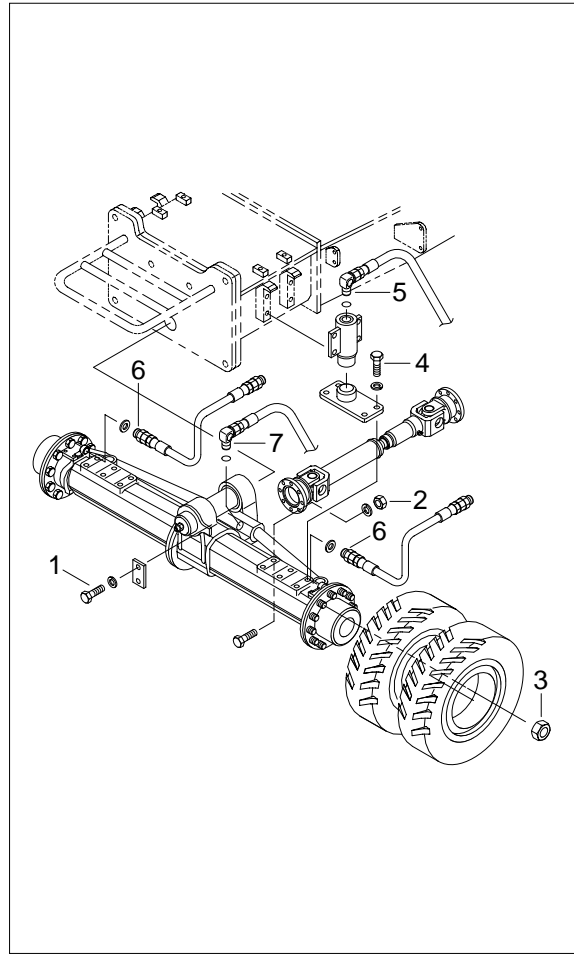


## GROUP 11 FRONT AXLE

### 1. REMOVAL FRONT AXLE

- 1) Pivot pin mounting bolt(1, M12)
  - Tightening torque :  $9.3 \pm 1.9 \text{ kgf} \cdot \text{m}$   
( $67.3 \pm 13.7 \text{ lbf} \cdot \text{ft}$ )
- 2) Propeller shaft mounting nut(2, M10)
  - Tightening torque :  $5.9 \pm 0.6 \text{ kgf} \cdot \text{m}$   
( $42.7 \pm 4.3 \text{ lbf} \cdot \text{ft}$ )
- 3) Wheel nut(3, M22)
  - Tightening torque :  $60^{+0}_{-5} \text{ kgf} \cdot \text{m}$   
( $434^{+0}_{-36} \text{ lbf} \cdot \text{ft}$ )
- 4) Oscillating cylinder supporting mounting bolt(4, M16)
  - Tightening torque :  $29.6 \pm 3.2 \text{ kgf} \cdot \text{m}$   
( $214 \pm 23.1 \text{ lbf} \cdot \text{ft}$ )
- 5) Hose assy(5, PF 1/4)
  - Tightening torque :  $4.0 \text{ kgf} \cdot \text{m}$ ( $28.9 \text{ lbf} \cdot \text{ft}$ )
- 6) Hose assy(6, PF 3/8)
  - Tightening torque :  $5.0 \text{ kgf} \cdot \text{m}$ ( $36.2 \text{ lbf} \cdot \text{ft}$ )
- 7) Hose assy(7, PF 1/2)
  - Tightening torque :  $6.0 \text{ kgf} \cdot \text{m}$ ( $43.4 \text{ lbf} \cdot \text{ft}$ )
- 8) Front axle weight : 620kg(1367lb)



## **2. GENERAL INSTRUCTIONS**

### **1) GENERAL WORKING INSTRUCTIONS**

- (1) This manual has been developed for the skilled serviceman, trained by the axle manufacturer.
- (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 manufacturer, will be used.
- (4) The special tools have 10 digit subject numbers and are available from manufacturer.
- (5) After the disassembly, all components must be cleaned, especially corners, cavities and recesses of housing and covers.
- (6) The old sealing compound must be carefully removed.
- (7) Check lubricating holes, grooves and pipes for free passage. They must be free of residues, foreign material or protective compounds. 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) To heat 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 into a vessel, filled with oil, which is then heated with the flame, thus avoiding damage to the bearings.
- (12) Ball bearings, covers, flanges and parts like that must be heated to about 90 to 100°C.
- (13) Hot-mounted parts must be reset after cooling in order to assure a proper contact.
- (14) Before pressing shafts, bearings etc. in place, both parts must be lubricated.
- (15) During the reassembly, all specified adjustment values, testing specifications and torque limits have to be respected.
- (16) For the procedure and the permitted oil qualities refer to the operator's manual, resp. to the lubrication instructions and the corresponding list of lubricants.
- (17) After the oil filling, tighten the oil level and oil drain plugs to the specified torque.
- (18) The numbers in brackets underneath the figures of the pages for the disassembly and the reassembly, refer to an available dispositive for training purposes concerning the repair of the unit.

## **2) IMPORTANT INSTRUCTIONS CONCERNING THE LABOR SAFETY**

- (1) In principle, repairers are themselves responsible for the labor 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 SPECIFICATIONS**

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

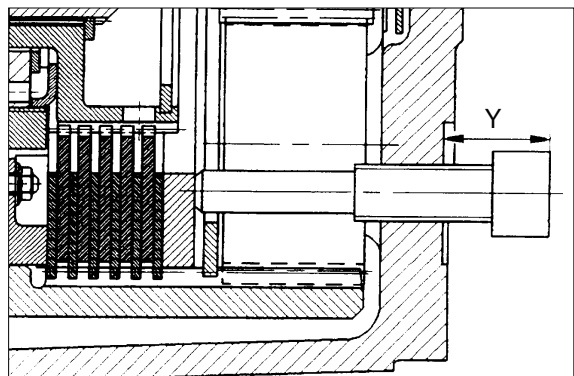
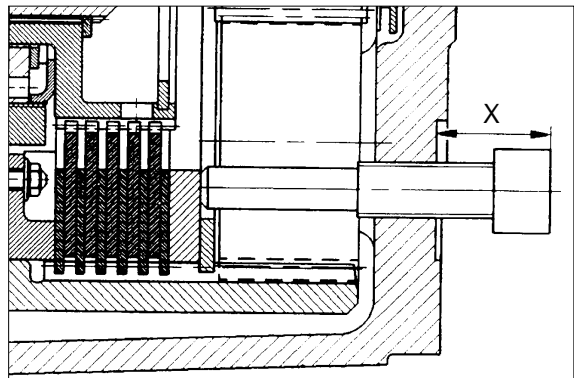
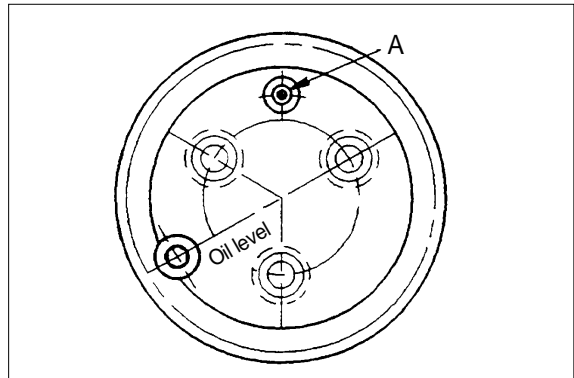
## 4) BRAKE LINING WEARING TEST

