GROUP 12 REAR AXLE

1. REMOVAL REAR AXLE

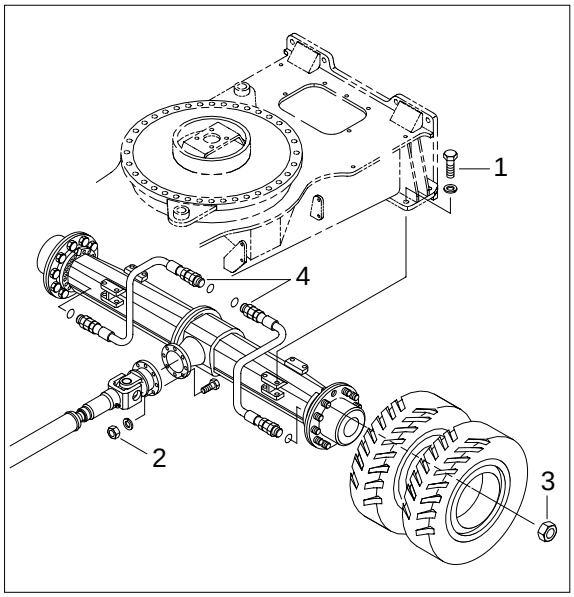
1) Rear axle mounting bolt(1, M20)
   · Tightening torque : 58 ±6.3(kgf · m)
   (420±45.6lbf · ft)

2) Propeller shaft mounting bolt(2, M10)
   · Tightening torque : 5.9 ±0.6kgf · m
   (42.7 ±4.3lbf · ft)

3) Wheel nut(3, M20)
   · Tightening torque : 50^{+0}_{-5} kgf · m
   (362^{0}_{-36} lbf · ft)

4) Hose assy(4, PF 1/4)
   · Tightening torque : 4kgf · m(28.9lbf · ft)

5) Axle weight : 350kg(770lb)



2. GENERAL INSTRUCTIONS

1) GENERAL WORKING INSTRUCTIONS

(1) This manual has been developed for the skilled serviceman, trained by the ZF-Passau.

(2) During all operations, pay attention to cleanliness and skilled working.
Therefore, axle removed from the machine, must be cleaned prior to open them.

(3) We assume that the special tools, specified by ZF, will be used.
The special tools are available from ZF-Passau.

(4) After the disassembly, all components must be cleansed, especially corners, cavities and recesses of housing and covers.

(5) The old sealing compound must be carefully removed.

(6) Check lubricating holes, grooves and pipes for free passage. They must be free of residues, foreign material or protective compounds.

(7) The latter refers especially to new parts.

(8) Parts which have been inevitably damaged in a disassembly operation, must be generally replaced by new ones, e.g. rotary seal rings, O-rings, U-section rings, cap boots, protective caps etc..

(9) Components such as roller bearings, thrust washers, synchronizing parts etc. which are subject to normal wear in automotive operation, must be checked by the skilled Serviceman.
He will decide if the parts can be reused.

(10) For the heating of bearings etc., hot plates, rod heaters or heating furnaces must be used.

(11) Never heat parts directly with the flame. An auxiliary solution would be to immerse the bearing in a vessel filled with oil, which is then heated with the flame.
In this way, damage to the bearings could be avoided.

(12) Ball bearings, covers, flanges and parts like that must be heated to about 90 to 100℃.

(13) Hot-mounted parts must be reset after cooling in order to assure a proper contact.

(14) Before pressing shafts, bearings etc. in position, both parts must be lubricated.

(15) During to reassembly, all specified adjustment values, testing specifications and tightening torque must be respected.

(16) After the repair, units are filled up with oil.

(17) After the oil filling, the oil level plugs and oil drain plugs must be tightened to the specified tightening torque.

2) IMPORTANT INSTRUCTIONS CONCERNING THE LABOUR SAFETY

(1) In principle, repairers are themselves responsible for the labour safety.

(2) The observance of all valid safety regulations and legal rules is a precondition to prevent damage to individuals and products during the maintenance and repair operations.

(3) Before starting the work, the repairers have to make themselves familiar with these regulations.

(4) The proper repair of these products requires especially trained personnel.

(5) The repairer himself is obliged to provide for the training.

3) LUBRICANT AND MAINTENANCE SPECIFICATIONS

(1) Lubricant

① Gear oils with limited - slip additives.
② API GL-5
③ MIL-L-2105D(SAE 85W-90, 85W-140 with LS-Additive)

(2) Maintenance

① Oil change interval
- 1st : 500hr
- Every 1000hr or at least once a year.

② Grease
-Monthly

4) BRAKE LINING WEARING TEST

(1) General

① The brake lining wearing test gives a limited information about the overall condition of the brake plate pack - without disassembly of the planetary carrier, resp. of the plates.

② The wearing test has to be carried out in case of the following criteria :
- In the course of the oil change intervals(Min. once a year)
- Braking noises
- Reduced braking power
- Change of deceleration, of the brake fluid level as well as of the brake pressure
- In case of a general change of the brake performance.

③ Carry out the wearing test on both final drive sides.
- Permitted piston stroke max. : 5.0mm
- Piston stroke in new condition of the plate pack : 3.1-3.5mm

(2) Carry out the wearing test

① Turn the planetary carrier until screw plug A(M16 × 1.5) is in the upper position(12 o'clock position).
Now, remove the screw plug.

② Apply the brake(Required brake pressure min. 40bar).

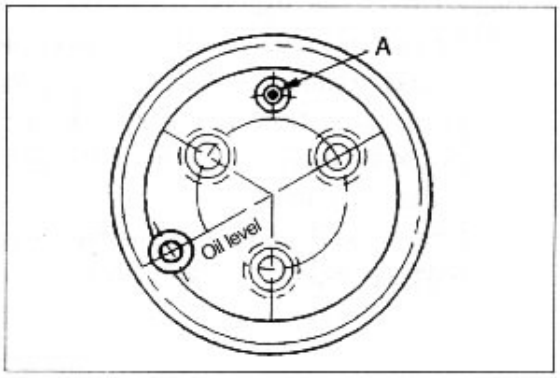
③ Screw measuring screw(M16 × 1.5) in until contact is obtained and tighten it with a torque of 1kgf · m.

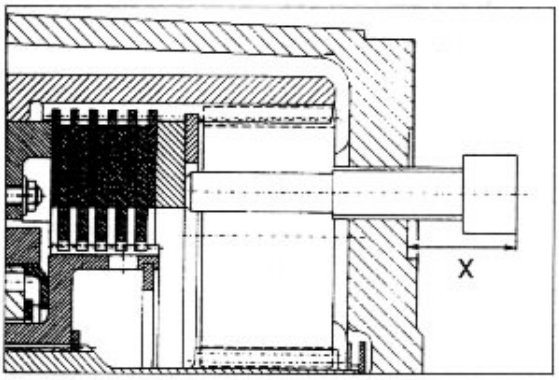
④ Determine dimension X according to the figure on the right.

⑤ Release the brake and equalize the plate clearance by resetting the measuring screw.
· Tightening torque : 1kgf · m.

⑥ Determine dimension Y according to the figure on the right.

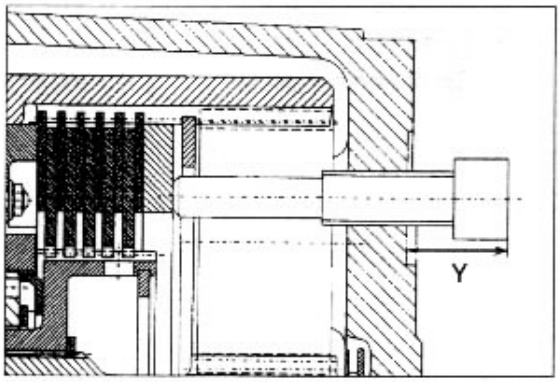
⑦ The difference of the two dimensions (X-Y) corresponds to the piston stroke (Actual state).





(3) Result

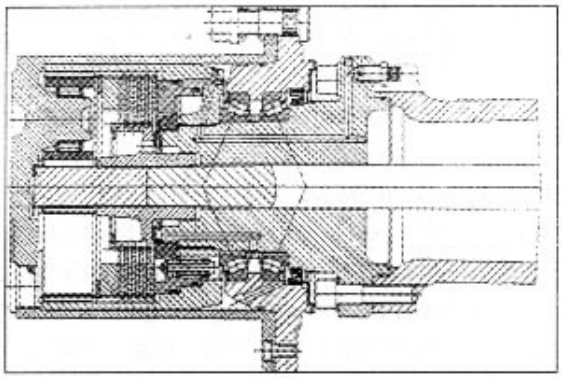
If the max. permitted piston stroke(5.0mm) is exceeded, the lining plates must be renewed on both final drive sides.



3. OUTPUT DISASSEMBLY AND ASSEMBLY(With multi disk brake)

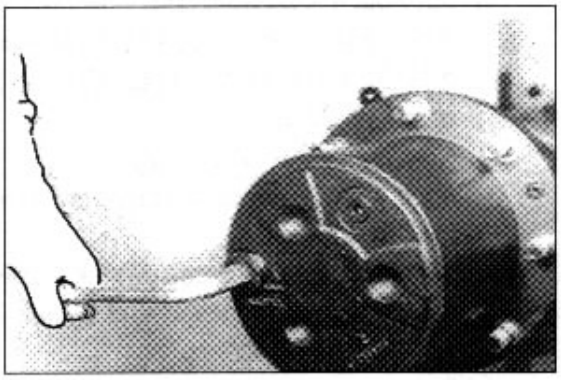
1) DISASSEMBLY

(1) See draft on the right.

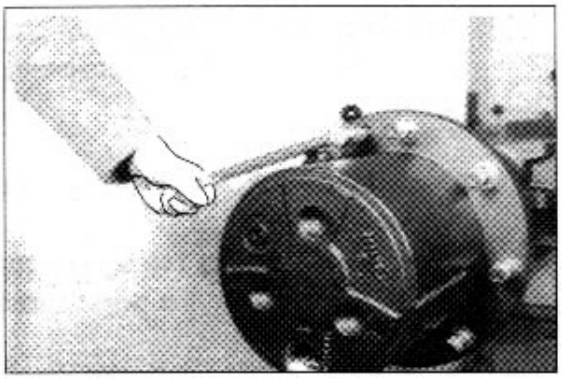


(2) Loosen screw plug and drain oil.

※ To prevent and injury by a possible pressure build-up in the oil supply of the planet carrier, bring filler, resp. level check plug in the uppermost position(12-o'clock) and screw it carefully out.
Now, bring drain hole in the lowermost position(6-o'clock) and drain the oil.

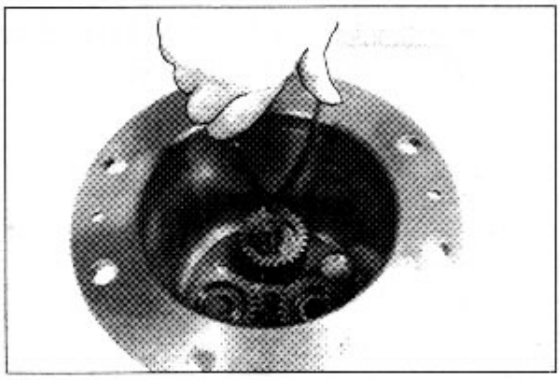


(3) Loosen socket head screws and pull planet carrier from the hub.



(4) Squeeze circlip out.

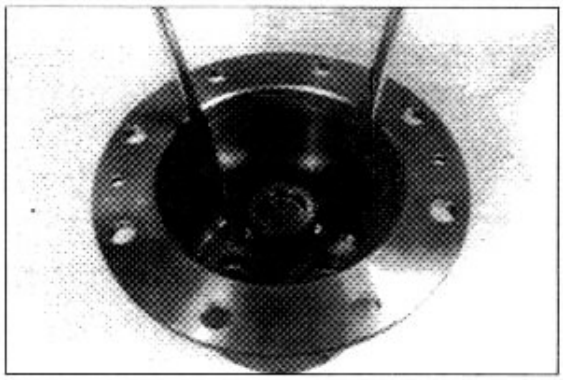
※ Special tool
Set of external pliers 5870 900 015



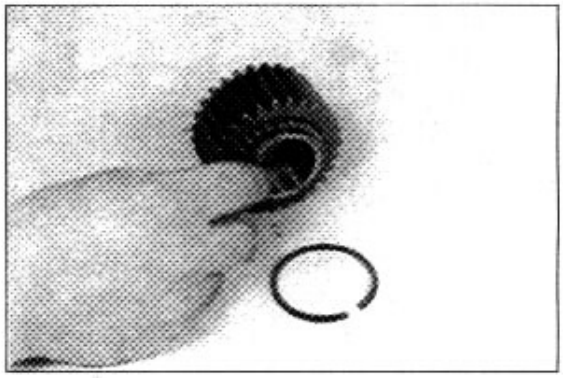
(5) Pry off planetary gear.

※ Special tool

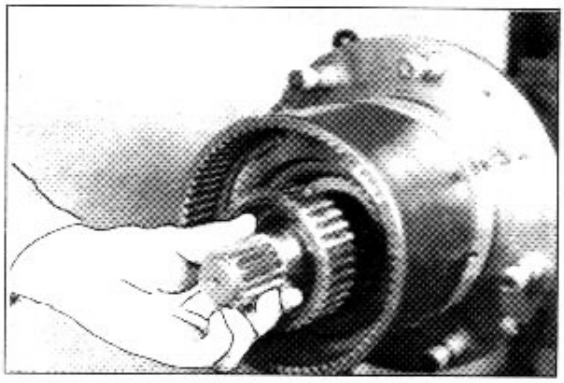
Crow bar 5870 345 071



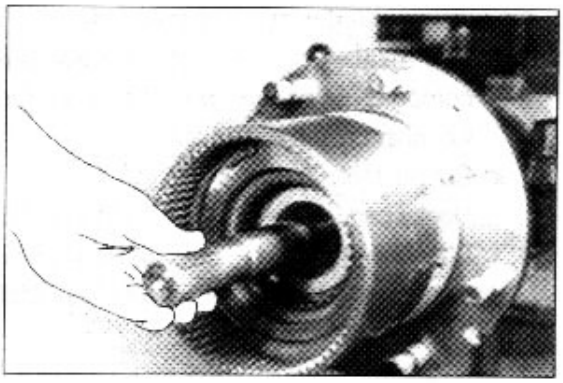
(6) Squeeze angle rings out and pull the roller bearing out of the planetary gear.



(7) Pull sun gear and plate carrier from the stub shaft, resp. out of the plate pack. Remove released thrust washer.



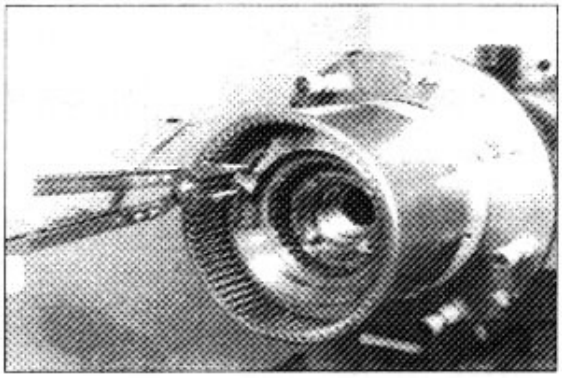
(8) Pull stub shaft out of the axle casing.



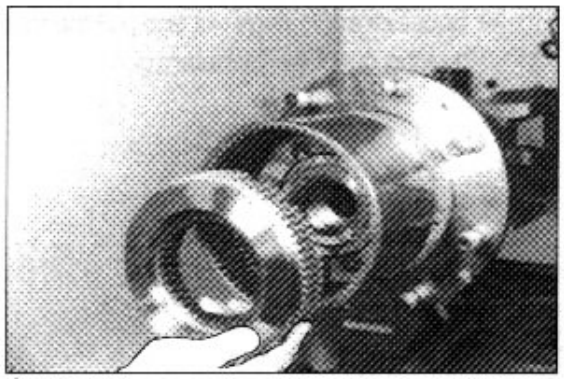
(9) Squeeze circlip out.

※ Special tool

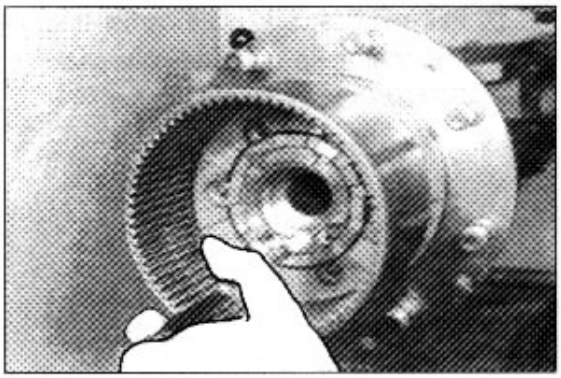
Clamping pliers	5870 900 021



(10) Pull end shim and plate pack out of the internal gear.



(11) Squeeze circlip out.

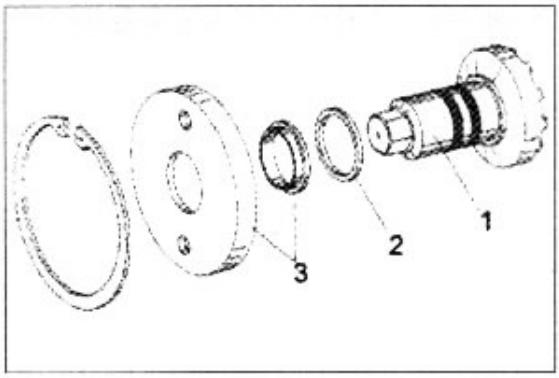


Loosen slotted nut (Figure (12)~(14))

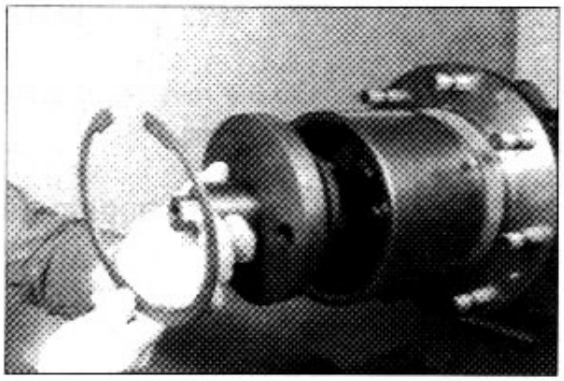
(12) The draft on the right shows the components of the special tool for the loosening of the slotted nut.

