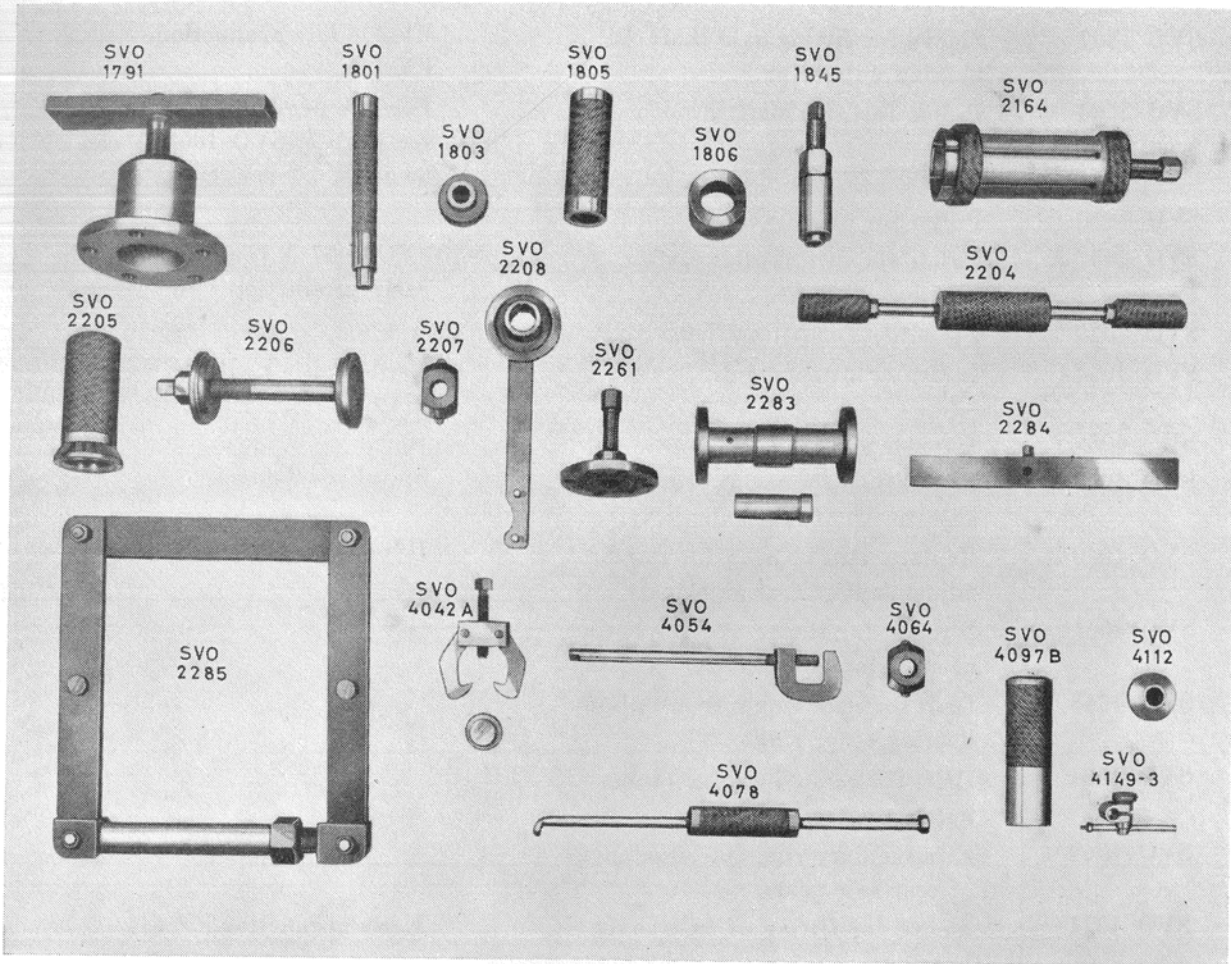


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No.	Description	Remarks
SVO 1446 A	Puller for wheel hubs.	PV 444, early production (Models A and B) PV 444, early production (Models A and B) PV 444 late production, PV 445.
SVO 1791	Puller for wheel hubs.	
SVO 1801 SVO 1803	Standard handle 18×200. Tool for fitting of axle shaft seal rings.	

