

4. DRIVE UNIT / DIFFERENTIAL DISASSEMBLY AND ASSEMBLY

1) DISASSEMBLY

(1) Differential carrier

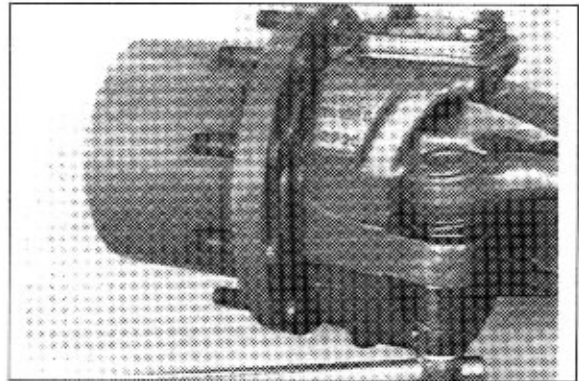
① Version with integrated steering assembly.

※ Before separating the differential carrier from the axle housing pull both universal shafts out of the differential, resp. separate the final drive assemblies from the axle (Figure ① and ②).

② Unlock castle nut, loosen and unhook tie rod.

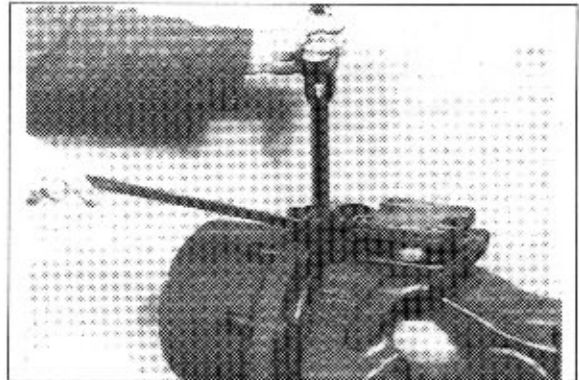
Pry bar

5870 345 065



③ Loosen hexagon head screws, remove steering knuckle bearing pins and separate final drive assembly from the axle housing.

※ Pay attention to the released spacing washer (Only with the upper bearing pin installed).



④ Loosen all hexagon head screws and hexagon nuts and screw in two adjusting screws.

Adjusting screw

5870 204 022

Back off differential carrier by means of pry bar and separate it from the axle housing, using lifting device.

Pry bar

5870 345 065

Lifting device

5870 281 003

If required (According to the version) the tie rod must be separated from the piston rod and the piston guide must be removed to make the loosening of the upper lock nut possible (See figure).



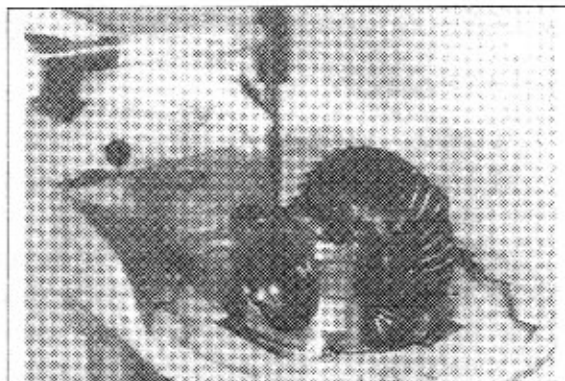
- ⑤ Clamp differential carrier into the assembly jig.

Drive out both roll pins.

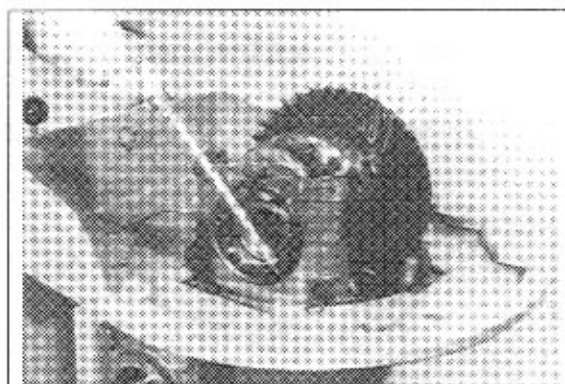
Assembly car 5870 350 000

Support "R" 5870 350 004

Clamping ring "B/C" 5870 350 005

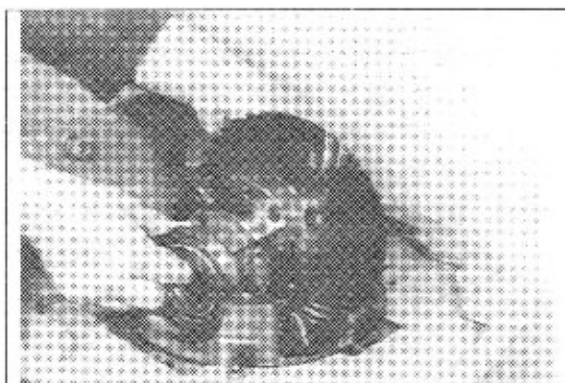


- ⑥ Loosen adjusting nuts.



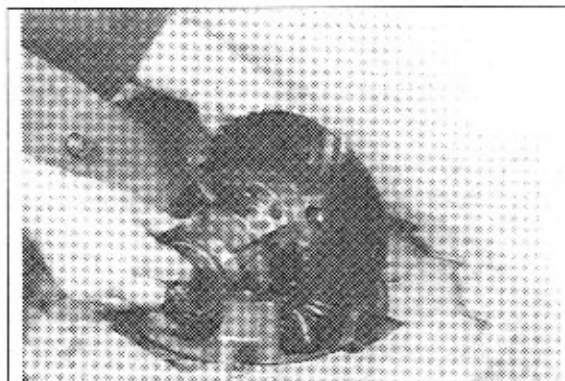
- ⑦ Loosen hexagon head screws and remove both bearing caps.

※ Mark bearing caps with axle carrier, see arrows.



- ⑧ Remove adjusting nuts and lift differential assembly out of the axle carrier.

※ Mark installation position of the crown wheel with the axle carrier.



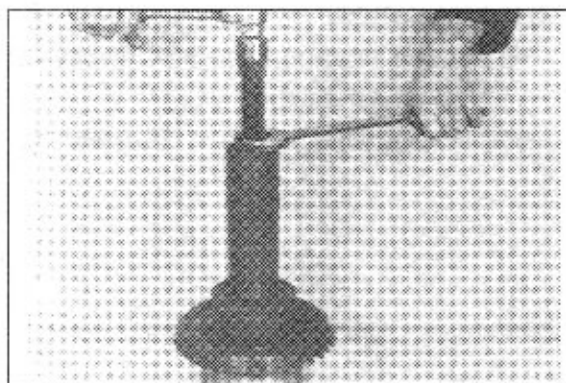
(2) Differential assembly

- ① Pull off both bearing inner races.

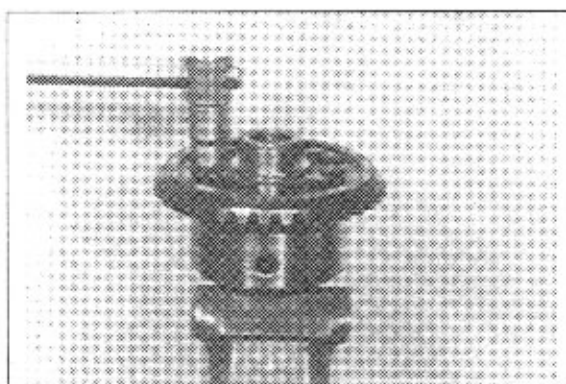
Grab sleeve "Super" 5870 026 023

Thrust piece 5870 506 058

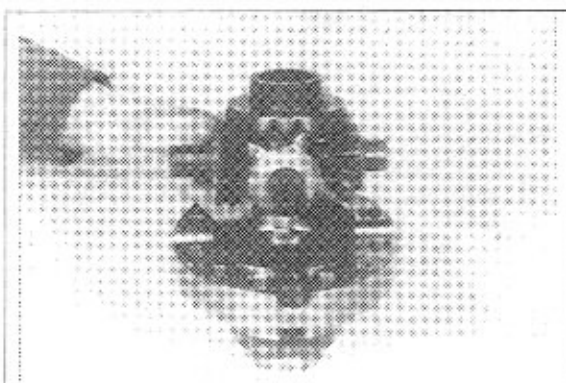
Back off insert 5870 026 100



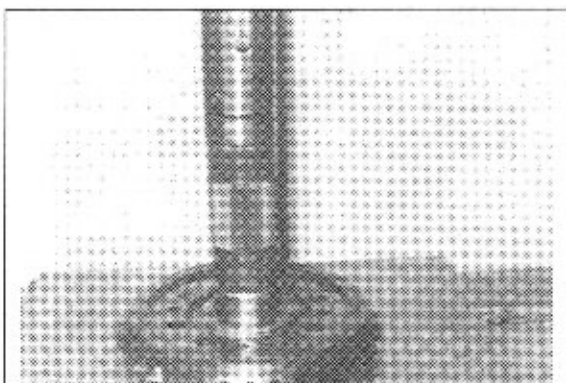
- ② Loosen all hexagon head screws and separate differential case halves.



- ③ Remove all components of the differential.



- ④ Press crown wheel from the differential case.

