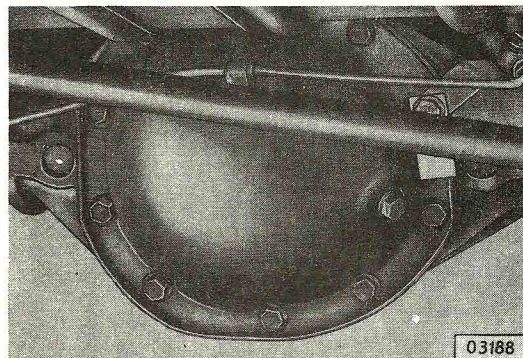


## Overhauling Rear Axle

- Rear axle and rear axle shafts removed -

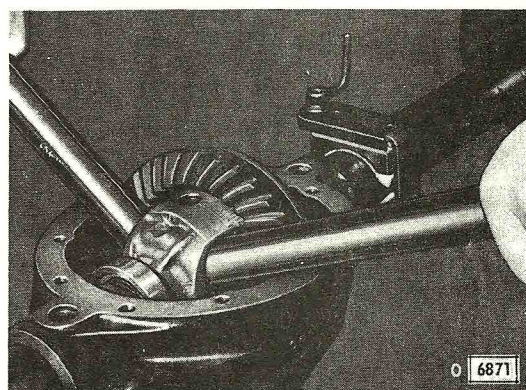
### Removing differential

For draining oil unscrew rear axle filler plug and lower bolt of rear axle housing cover. After draining oil bend up retaining clamp on housing cover and after loosening T-connector bend brake line somewhat towards the rear.



Unscrew rear axle housing cover and remove it together with gasket.

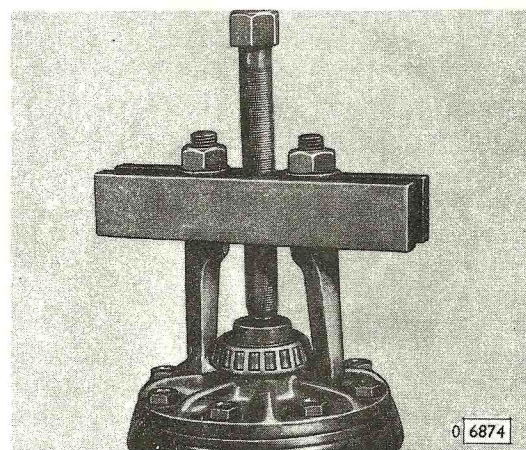
Mark relative position of roller bearing caps to rear axle housing (to facilitate installation) and with two suitable pieces of wood remove differential.



### Disassembling And Assembling Differential without Thrust Springs

Applies to vehicles up to chassis no. 23 55 525 as well as to vehicles +

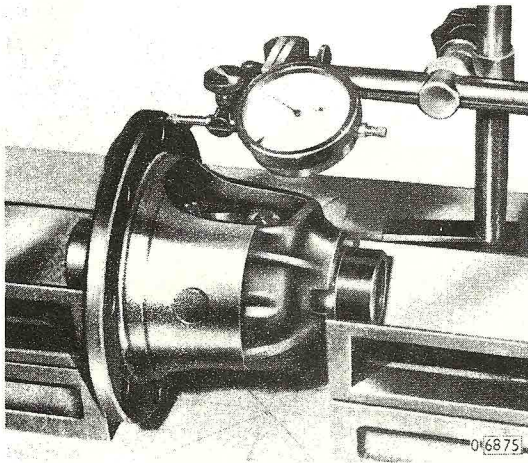
Pull both roller bearings off differential case, using puller S-13. When doing this, make sure that on application of the thrust spindle the respective thrust plate of tool S-13/5 (S-13/7 +) is used.



Unscrew ring gear bolts.  
With a brass drift strike off ring gear.

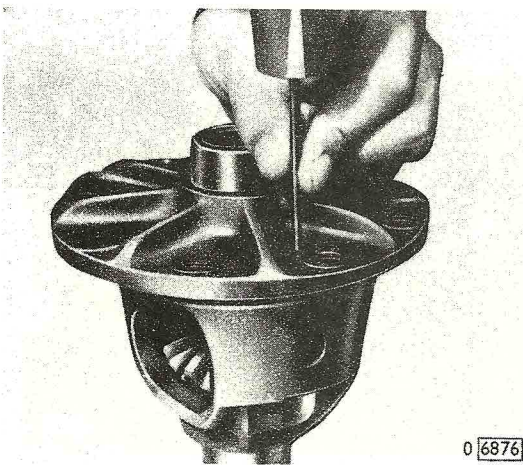
+ refer to "Introduction"



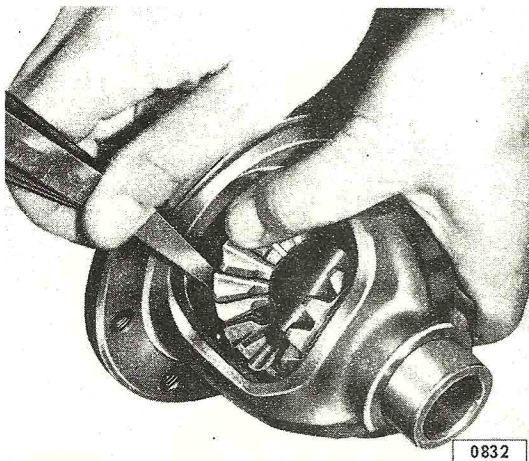


Place differential case in V-blocks and check axial runout of ring gear contacting area.

Permissible axial runout = .0010 in. (0.025 mm)



With a suitable drift drive lock pin from ring gear side out of pinion shaft.



With a suitable drift drive pinion shaft out of differential case and take differential pinions and side gears out of differential case. If shims are installed, remove them too and, if necessary, replace them with new shims.

Assemble differential in reverse sequence to disassembly, noting the following:

Select shims between rear axle shaft side gears and differential case so that with backlash "0" (rear axle shaft side gear pushed by hand against differential pinion) there exists a lateral play of max. .0059 in. (0.15 mm) (check with feeler gauge).