### (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
  - 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. : 6.25mm
  - Piston stroke in new condition of the plate pack : 2.4~2.8mm

### (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 1kg · 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.  
Torque limit 1kg · 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).



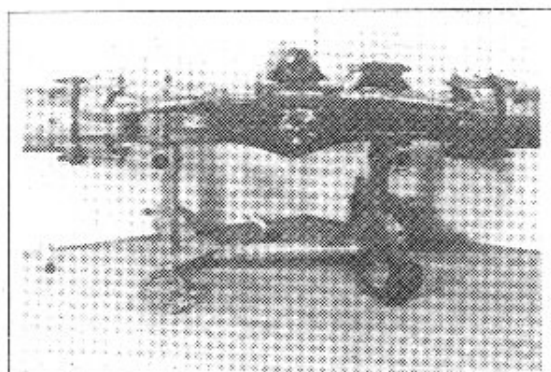
### (3) Result

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

### 3. FINAL DRIVE DISASSEMBLY AND ASSEMBLY

#### 1) DISASSEMBLY

Adjacent illustration shows the total view of the ZF axle.

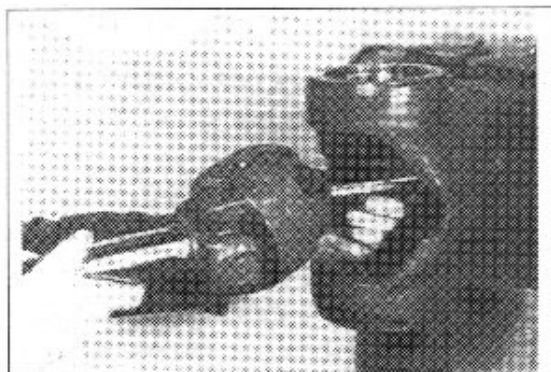


#### (1) Planetary carrier

- ① Remove screw plug and drain oil.

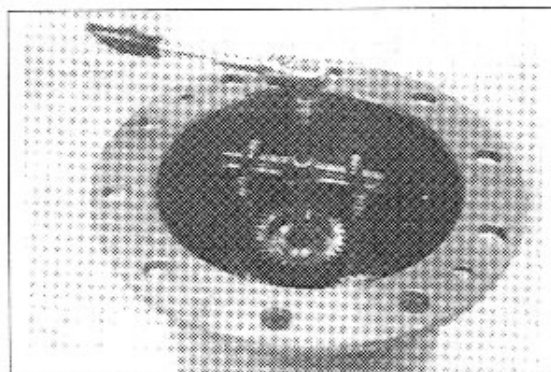


- ② Loosen socket head screws and separate planetary carrier from the hub.

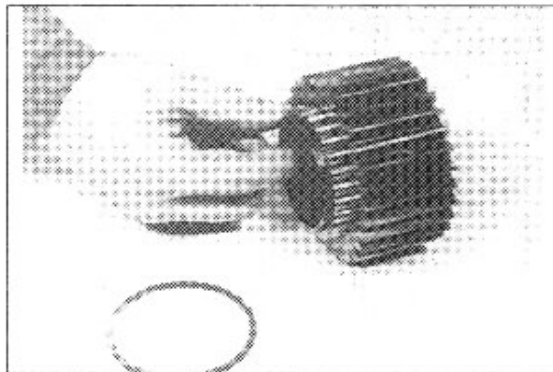


- ③ Squeeze out circlips and pull off planetary gears.  
Tow leg puller

5870 970 002

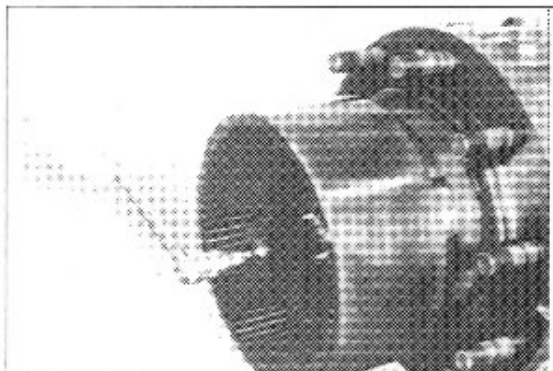


- ④ Squeeze out L-shaped rings and pull bearing inner race (Together with cylindrical rollers) out of the planetary gear.

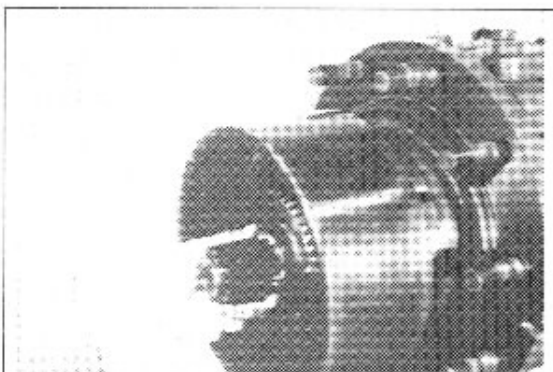


**(2) Internal gear**

- ① Squeeze out circlip, remove shim and loosen socket head screw.

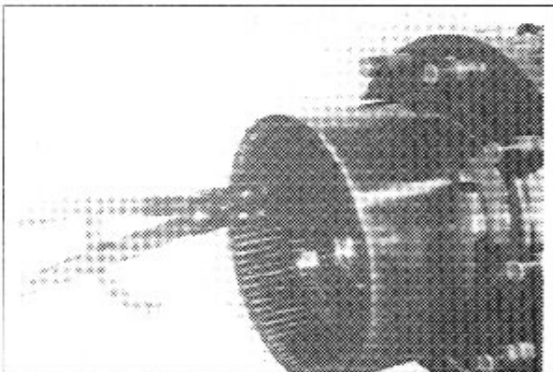


- ② Pull sun gear shaft together with inner plate carrier from the universal shaft, resp. out of the plate pack.  
Remove released thrust washer.