※ Special tool

Hook spanner	5870 401 085
Spacer ring	5870 912 017
Centering disk compl.	5870 912 009



(13) Position hook spanner(compl.) and fix it by means of circlip.

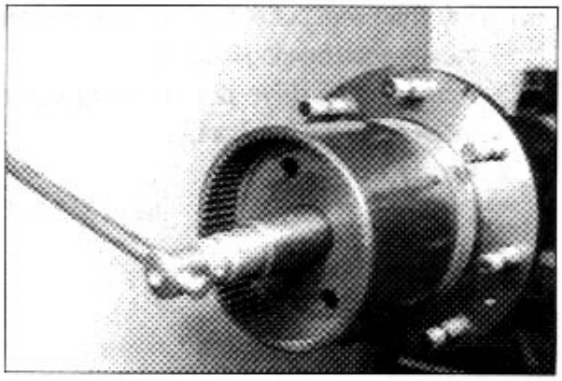


(14) Loosen slotted nut.

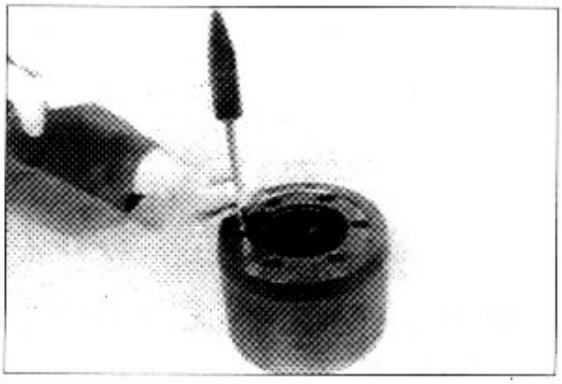
※ Pay attention to the released internal gear. By the supporting of the hook spanner on the circlip, the internal gear will be pulled off from the hub carrier at the unscrewing of the slotted nut.

※ Due to the high tightening torque of the slotted nut(153kgf · m), a supporting of the axle, resp. of the assembly car at the loosening of the slotted nut, is absolutely necessary.

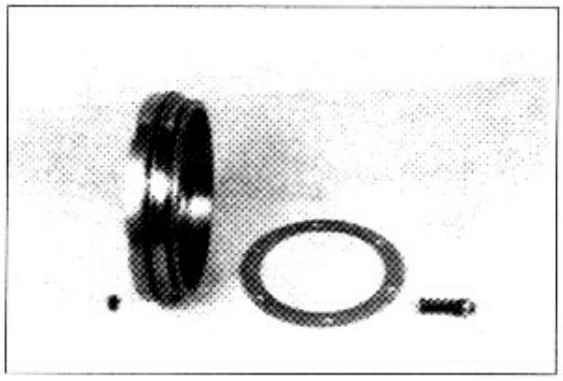
Now, remove slotted nut, angle ring and O-ring.



(15) Drive piston evenly out of the cylinder bore.



(16) Loosen lock nuts as well as socket head screws and remove released components.

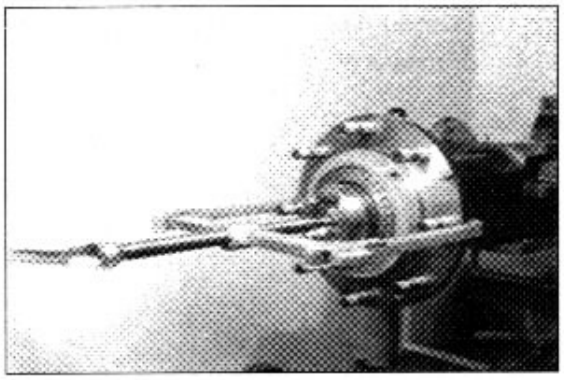


(17) Pull hub from hub carrier, using two-leg puller.

※ Pay attention to the released bearing inner race and spacer ring.

※ Special tool

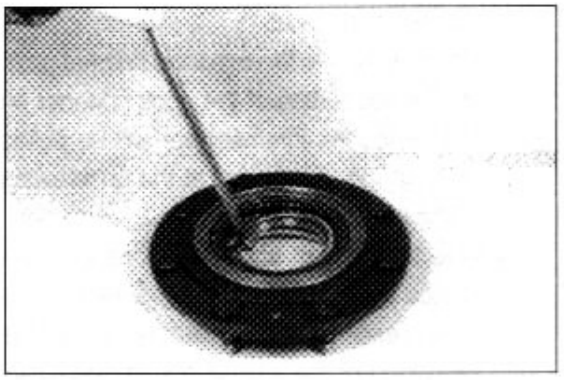
Two leg puller	5870 970 006



(18) Pry shaft seal out of the hub and remove the released bearing inner race.
If necessary, drive both bearing outer races out of the hub bores.

※ Special tool

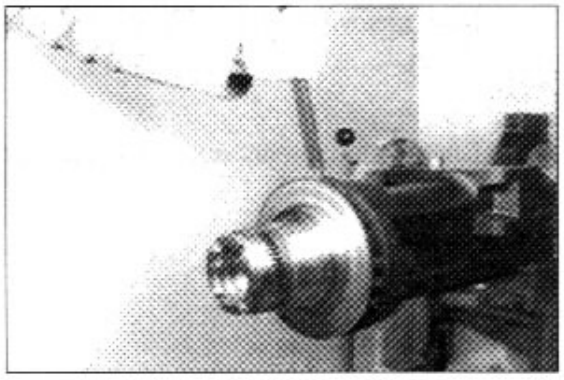
Crow bar	5870 345 071



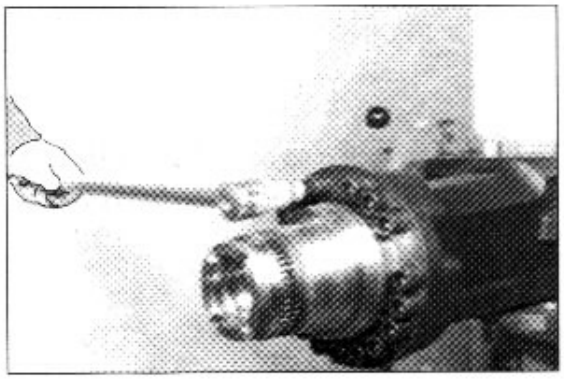
(19) Pry off support plate from hub carrier.

※ Special tool

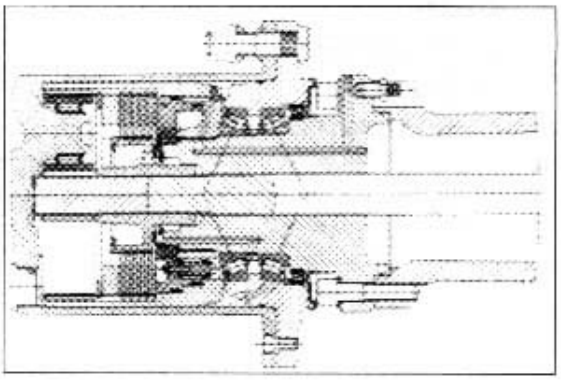
Pry bar	5870 345 065



(20) Loosen socket head screws and separate hub carrier from axle.

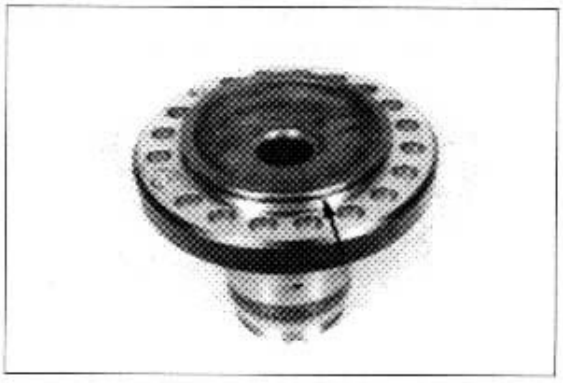


2) REASSEMBLY(With multi-disk brake)
See draft on the right.



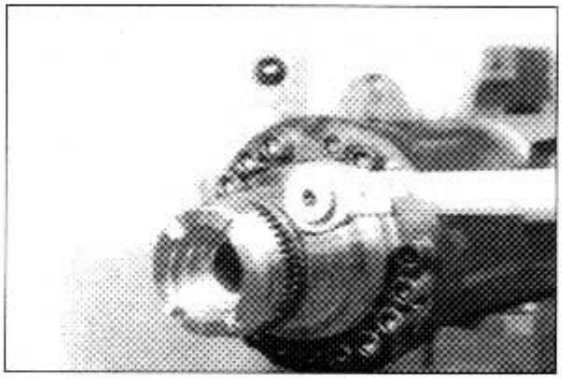
(1) Hub carrier

① Insert O-ring(See arrow) into the annular groove and grease it.



② Fasten hub carrier on axle casing, using socket head screws and disks.
· Tightening torque(M16/10.9)
28.6kgf · m(207lbf · ft)

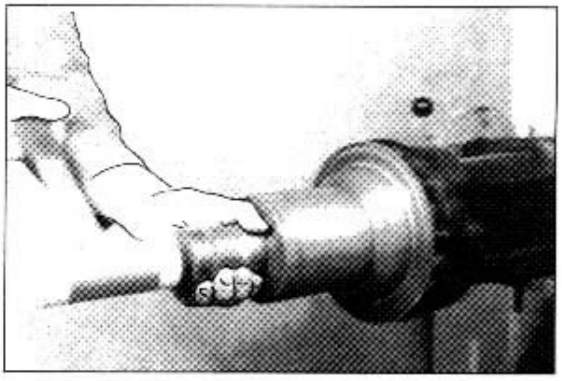
※ Special tool
Adjusting screws 5870 204 023



③ Mount support plate.

※ At application of the prescribed driver, the exact installation position of the support plate is obtained.

※ Special tool
Driver 5870 048 101



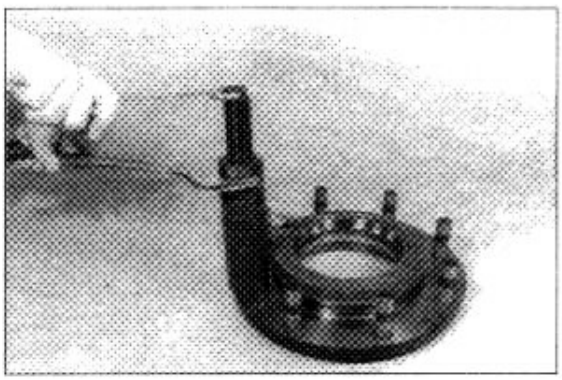
(2) Hub

① Mount wheel studs.

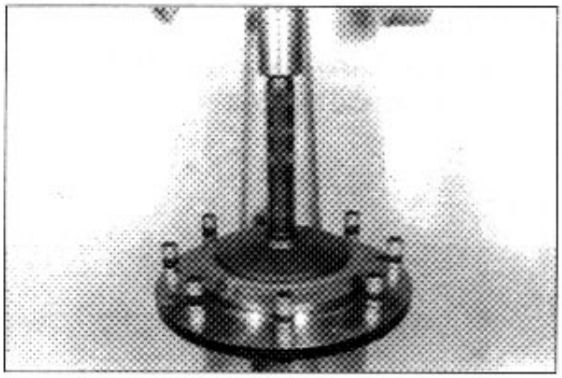
※ Special tool

Wheel stud puller basic tool 5870 610 001

Insert M20×1.5 5870 610 003

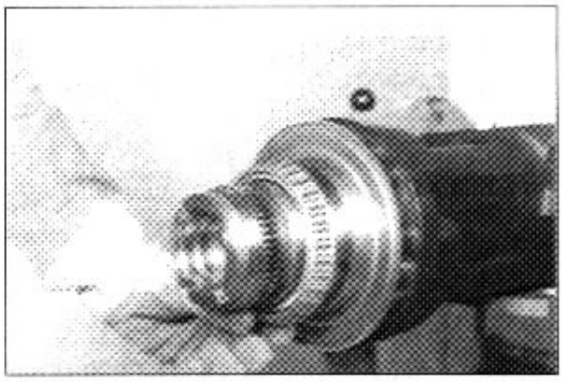


② Press both bearing outer races into the hub until contact is obtained.



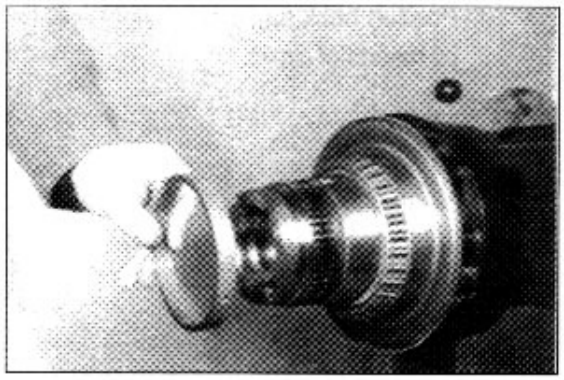
③ Adjust rolling moment of the wheel bearing 0.8~1.2kgf · m(Figure ④ ~ ⑪).

④ Heat bearing inner race and line it up until contact is obtained.



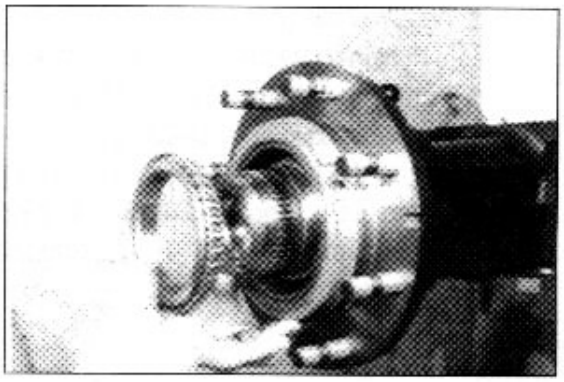
⑤ Line up adjusting ring e.g. 14.48mm (Empirical value) until contact on the bearing inner race is obtained.

※ If the hub as well as both wheel bearings have not been renewed, we recommend to install the actual spacer ring again. Decisive however is the rolling moment of the wheel bearing(Figure ⑪ / Page 8-274).

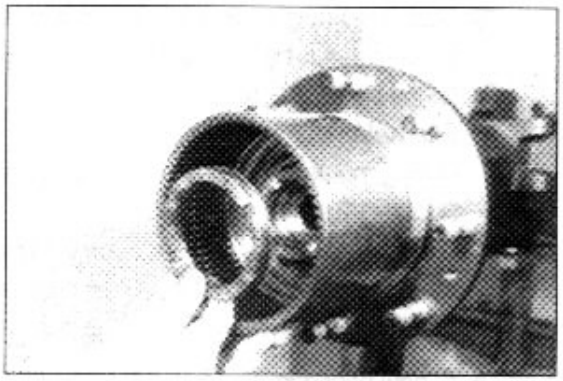


⑥ Line up hub(Without shaft seal) and fix it by means of heated bearing inner race.

※ The installation of the shaft seal will be carried out after the adjustment of the wheel bearing.



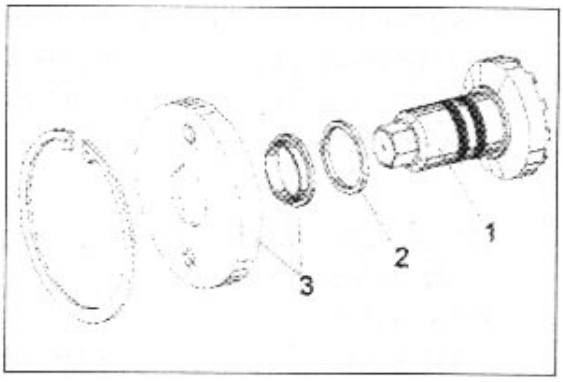
⑦ Line up internal gear, cover thread of slotted nut with lubricant(Molykote 1000) and screw it on by hand.



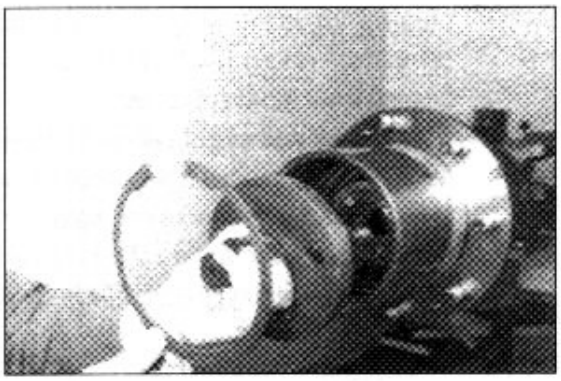
⑧ Tighten slotted nut(Figure ⑧ ~ ⑩):
The draft on the right shows the component of the special tool for the tightening of the slotted nut.

※ Special tool

1	Hook spanner	5870 401 085
2	Spacer ring	5870 912 017
3	Centering disk compl.	5870 912 009



⑨ Position hook spanner(Compl.) and fix it by means of circlip.

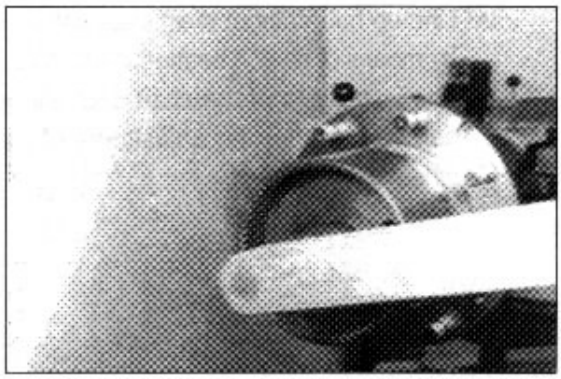


⑩ Tighten slotted nut.

· Tightening torque 158±51kgf · m

※ During the tightening, rotate the hub several times in both directions.

※ Due to the high tightening torque of the slotted nut, a supporting of the axle, resp. the assembly car, is absolutely necessary.