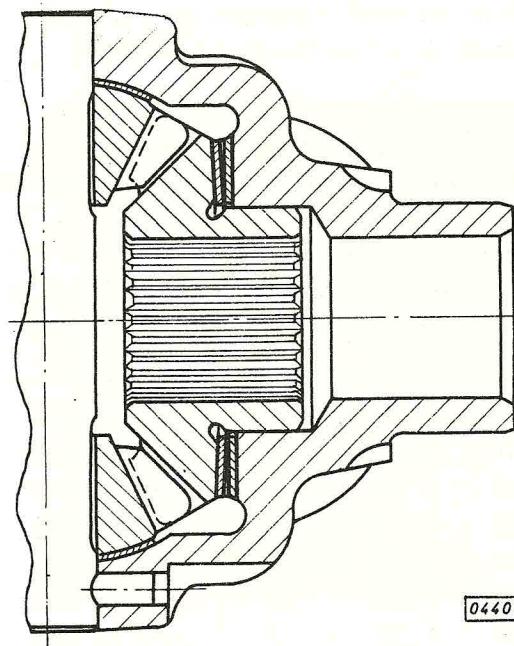
Select shims as per table in the "Adjustment And Installation Specifications".



## Disassembling And Assembling Differential With Thrust Springs

Applies to vehicles after chassis no. 23 55 525 and Voyage, except vehicles with 16 N-engine

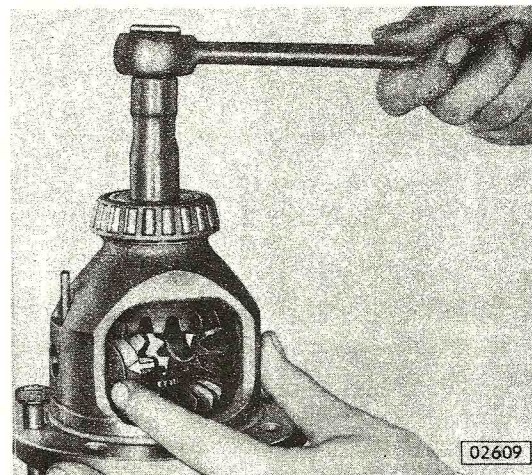
The difference between the two designs is an additional thrust spring per side, arranged between the side gear and compensating plate between side gear and differential case.



4

### Disassembly

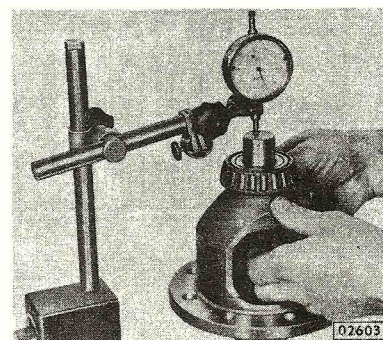
After removal of ring gear and differential pinion shaft clamp differential in a vise. Remove differential pinions out of housing.



**Note:** For clamping differential in a vise and for removing differential pinions use tool SW-238 to be made up in own repair shop. This tool is not supplied by Messrs. Matra-Werke. For this purpose rework scrapped rear axle shafts with undamaged splines. These tools have already been required on KAD/B models with 6-cylinder engines. Values in parenthesis in the drawing under "Special Tools" in this group apply to tools for vehicles with 1.1 ltr. engines and 1.6 ltr. N-engines effective with approximate chassis no. 24 53 081, except Ascona Voyage, Consequently the values in ~~parantheses~~ do not apply to this operation.

### Assembly

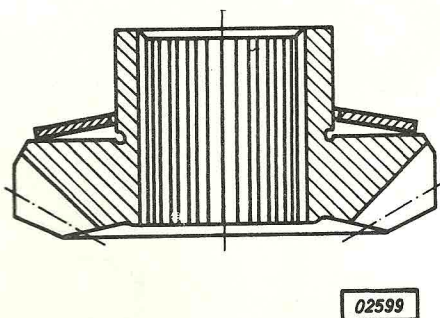
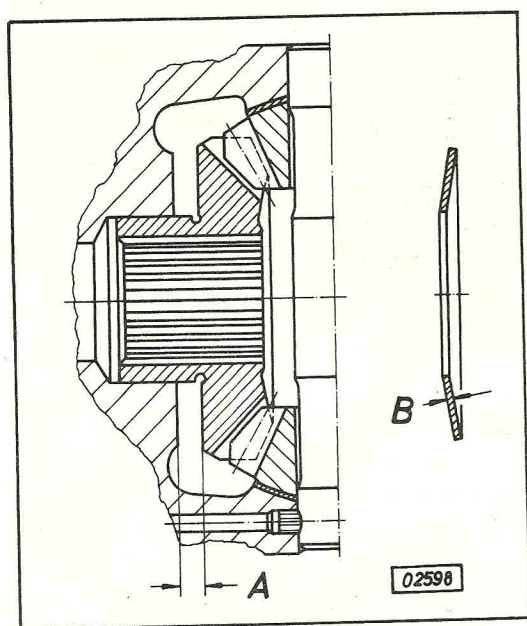
Install side gears with one .039 (1 mm) thick washer each and differential pinions with thrust washers into differential housing. Then measure on both sides distance between side gear and differential housing, using dial gauge and tool SW-237 made up in own repairshop (figure 02603). For this purpose carry out two measurements each: First with backlash "0" (lowest position of side gear) and then with side gear lifted up to the stop (highest position).



To obtain largest distance, revolve side gear several times.  
Determine total distances on both sides according to the following example.

Side gear shims with an outer diameter of 2.30 in. (58.5 mm)

Thickness in.	mm	Number of notches	Catalog no.
.039	1	0	4 10 651
.041	1.05	1	4 10 676
.043	1.10	1	4 10 652
.045	1.15	3	4 10 678
.047	1.20	2	4 10 653
.049	1.25	5	4 10 680
.051	1.30	3	4 10 654
.053	1.35	7	4 10 698
.053	1.40	8	4 10 699



Example:

	Ring gear side	Opposite side
Measured with dial gauge	1.45 mm	1.65 mm
plus shim thickness	<u>1.00 mm</u>	<u>1.00 mm</u>
Total distance (A)	2.45 mm	2.65 mm
With micrometer measure thickness (B) of thrust springs.		

Determine required shim thickness to be added to the thrust spring thickness according to the following example.

Important

To avoid that the respective thrust spring is not completely flattened, a value (C) of .002 in. (0.05 mm) has to be deducted.