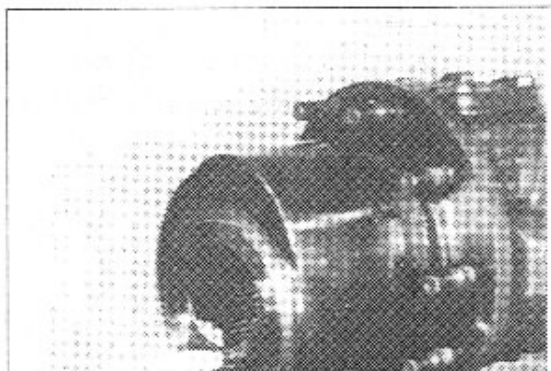


- ③ Squeeze out circlip.  
Clamping piers

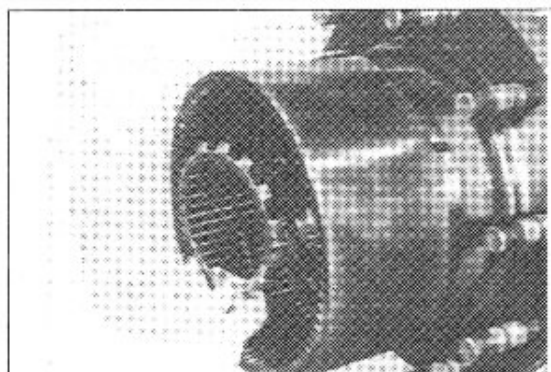
5870 900 001



- ④ Remove backing plate and plate pack.

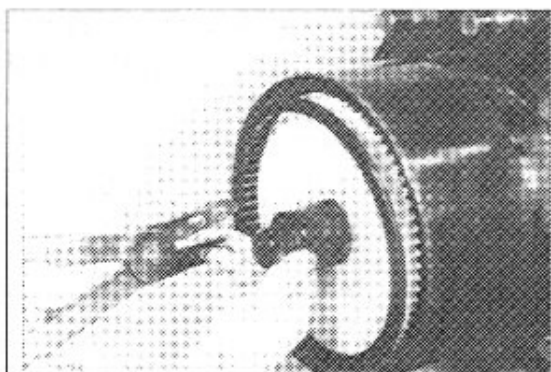


- ⑤ Remove lock plate

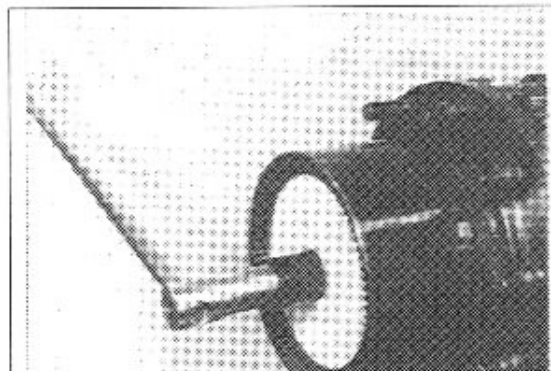


- ⑥ Apply hook spanner, assemble centering disk and fix it axially by means of circlip.

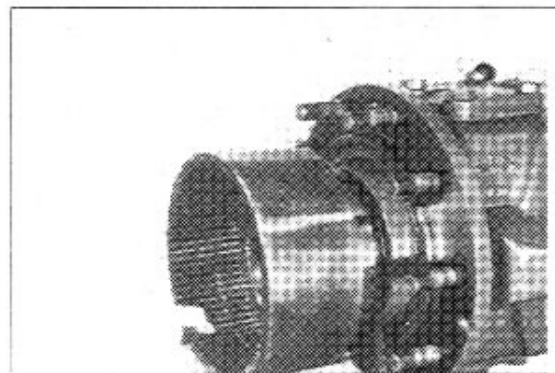
Hook spanner                    5870 401 105  
Centering disk                5870 912 011



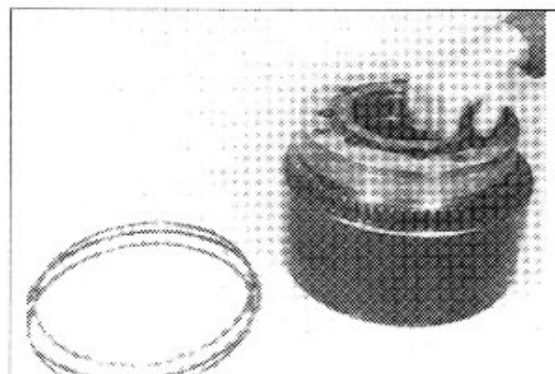
- ⑦ Loosen slotted nut.



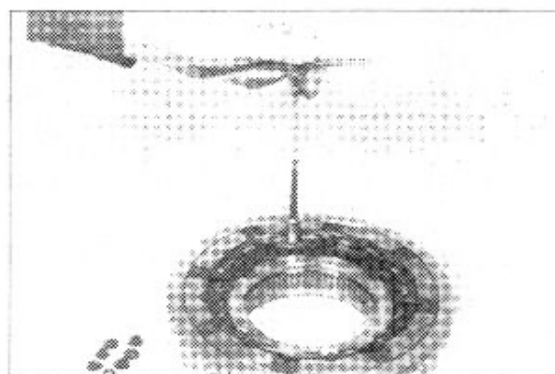
- ⑧ Separate internal gear.  
Internal gear carrier(Compl.) from the  
steering knuckle hull.



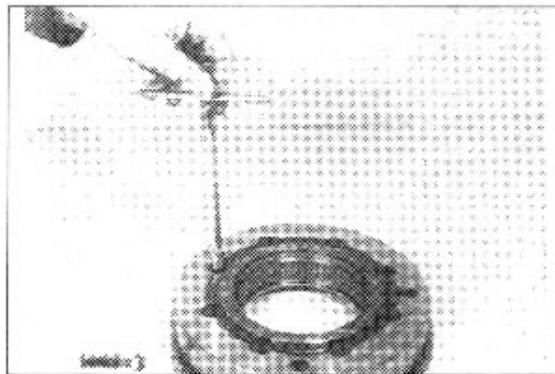
- ⑨ Squeeze out snap rings(3 pieces) and  
separate internal gear from internal gear  
carrier.