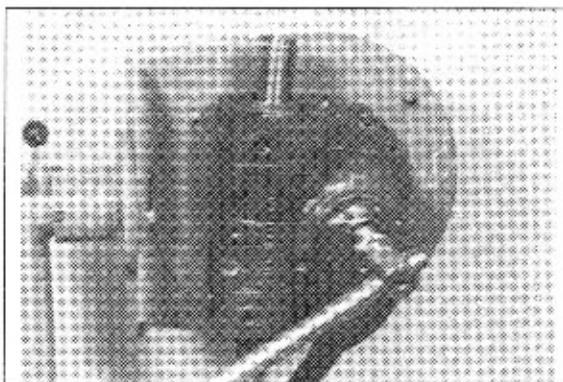


3) Drive assembly

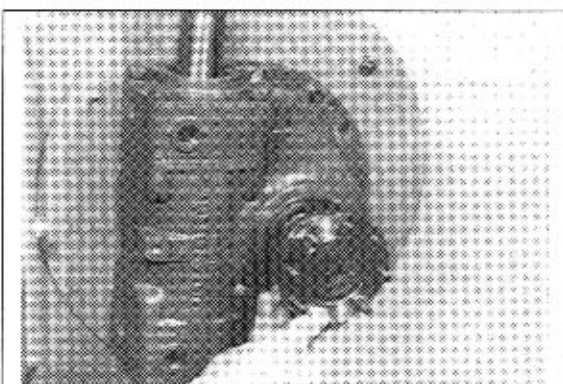
- ① Loosen hexagon nut and remove it together with washer.

Clamping yoke

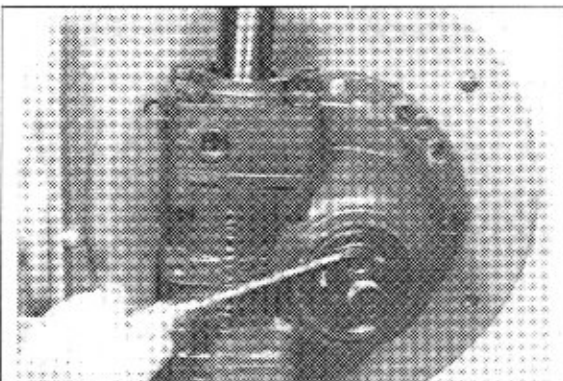
5870 240 025



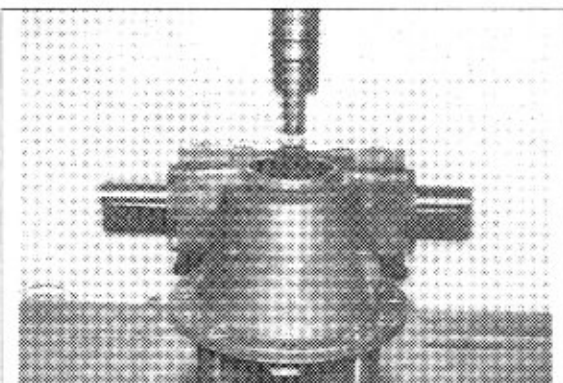
- ② Pull off drive flange.



- ③ Lift out shaft seal.



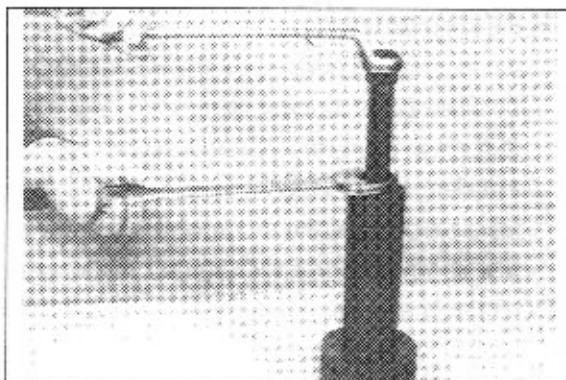
- ④ Press drive pinion out of the axle carrier.



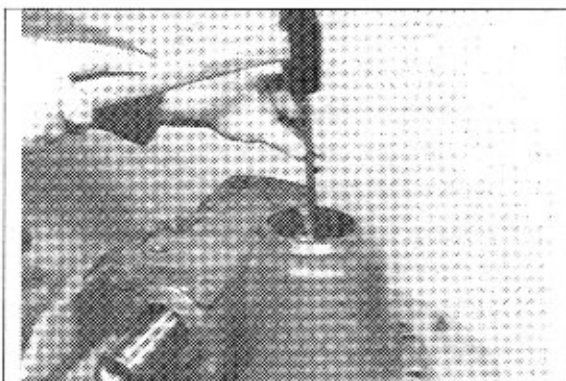
- ⑤ Remove omega sleeve and pull off tapered roller bearing from the drive pinion.

Grab sleeve "Super" 5870 026 001

Basic set 5870 026 000



- ⑥ Drive both bearing outer races out of the axle carrier.



2) REASSEMBLY

- ※ If crown wheel or drive pinion are damaged, both components must be renewed together. If a new complete crown wheel set is installed, pay attention that crown wheel and drive pinion have the same mating numbers. If a complete crown wheel set or an axle carrier are exchanged, pay attention to the draft.

(1) Determine thickness of shim

(To obtain a correct contact pattern)

- ※ Carry out the following measuring operations with utmost precision. Incorrect measurements give an incorrect contact pattern and after the contact pattern has been taken (Figure ⑧ at page 8-236), another disassembly and reassembly of the drive pinion and the differential (Partially) would become necessary.

1 Measuring pin	5870 500 002
2 Adjusting piece	5870 500 010
3 Measuring shaft	5870 500 001

- ① Determine by means of feeler gauge the gap (Dimension **b**) between measuring piston and measuring shaft.

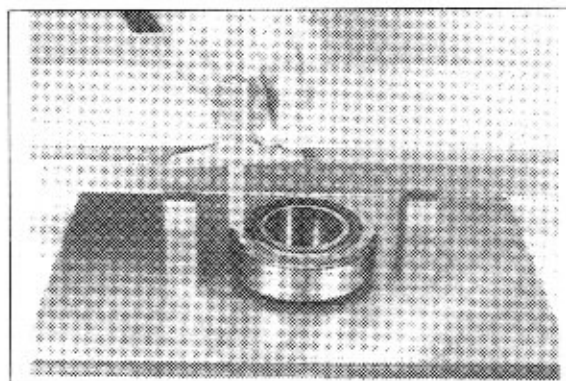
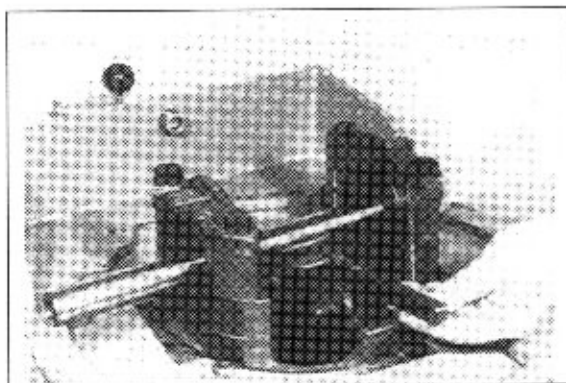
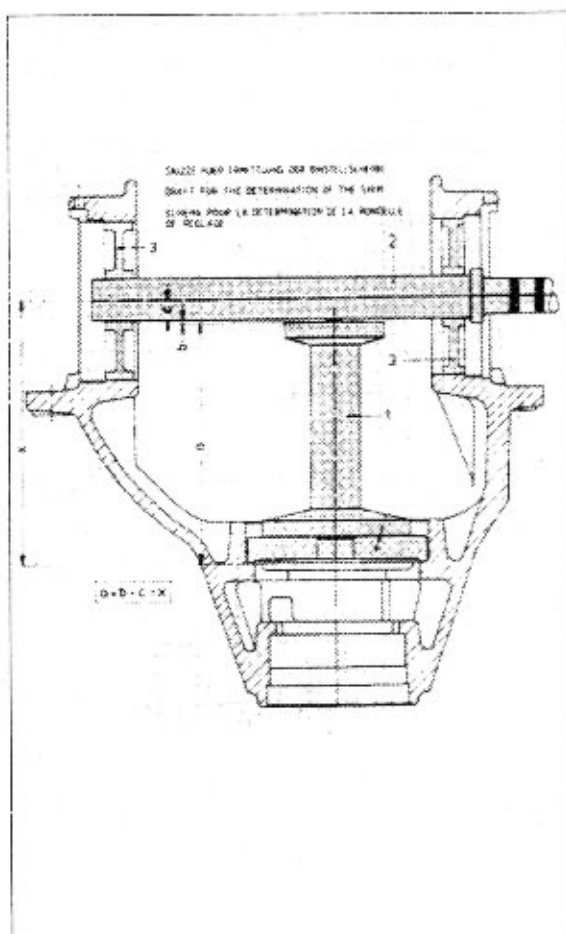
• Dimension **b** e.g. 1.10mm

Example I

Dimension a (Measuring piston)	147.0mm
Dimension b	+ 1.10mm
Dimension c	+ 15.0mm
Gives Dimension X	163.1mm

- ② Determine bearing width.