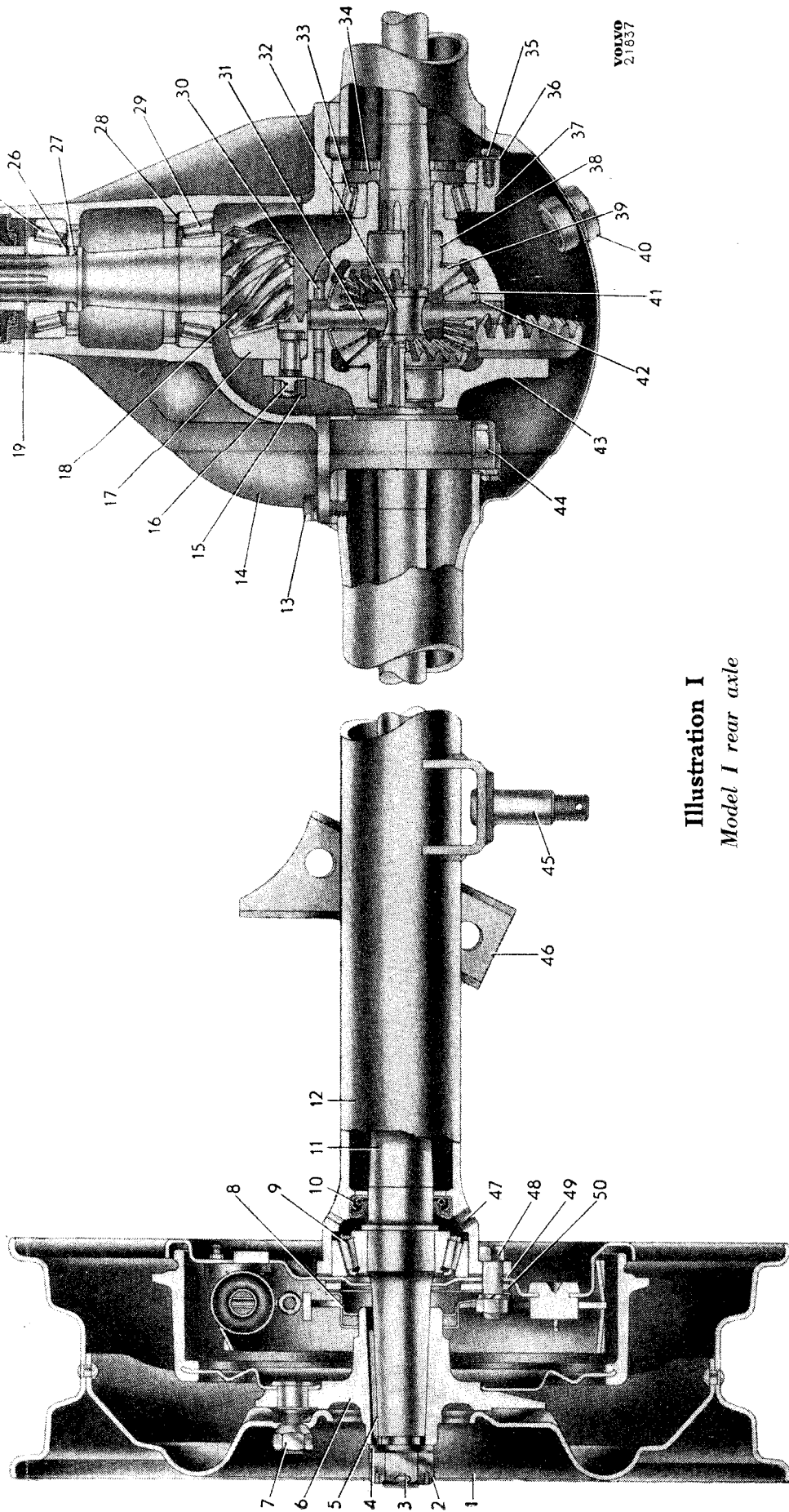
No.	Description	Remarks
SVO 1805	Drift for fitting axle shaft bearings.	PV 444 late production, PV 445.
SVO 1806	Counter-ring for removing axle shaft bearings.	
SVO 1807	Sleeve for fitting axle shaft bearing outer ring.	PV 444 late production, PV 445.
SVO 2204	Puller for axle shafts.	For late production bearings, see page 5. SVO 4068 A can be used.
SVO 4030	Puller for pinion seal ring.	
SVO 4042 A	Puller for differential carrier bearings.	SVO 4047 A can be used on early production outer rings.
SVO 4049	Press tool for fitting flange.	
SVO 4054	Indicator attachment.	Used together with SVO 4149-3 and indicator dial.
SVO 4059	Wrench for adjusting nuts.	
SVO 4060 A	Replacement bearing for rough adjustment of rear axle gears.	Spiral bevel gears.
SVO 4060 B	Replacement bearing for rough adjustment of rear axle gears.	Hypoid gears.
SVO 4061	Wrench for flange and for fitting of seal ring and pinion.	
SVO 4063	Drift for removing forward pinion bearing outer ring.	
SVO 4064	Drift for removing rear pinion bearing outer ring.	
SVO 4069	Intermediary ring for adjustment of rear axle gears.	
SVO 4071	Sleeve for fitting of axle shaft bearings.	Early production PV 444.
SVO 4072	Ring for removing axle shaft bearings.	Early production PV 444.
SVO 4078	Puller for axle shaft seal rings.	
SVO 4091	Puller for rear pinion bearing.	For early production bearings, see page 5.
SVO 4097 B	Sleeve for assembling rear pinion bearing.	
SVO 4109	Stand for fixture SVO 4110.	
SVO 4110	Fixture for rear axle gears.	Used together with SVO 4109.
SVO 4112 A	Drift for assembling differential carrier bearing.	
SVO 4149-3	Holder for dial.	Used together with SVO 4054.
SVO 4157	Sleeve for assembling axle shaft bearing outer ring.	Early production PV 444.