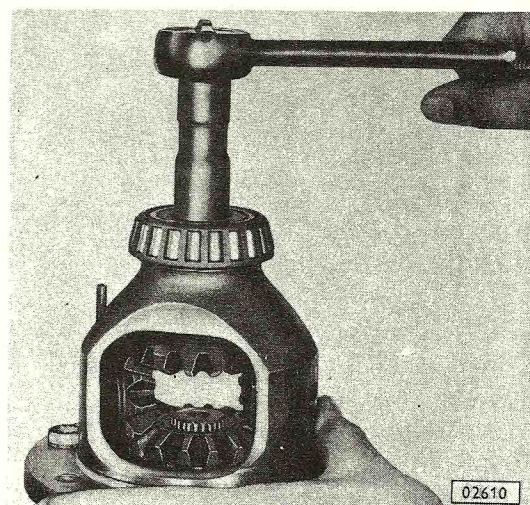
Example:

	Ring gear side	Opposite side
Total distance (A) minus thickness (B) of thrust spring	2.45 mm	2.65 mm
	<u>1.30 mm</u>	<u>1.30 mm</u>
	<u>1.15 mm</u>	<u>1.35 mm</u>
minus value C	<u>0.05 mm</u>	<u>0.05 mm</u>
Thickness of shims to be added	<u><u>1.10 mm</u></u>	<u><u>1.30 mm</u></u>

Place thrust spring with hollow side onto side gears (fig. 02599).

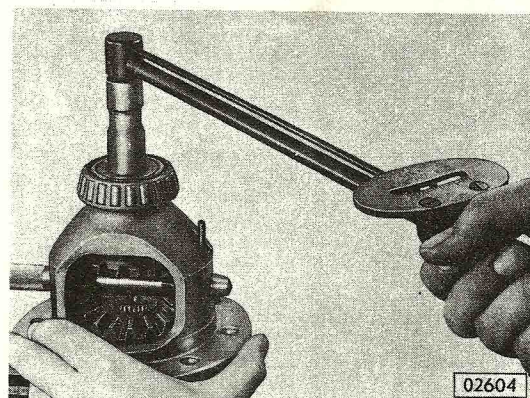


On installation of differential pinions make sure that the thrust washers are properly seated (fig. 02609).



Check torque (fig. 02604) - permissible torque = 14 - 17 ft. lbs. (2-2.4 kpm).

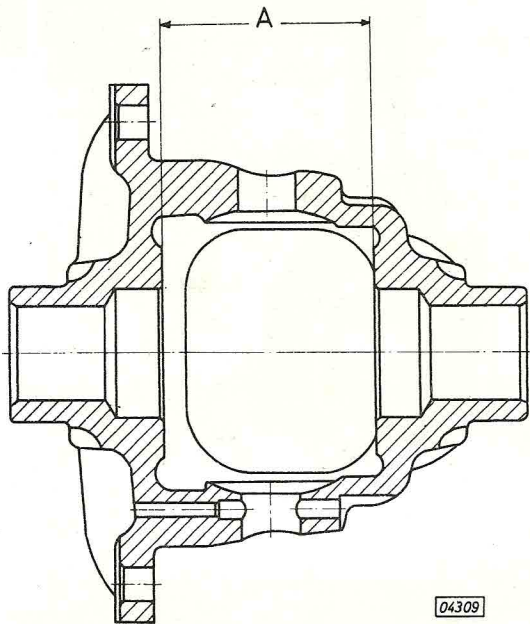
If the measured torque is too high or too low, add on one side the next thicker or thinner shim. If required, change shims on both sides.



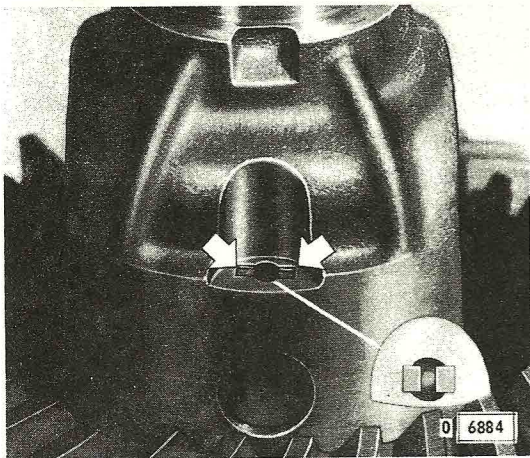
Note: In order to avoid a mix-up it is advisable to measure each shim with a micrometer.

The thrust spring has the catalog no. 4 10 901.





Due to the different measure "A" of 2.326 in. (59.08 mm) on differentials **with** the catalog no. 4 10 213 and 4 10 222 and of 2.417 in. (61.38 mm) on differentials with the catalog no. 4 10 225 and 4 10 226 no thrust springs must be subsequently installed in the differentials mentioned first.



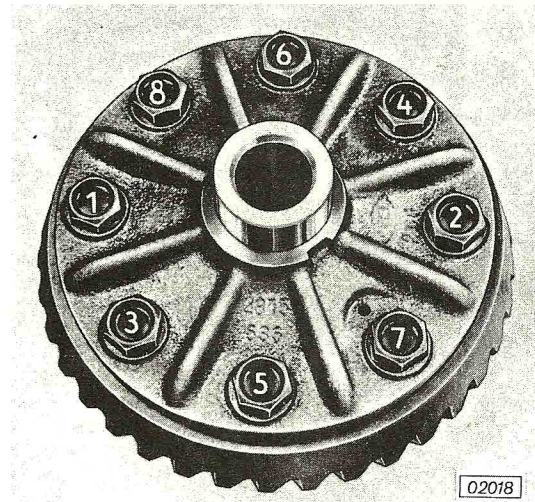
Drive lock pin into pinion shaft and secure.

Place ring gear at least 1 minute in boiling water and install it onto differential case.