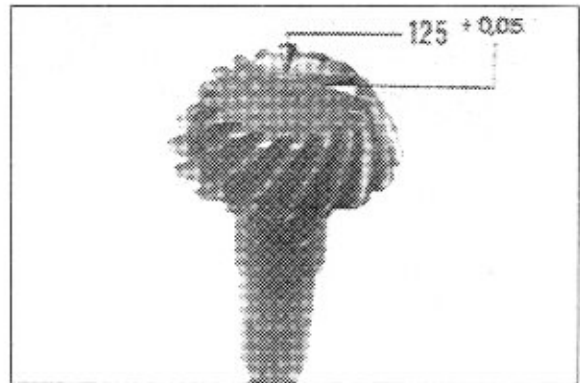
• Bearing width e.g. 36.55mm



- ③ Read pinion dimension.
 • Pinion dimension e.g. $(125^{+0.05})$ 125.05mm

Example I

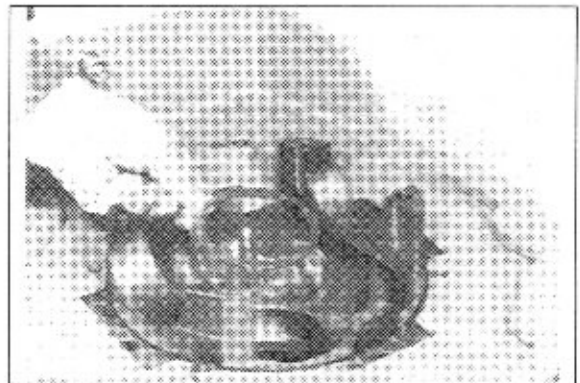
Bearing width	36.55mm
Pinion dimension	+ 125.05mm
Gives Dimension X_1	161.6mm



Example II

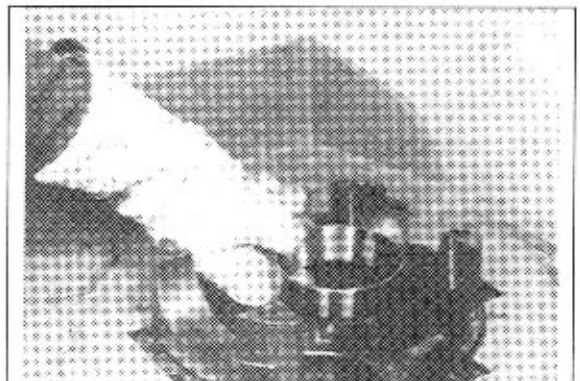
Dimension X	163.0mm
Dimension X_1	+ 161.6mm
Difference = Shim thickness	$s = 1.40\text{mm}$

- ④ Afterwards, remove bearing caps, adjusting pieces and measuring shaft again.
- ⑤ Insert shim (According to the example $s = 1.4\text{mm}$) into the housing bore.



- ⑥ Undercool bearing outer race and insert it firmly against shoulder.
 Install drive side bearing outer race in the same way.

Driver	5870 058 078
Driver	5870 058 061
Handle	5870 260 002

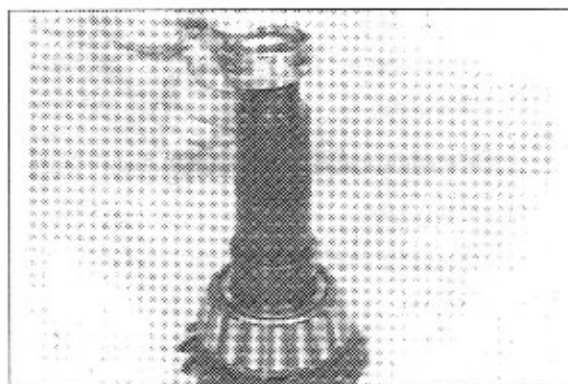


- ⑦ Heat bearing inner race, guide it over the drive pinion end and place it firmly against shoulder.



- ⑧ Assemble omega sleeve.

※ Use omega sleeve only one time (Install a new part).



- ⑨ Insert drive pinion into the axle carrier and assemble heated bearing inner race.

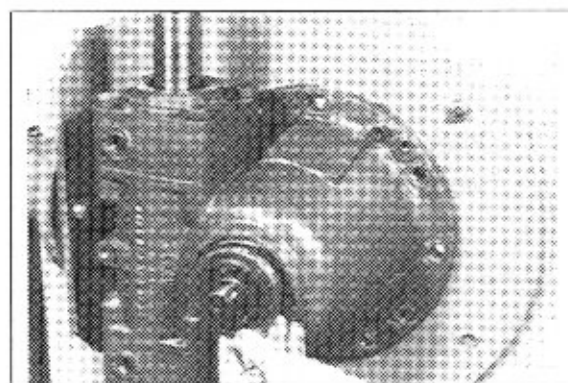


- ⑩ Cover outer diameter of shaft seal with sealing compound (Curil T) and install it.

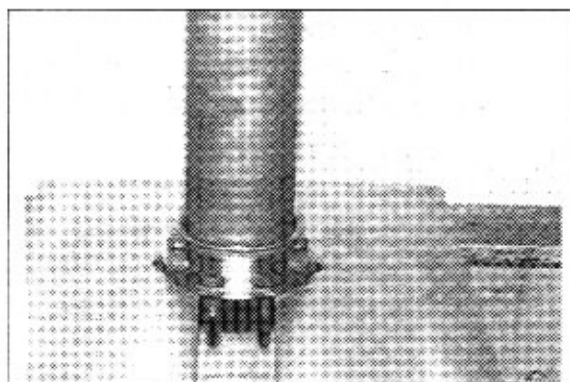
※ If the prescribed driver is used, the correct installation depth of the shaft seal is secured.

Driver

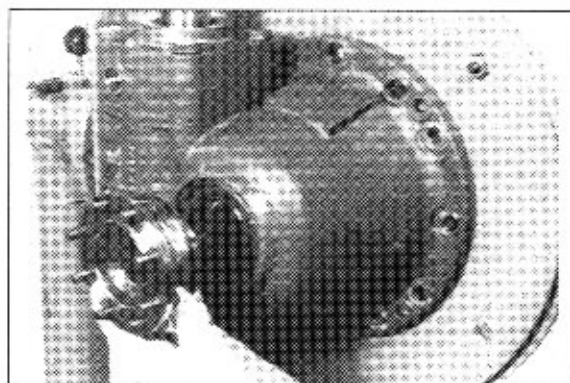
5870 048 114



- ⑪ Insert hexagon head screws into the drive flange bores and press dust plate over the drive flange collar.



- ⑫ Assemble drive flange.



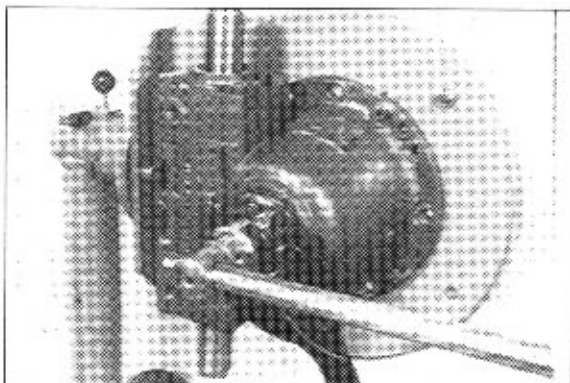
- ⑬ Assemble washer and tighten hexagon nut until the correct rolling resistance is obtained.

Rolling resistance of the drive pinion bearing $0.2\sim0.3\text{kgf}\cdot\text{m}(1.5\sim2.2\text{lbf}\cdot\text{ft})$

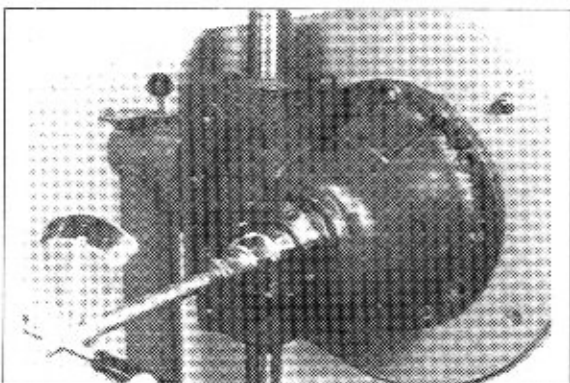
With the rolling resistance of $0.2\sim0.3\text{kgf}\cdot\text{m}(1.5\sim2.2\text{lbf}\cdot\text{ft})$, the rolling moment of the shaft seal (about $0.1\text{kgf}\cdot\text{ft}$) is already considered.

- ※ During the tightening, rotate the drive pinion several times in both senses.

Clamping yoke 5870 240 025



- ⑭ Check rolling resistance.

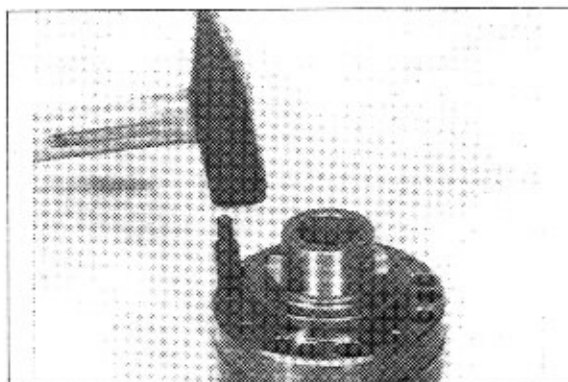


Differential assembly

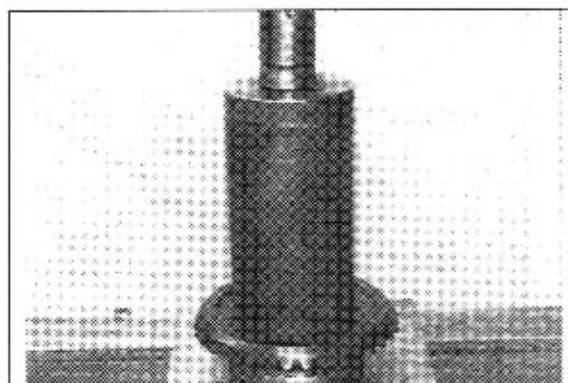
- * Lubricate all differential components according to the list of lubricants TE-ML 05, prior to the installation.

⑮ Drive roll pins(2 pieces/bore) into the blind hole(4 ×) of the differential case half.