- ⑩ Loosen lock nuts.

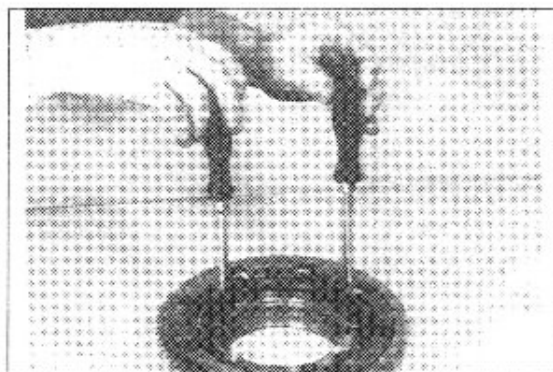


- ⑪ Loosen all hexagon head screws and  
remove them together with compression  
springs and spring caps.

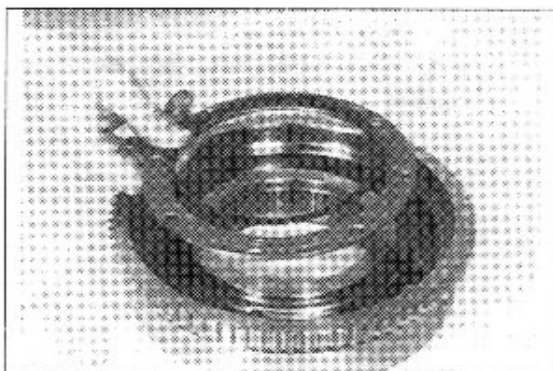




- ⑫ Press piston out of the bore of the internal gear carrier.



- ⑬ Squeeze out snap ring and remove it together with washer.

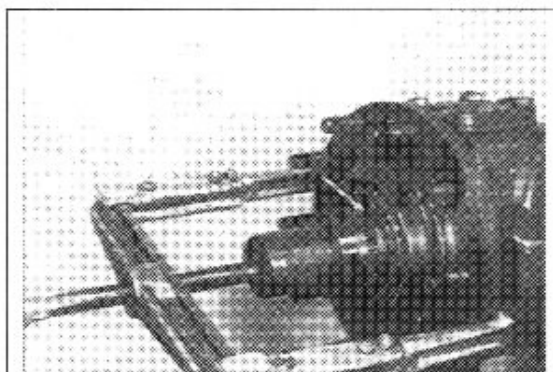


### (3) Hub

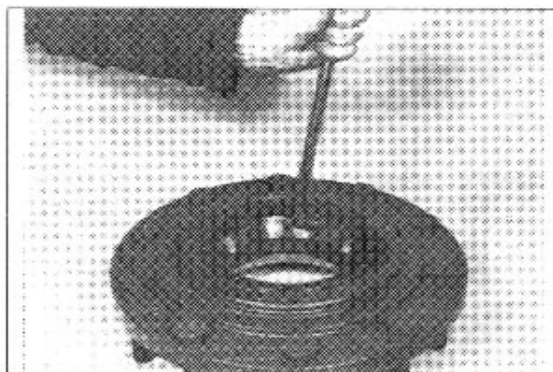
- ① Remove back up ring and O-ring, see arrow and separate hub from the steering knuckle hull by means of puller.
- ※ Pay attention to the released tapered roller bearing.

Tow leg puller

5870 970 007



- ② Remove plug in seal ring.
- If required, drive both bearing outer races out of the hub bores.

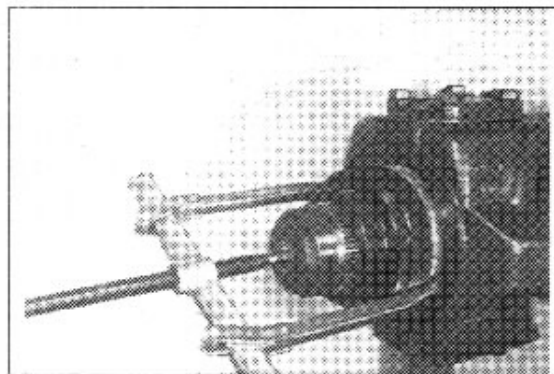


#### (4) Steering knuckle hull

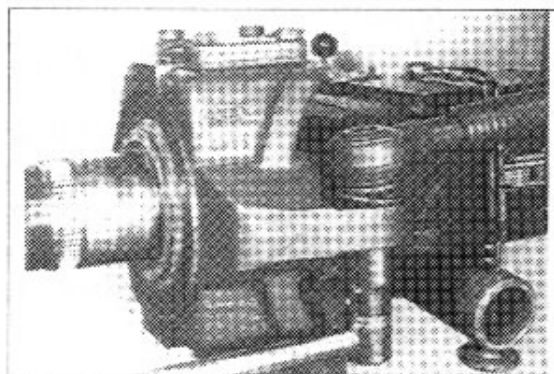
- ① Remove spacing ring and pull tapered roller bearing from the steering knuckle hull.

Grab sleeve Super 5870 028 009

Two leg puller 5870 970 006



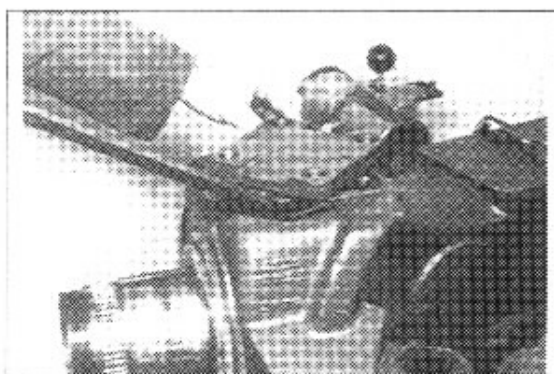
- ② Unlock castle nut, loosen and unhook tie rod.



- ③ Loosen hexagon head screws and remove both bearing pins(Compl.).

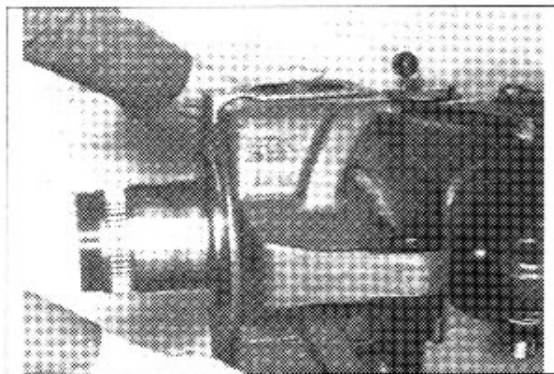
※ Pay attention to the released thrust washer(Only with upper bearing pin).