⑪ Check rolling moment of the wheel bearing, resp. traction force by means of spring scale.

Example:

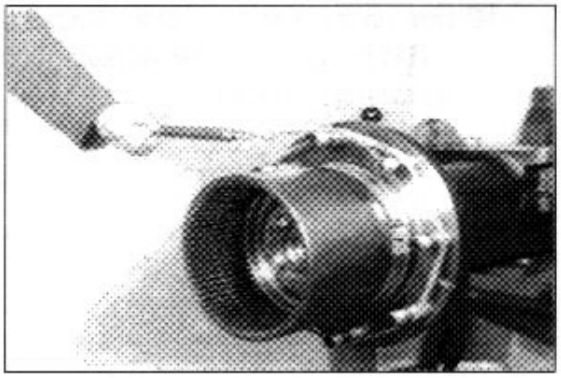
Rolling moment T 0.8~1.2kgf · m

Radius(1/2 ø Hub e.g. 145.5mm)

r = 0.147m

Traction force F min = T/r 5.5kgf · m

Traction force F max = T/r 8.4kgf · m



※ At new bearings, aim at the upper value. At deviations from the required rolling moment, correct again with corresponding adjusting ring(Figure ⑤ /Page 8-273) repeat adjustment operation(Figure ④ ~ ⑪).

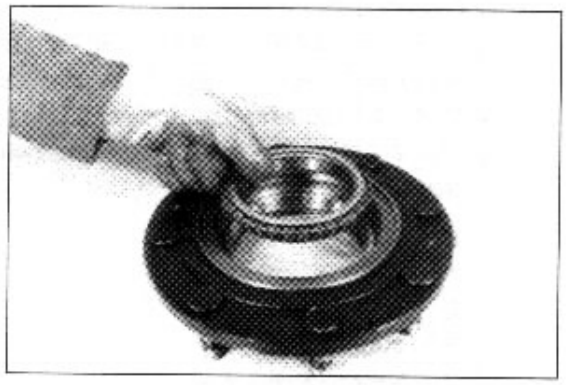
⑫ Now, loosen slotted nut again, remove internal gear and hub.

※ Special tool

Spring scale 5870 230 006

⑬ Heat bearing inner race and insert it into the hub.

※ To prevent the cooling down of the bearing inner race, the installation of the shaft seal as well as the lining up of the hub(Figure ⑭, ⑮) must be carried out immediately after the heated bearing inner race has been inserted.

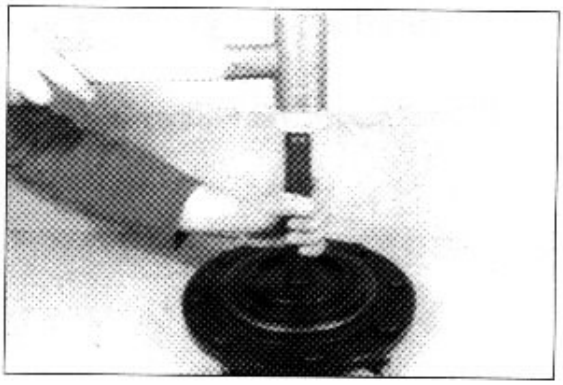


⑭ Install shaft seal.

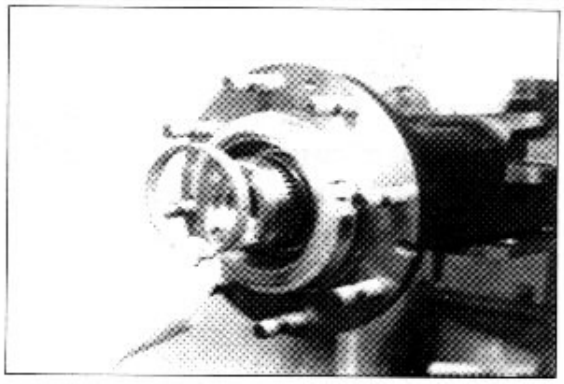
※ Wet outer diameter with sealing compound loctite(Type No. 574).
At application of the prescribed driver, the exact installation position of the shaft seal is obtained.

※ Special tool

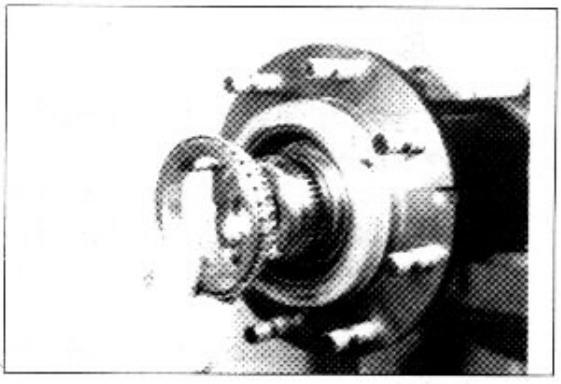
Driver	5870 051 022
Handle	5870 260 004



⑮ Line up the hub until contact is obtained and install the determined adjusting ring.



⑯ Heat bearing inner race and line it up until contact is obtained.



(3) Internal gear

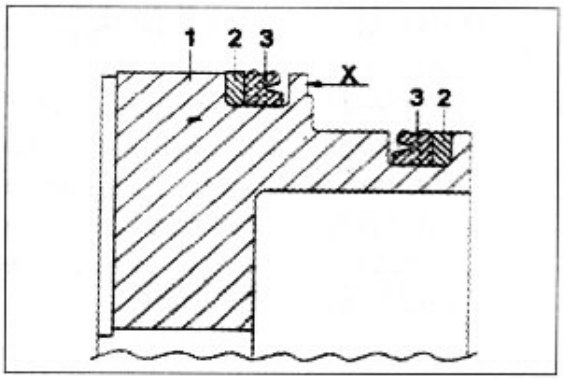
① Heat both supporting rings in an oil bath and insert them into the piston grooves, install subsequently grooved rings.

※ Pay attention to the installation position, see draft.

Ref. draft:

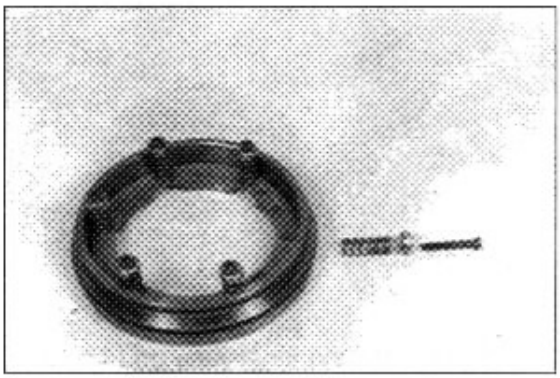
1 Piston
2 Supporting rings
3 Grooved rings
X Pressure chamber

After the cooling down, oil supporting rings and grooved rings(Use W-10 oil).



② Insert support shim into the piston

③ Fix the support shim provisionally by means of compression springs, spring sleeves and socket head screws.



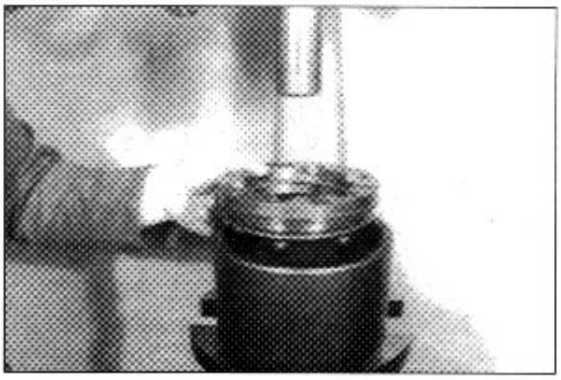
④ Introduce piston carefully and press it against shoulder.

※ To prevent the shearing off, resp. the canting of the grooved rings, install the piston with utmost care(By means of hand press).

※ Pay attention to the radial installation position.

※ Special tool

Installer 5870 347 013

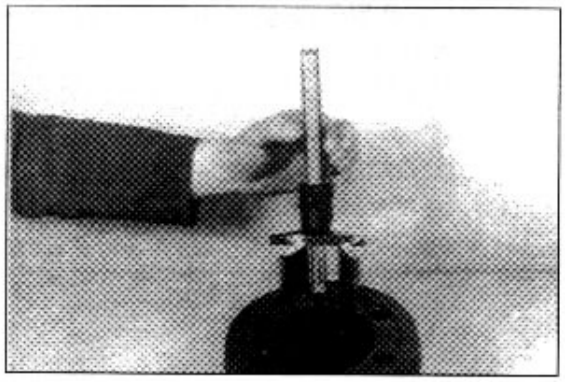


⑤ Adjust dimension **X** = 3.75~4.25 by means of socket head screws, see also the following draft.

※ Pay attention to the exact contact of the piston in the internal gear.

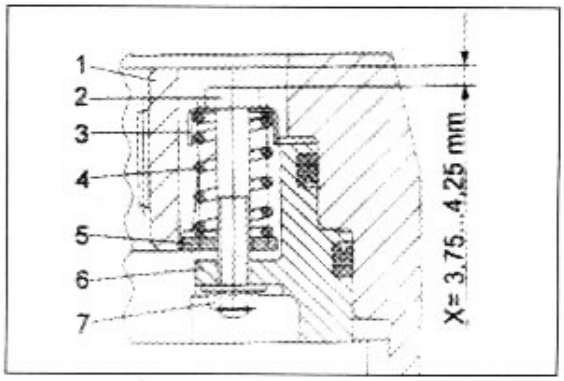
※ Special tool

Gauge blocks	5870 200 066
Digital depth gauge	5870 200 072



⑥ Ref. draft:

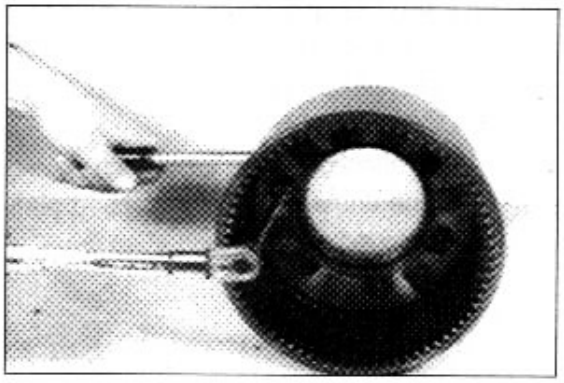
1 Internal gear
2 Socket head screw
3 Spring sleeve
4 Compression spring
5 Support shim
6 Piston
7 Lock nut



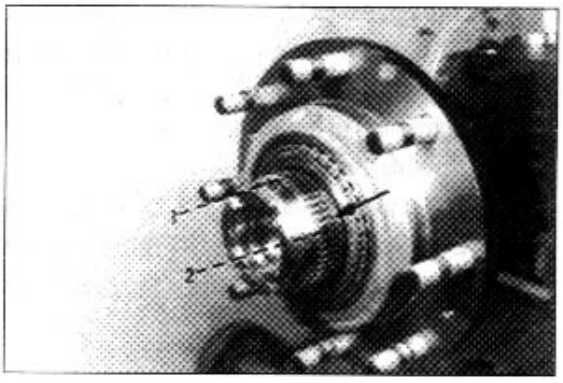
⑦ Secure socket head screws by means of lock nuts.

· Tightening torque 1.1kgf · m

※ Wet thread of lock nuts with loctite(Type No. 243). Only use of new lock nut permitted.

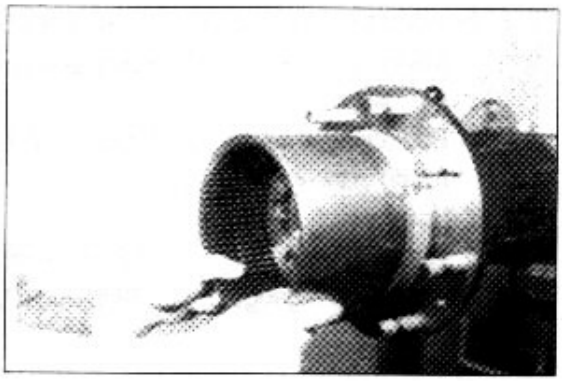


⑧ Insert O-ring(See arrow) into the annular groove of the hub carrier and oil it.



⑨ Guide internal gear over the hub carrier splines.

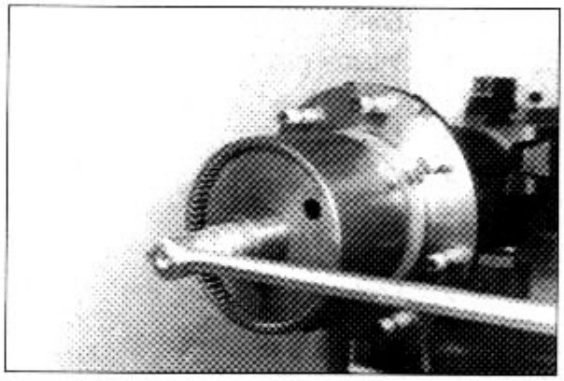
※ Pay attention to the radial installation position-the exact overlapping of the two oil ducts(Hub carrier/internal gear) must be absolutely ensured.
Position of the oil ducts 1 and 2 on the hub carrier, see figure ⑧.



⑩ Pull internal gear at the moment up to the shoulder, using slotted nut.
Now, remove slotted nut again.

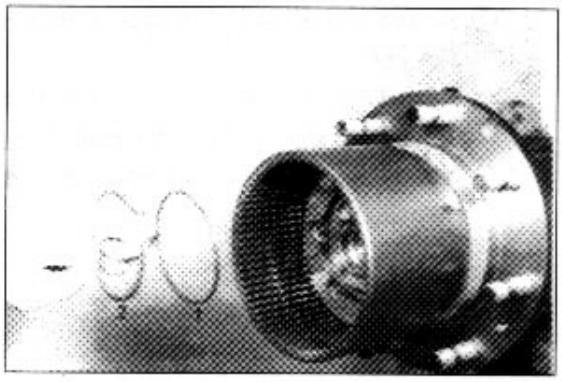
※ Special tool

Hook spanner	5870 401 085
Centering ring	5870 912 017
Centering disk	5870 912 009



⑪ Insert O-ring(1) evenly into the gap of hub carrier and internal gear.
Install subsequently angle ring(2).

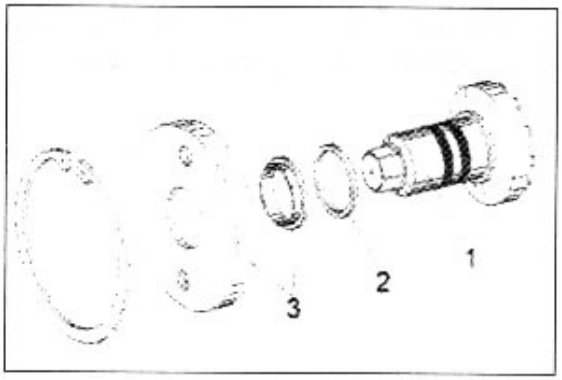
※ Oil O-ring and angle ring.
Pay attention to the installation position of the angle ring install stepped plane face facing the O-ring.



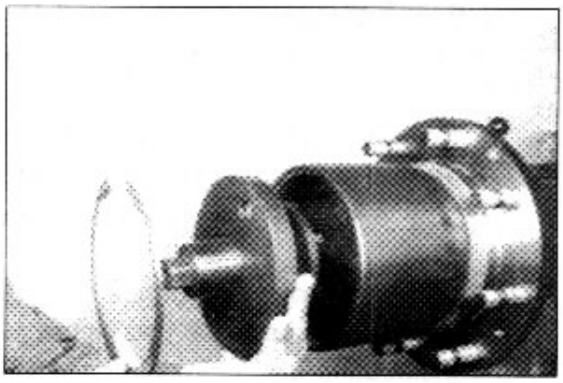
⑫ Tighten slotted nut(Figure ⑫ ~ ⑭).
The draft on the right shows the components of the special tool for the tightening of the slotted nut.

※ Special tool

1	Hook spanner	5870 401 085
2	Spacer ring	5870 912 017
3	Centering disk compl.	5870 912 009



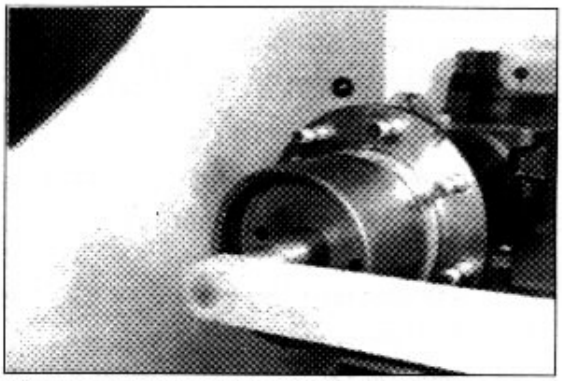
⑬ Cover thread of slotted nut with lubricant (Molykote 1000) and screw it on by hand.
Position hook spanner and locate it by means of circlip.



⑭ At the moment, tighten slotted nut to 158kgf · m.

※ During the tightening, rotate hub several times in both directions.

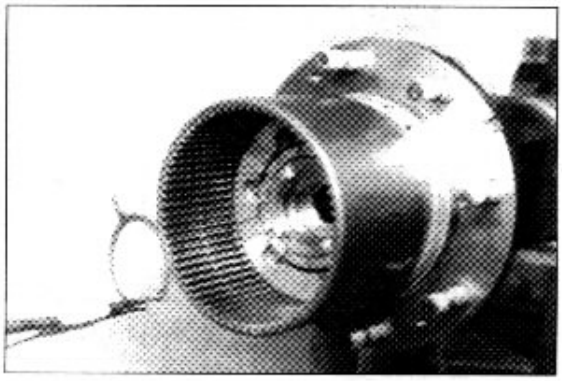
※ Due to the high tightening torque of the slotted nut, a supporting of the axle, resp. the assembly car, is absolutely necessary.