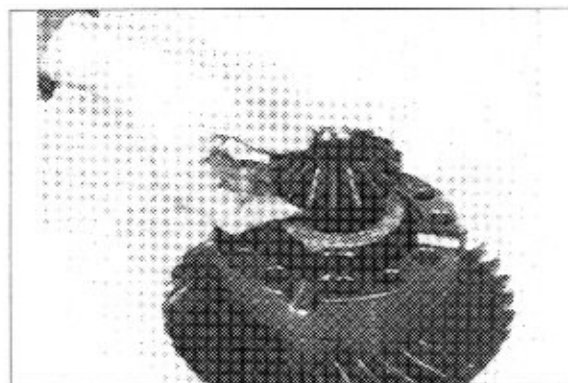
- * Install openings of the two roll pins in circumferential direction and displaced for 180°.



⑯ Press crown wheel over the roll pins and position it against shoulder.

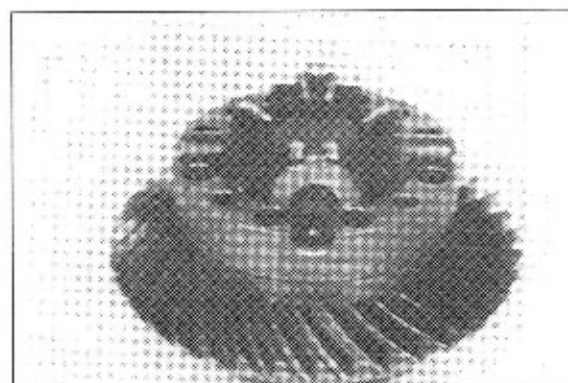


⑰ Insert thrust washer and place side gear upon it.



⑱ Place complete differential spider over the side gear.

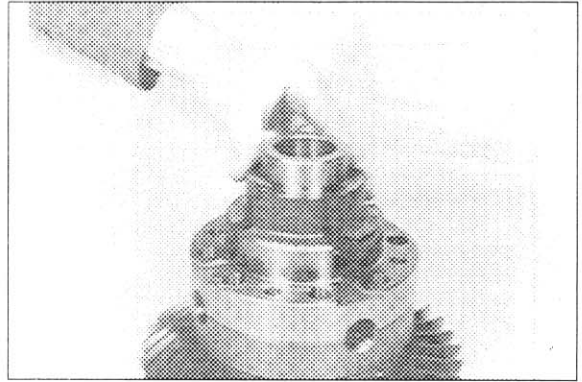
- * Pay attention to the radial installation position of the thrust washers lobes are showing towards above.



- ⑲ Cover thrust washer with grease and make it adhere in the differential case half Ⅱ.

Lay 2nd side gear upon the differential spider and replace differential case half Ⅱ.

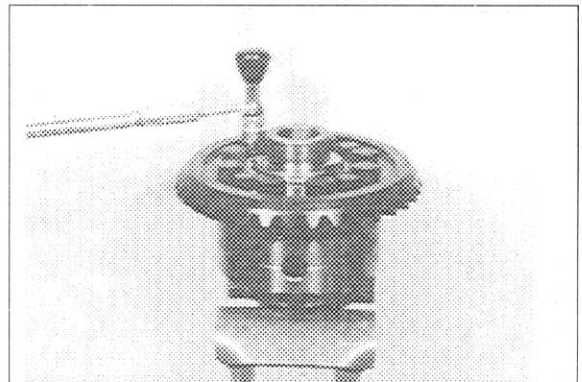
- ※ Pay attention to the installation position, see denomination(ZP-No.)



- ⑳ Connect differential case halves by means of hexagon head screws.

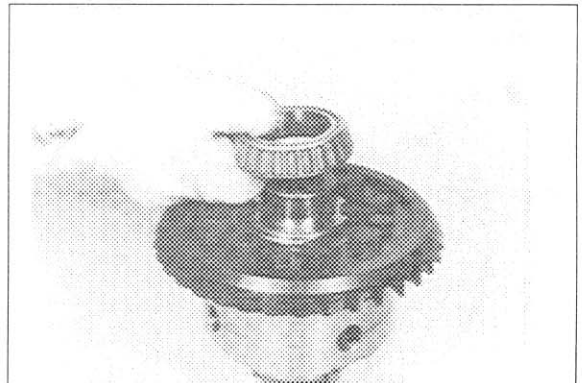
- Torque limit : 12.7kgf · m(92.2lbf · ft)
- Torque limit : 32.1kgf · m(232.3lbf · ft)

- ※ Install hexagon head screws with loctite NO.270.



- ㉑ Heat both bearing inner races and install them firmly against shoulder.

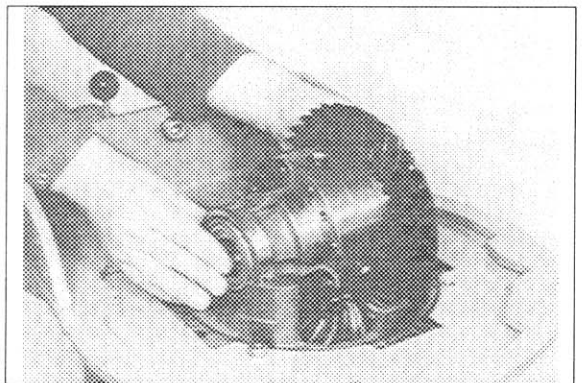
Thrust piece 5870 506 058



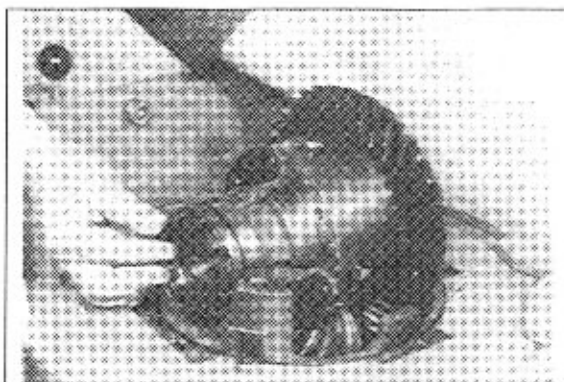
- ㉒ Replace bearing outer races and install differential assembly into the axle carrier.

- ※ Pay attention to the installation position of the crown wheel, see marking.

With installed condition of the differential carrier, the crown wheel seen from the drive side is situated "Left".



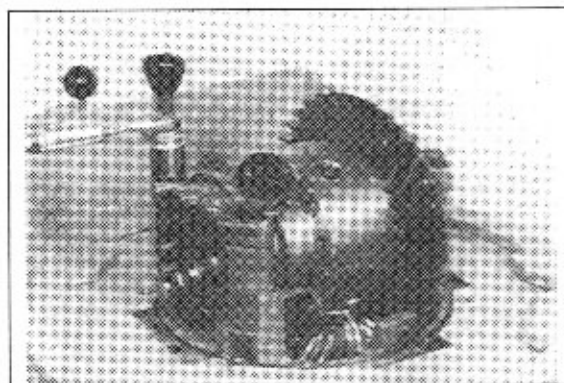
- ② Screw both adjusting nuts into the lower bearing bores.



- ② Replace both bearing caps and fasten by means of washers and hexagon head screws.

• Torque limit : $19.4\text{kgf} \cdot \text{m}$ ($140.1\text{lbf} \cdot \text{ft}$)

※ Pay attention to the markings, see arrow.



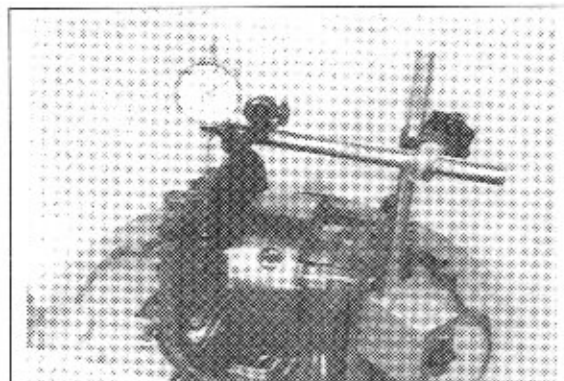
Adjust backlash

- ② Apply dial indicator at a right angle on the outer diameter of the tooth flank/crown wheel.

Adjust the adjusting nut on the crown wheel side until the correct backlash-see value etched on the outer diameter of the crown wheel - is obtained.

Screw in the adjusting nut (Opposite to the crown wheel side) until the differential bearing is free of play.

Afterward, tighten adjusting nut again for 2 notches, in order to obtain the correct bearing preload of the differential bearing $0.1\sim 0.4\text{kgf} \cdot \text{m}$ ($0.7\sim 3.0\text{lbf} \cdot \text{ft}$).



- ②⑥ Check backlash again and correct if required.

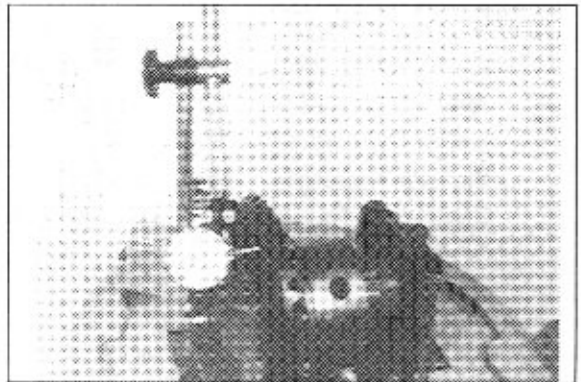
※ During this step, rotate differential several times.

Measure yoke with (Normal value $258 \pm 0.1\text{mm}$) and correct, if necessary (Repeat steps of figure and ②④, ②⑤ 123).