Tools for Model II rear axle



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No.	Description	Remarks
SVO 1791	Puller for wheel hubs.	
SVO 1801	Standard handle 18×200 mm.	
SVO 1803	Drift for fitting seal rings on axle shafts.	
SVO 1805	Sleeve for fitting axle shaft bearings.	
SVO 1806	Counter-ring for removing axle shaft bearings.	
SVO 1845	Press tool for fitting flange.	Used together with SVO 2208 when adjusting backlash and fitting seal ring.
SVO 2164	Puller for rear pinion bearing.	
SVO 2204	Puller for axle shafts.	
SVO 2205	Sleeve for fitting axle shaft bearing outer rings.	
SVO 2206	Tool for fitting pinion bearing outer rings.	
SVO 2207	Drift for removing rear pinion bearing outer ring.	
SVO 2208	Wrench for flange and for fitting of pinion seal ring.	
SVO 2261	Puller for flange.	SVO 4068 A can be used.
SVO 2283	Pinion adjustment measuring tool.	
SVO 2284	Holder for dial.	
SVO 2285	Tensioning frame for removing differential.	
SVO 4042 A	Puller for differential carrier bearing.	
SVO 4054	Dial indicator attachment.	Used together with SVO 4149-3 and dial.
SVO 4064	Drift for removing forward pinion bearing outer ring.	
SVO 4078	Puller for axle shaft seal rings.	
SVO 4097 B	Sleeve for assembling rear pinion bearing.	
SVO 4112 A	Drift for assembling differential carrier bearing.	
SVO 4149-3	Holder for dial.	Used together with SVO 4054.



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Illustration I
Model I rear axle

- | | | | | |
|----------------------------|----------------------------|----------------------------|----------------------------------|--|
| 1. Wheel | 11. Axle shaft | 21. Flange | 31. Differential pinion shaft | 41. Differential pinion gear |
| 2. Castellated nut | 12. Rear axle housing | 22. Castellated nut | 32. Spacer block | 42. Recessed thrust washer |
| 3. Cotter pin | 13. Bolt with spring | 23. Cotter pin | 33. Differential carrier bearing | 43. Differential carrier |
| 4. Washer | 14. Rear axle gear housing | 24. Washer | 34. Adjusting nut | 44. Bolt for bearing cap |
| 5. Cross key | 15. Bolt | 25. Forward pinion bearing | 35. Bolt | 45. Bracket for track rod |
| 6. Wheel hub | 16. Lock washer | 26. Shims | 36. Lock washer | 46. Bracket for support arms
(early production) |
| 7. Wheel nuts | 17. Crown wheel | 27. Spacer ring | 37. Cap for bearing | 47. Plug |
| 8. Retainer with felt seal | 18. Pinion | 28. Shims | 38. Differential side gear | 48. Bolt with nut and spring washer |
| 9. Roller bearing | 19. Washer | 29. Rear pinion bearing | 39. Thrust washer, plain | 49. Shims |
| 10. Seal ring | 20. Seal ring | 30. Lock pin | 40. Oil filler plug | 50. Washer |