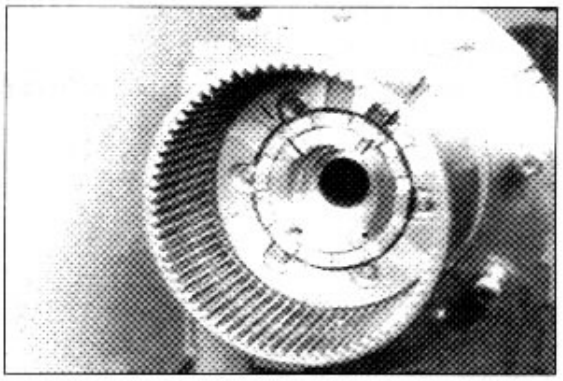


⑮ Fix slotted nut by means of circlip.

※ The securing of the slotted nut is only on one of the two upper grooves permitted, see below figure.
If necessary, increase the tightening torque of the slotted nut within the permitted tolerance range.
· Tightening torque 158±51kgf · m

※ Special tool
Set of pliers 5870 900 013





(4) Multi disk brake

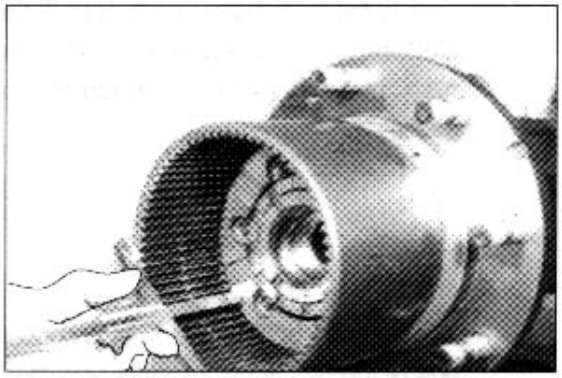
① Version with 4 lined plates and 5 outer plates.
Required piston stroke 2.5~2.9mm.

※ The following piston stroke adjustment is only valid for the installation of new plates.

※ We know from experience that the required piston stroke is obtained by the installation of 5 outer plates with a thickness of s=2.5mm.
However, the measuring of the piston stroke is still necessary, to ensure a correct function of the multi disk brake.

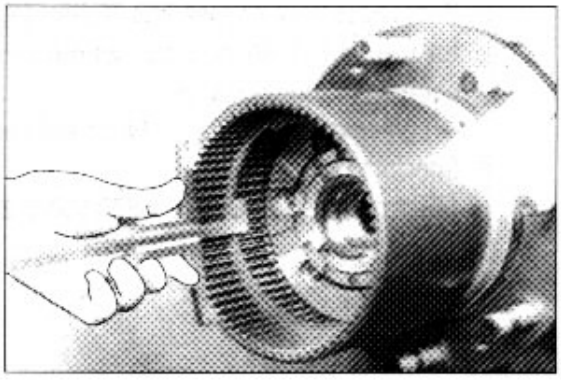
② Determine dimension Ⅰ from the thrust face of the internal gear to the contact face of the piston.
· Dimension Ⅰ e.g. 90.6mm

※ Special tool
Depth gauge 5870 200 086



③ Squeeze circlip in and position it on the outer face of the recess until contact is obtained.
Measure dimension Ⅱ from the thrust face of the internal gear to the inside face of the circlip.
· Dimension Ⅱ e.g. 46.5mm
Now, squeeze circlip out again.

※ Special tool
Depth gauge 5870 200 086



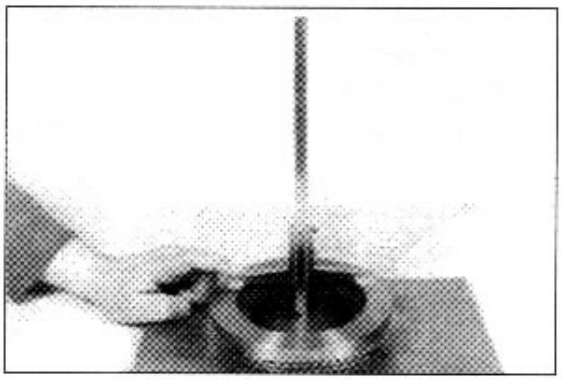
④ Determine dimension Ⅲ, total height of the plate pack along with end shim.

· 5 Outer plate	s = 2.5mm	12.5mm
· 4 Inner plates	s = 3.6mm	14.4mm
· 1 End shim	s = 14.5mm	14.5mm
Gives the total height, resp. dimension Ⅲ		41.4mm

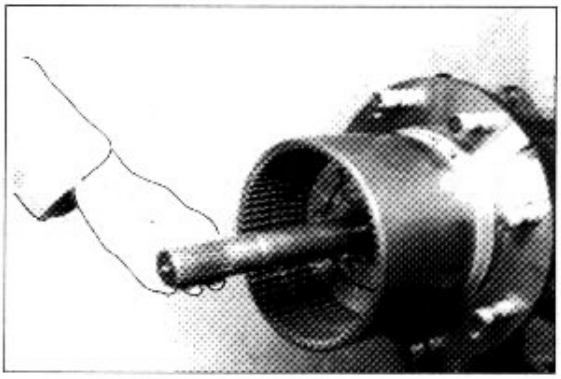
Example

Dimension Ⅰ	90.6mm
Dimension Ⅱ	- 46.5mm
	44.1mm
Dimension Ⅲ	- 41.4mm
Difference=Piston stroke	2.7mm

※ At deviations from the required piston stroke, correct with corresponding outer plate(s = 2.0 or s = 3.0mm)



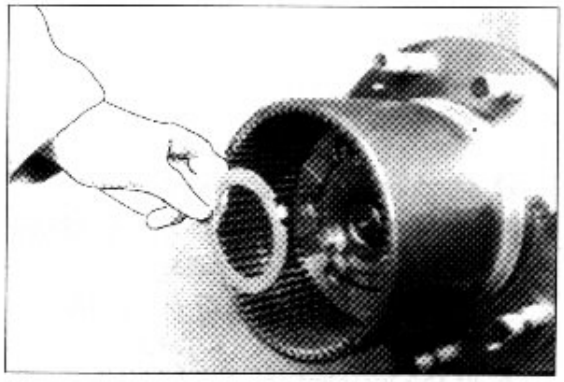
⑤ Introduce stub shaft into the axle casing until the splines are accommodated in the differential.



⑥ Install thrust washer.

※ To ensure the exact contact, both tongues of the thrust washer must be brought to overlap with the free grooves of the hub carrier.

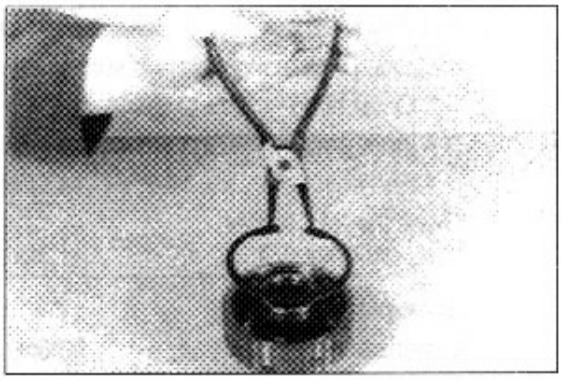
Grease contact face.



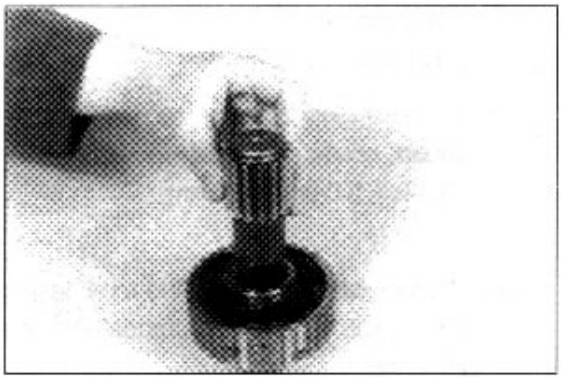
⑦ Squeeze circlip into the groove of the plate carrier.

※ Special tool

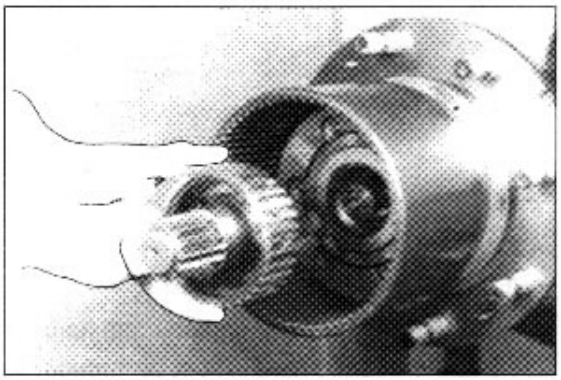
Set of pliers 5870 900 013



⑧ Introduce sun gear into the plate carrier until contact is obtained.



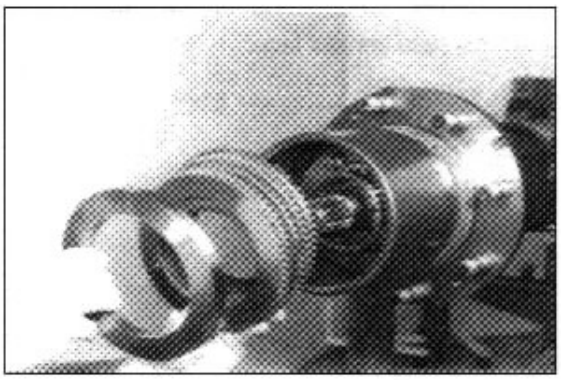
⑨ Line up the pre-assembled plate carrier upon the stub shaft until contact is obtained.



⑩ Introduce plate pack and end shim.

※ Install alternately outer and inner plates, starting with one outer plate.
Oil plates according to ZF-list of lubricants TE-ML 05.

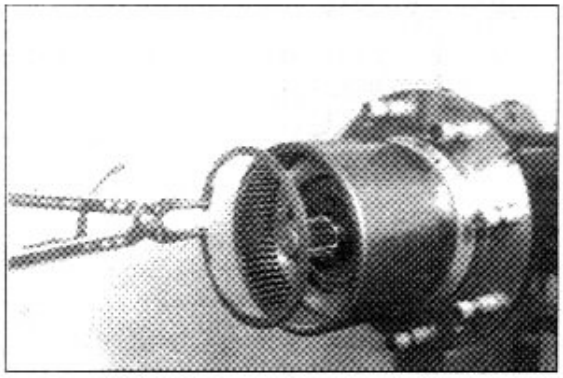
※ At the installation of outer plates with different thicknesses, the thinner outer plates must be principally installed on the piston side and/or on the end shim side.



⑪ Fix plate pack by means of circlip.

※ Special tool

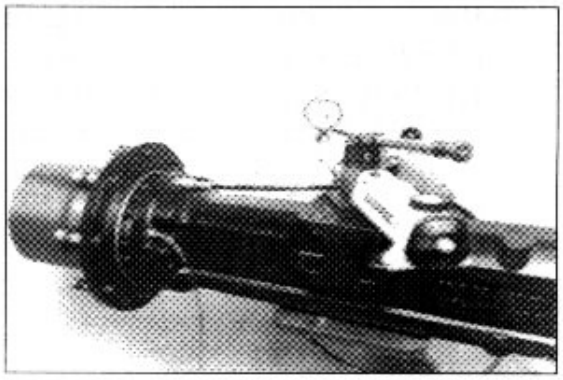
Clamping pliers 5870 900 021



Check leak tightness of the brake hydraulic system

⑫ Mount pressure connection and bleeder.

※ Prior to start the test, bleed the brake hydraulic system and actuate it subsequently several times(At least 10 times).



High pressure test:

Build up test pressure p = 120bar and close connection to the HP=pump by means of shut-off valve.

During a test period of 5 minutes, a pressure drop of max. 2%(p = 117bar) is permitted.

Low pressure test:

Reduce test pressure to p = 5bar and close shut-off valve again.

At a test period of 5 minutes, a pressure drop is not permitted.

Test dedia:

Motor oil SAE 10-W corresponds to:
MIL-L 2104 C, MIL-L 46152,
API-CC, CD, SC, SD, SE,
ATF-Oils type A, Suffic A dexron of Ⅱ D.

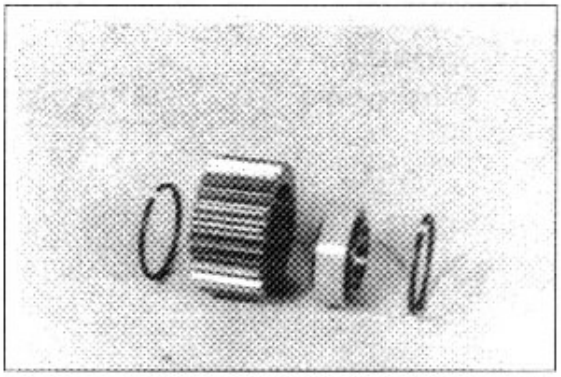
※ Special tool

HD pump 5870 287 007

(5) Planet carrier

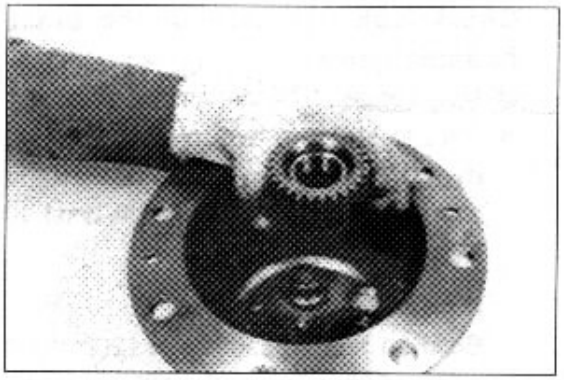
① Install components, as illustrated in the figure on the right.

※ Mount stepped plan face of angle rings showing upward.



② Heat bearing inner race and line up the planetary gear until contact is obtained.

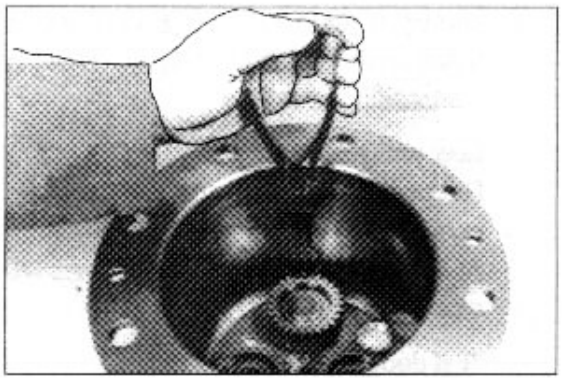
※ Install large radius of the bearing inner race facing the planet carrier(Downward).



③ Fix planetary gear by means of circlip.

※ Special tool

Set of external pliers 5870 900 015



Adjust end float of the sun gear shaft 0.3~0.6mm(Figure ④ ~ ⑦)

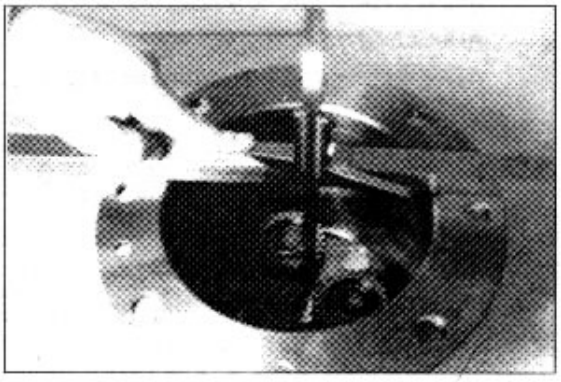
④ Determine dimension I from the mounting face to the locating face of the thrust washer.

· Dimension I e.g. 199.2mm

※ Special tool

Straightedge 5870 200 022

Depth gauge 5870 200 086



⑤ Determine dimension Ⅱ from the thrust face of the sun gear to the mounting face of the hub.

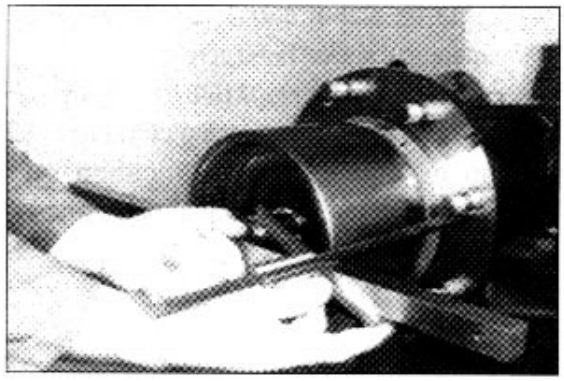
· Dimension Ⅱ e.g. 196.8mm

Example

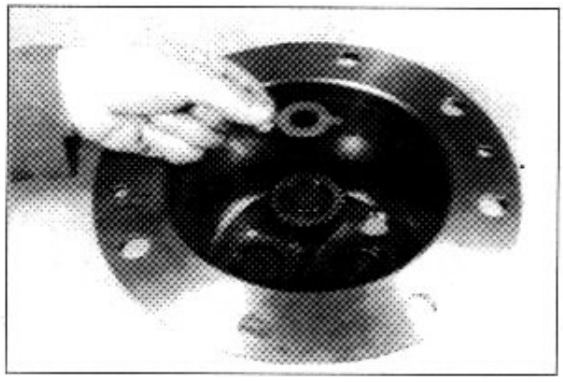
Dimension Ⅰ e.g.		199.2mm
Dimension Ⅱ e.g.		- 196.8mm
Difference		2.4mm
Required end play e.g.		- 0.4mm
Result = Thrust washer	s =	2.0mm

※ Special tool

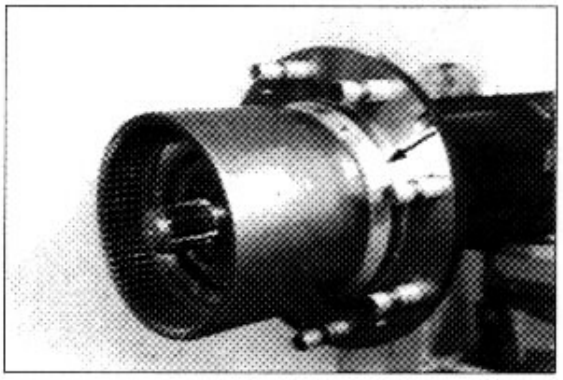
Straightedge	5870 200 022
Depth gauge	5870 200 086



⑥ Insert thrust washer(e.g. s= 2.0mm) into the planet carrier and press it against shoulder.