Pry bar 5870 345 065



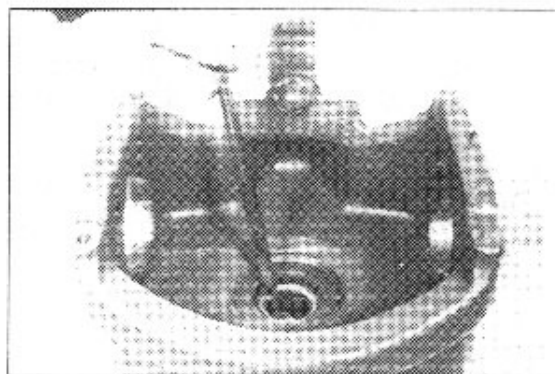
- ④ Separate steering knuckle hull from the axle.

※ Pay attention to the released universal shaft.



- ⑤ Remove sealing components and pull liner situated behind it out of the bore, using internal puller.

Pry bar	5870 345 065
Internal puller	5870 300 007
Support	5870 300 003

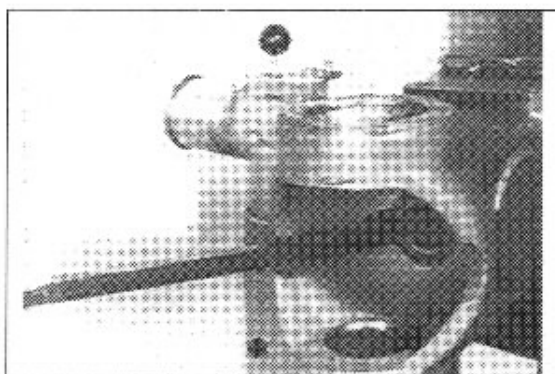


#### **(5) Axle housing**

- ① Remove sealing component and pull liner out of the bore.

Pry bar	5870 345 065
Internal puller	5870 300 007
Support	5870 300 003

- ※ If required, drive both sealing caps and bearing outer races out of the steering knuckle bores.



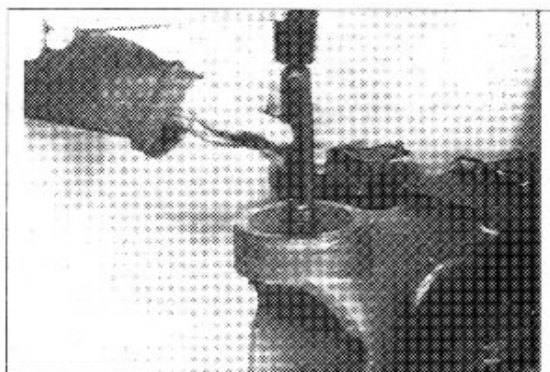
## 2) REASSEMBLY

### (1) Axle housing

- ① Install sealing caps, resp. bearing outer races.

※ Install sealing caps with loctite No.573.

Driver	5870 057 015
Driver	5870 058 078
Handle	5870 260 002



- ② Drive in sleeve flush mounted.

※ Pay attention to the radial installation position(lubricating groove below) of the sleeve.

Drive	5870 055 081
Handle	5870 260 002



- ③ Install sealing component firmly against shoulder.

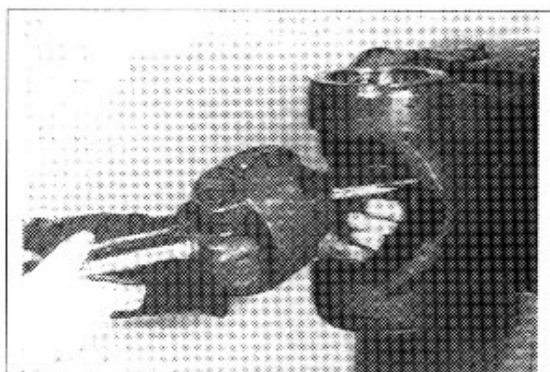
※ Cover outer diameter with sealing compound(Curil T).

Lubricate sealing lip and liner.

Driver	5870 055 081
Handle	5870 260 002



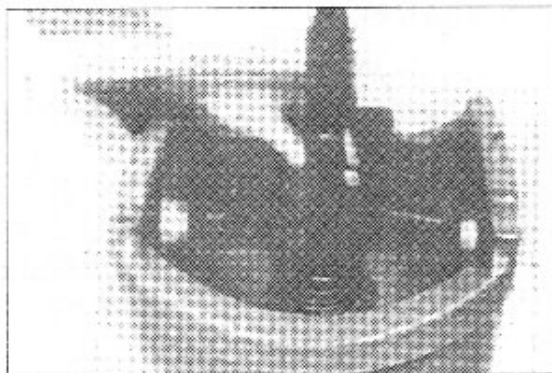
- ④ Introduce universal shaft into the axle housing until the splines have been received in the differential.



## (2) Steering knuckle hull

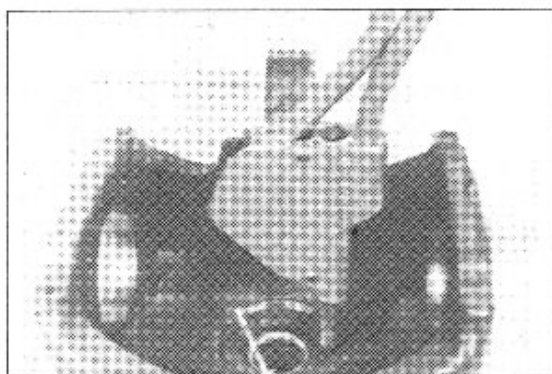
- ① Drive in sleeve flush mounted.
  - ※ Pay attention to the installation position with installed steering knuckle hull, the lubricating groove of the sleeve must be showing towards below.
  - ※ Cover shaft seal with sealing compound and drive it firmly against shoulder. Lubricate sealing lip of the shaft seal and the liner.

Driver	5870 055 081
Handle	5870 260 002

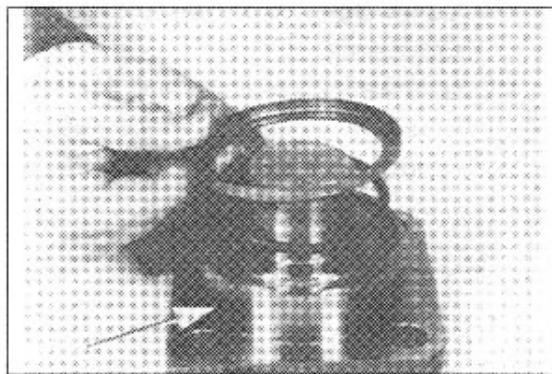


- ② Close both bores by means of king plugs.
  - ※ Clean oil bores carefully from residues (Anti-corrosion agent), prior to the installation of the screw plugs.