- ②⑦ Apply dial indicator at the plane face/ crown wheel, rotate crown wheel for at least one turn and record run out.

Admitted run out max 0.08mm.



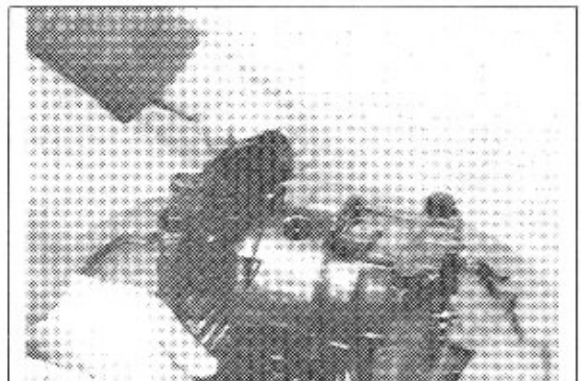
- ②⑧ Cover some tooth flanks of the crown wheel with gear marking compound.

Roll crown wheel in both senses over the drive pinion.

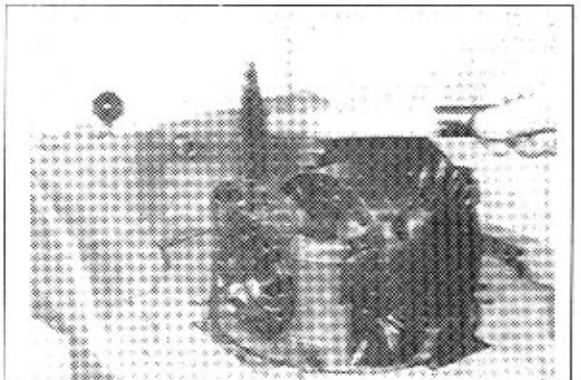
Take the contact pattern and compare it with the page **Examples of contact patterns** at page 8-238A.

In case of a greater contact pattern deviation, a spacing error has been made during the reassembly of the drive pinion.

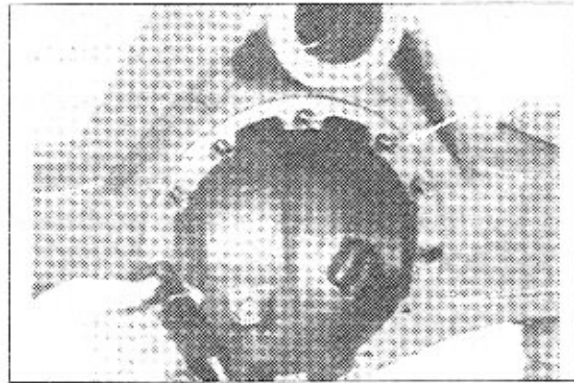
The error must be absolutely corrected.



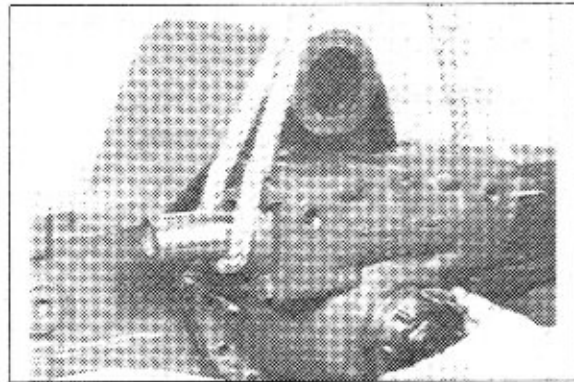
- ②⑨ Secure both adjusting nuts against loosening by means roll pins.



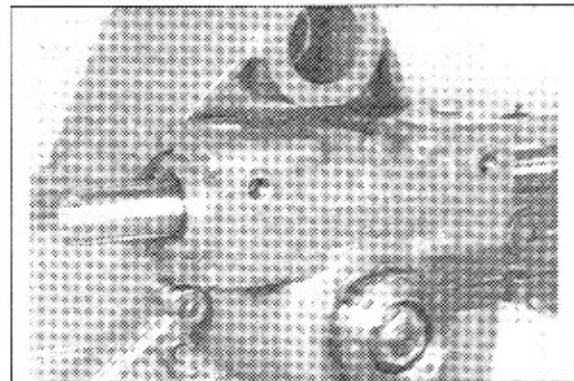
- ⑩ Insert gauge sleeves and install set screws(5 ×), see arrow.
- * Insert set screws with loctite No.270.



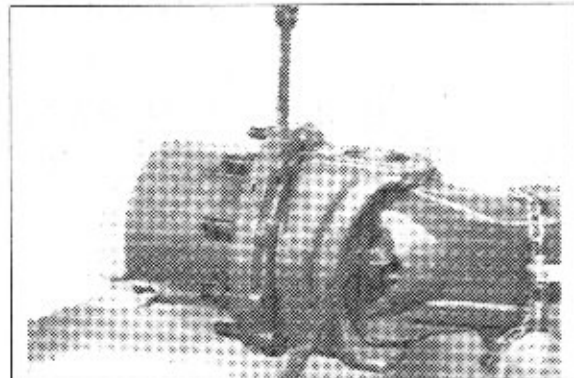
- ⑪ Cover flange facing with sealing compound loctite(No.573), screw in two adjusting screws and place differential carrier by means of lifting device against the axle housing until contact is obtained.
- Adjusting screw 5870 204 022



- ⑫ Fasten differential carrier by means of screws and nuts.
- Torque limit : 25.5kgf · m(184.4lbf · ft)
- * Use locking screws and nuts only one time.



- ⑬ Assemble universal shaft and position final drive assembly at the axle.
 - * The lifting of the universal shaft by means of the pry bar will facilitate the assembling of the shaft into the differential.
- Pry bar 5870 345 065

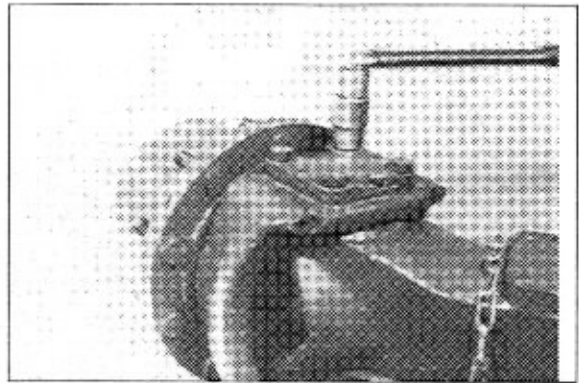


- ⑭ Fix final drive assembly by means of both steering knuckle pins.

Tighten hexagon head screws.

• Torque limit : 41.8kgf · m(302.4lbf · ft)

- ※ With the upper steering knuckle pins, install spacing washer.

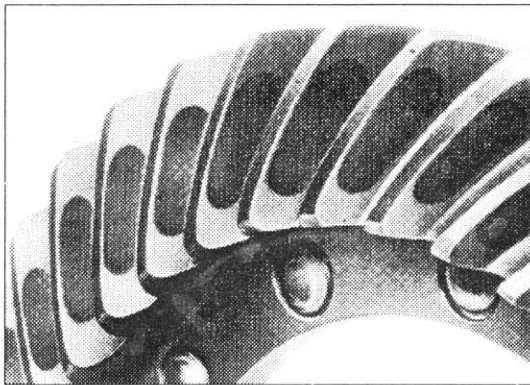


- ⑮ Install both tie rods.

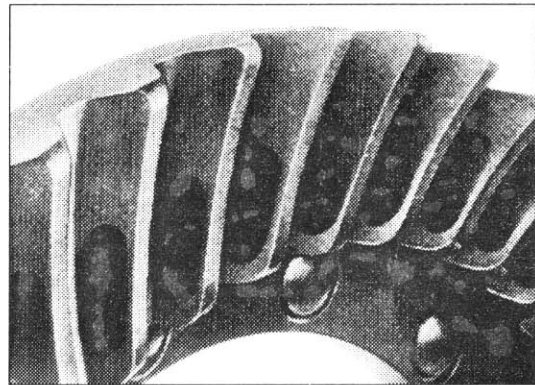
- ※ Pay attention to the lubrication instructions in at page 8-199.