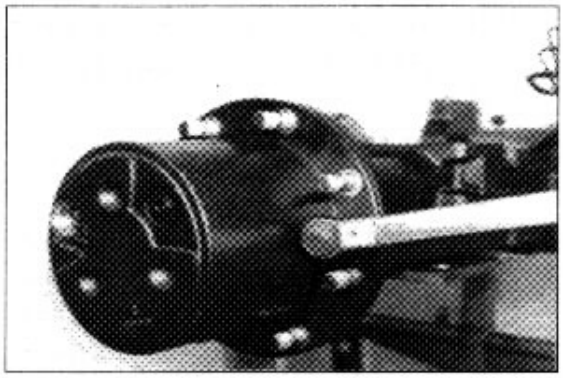
⑦ Insert O-ring into the annular groove of the hub(See arrow) and grease it.



⑧ Line up planet carrier and fasten it by means of socket head screws.

· Tightening torque(M10/8.8) 3.3kgf · m

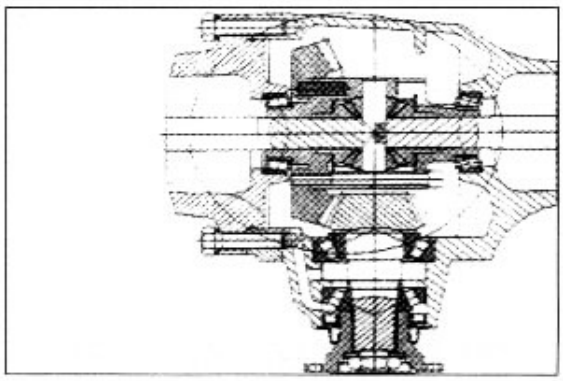
※ Prior to the commissioning of the axle, fill in oil according to lubrication and maintenance instructions, see page 8-264.



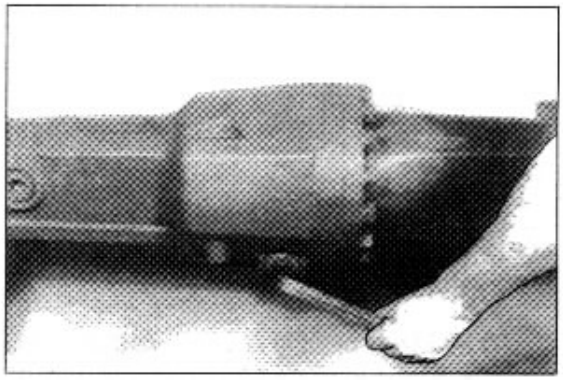
4. INPUT DISASSEMBLY AND ASSEMBLY

1) DISASSEMBLY

(1) See draft on the right.

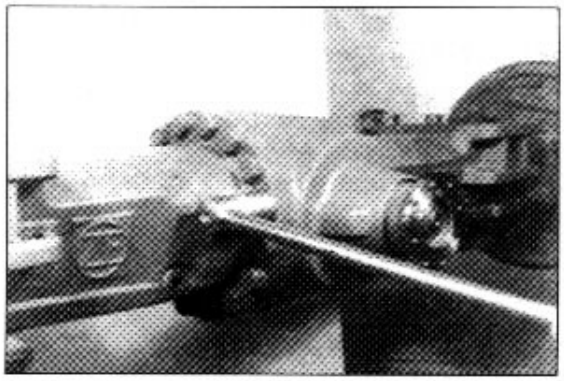


(2) Loosen screw plug and drain oil.



(3) Loosen hexagon head screws and fitting bolts.

※ Mark installation position of axle casing Ⅰ with axle casing Ⅱ.

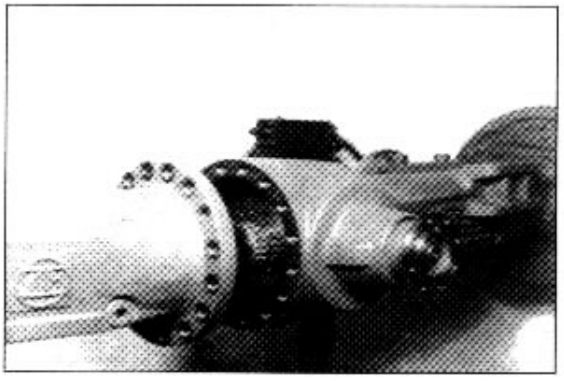


(4) Separate axle casing Ⅱ from axle casing Ⅰ, using lifting device.

※ If necessary, pay attention to the released differential.

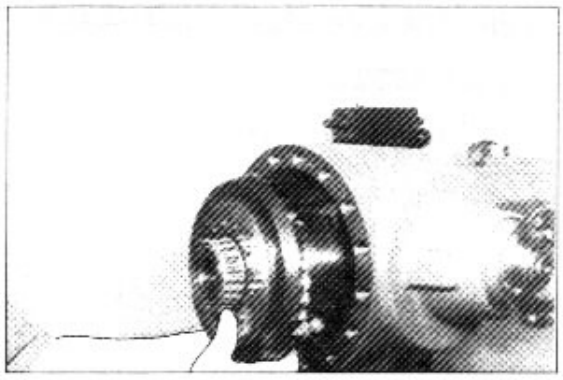
※ Special tool

Lifting strap 5870 281 026

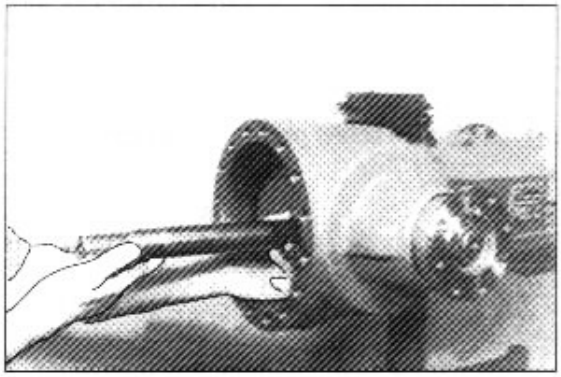


(5) Remove differential.

※ The disassembly of the different differentials is starting from page 8-290.



(6) Pull stub shaft out of the axle casing.

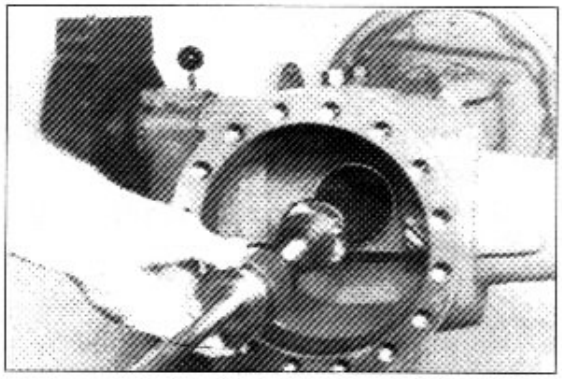


(7) Pull both bearing outer races(Differential bearing) out of the bearing bores of the axle casing Ⅰ and Ⅱ.

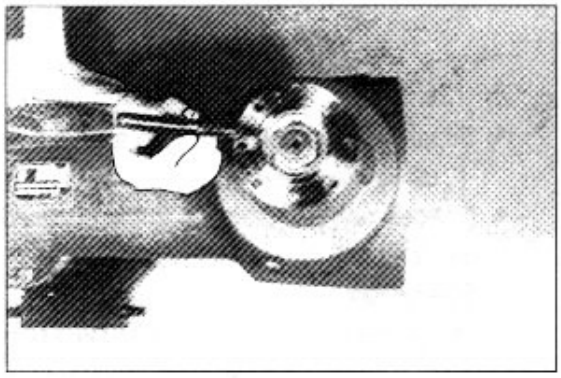
※ Pay attention to released shims.

※ Special tool

Striker 5870 650 004



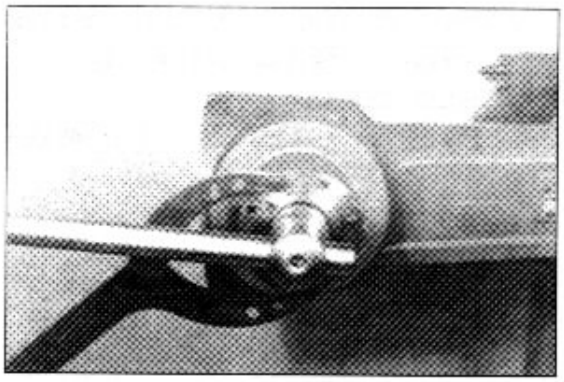
(8) Remove lock plate.



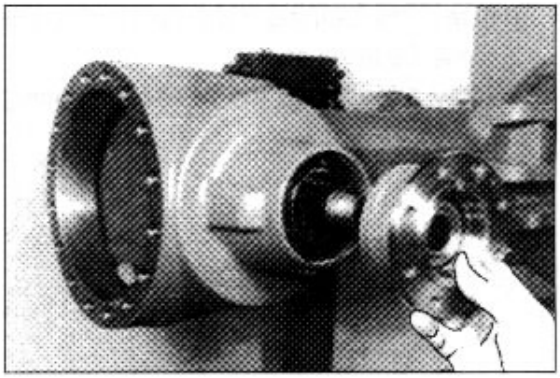
(9) Loosen hex nut.

※ Special tool

Clamping yoke	5870 240 025



(10) Pull off input flange.

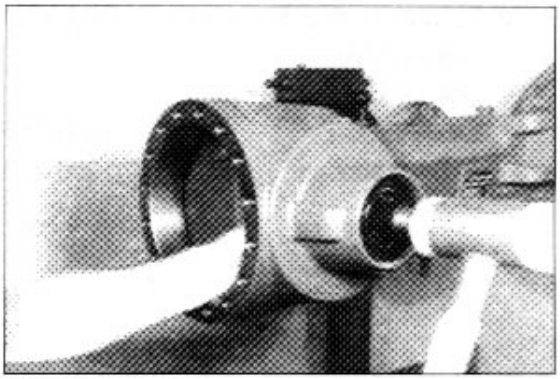


(11) Drive the drive pinion out.

※ If the pinion bearing should not be renewed, pay attention that during the driving out of the drive pinion, the outer bearing inner race has always contact on the bearing outer race.
Otherwise, the bearing will be damaged and must therefore be renewed.

※ Special tool

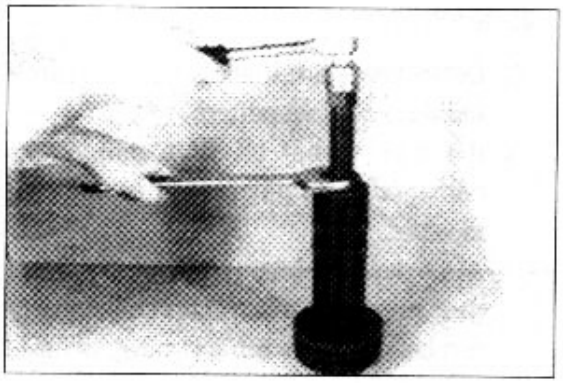
Plastic mallet	5870 280 004



(12) Removes spacer ring and pull roller bearing from drive pinion.

※ Special tool

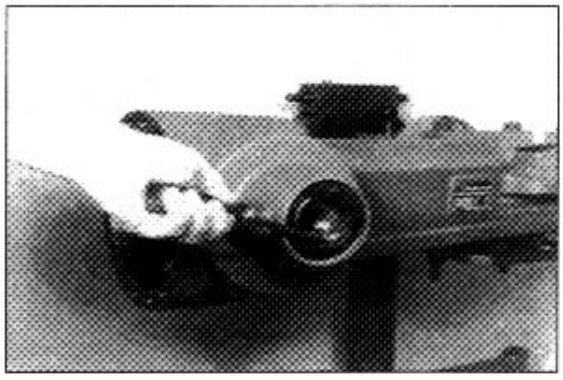
Grab sleeve Super	5870 001 037
Basic set	5870 001 000



(13) Pry shaft seal out of the axle casing and remove the released roller bearing.

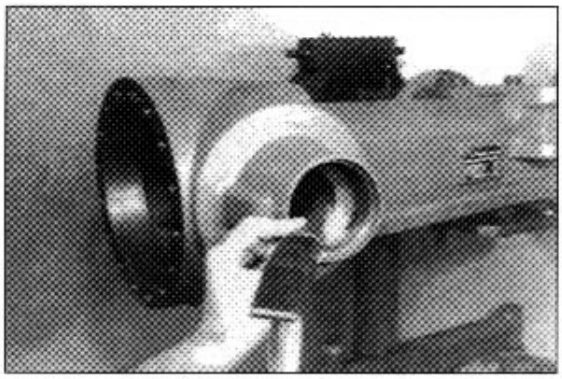
※ Special tool

Pry bar	5870 345 065



(14) Drive the bearing outer race out of the inner bearing bore.

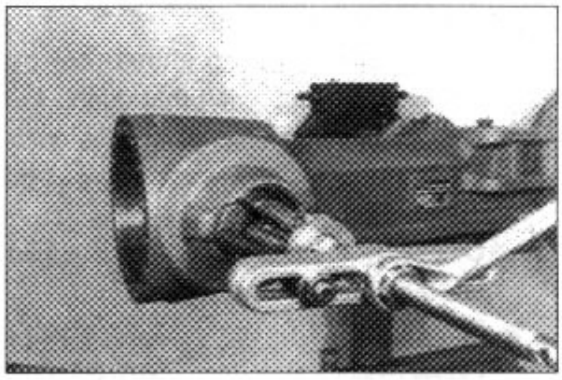
※ Pay attention to the released spacing washer.



(15) Pull the bearing outer race out of the outer bearing bore.

※ Special tool

Internal puller	5870 300 019
Counter support	5870 300 020



2) REASSEMBLY

(1) Determine shim thickness, to obtain a faultless contact pattern

※ If crown wheel or drive pinion are damaged, both parts must be renewed together.

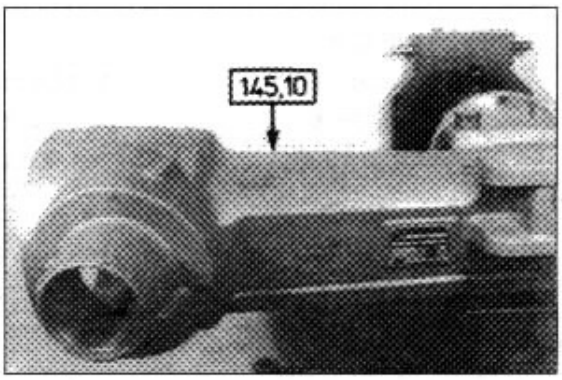
At the new installation of a complete bevel gear set, pay attention to the same mating number of drive pinion and crown wheel.

Determination of the shim thickness with specified dimension Ⅰ (Punch-marked upon axle casing/Part Ⅱ)

※ The following measuring operations have to be carried out with utmost accuracy. Inexact measurements will give faulty contact pattern and another disassembly and reassembly of the drive pinion will become necessary.

① Read dimension Ⅰ from the axle casing (Part Ⅰ)

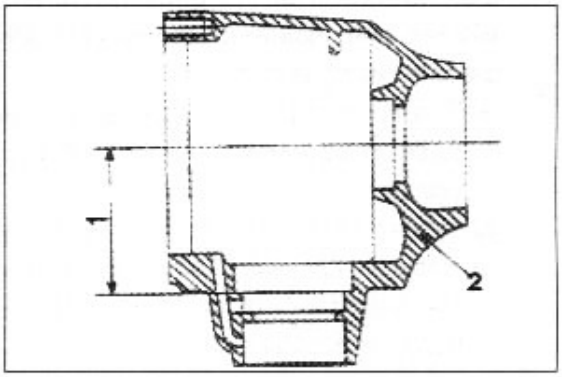
· Dimension Ⅰ e.g. 145.1mm



② Ref. draft:

1 Dimension Ⅰ

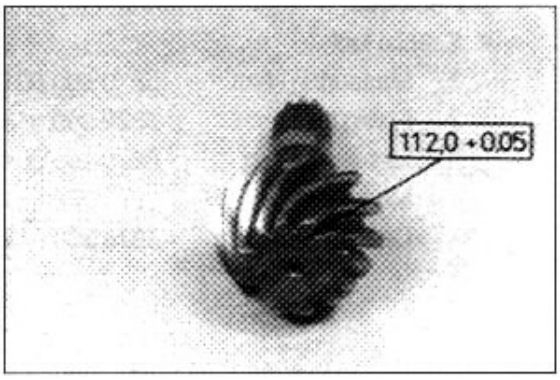
2 Axle casing



③ Read dimension Ⅱ (Pinion dimension).

· Dimension Ⅱ e.g.

$112.0^{+0.05}$ mm = 112.05mm

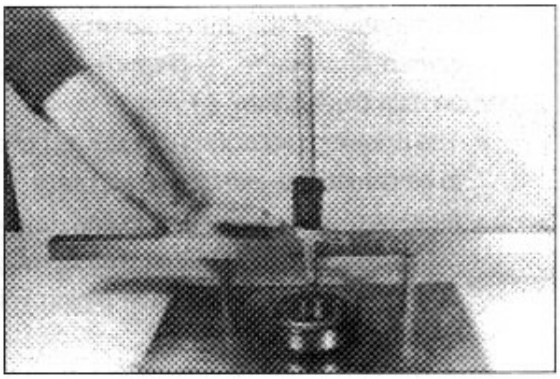


④ Determine Dimension Ⅱ (Bearing width).

· Dimension Ⅲ e.g. 31.95mm

※ Special tool

Straightedge	5870 200 022
Gauge blocks	5870 200 066
Digital-depth gauge	5870 200 072



⑤ **Example A**

Dimension Ⅰ	112.05mm
Dimension Ⅲ	+ 31.95mm
Gives dimension **X**	144.00mm

Example B

Dimension Ⅰ	145.10mm
Dimension **X**	- 144.00mm
Difference = Shim thickness	s = 1.10mm

Determination of the shim thickness without specification dimension Ⅰ (On the axle casing part Ⅰ)

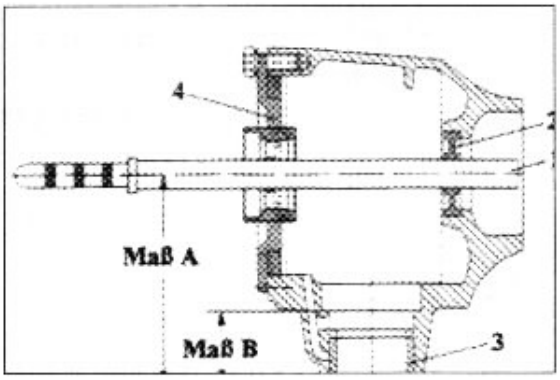
※ The following measuring operations have to be carried out with utmost accuracy.