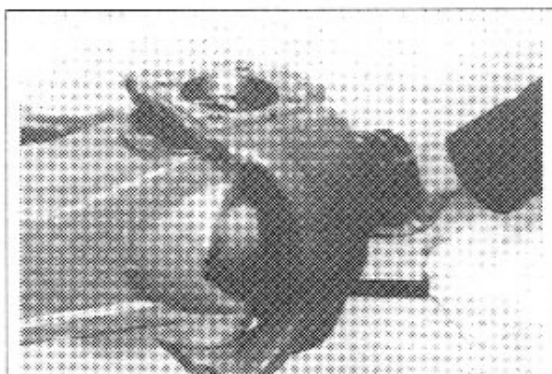
Lever riveting tongs	5870 320 006
----------------------	--------------



- ③ Grease O-ring, insert it into the annular groove of the bearing pin and replace sealing cap with the plane face showing towards the O-ring. Heat tapered roller bearing and replace it firmly against shoulder.
  - ※ Cover collar of the planetary shaft (See arrow) with anti-corrosion agent.



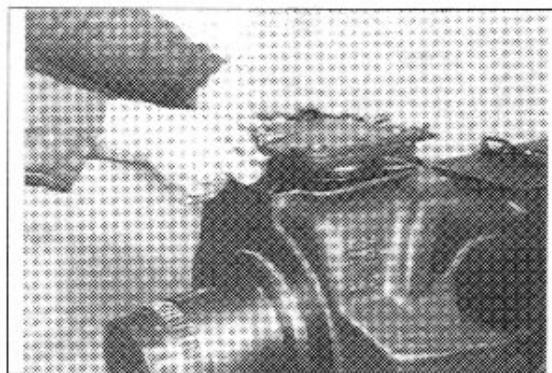
- ④ Guide steering knuckle hull over the dual joint shaft and position it at the axle housing.
  - ※ The lifting of the universal shaft would avoid damaging of the shaft seal.





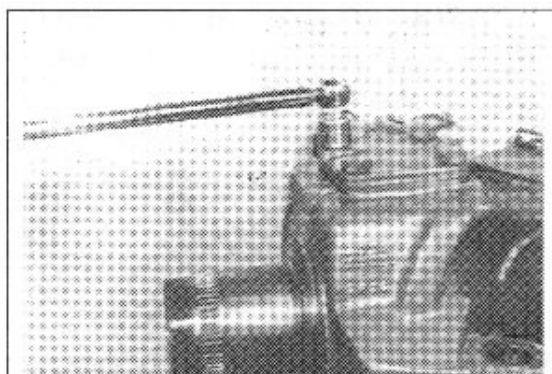
- ⑤ Fix steering knuckle hull by means of both bearing pins.

※ With the upper bearing pin insert spacing washer(Experimental value  $s = 1.0\text{mm}$ ). Pay attention to the installation position of the bearing pins threads for grease nipple showing towards the axle center.



- ⑥ Fasten both bearing pins by means of hexagon head screws.

• Torque limit :  $41.8\text{kgf} \cdot \text{m}$ ( $302.4\text{lb} \cdot \text{ft}$ )



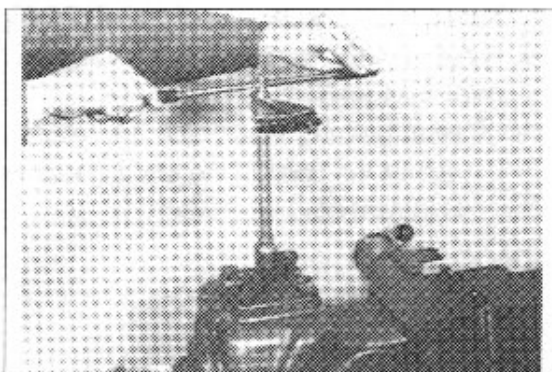
- (3) Check bearing rolling moment of the steering knuckle bearing.

Normal value  $4.1\sim 5.1\text{kgf} \cdot \text{m}$ ( $29.5\sim 36.9\text{lb} \cdot \text{ft}$ )

- ① In case of deviations from the prescribed rolling moment, correct by means of a corresponding spacing washer(Figure ⑤ above).

Spaner

5870 656 004



- (4) Hub

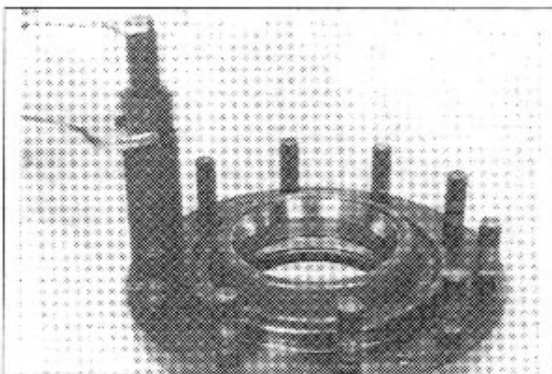
- ① Pull wheel studs into the hub bores.

Wheel stud puller basic set

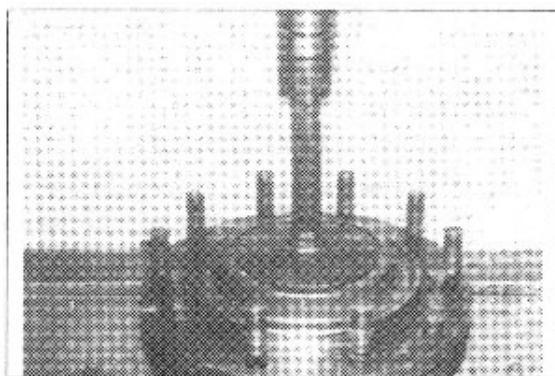
5870 610 001

Insert M22  $\times$  1.5

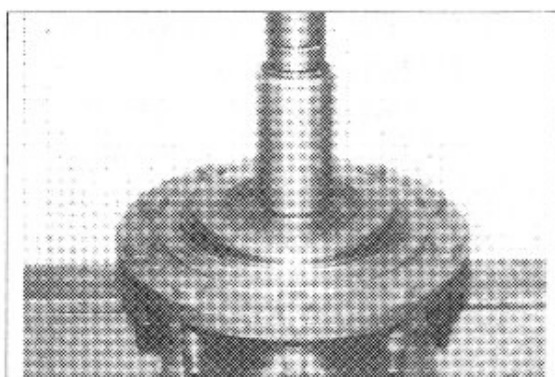
5870 610 002



- ② Press bearing outer races into both hub bores.