3) CONTACT PATTERNS

(1) Ideal tooth contact pattern(Pinion distance is correct)

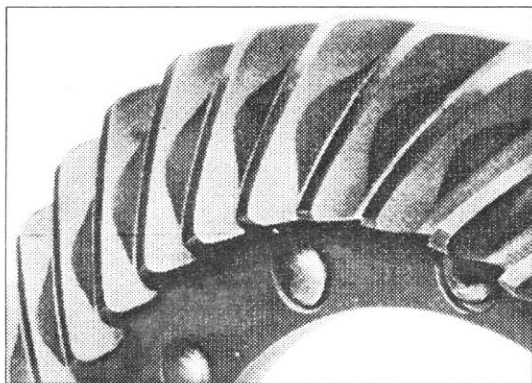
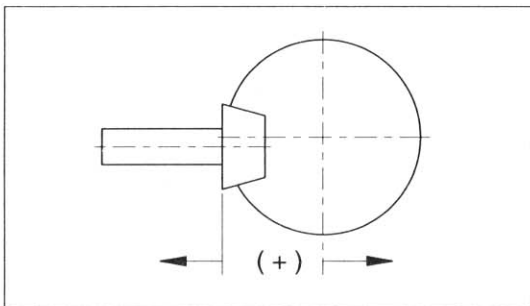


Coast side(Concave)



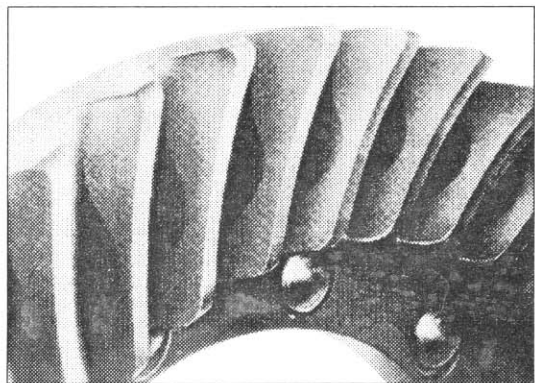
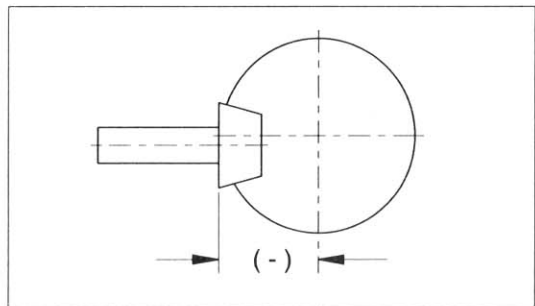
Drive side(Convex)

(2) Pinion distance must be increased

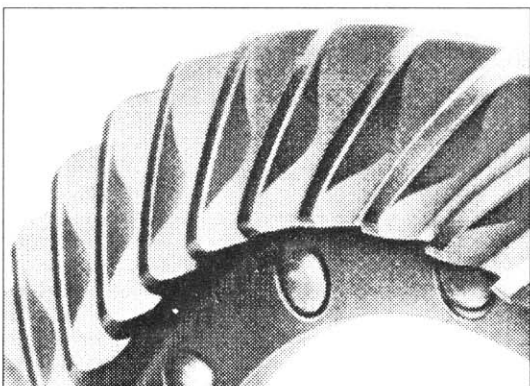


Coast side(Concave)

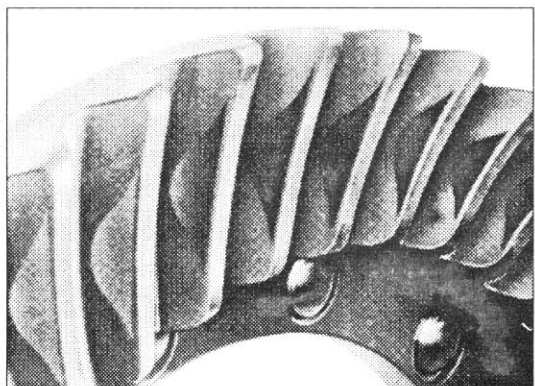
(3) Pinion distance must be decreased



Coast side(Concave)



Drive side(Convex)



Drive side(Convex)

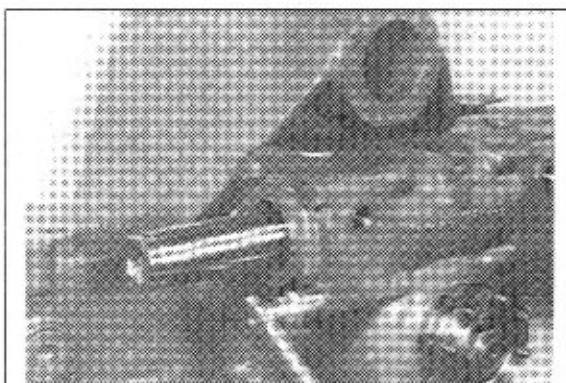
5. FRONT AXLE - STEERING ASSEMBLY

1) DISASSEMBLY

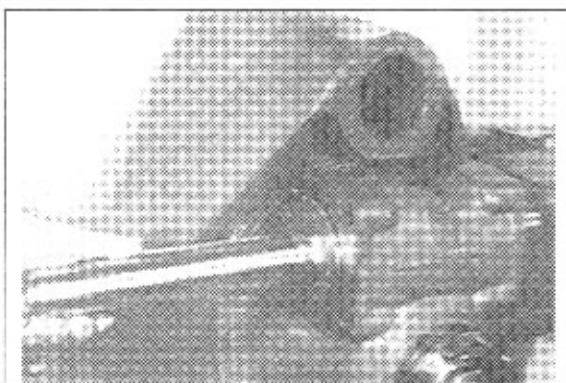
- (1) Unlock both tie rods and separate them from the piston rod.



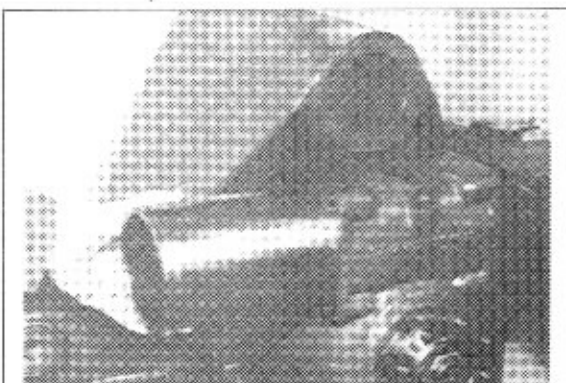
- (2) Loosen hexagon head screws, tap guide loose and pull it from the piston rod. Remove opposite guide in the same way.
※ Pay attention to the released spacing washer.



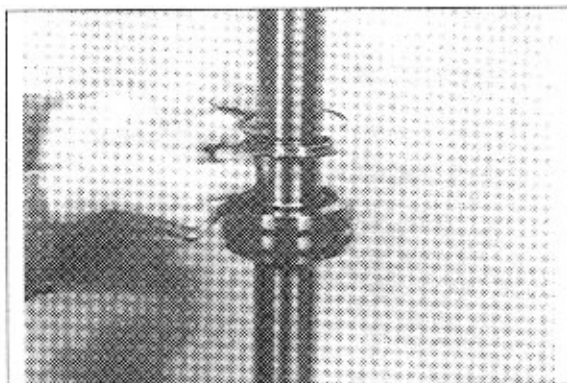
- (3) Pull piston rod(Compl.) out of the cylinder.



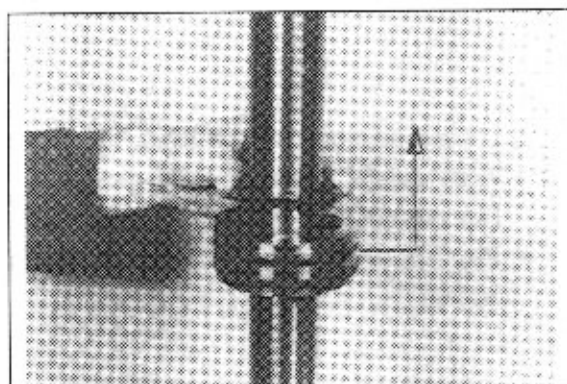
- (4) Remove both O-ring and the cylinder.



- (5) Squeeze out snap ring and remove washer.



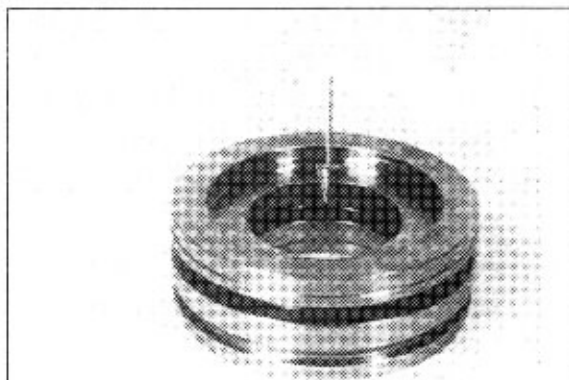
- (6) Remove split ring and pull (in direction of the arrow) the piston from the piston rod. Remove all sealing components of the piston.



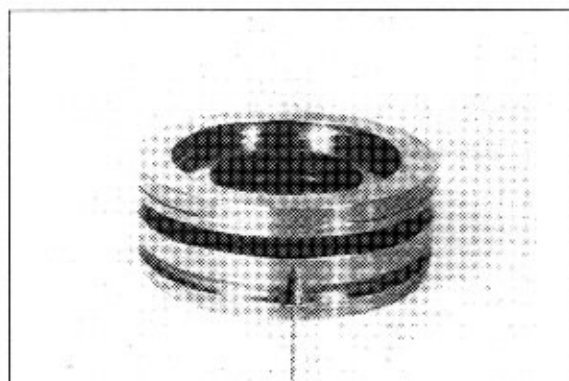
2) REASSEMBLY

(1) Piston

- ① Lay O-ring(7) into the annular groove of the piston, see arrow.



- ② Insert O-ring into the outer annular groove of the piston, see arrow.

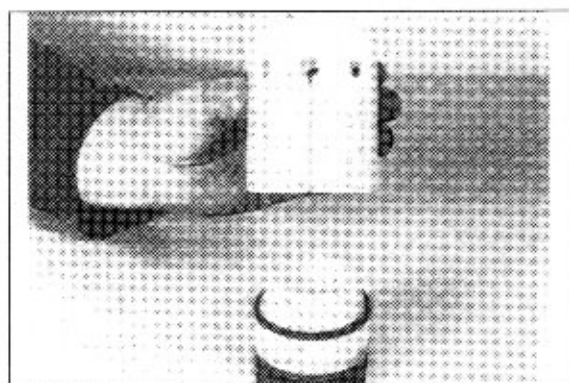


- ③ Heat turcon ring(11) in an oil bath(About 90°), replace installer and press on turcon ring by means of pressure sleeve until it is engaged in the annular groove of the piston.

※ Position of the components, see also draft(Figure ④).