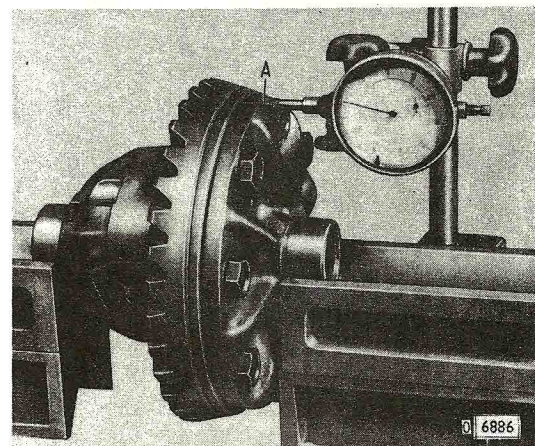
In the sequence shown torque ring gear bolts (tensilock bolts) to 47 ft. lbs. (6.5 kpm) and on limited-slip differential to 54 ft. lbs. (7.5 kpm).

On vehicles <sup>+</sup> coat hex head shaft bolts at a length of approximately .4 in. (10 mm) with sealing compound L 000 161/3.



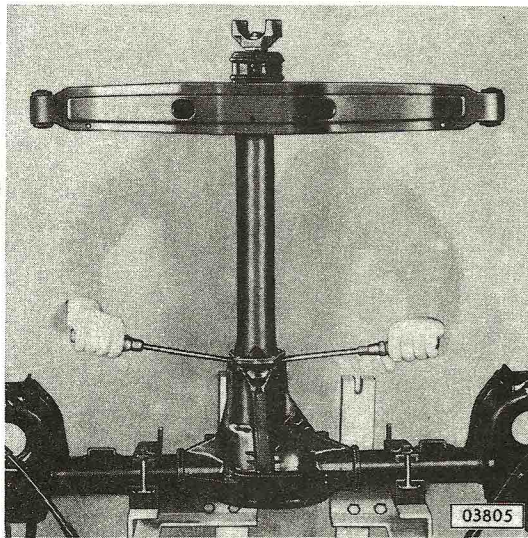
Check lateral runout of installed ring gear in V-blocks. Max. permissible runout = .0031 in. (0.08 mm).

Use dial gauge adapter with cylindrical pin (A).



<sup>+</sup> refer to "Introduction"

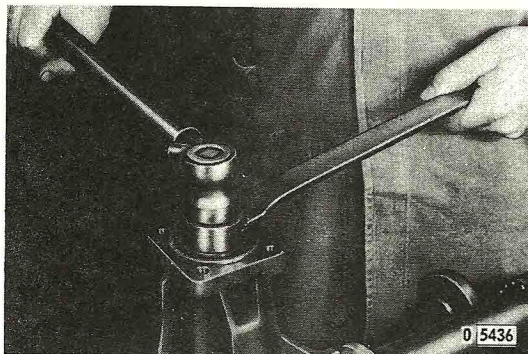




In case of excessive runout establish cause for runout, for instance dirt or burrs between contacting surfaces or bolts unevenly tightened.

#### Removing drive pinion

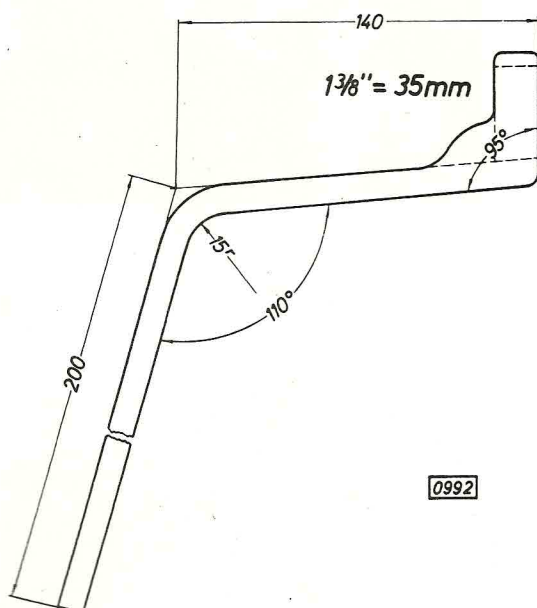
Unscrew torque tube attaching bolts. Using a mallet loosen torque tube from its seat and with two screwdrivers centrally press off torque tube. Remove torque tube and drive pinion shaft extension.



Counterholding with tool KM 106 (S-1288 +) unscrew drive pinion nut. With tool SW-209 carefully push drive pinion together with roller cage of inner bearing and clamp ring out of rear axle housing

With tools SW-94 and SW-95 push outer and inner race as well as seal ring out of rear axle housing.

On vehicles + press out outer race with small thrust plate and thrust bolt of tool S-1204. Press out inner race with large thrust plate and thrust bolt of tool S-1204.

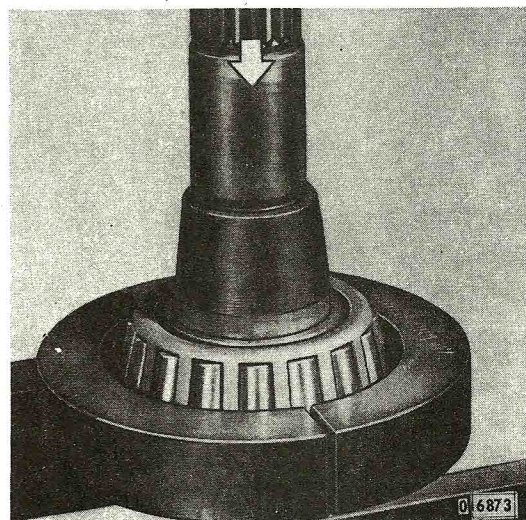


+ refer to introduction



With tool S-1307 press off drive pinion roller cage.

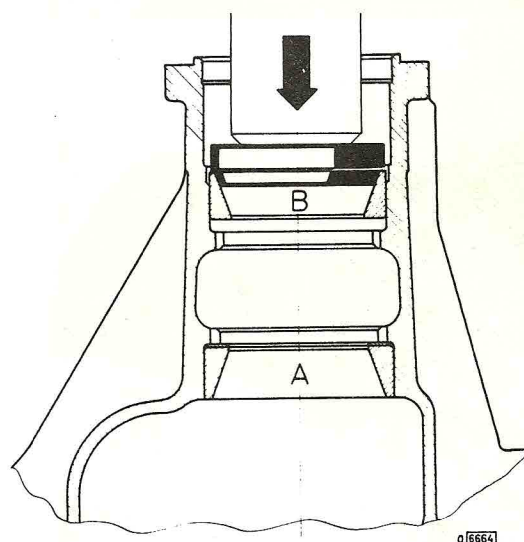
On vehicles <sup>+</sup> press off drive pinion roller cage with tool S-120.