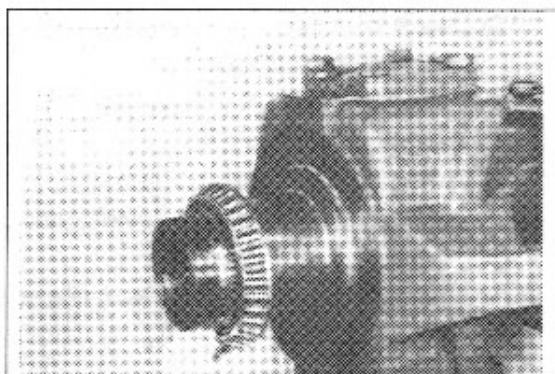


- ③ Press in plug in seal ring flush mounted.  
 ※ Cover outer diameter with sealing compound(Curil T).  
 Driver 5870 051 018  
 ※ To be used with hand lever press.

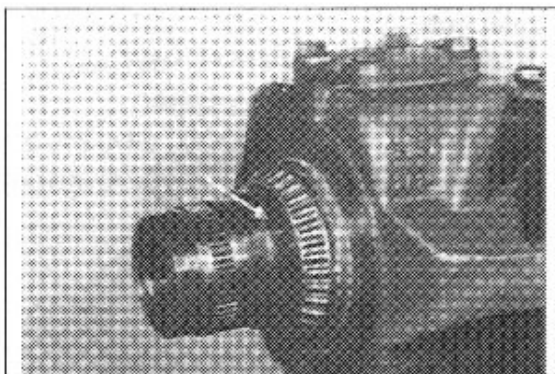


#### **Adjust rolling resistance of wheel bearing**

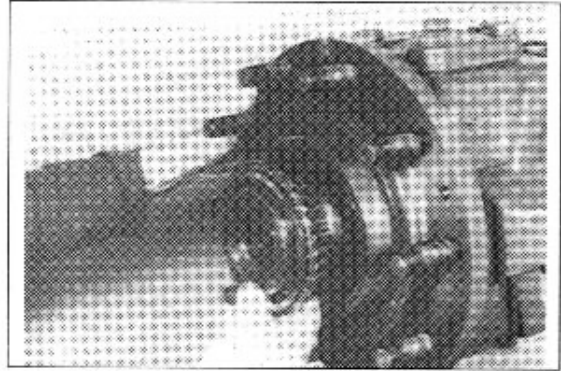
- ※ Rated value for new bearing :  $13 \sim 1.8 \text{ kgf} \cdot \text{m}$   
 (With shaft seal)  
 ④ Heat bearing inner race and place it against the collar of the steering knuckle hull until contact is obtained.



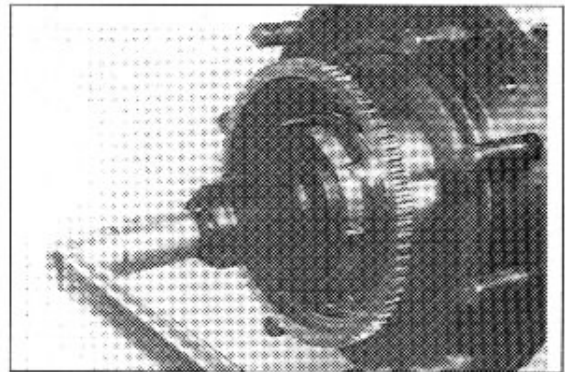
- ⑤ Assemble spacing ring, see arrow.  
 ※ If the hub as well as both wheel bearings have not been renewed, we recommend to install the actual spacing ring again. Important, however, is the rolling resistance of the wheel bearings(See figure (5), next page).



- ⑥ Assemble preassembled hub and fix by means of heated bearing inner race.



- ⑦ Assemble internal gear carrier and tighten slotted nut provisionally.  
• Torque limit : 122.4~142.8kgf · m  
(885~1033lbf · ft)



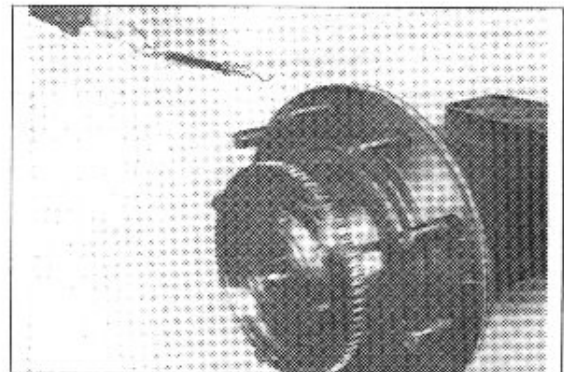
**(5) Check rolling resistance of the wheel bearing "T=F × R"**

T = Rolling resistance in kgf · m

F = Traction force in kgf · m

R = Radius in m

- ※ If the required rolling resistance (1.3~1.8kgf · m) is not obtained, correct by means of a corresponding ring(Figure ⑤ at page 8-211).



- ① Afterwards, loosen slotted nut again and remove internal gear carrier.

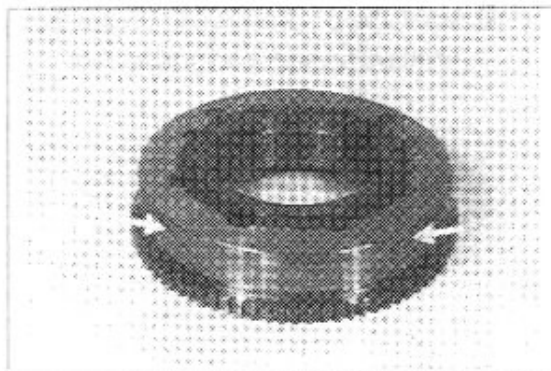


**(6) Internal gear**

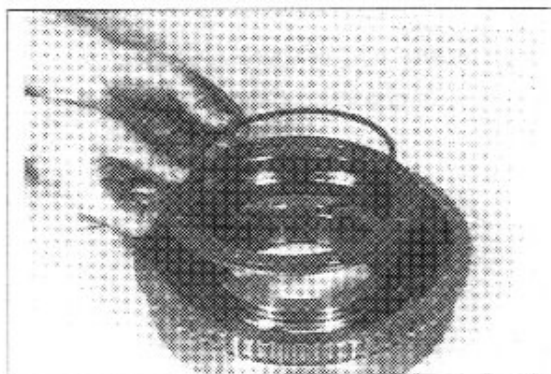
- ① Close both bores by means of king plugs, see arrows.