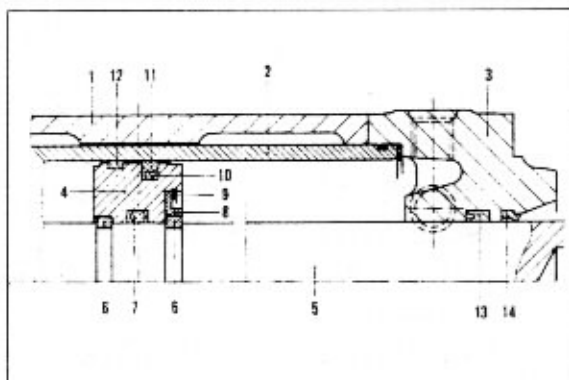
Installer 5870 651 045

Pressure pin 5870 651 046



④ Legend of draft

1	Housing	8	Circlip
2	Cylinder	9	Snap ring
3	Guide	10	O-ring
4	Piston	11	Turcon ring
5	Piston rod	12	Guide ring
6	Split ring	13	U section ring
7	O-ring	14	Scraper ring



- ⑤ Insert split ring and assembly ring into the recesses of the piston rod.

Guide preassembled piston over the piston rod firmly against shoulder.

- * Pay attention to the position of the components, see figure.

After the installation of the piston, the assembly ring will be removed again.

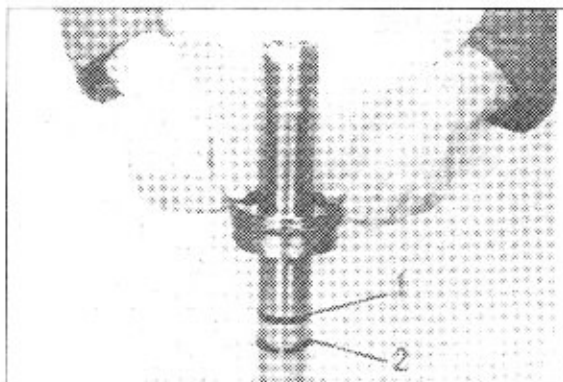
Use assembly grease.

1 Assembly ring

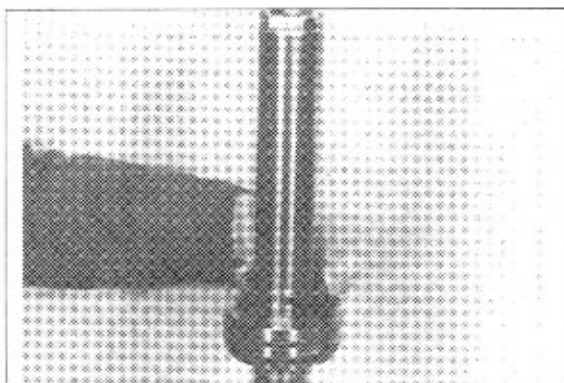
2 Split ring

Assembly ring

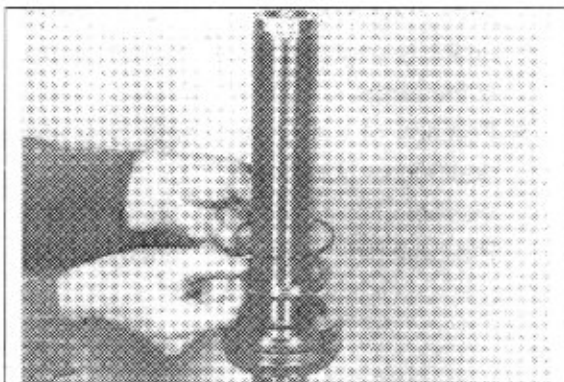
5870 506 077



- ⑥ Remove assembly ring and exchange it by the split ring.



- ⑦ Replace washer and fix it by means of snap ring.

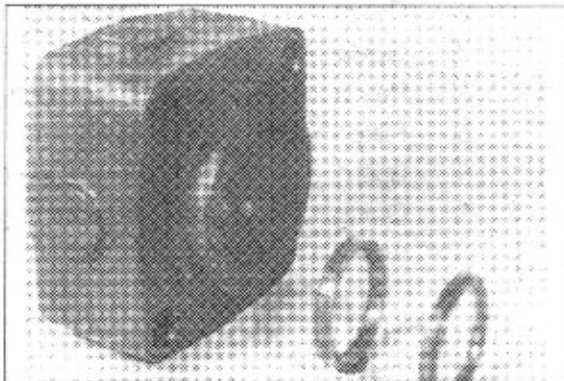


- ⑧ Install scraper ring and U section ring (See also draft ④ previous page).

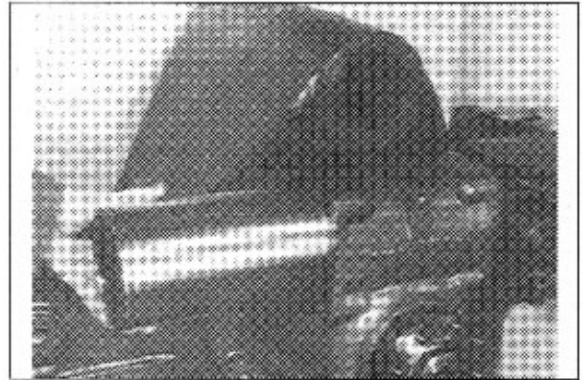
- * Sealing lip of U section ring is showing towards the pressure chamber.

Dust lip of scraper is showing towards the outside.

Preassemble 2nd guide in the same way.



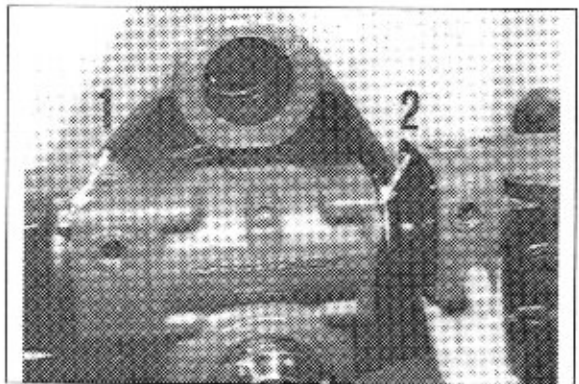
- ⑨ Introduce cylinder.



- ⑩ Fix cylinder provisionally by means of guide(Arrow 1).

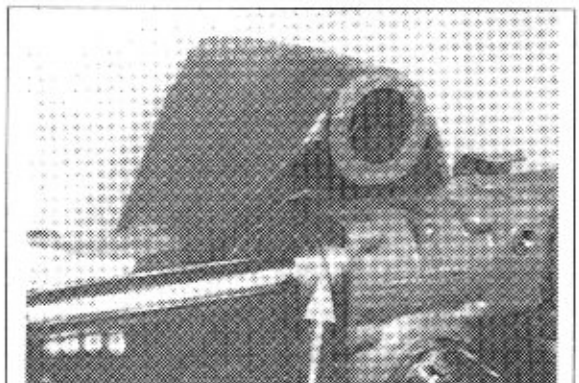
Insert O-ring into the annular groove (Arrow 2), place preassembled guide firmly against shoulder and fasten it by means of hexagon head screws.

- * Pay attention to the installation position.
• Torque limit : 30.6kgf · m(221.3lbf · ft)
Afterwards, remove guide(Arrow 1) again.



- ⑪ Make guide ring adhere with grease in the annular groove of the piston, see arrow.

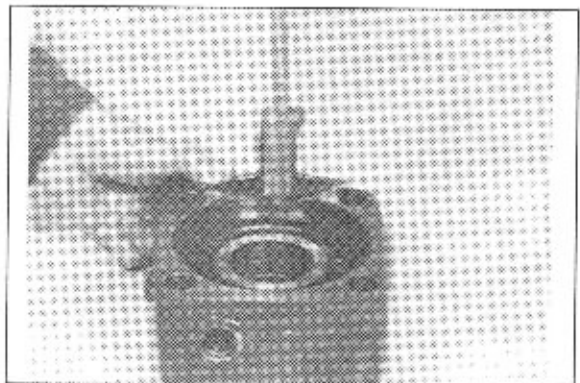
Introduce piston rod(Compl.) into the cylinder.



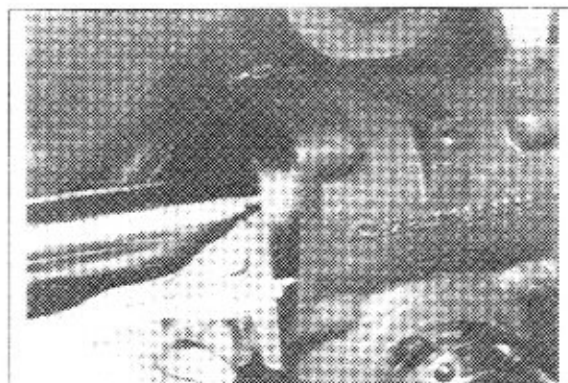
Determination of the shim

- ⑫ Measure dimension **A** from the flange facing to the contact face/cylinder.