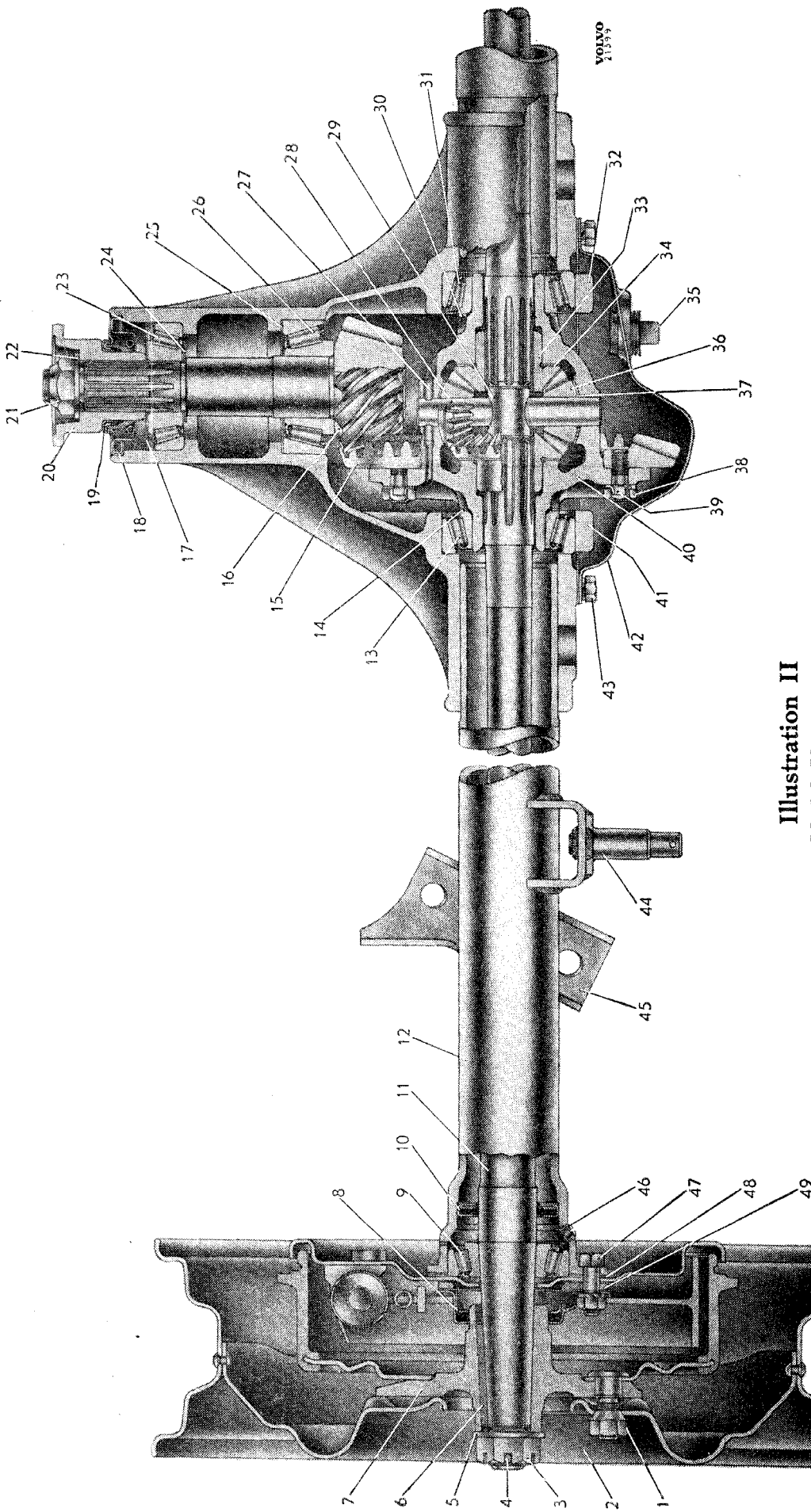


Illustration II
Model II rear axle

- | | | | | |
|----------------------------|----------------------------------|-------------------------------|----------------------------------|-------------------------------------|
| 1. Wheel nut | 11. Axle shaft | 21. Nut (self-locking) | 31. Differential carrier bearing | 41. Cap |
| 2. Wheel | 12. Rear axle housing | 22. Washer | 32. Cap | 42. Cover |
| 3. Castellated nut | 13. Differential carrier bearing | 23. Forward pinion bearing | 33. Differential side gear | 43. Bolt with spring washer |
| 4. Cotter pin | 14. Shims | 24. Shims | 34. Thrust washer, plain | 44. Bracket for track rod |
| 5. Washer | 15. Crown wheel | 25. Shims | 35. Oil filler plug | 45. Bracket for support arms |
| 6. Cross key | 16. Pinion | 26. Rear pinion bearing | 36. Differential pinion gear | (early production) |
| 7. Wheel hub | 17. Washer | 27. Lock pin | 37. Thrust washer, recessed | 46. Plug |
| 8. Retainer with felt seal | 18. Seal ring | 28. Differential pinion shaft | 38. Bolt | 47. Bolt with nut and spring washer |
| 9. Roller bearing | 19. Protector plate | 29. Spacer block | 39. Lock washer | 48. Shims |
| 10. Seal ring | 20. Flange | 30. Shims | 40. Differential carrier | 49. Washer |