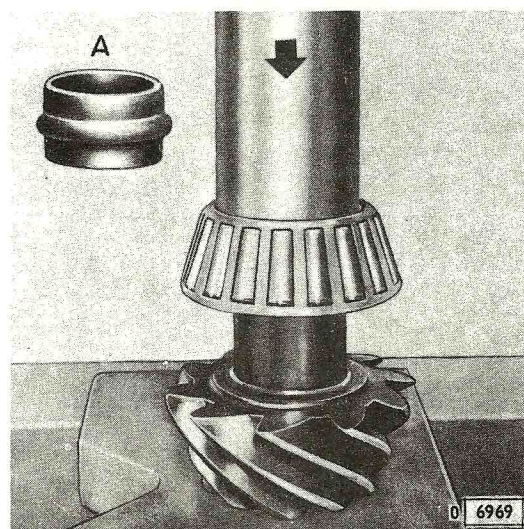
#### Installing and adjusting drive pinion

With installer plate of tool SW-96 press in outer race (A) for the present without shims and with installer plate of tool SW-95 press in outer race (B).

On vehicles <sup>+</sup> press in outer race (A) without shims, using tool S-1204 and outer race (B) with large thrust plate and thrust bolt of tool S-1204.

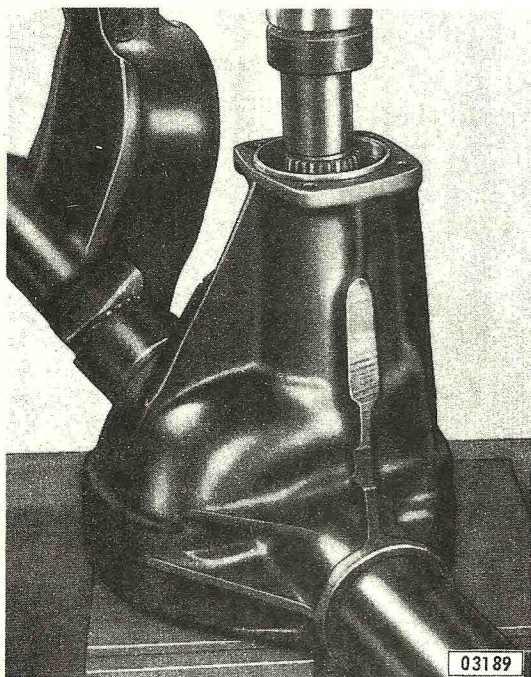


With tool SW-56 (S-1205<sup>+</sup>) press roller cage onto drive pinion. For measuring drive pinion height, install drive pinion without tension ring (A) but with slotted sleeve.



<sup>+</sup> refer to "Introduction".





To do this with sleeve SW-56 (S-1254-1<sup>+</sup>) press slotted sleeve onto drive pinion until hex nut catches.

Tighten hex nut gradually, simultaneously checking bearing preload with torque wrench 76/25.

Permissible bearing preload:

New bearings 6 - 11 in. lbs. (7 - 13 kpcm).

Aim at 9 in. lbs. (10 kpcm).

Used bearings 5 - 8 in. lbs. (6 - 9 kpcm).

Aim at 7 in. lbs. (8 kpcm).

On vehicles<sup>+</sup> permissible bearing preload:

New bearings 4 - 10 in. lbs. (5 - 12 kpcm).

Aim at 7 in. lbs. (8.5 kpcm).

Used bearings 3 - 5 in. lbs. (3 - 6 kpcm).

Aim at 4 in. lbs. (4.5 kpcm).

Carry out height control of drive pinion. The drive pinion is adjusted according to the control figure on drive pinion face.

General explanation:

+ 20 Control figure indicates how many hundredths of a millimeter the pinion head face has to be positioned below the zero line.

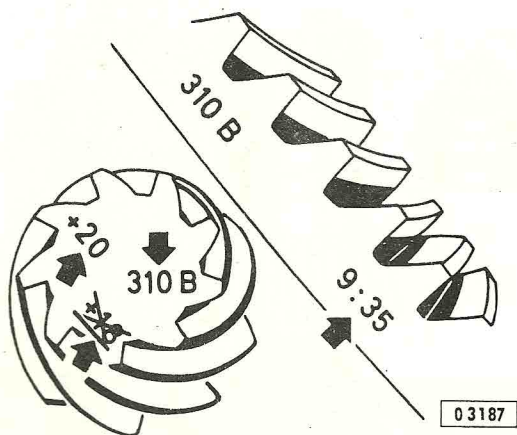
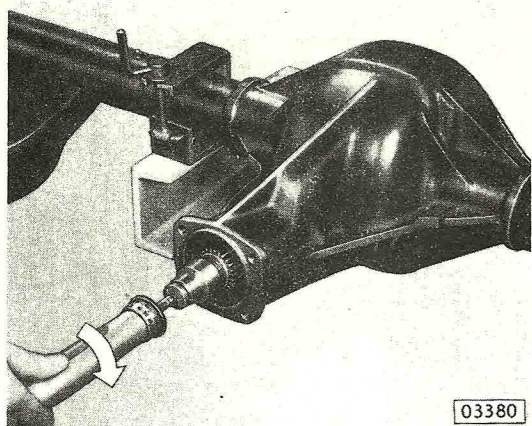
A minus indexed figure (-20) indicates how many hundredths of a millimeter the pinion head face has to be positioned above the zero line.

310 B Matching figure for ring gear and drive pinion.

+ 18 Underlined figure - without significance for service

9:35 Number of teeth of ring gear and drive pinion.

<sup>+</sup> refer to "Introduction".





The zero line (A) passes the highest point on inserted arbor.

On vehicles <sup>+</sup> the zero line passes the highest point on arbor S-1203.

Adjust dial gauge to "0" on highest point of arbor of tool S-1063 (S-1203 <sup>+</sup>) (A).

Shift measuring rail of tool S-1063 until feeler of dial gauge rests on arbor S-1308 (S-1283 <sup>+</sup>) (B).