- Dimension **A** e.g. 14.1mm



- ⑬ Slide cylinder in and firmly against shoulder. Determine dimension **B** from the end face/cylinder to the flange facing.
- Dimension **B** e.g. 12.6mm



Example

Dimension **A** 14.1mm

Dimension **B** - 12.6mm

Difference = Shim thickness $s = 1.50\text{mm}$

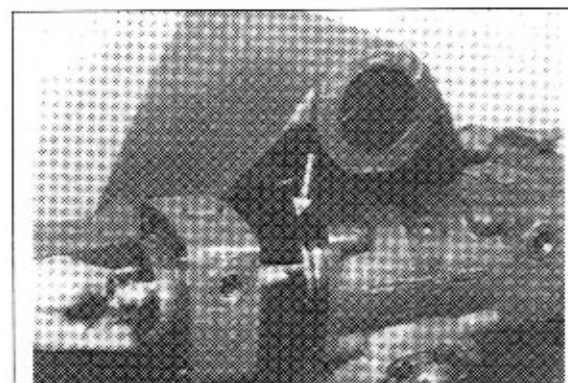
- ⑭ Cover determined shim(e.g. $s = 1.5\text{mm}$) with grease and make it adhere in the guide.



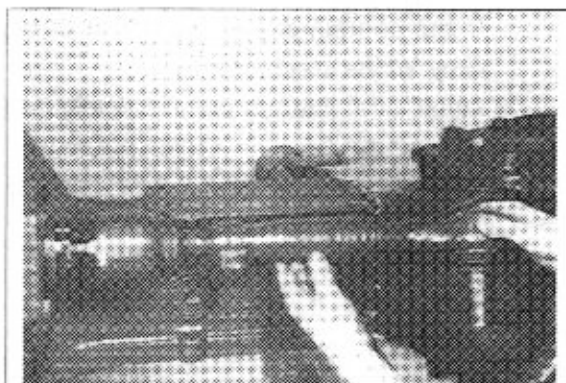
- ⑮ Lay O-ring into the annular groove of the cylinder, see arrow.
- Assemble guide and fasten it by means of hexagon head screw.

- Torque limit : $30.6\text{kgf} \cdot \text{m}$ ($221.3\text{lbf} \cdot \text{ft}$)

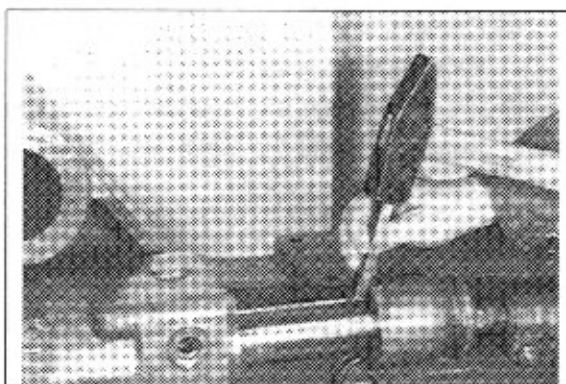
※ Pay attention to the installation position.



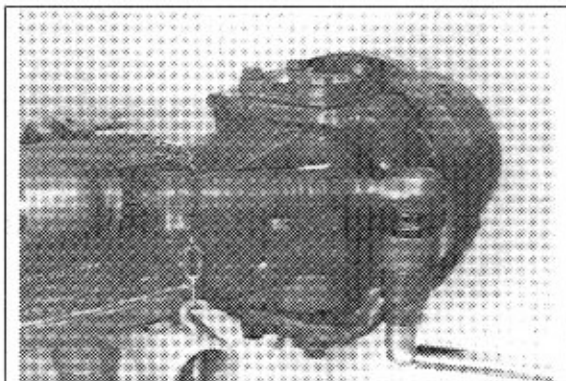
- ⑩ Fasten tie rod at the piston rod.
※ Cover tie rod (About 3 threads) with
loctite (No.242).
• Torque limit : 40.8kgf · m (295lbf · ft)



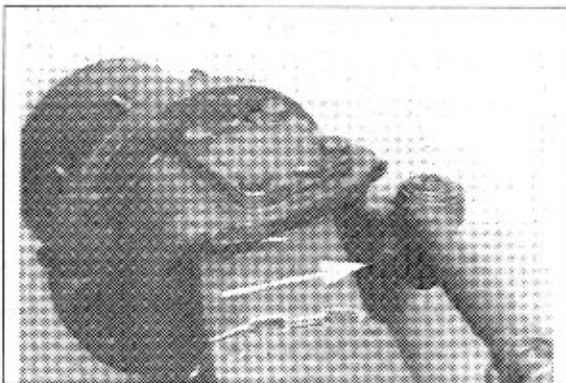
- ⑪ Secure tie rod by beading the collar.



- ⑫ Tighten castle nut and secure it by
means of cotter pin.
• Torque limit : 34.8~36.7kgf · m
(250.8~265.5lbf · ft)



- ⑬ Tighten stop screw, see arrow.



**Initial adjustment of the wheel track,
resp. of the steering lock**

- ②① Install straightedge symmetrically and horizontally.

Straightedges

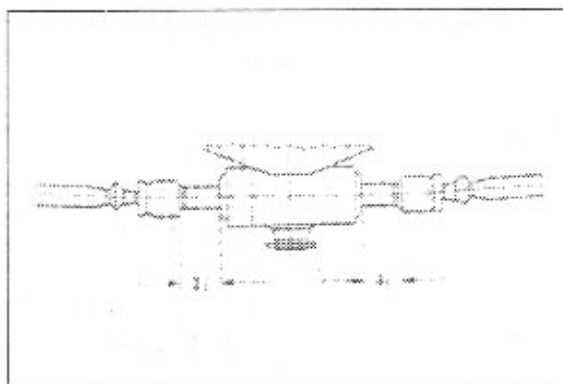
5870 200 029



- ②① Center piston rod, see figure.

Dimension $a_1 = a_2$

- ※ Do not change the axial position of the piston rod until the track adjustment is terminated.

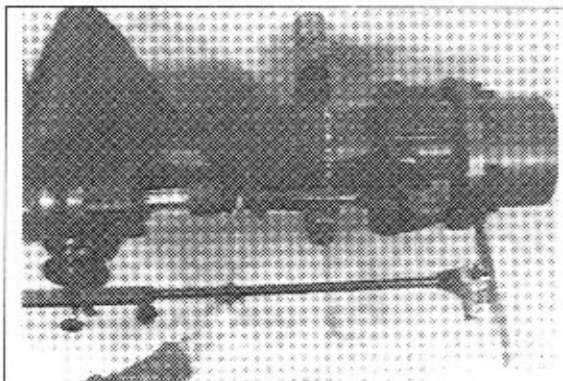


- ②② Displace the tie rod axially until 0° can be read on the measuring device (This is corresponding with a track adjustment of 0mm).

- ※ Carry out the adjustment on both sides.

Measuring device

5870 200 033



Fine adjustment of the wheel track

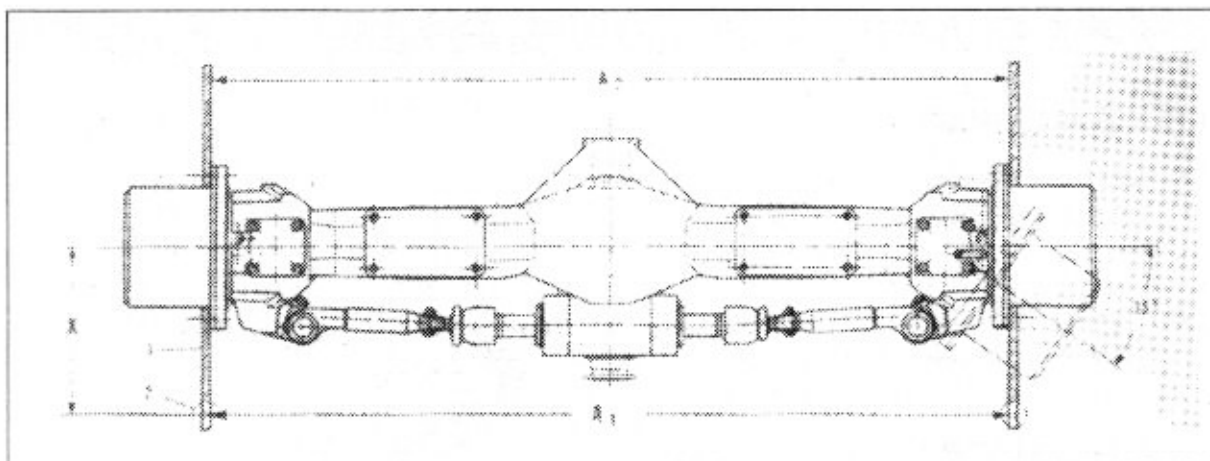
(See draft, page 8-249)

- ②③ Determine dimension **A1**, starting from the marking notches of the straightedges. Afterwards turn both wheel hubs for 180° and determine dimension **A2**.

Adjust the wheel track according to the instructions of the manufacturer by axial displacement to tie rods.

- ※ During the wheel track adjustment, the distance of the straightedges (Wheel track) must be modified equally on both tie rods.

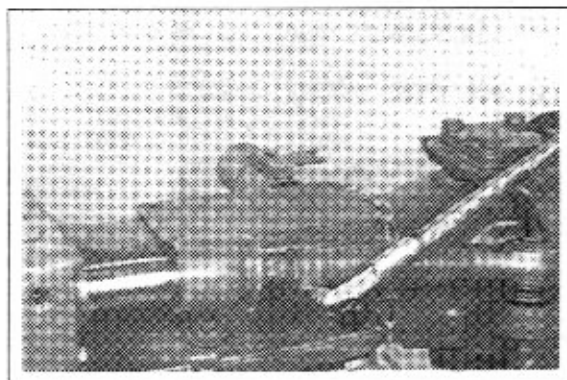
Dimension X (See draft) corresponds to the distance "Wheel center to wheel flange".



1 Straightedge

2 Marking notch

②④ Fix tie rod by means of clamp.



②⑤ Check steering assembly in both steering directions for tightness.

Test pressure : 150bar

HD hand pump compl.

5870 287 007