⑥ Inexact measurements will give faulty contact pattern and another disassembly and reassembly of the drive pinion will become necessary.

⑦ Ref. draft:

※ Special tool

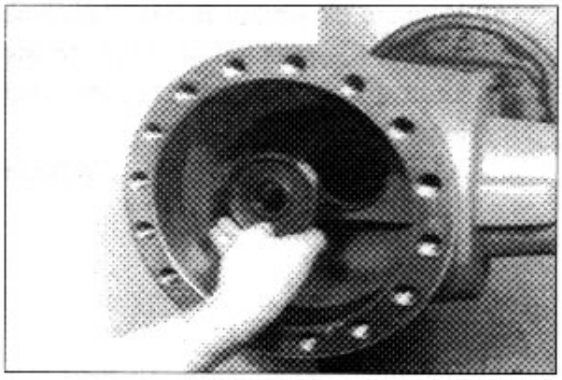
1	Measuring shaft	5870 500 001
2	Fitting piece	5870 500 013
3	Measuring ring	5870 200 064
4	Measuring cover	5870 200 034
	Centering ring	5870 200 042



⑧ Insert fitting piece(2) into the bore of axle casing/part I (Differential bearing).

※ Special tool

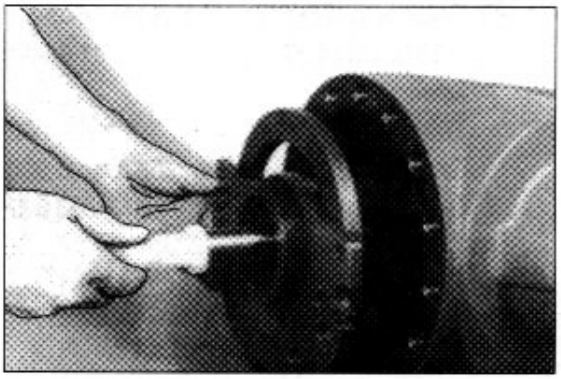
Fitting piece	5870 500 013



⑨ Mount measuring cover(4) and fasten it by means of hex. head screws.
Introduce measuring shaft(1) until accommodation in the bore of the fitting piece(2) is obtained.

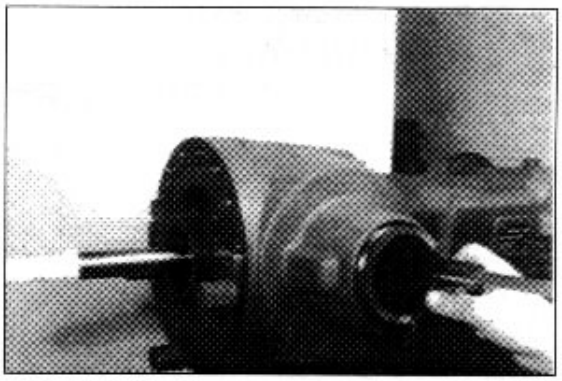
※ Special tool

Measuring cover	5870 200 034
Centering ring	5870 200 042
Measuring shaft	5870 500 001



⑩ Position measuring ring(3) on the locating face of the outer roller bearing until contact is obtained.
Determine dimension **A** from the plane face of the measuring ring(3) to the middle of the measuring shaft(1)(See draft ⑦, page 8-292).

· Determined dimension e.g. 208.80mm

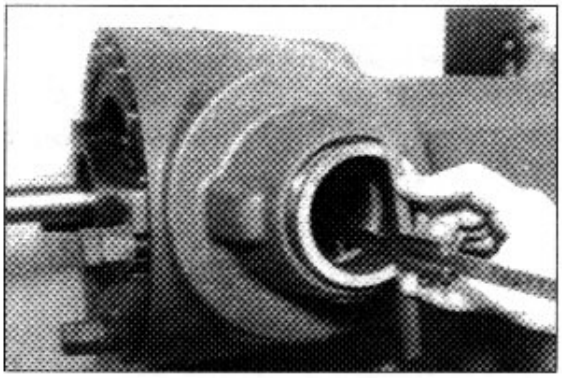


⑪ **Example C**

Determined dimension e.g.	208.80mm
1/2 ø measuring shaft	+ 15.00mm
Gives dimension **A**	223.80mm

⑫ Measure dimension **B** from the plane face of the measuring ring(3) to the locating face of the inner bearing outer race(See draft).

· Determined **B** e.g. 78.70mm

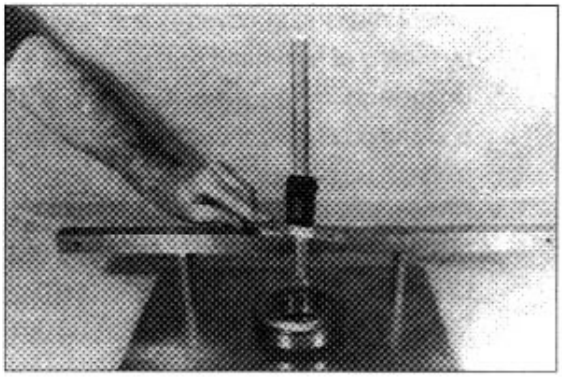


⑬ Determine dimension **C**(Bearing width)

· Determined **C** e.g. 31.95mm

※ Special tool

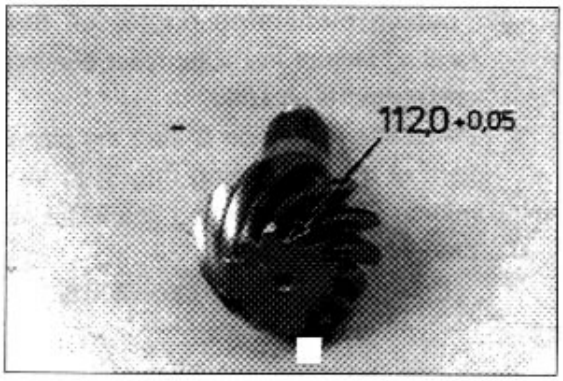
Straightedge	5870 200 022
Gauge blocks	5870 200 066
Digital-depth gauge	5870 200 072



⑭ Read pinion dimension

· Pinion dimension e.g.

$112^{+0.05}$mm = 112.05mm



⑮ **Example D**

Dimension **A**	223.80mm
Dimension **B**	- 78.70mm
Gives dimension Ⅰ	145.10mm

Example E

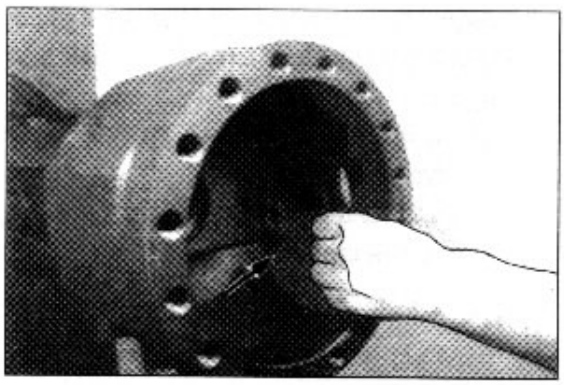
Dimension **C**(=Bearing width)	31.95mm
Pinion dimension	+ 112.05mm
Gives dimension Ⅱ	144.00mm

Example E

Dimension Ⅰ	145.10mm
Dimension Ⅱ	- 144.00mm
Difference = Shim thickness	s = 1.10mm

(2) Install drive pinion

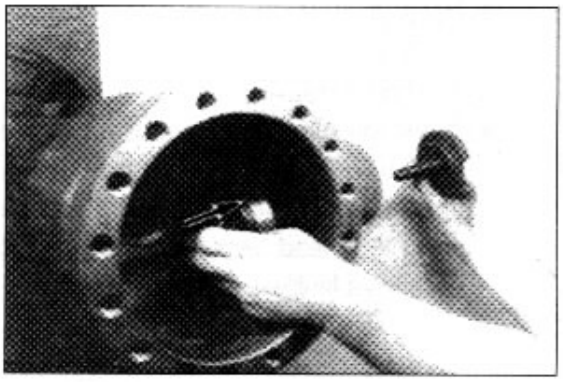
① Insert determined shim e.g. s= 1.10mm into the bearing bore.



② Undercool bearing outer race(Arrow) and position it against shoulder, using special device.

※ Special tool

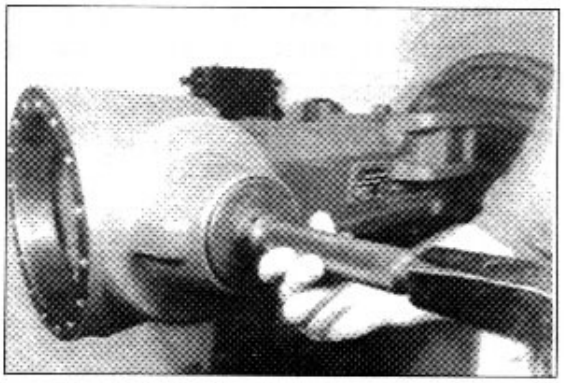
Assembly jig	5870 345 049
Pressure ring	5870 345 056



③ Undercool second bearing outer race and insert it until contact is obtained.

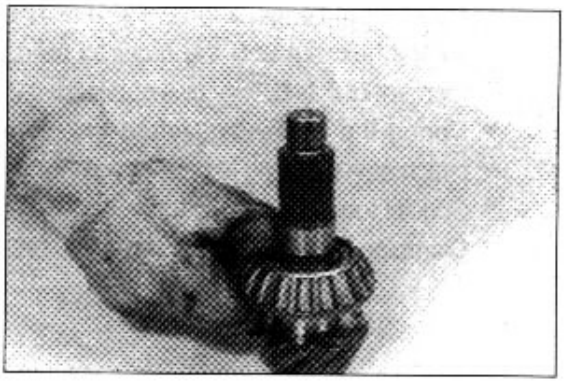
※ Special tool

Driver	5870 058 083
Handle	5870 260 002



④ Heat tapered roller bearing and line it up until contact is obtained.

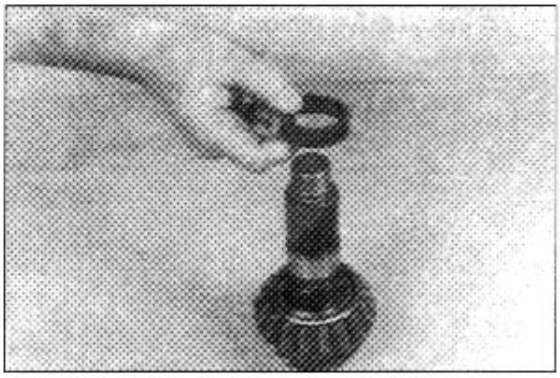
※ Reset the bearing after the cooling down.



Adjust rolling moment of the drive pinion bearing 0.1~0.2kgf · m(Without shaft seal) figure ⑤ ~ ⑬.

⑤ Lay measuring ring upon the collar of the drive pinion.

※ Shape and description of the measuring ring, see the following draft.

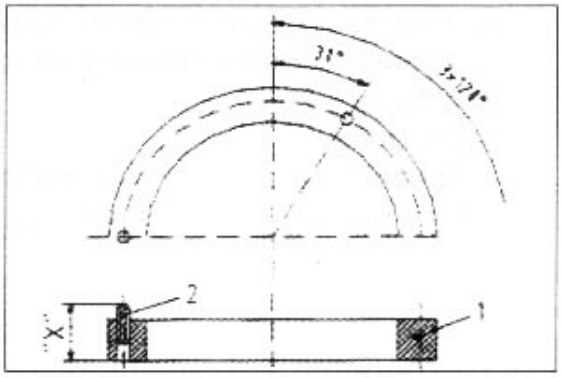


⑥ Ref.draft:

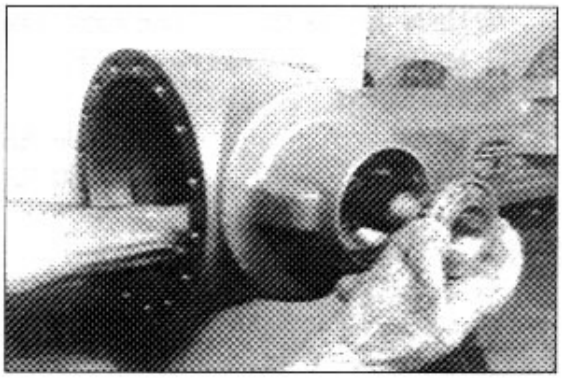
1 Ring

2 Roll pins(3EA)

※ Drive roll pins far enough out of the measuring ring bores so that at the tightening of the hex. nut, it will be possible to lead back the roll pins, thus ensuring a faultless measuring result.



⑦ Insert the pre-assembled drive pinion and line up the heated bearing inner race until contact is obtained.

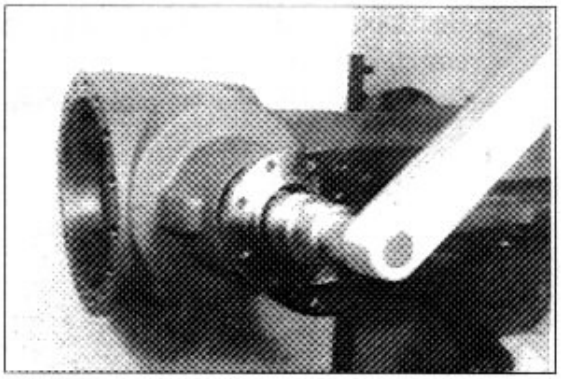


⑧ Install input flange, line up the disk and tighten hex. nut until the required rolling moment of 0.1~0.2kgf · m is obtained.

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

※ Special tool

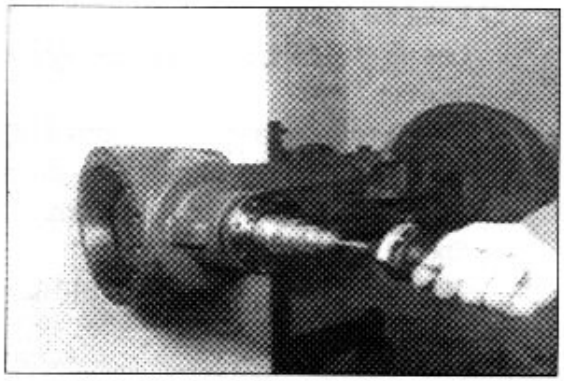
Clamping yoke 5870 240 025



⑨ Check rolling moment(0.1~0.2kgf · m).

※ Special tool

Torque spanner 5870 203 019

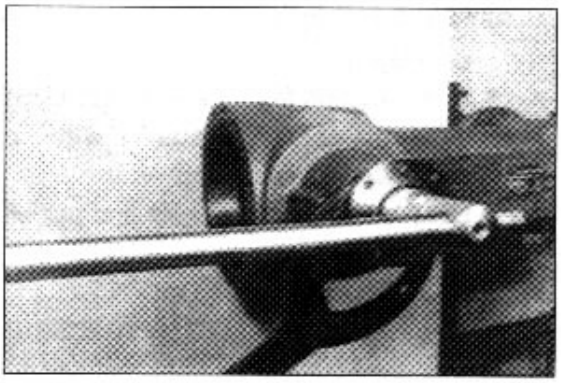


⑩ Loosen hex. nut and remove the drive pinion again.

※ To prevent a damage of the pinion bearing, pay attention that at the driving out of the drive pinion, the outer bearing inner race has always contact on the bearing outer race.

※ Special tool

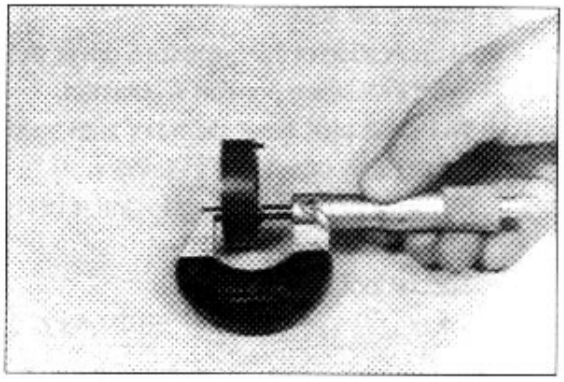
Clamping yoke 5870 240 025



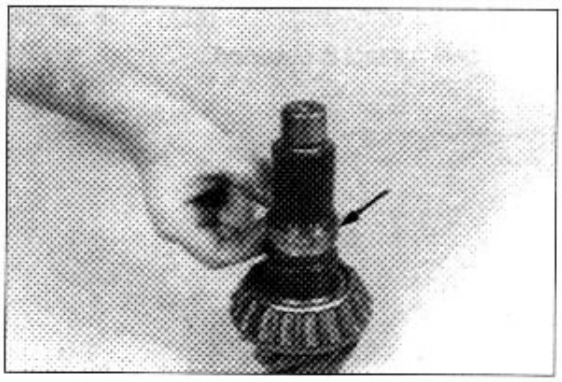
⑪ Demount the measuring ring from the drive pinion and determine dimension **X** (See also draft ⑥, page 8-296).

· Dimension **X** e.g. 11.39mm

※ Dimension **X** corresponds to the thickness of the spacer ring to be installed.



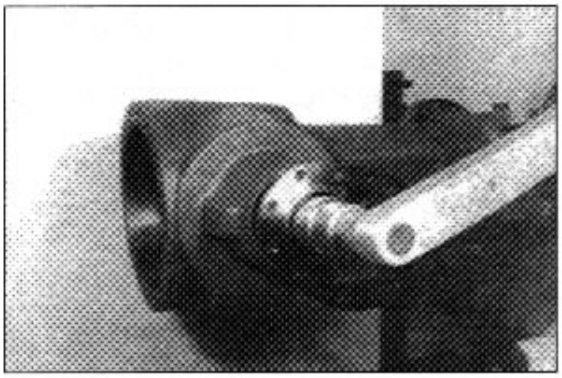
⑫ Line up the determined spacer ring(e.g. s = 11.39mm) instead of the measuring ring.