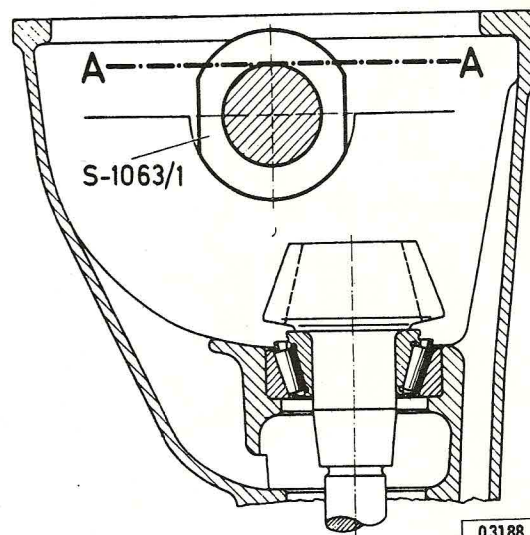
Take dial gauge reading and determine how many hundredths of a millimeter the arbor is positioned above or below zero line.

Established value, for instance :

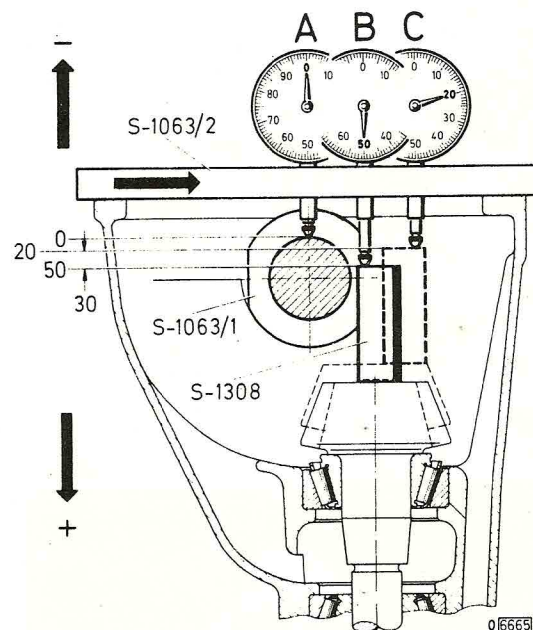
$50/100 = .50 \text{ mm (B)}.$

According to the control figure, the drive pinion must not be positioned more than .20 mm below zero line (C) which means that the drive pinion must be positioned higher by  $.50 - .20 = .30 \text{ mm}$ . Add a corresponding number of shims below outer race of inner bearing.

<sup>+</sup> refer to "Introduction".



4



#### Drive pinion shims

2.79 in. (70.5 mm) (2.40 in. (61 mm) )  
outer diameter

Thickness		Number of notches at circumference
in.	mm	
.0020	0.05	-
.0098	0.250	0
.0108	0.275	1
.0118	0.300	2
.0128	0.325	3
.0138	0.350	4
.0148	0.375	5

With a minus indexed figure, e.g. "-20", the pinion head face has to be positioned .20 mm above zero line.

#### Example :

$.50 + .20 = .7$  mm (thickness of shims).

Remove drive pinion. Press out inner bearing race, install required number of shims and press in again, making sure that shims are properly centered in bearing seat.

Prior to installation coat seal ring with protective grease, catalog No. 19 48 814.

Install seal ring using tool KM 107 (KM 104<sup>+</sup>).

Coat both roller bearings with hypoid gear lubricant GM 4744-M or GM 4655-M.

Install drive pinion together with new tension ring and adjust bearing preload.

#### Important

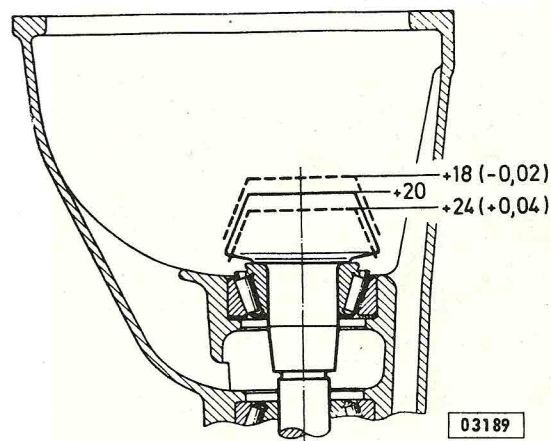
If preload has been exceeded, replace tension ring and repeat adjustment.

<sup>+</sup> refer to "Introduction"



Permissible tolerance in drive pinion seat height after installation of shims:

+ .0016 in. (0.04 mm) - .008 in. (0.02 mm)  
(corresponds to measurement: + 24 up to + 18).



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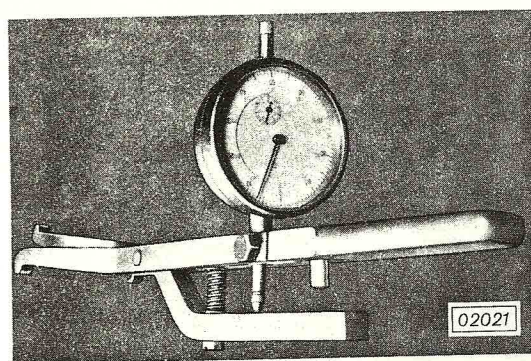
The hex nut in front of the slotted sleeve is self-locking and need not be secured. Therefore always use a new nut.

#### Installing differential and adjusting backlash

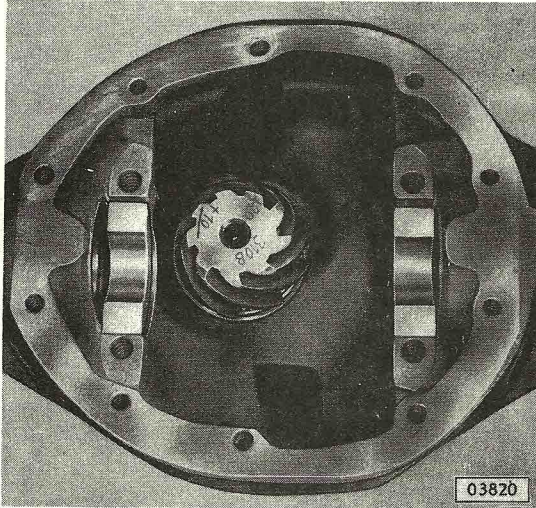
For determination of shim thickness as well as for measuring width of differential side bearings use ring gear and pinion backlash measuring gauge S-1344 (S-1202<sup>+</sup>). This gauge consists of

1. measuring scissors in conjunction with dial gauge (not included in S-1344 and S-1202).
2. measuring block for setting measuring scissors to a width of 20.0 mm (18 mm),
3. two split rings.

Insert dial gauge into bore of straight arm of measuring scissors until feeler guide is flush with underside of arm. Thereby the feeler preload required for taking measurements is obtained. Tighten dial gauge by turning clamp screw. Screw in spring-loaded screw of bent arm.

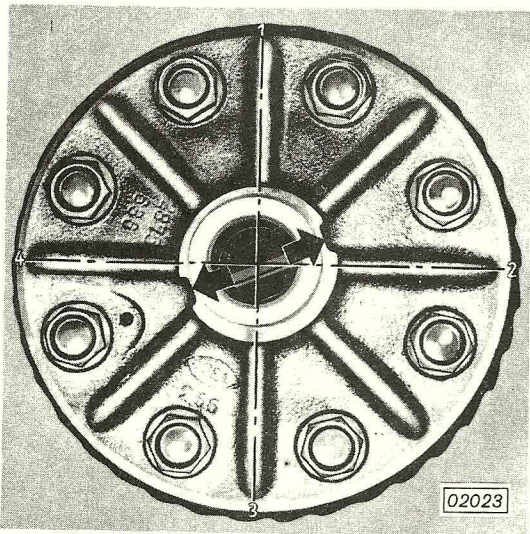


<sup>+</sup> refer to "Introduction"

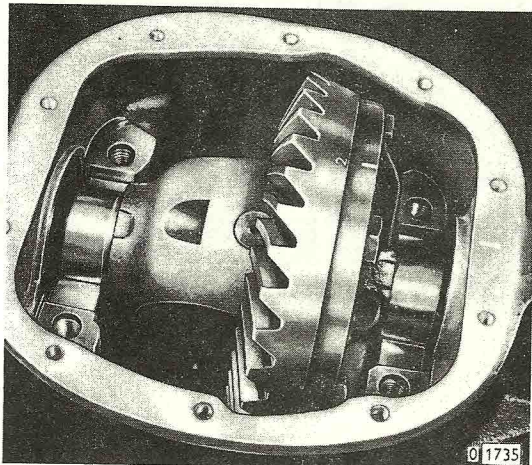


### Adjustment

Place split ring halves into bearing seats in differential housing.



Mark four equally spaced points, numbered from 1 to 4 on ring gear circumference as shown in the illustration and carefully place differential case without roller bearings into split ring halves.



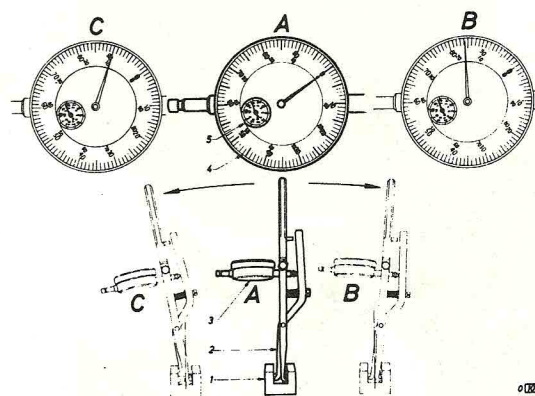
The markings are required to determine the smallest width between differential case and rear axle housing.



Place measuring scissors into gauge block and at maximum deflection of pointer set dial gauge to "0" (A).

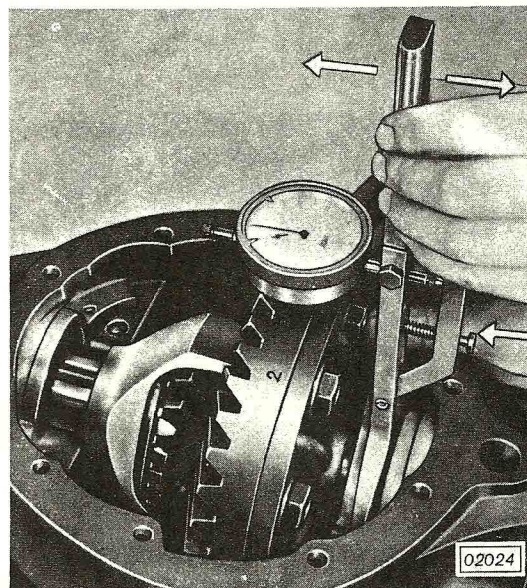
In zero position of the dial gauge set measuring scissors to a width of .79 in. (20 mm) (.71 in. (18 mm)<sup>+</sup>).

Always measure width on ring gear side first.



4

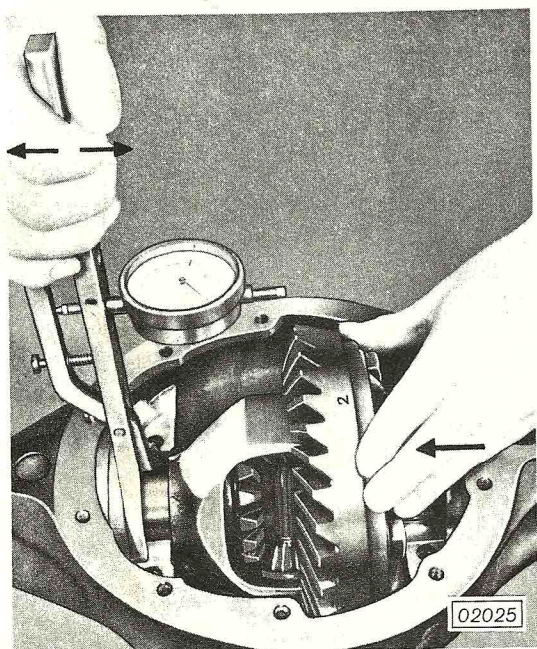
Turn differential case so that a marking figure points towards measuring scissors. Push differential case and ring gear against drive pinion so that a backlash can no longer be felt.