⑬ Install the pinion again.
Line up drive flange and disk, and tighten hex. nut.
· Tightening torque 43.9kgf · m(318lbf · ft)

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

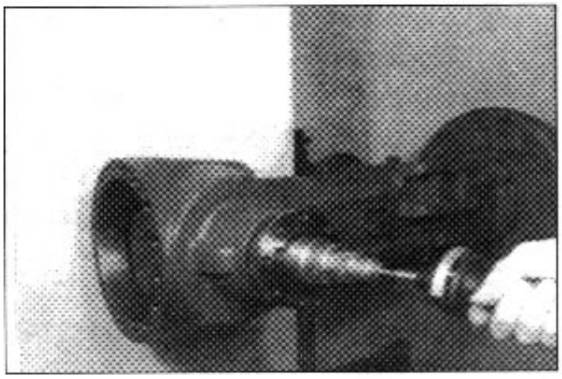
※ Special tool
Clamping yoke 5870 240 025



⑭ Check rolling moment 0.1~0.2kgf · m once again.

※ At a deviation from the required rolling moment, correct again with a corresponding spacer ring.
Now, loosen hex. nut again and pull off the input flange.

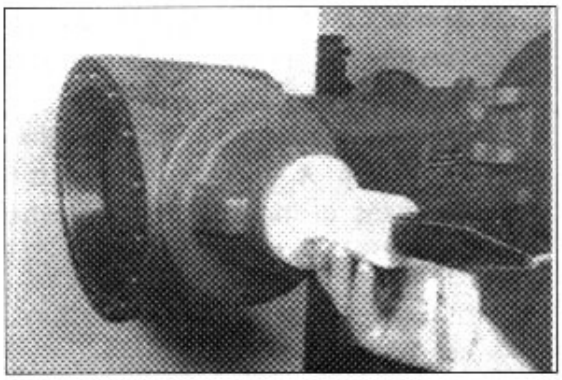
※ Special tool
Torque spanner 5870 203 019



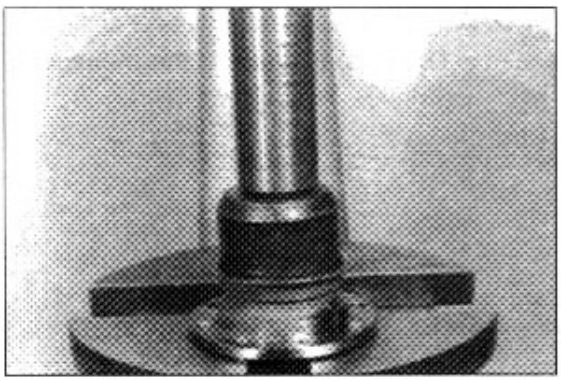
⑮ Install shaft seal.

※ At application of the prescribed driver, the exact installation position is obtained.
Wet shaft seal outer diameter with spirit immediately prior to the installation.
Fill cavity between sealing lip and dust lip with grease.

※ Special tool
Driver 5870 048 120



⑯ Press screening plate upon drive flange until contact is obtained.

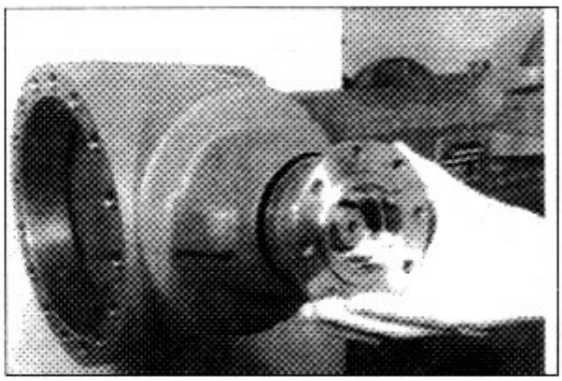


⑰ Line up drive flange and fasten it finally by means of disk and hex. nut.

· Tightening torque 43.9kgf · m(318lbf · ft)

※ Special tool

Clamping yoke	5870 240 025

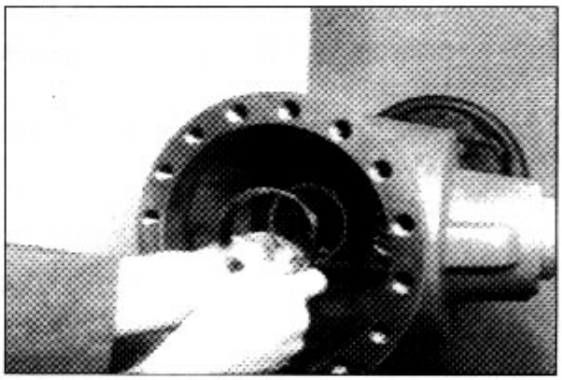


(3) Adjust backlash of the bevel gear set and the bearing preload of the differential(Figure ① ~ Example **G**)

· Backlash 0.15~0.20mm

· Bearing rolling moment 0.1~0.4kgf · m

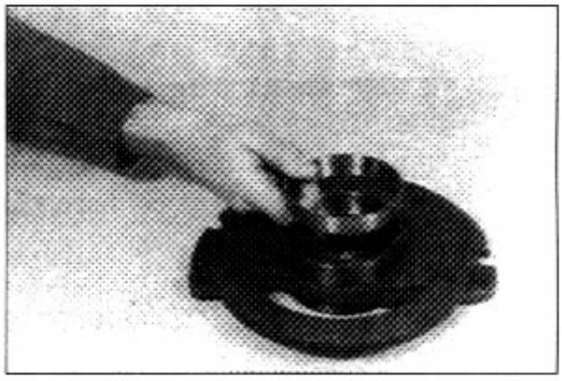
① Insert shim e.g. s= 2.0mm(Empirical value) into the bearing bore and install bearing outer race subsequently.



② Insert crown wheel side bearing outer race into the measuring cover.

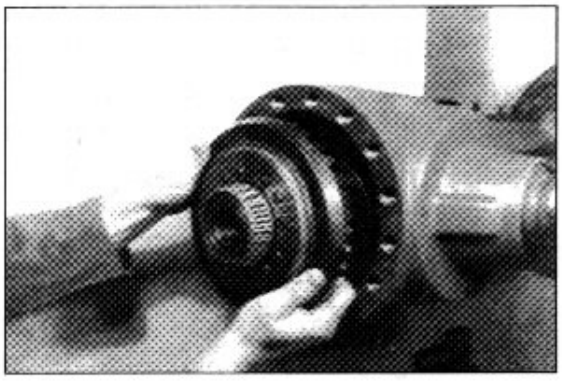
※ Special tool

Measuring cover	5870 200 034
Spacer ring	5870 200 042

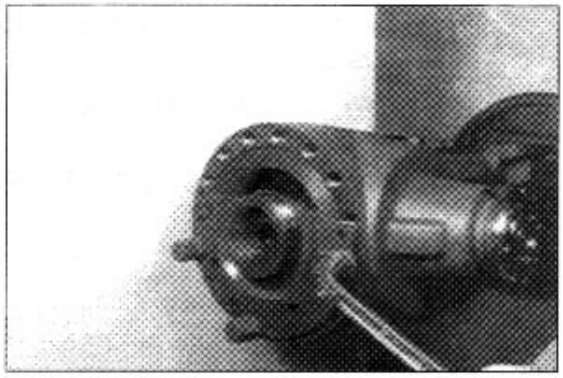


③ Insert differential into the axle casing.

※ Assembly of the differential. see page 8-305.



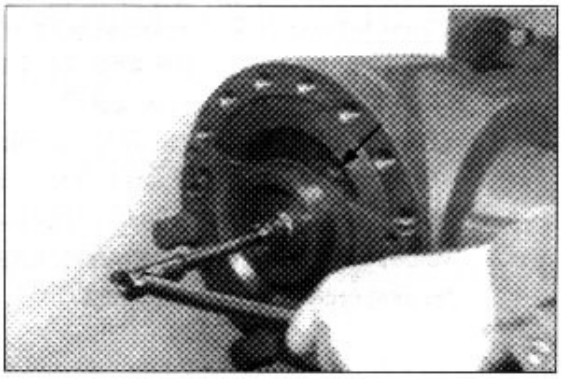
④ Insert measuring cover into the axle casing and fasten it by means of hex. head screws.



⑤ Adjust differential without play and pressure by application of the threaded spindle.
Now, fix threaded spindle by means of locking screw(Arrow).

※ Special tool

Measuring cover	5870 200 034
Spacer ring	5870 200 042

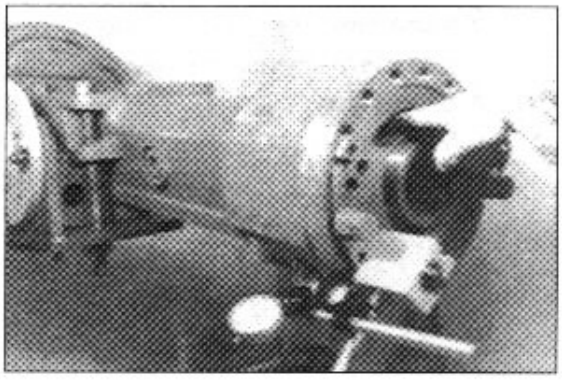


⑥ Apply dial indicator through the oil drain bore at a right angle on a tooth flank of the crown wheel and check the backlash (0.15~0.20mm).

※ At a deviation from the required backlash, correct with corresponding shim(Figure ①, page 8-299).

※ Special tool

Magnetic stand	5870 200 055
Dial indicator	5870 200 057

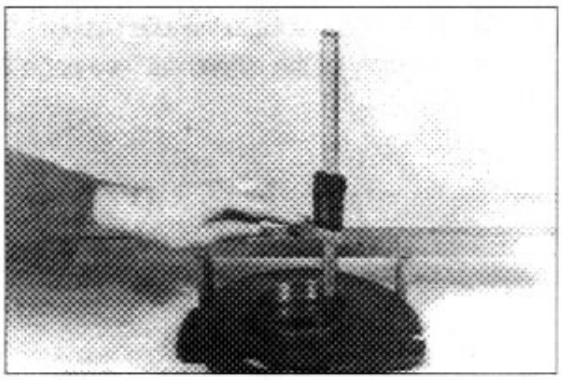


⑦ After completion of the backlash adjustment, demount measuring device and remove bearing outer race.
Determine dimension I from the mounting face to the locating face of the bearing outer race.

· Dimension I 16.37mm

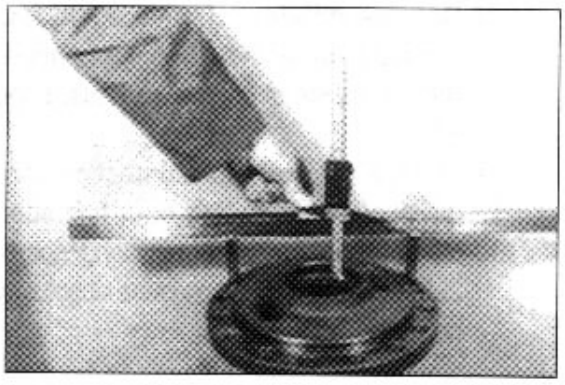
※ Special tool

Straightedge	5870 200 022
Gauge blocks	5870 200 066
Digital-depth gauge	5870 200 072



⑧ Measure dimension Ⅱ from the mounting face of the axle casing(Part Ⅰ) to the locating face of the bearing outer race.

· Dimension Ⅱ e.g. 13.87mm

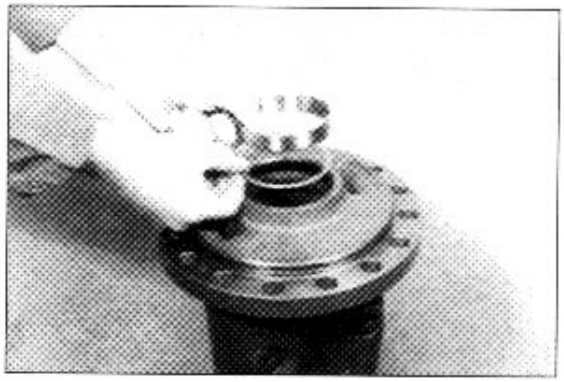


⑨ **Example G**

Dimension Ⅰ	16.37mm
Dimension Ⅱ	- 13.87mm
Difference	2.50mm
Required bearing preload	+ 0.10mm
Gives shim	s = 2.60mm

At a bearing preload of 0.10mm, the required bearing rolling moment of 0.1~0.4kgf · m is obtained.

⑩ Insert determined shim(s) e.g. s = 2.60mm into the bearing bore of axle casing Ⅱ, and install bearing outer race subsequently until contact is obtained.



Check contact pattern(Figure ⑪ and ⑫)

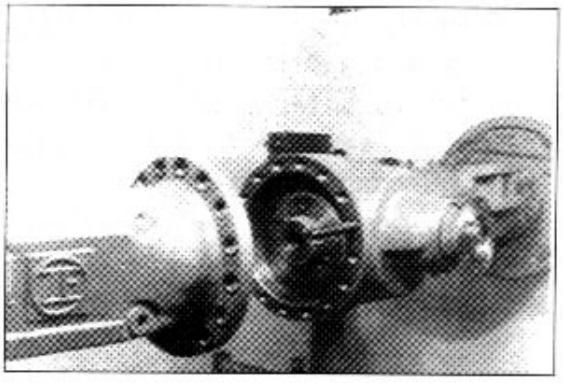
⑪ Wet some tooth flanks of the crown wheel with marking ink and insert the differential into the axle casing.

Fasten axle casing Ⅱ provisionally on axle casing Ⅰ, using some hex. head screws.

Now, roll crown wheel several times in both directions over the drive pinion.

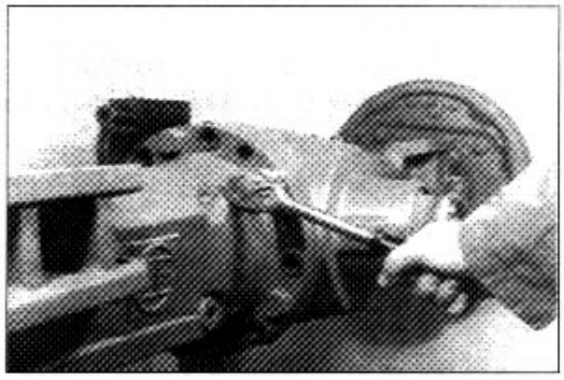
※ Special tool

Adjusting screws 5870 204 026

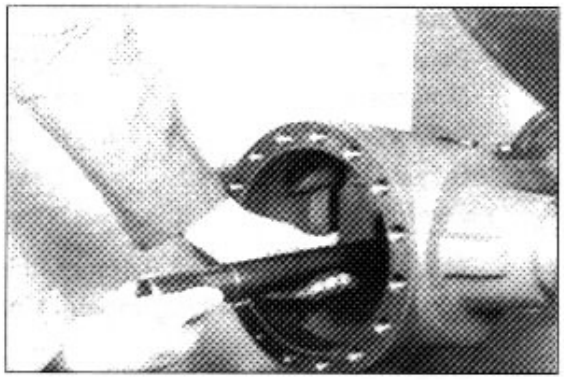


⑫ Remove differential once again and compare the obtained contact pattern with examples of contact patterns, page 8-304.

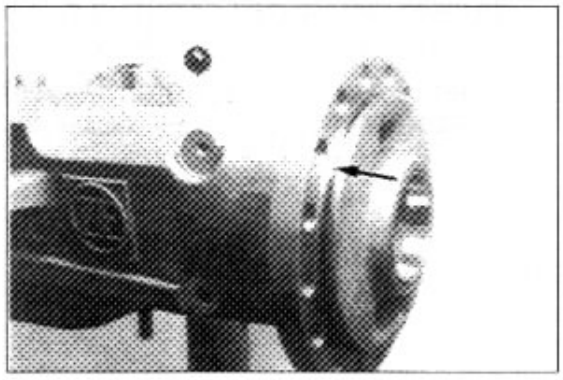
※ In case of a greater contact pattern deviation, a measuring error has been made at the shim determination(Page 8-295/ Figure ①) which must be absolutely corrected.



⑬ Introduce stub shaft into the sleeve until contact is obtained.



⑭ Insert O-ring(See arrow) into the annular groove of axle casing Ⅱ and grease it.

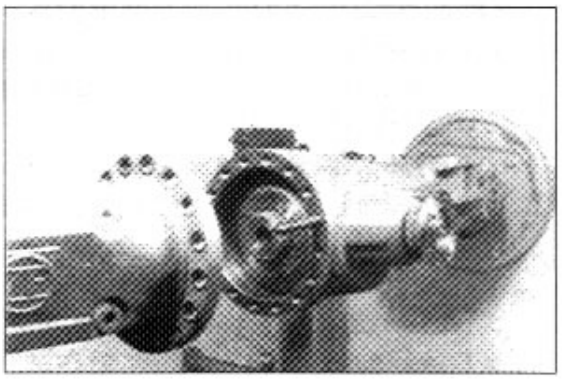


⑮ Introduce second stub shaft into axle casing Ⅰ until contact is obtained.
Now, install two adjusting screws and position axle casing Ⅰ against shoulder until contact is obtained.

※ Pay attention to the installation position.

※ Special tool

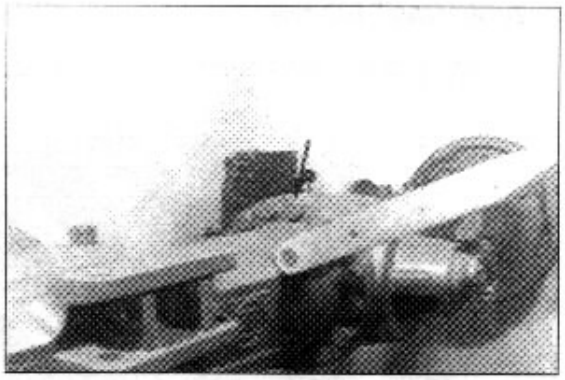
Adjusting screws	5870 204 026



⑯ Fasten axle casing finally, using disks and hex. head screws.