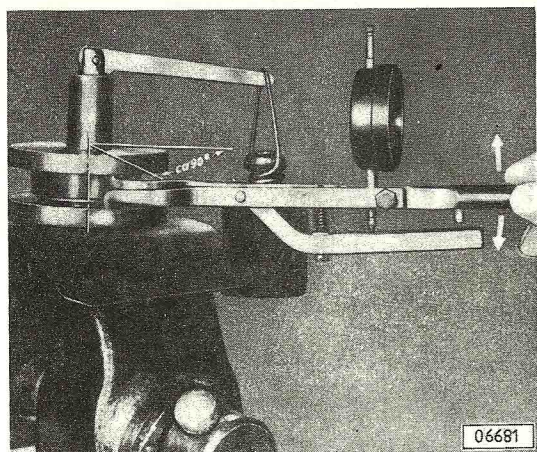
Check width at the four markings on ring gear to determine smallest width between differential case and rear axle housing. For control measuring rotate ring gear one turn in opposite direction to the previous rotation to the point with the smallest value.

The now established width is the actual width for shim thickness determination.

<sup>+</sup> refer to "Introduction"



Then measure width on opposite side of differential while pushing differential case with ring gear against drive pinion. There must be no backlash. The width on differential case side has to be measured at the marking at which the smallest width on ring gear side was established. Write down value obtained.



Measure width of both differential side bearings, using gauge S-1065 and measuring scissors. Prior to taking measurement rotate bearing a few times, then suspend a 2.2 lbs. (1 kg) weight from gauge lever so that bearings are properly preloaded.

#### Note

Applies to all vehicles except vehicles with <sup>†</sup>. The adjustment can also be performed with tool S-1065 and measuring scissors.

Select shims with a thickness equal to the difference between rear axle housing and differential case and width of differential side bearing as per table in "Adjustment And Installation Specifications". To the measured difference in width between rear axle housing and differential case and width of roller bearing add to each bearing a preload of .0020 in. (0.05 mm) on new bearings and .0012 in. (0.03 mm) on used bearings.

<sup>†</sup> refer to "Introduction"



The backlash between ring gear and drive pinion amounts to .0039 - .0078 in. (0.10 - 0.20 mm). On adjustment a backlash of .0047 in. (0.12 mm) should be aimed at. The backlash of .0047 in. (0.12 mm) is obtained by subtracting .0059 in. (0.15 mm) from the established shim thickness on ring gear side and adding .0059 in. (0.15 mm) to the established shim thickness on differential case side (see following example).

Shims for differential side bearings

1.97 in. (50 mm) (1.81 in. (46 mm) <sup>+</sup>) outer diameter

Shim Thickness in.	mm	Number of notches at circumference
.0059	0.150	0
.0069	0.175	1
.0079	0.200	2
.0089	0.225	3
.0098	0.250	4
.0108	0.275	5
.0197	0.500	6
.0394	1.000	7

Example for determination of shim thickness for differential side bearings under consideration of backlash and roller bearing preload, applies analogously also for vehicles<sup>+</sup>.

Ring gear side:

Smallest width between rear axle housing and differential case	21.5 mm
Side bearing width, measured in gauge S-1065	20.1 mm
Difference	1.4 mm
Roller bearing preload	0.05 mm
Total	1.45 mm
Subtract value for backlash of 0.12 mm	0.15 mm
Shim thickness on ring gear side	<u>1.30 mm</u>

Shim selection according to table: 7 + 0 + 0

Opposite side:

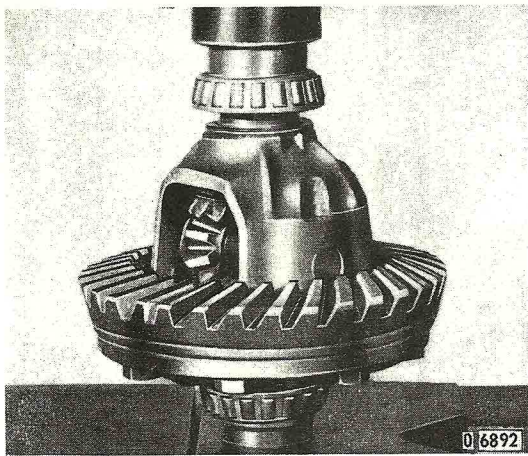
Smallest width between rear axle housing and differential case	20.6 mm
Side bearing width, measured in gauge S-1065	20.06 mm
Difference	0.54 mm
Roller bearing preload	0.05 mm
Total	0.59 mm
Add value for backlash 0.12 mm	0.15 mm
Total	0.74 mm
Shim thickness on opposite side of ring gear	<u>0.75 mm</u>

Shim selection according to table: 6 + 4

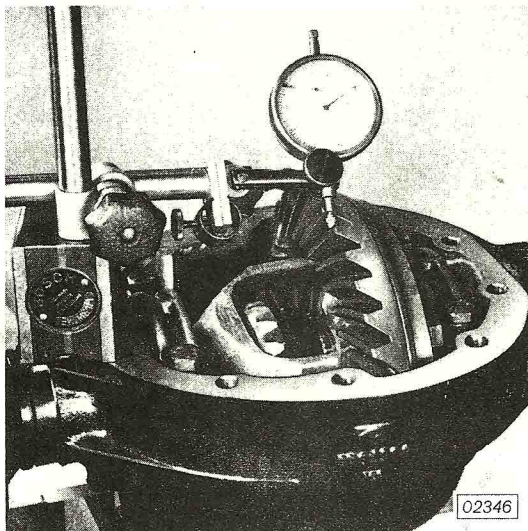
<sup>+</sup> refer to "Introduction"

## Note

Install shims so that the thickest shim is always located on differential case side.



Install side bearings together with shims, using tool SW-221 (S-1206<sup>+</sup>).



Check bearing preload. The bearings are properly preloaded, if the differential case can be pushed by hand three quarters of the way down in the bearing seats. The last quarter has to be equally seated by means of the bearing caps to a torque of 33 ft. lbs. (4.5 kpm).

Check backlash once more. Final backlash should amount to .0047 in. (0.12 mm).

Install rear axle housing cover. Provide upper and lower bolt with sealing compound, part No. 15 03 161. Then torque all bolts to 22 ft. lbs. (3 kpm).

<sup>+</sup> refer to "Introduction"