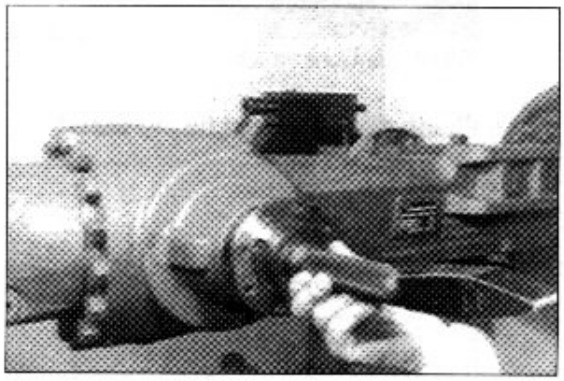
※ Pay attention to the installation position of the fitting bolt, see arrow.

· Tightening torque 39.8kgf · m(288lbf · ft)



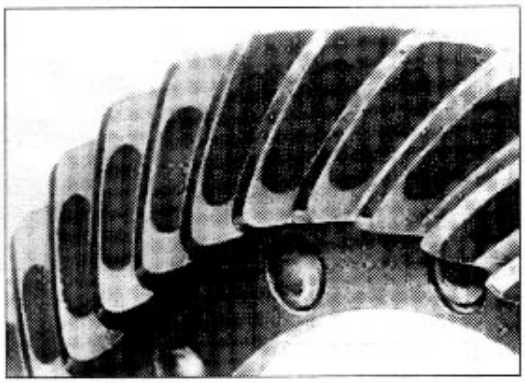
⑰ Fix hex. nut by means of lock plate.
Now, stake lock plate on the input flange.

※ Prior to the commissioning of the axle, fill in oil according to lubrication and maintenance instructions, see page 8-264.

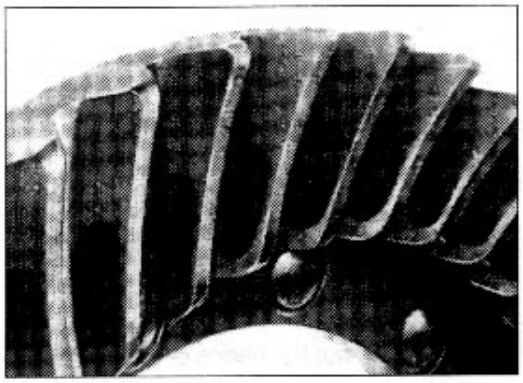


3) CONTACT PATTERNS

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

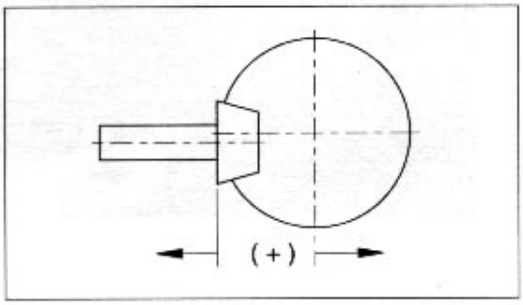


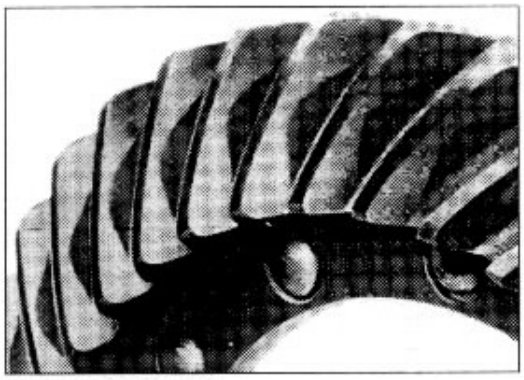
Coast side(Concave)



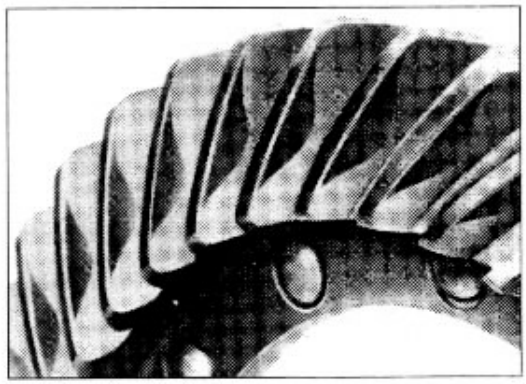
Drive side(Convex)

(2) Pinion distance must be increased



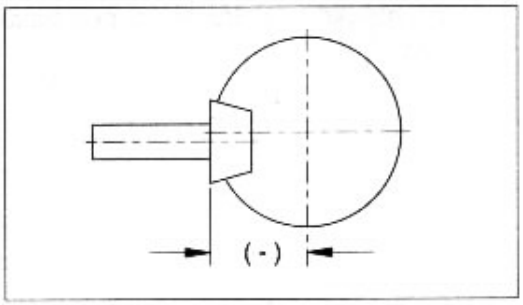


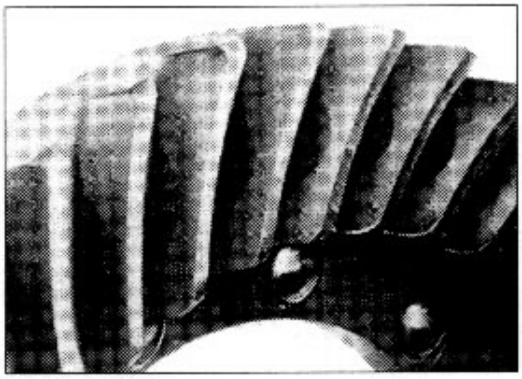
Coast side(Concave)



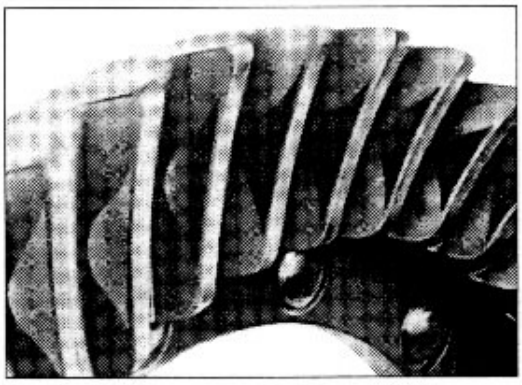
~~Drive side(Convex)~~
Coast side(Concave)

(3) Pinion distance must be decreased





~~Coast side(Concave)~~
Drive side(Convex)

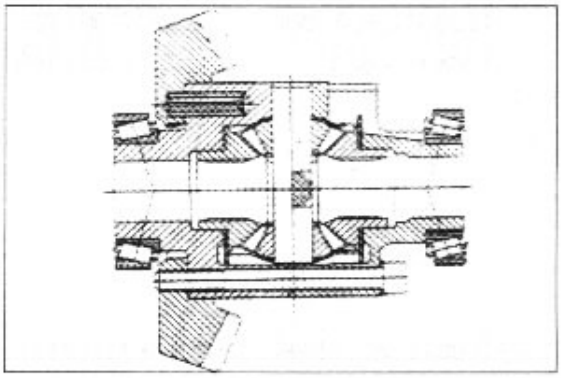


Drive side(Convex)

5. DIFFERENTIALS DISASSEMBLY AND ASSEMBLY

1) DISASSEMBLY(Without plates)

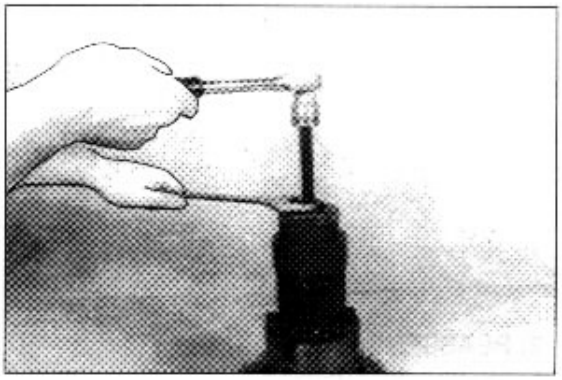
(1) See draft on the right.



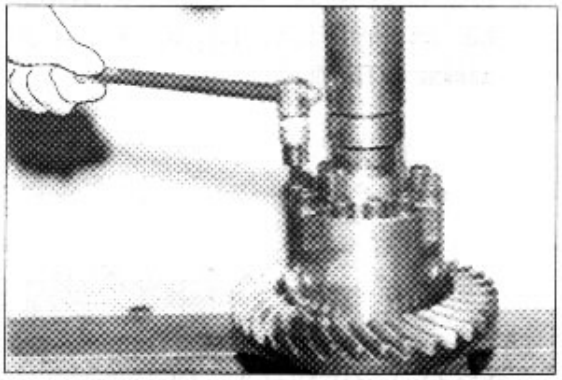
(2) Pull roller bearing from differential case.

※ Special tool

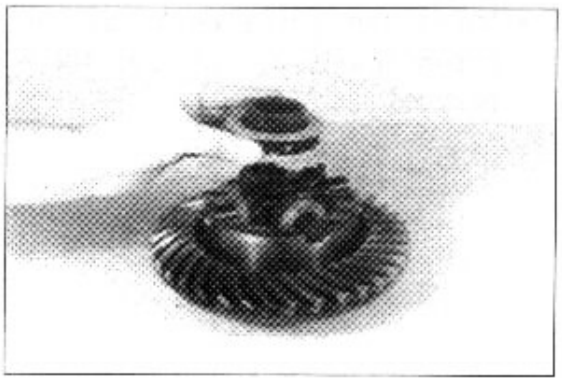
Grab sleeve Super	5870 001 020
Back off insert	5870 026 100



(3) Locate differential by means of press and loosen socket head screws.



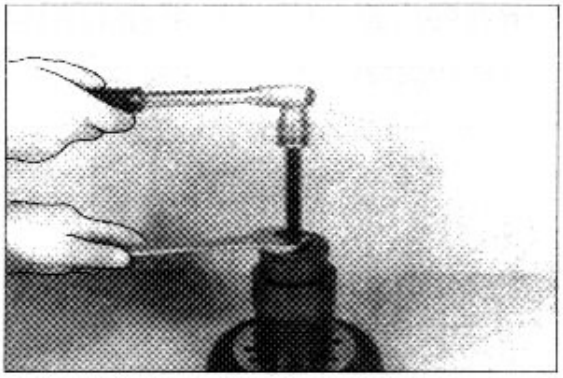
(4) Separate differential case halves and remove the released components.



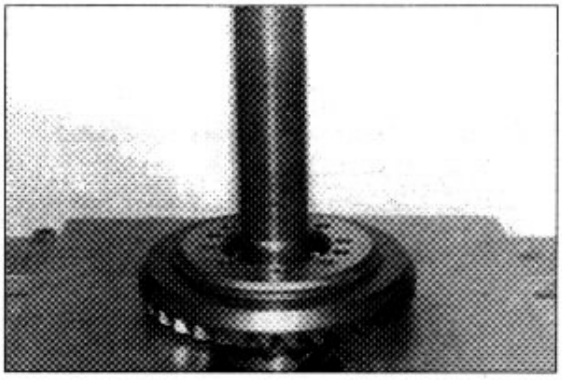
(5) Pull crown wheel side roller bearing from differential

※ Special tool

Grab sleeve Super	5873 001 020
Back off insert	5870 026 100



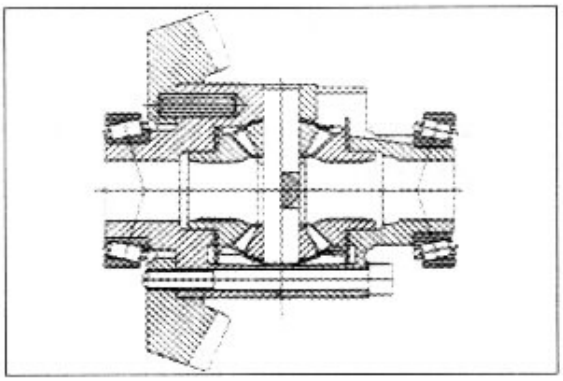
(6) Press crown wheel from differential case.



2) REASSEMBLY(Without plates)

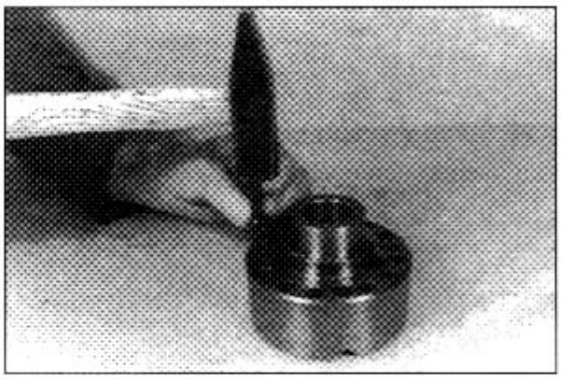
(1) See draft on the right.

※ Prior to the installation, oil all differential components according to ZF-List of lubricants TE-ML 05.

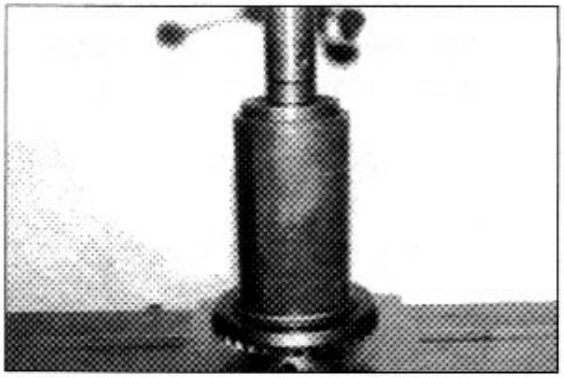


(2) Drive roll pins(2 pieces each bore) into the blind holes(4EA) of the differential case halves.

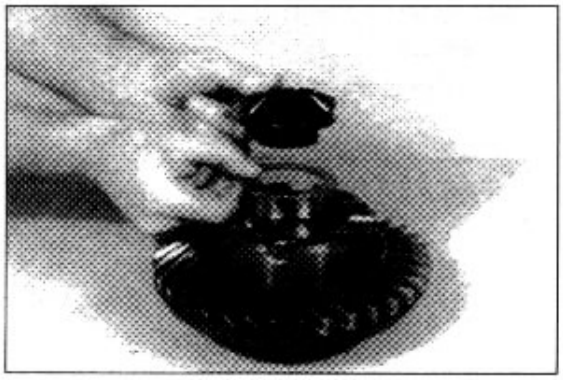
※ Install roll pin slots always in circumferential direction and 180 ° displaced.



(3) Press crown wheel upon the roll pins until contact is obtained.

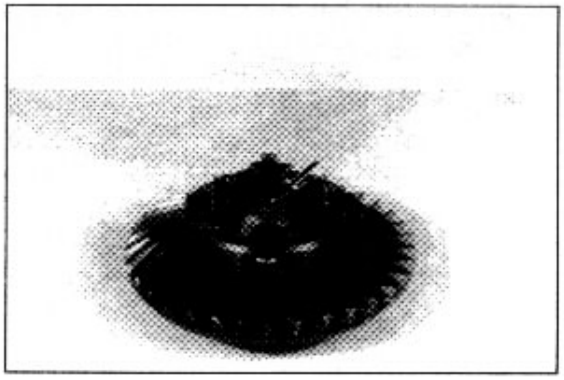


(4) Insert thrust washer and side gear into the differential case half.

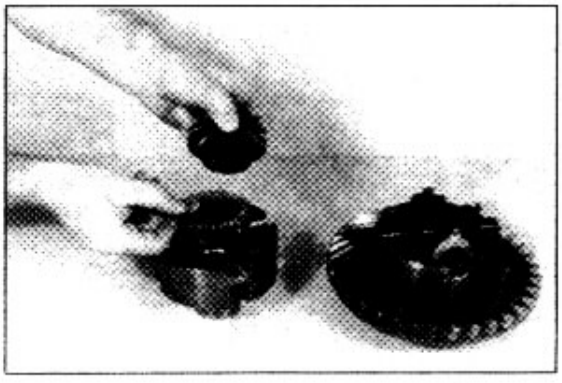


(5) Mount differential assembly.

※ Pay attention to the radial installation position of the thrust washers.
Noses are showing vertically upward(See Arrow).

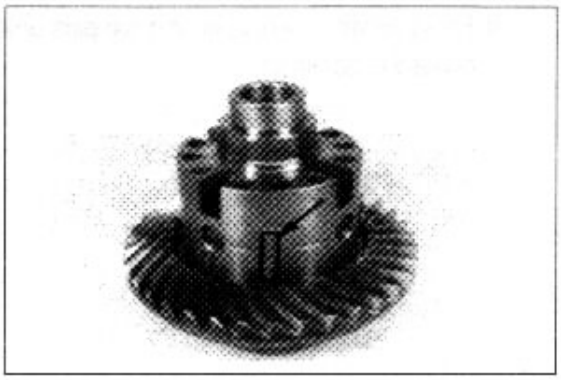


(6) Make thrust washer adhere with grease in the differential case half.
Now, install second side gear.



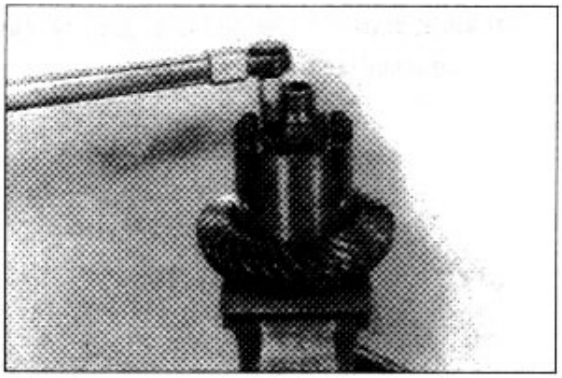
(7) Mount second differential case half.

※ Pay attention to the radial installation position, see designation(ZF-No.).



(8) Lay on segments and tighten socket head screws.

· Tightening torque 14.8kgf · m(107lbf · ft)



(9) Heat both bearing inner races and line them up until contact is obtained.