Lever riveting tongs

5870 320 016



- ② Insert disk and fix it by means of snap ring.

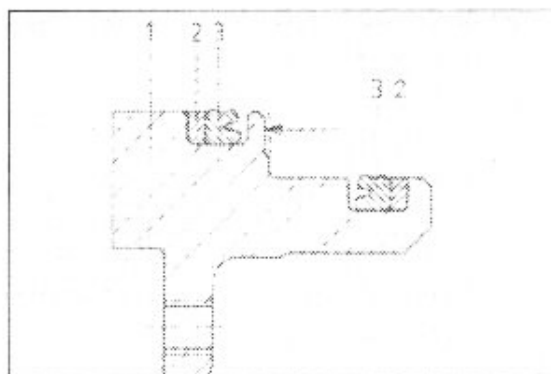


- ③ Heat both back up rings and insert them into the recesses of the piston.

Install U section rings with the sealing lip showing to the pressure chamber (Arrow).

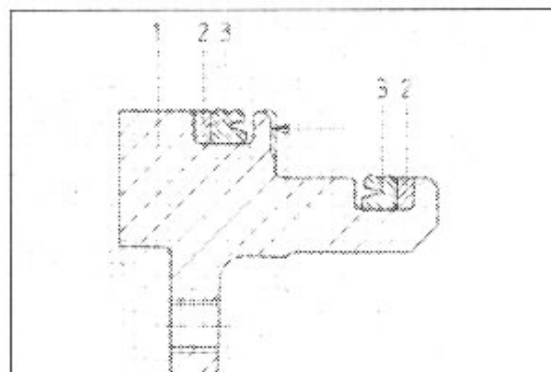
- \* Lubricate back up rings and U section rings (Use W10 oils).

- 1 Piston
- 2 Back up ring
- 3 U section ring
- X Pressure chamber



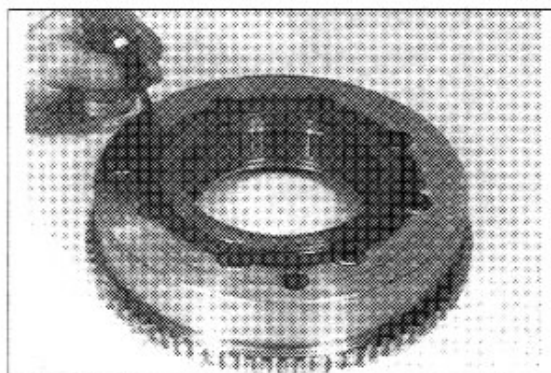
- ④ After the back up rings have cooled down, insert piston firmly into the internal gear carrier.

- \* Pay attention to a radial installation position.

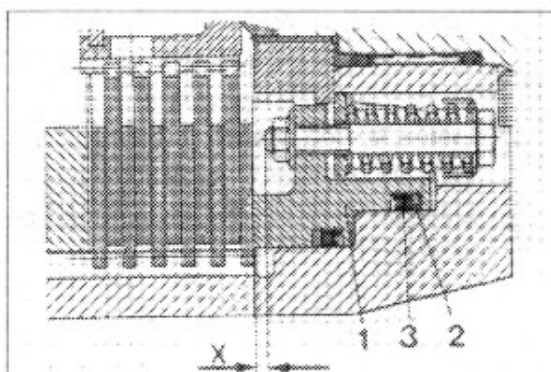


- ⑤ Assemble spring caps and compression springs and fix piston by means of hexagon head screws.

※ Screw in the screws until a dimension X of 0.5~1.0mm measured from the plane face/piston to the screw end has been obtained, see figure 51 below.



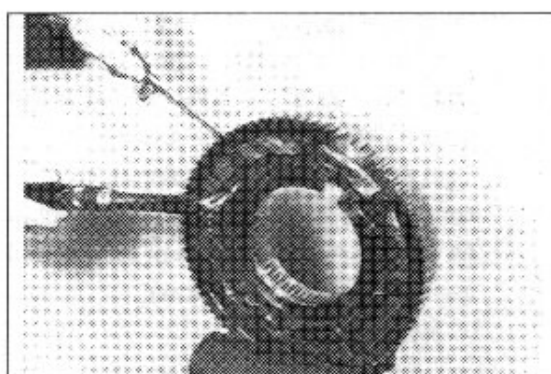
- 1 Piston  
2 Retaining ring  
3 Grooved ring  
X 0.5~1.0mm



- ⑥ Hold hexagon head screws tight and check them by means of lock nuts.

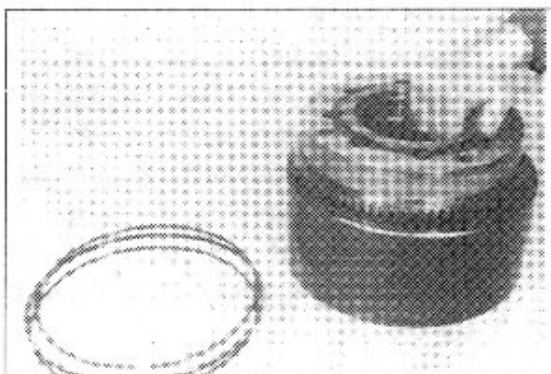
• Torque limit : 1.1kgf · m(8.1bf · ft)

※ Secure locking nut with loctite No.242.

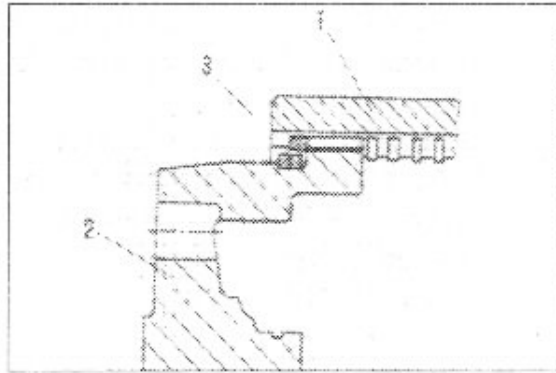


- ⑦ Insert preassembled internal gear carrier into the internal gear and fix by means of snap rings(3 pieces).

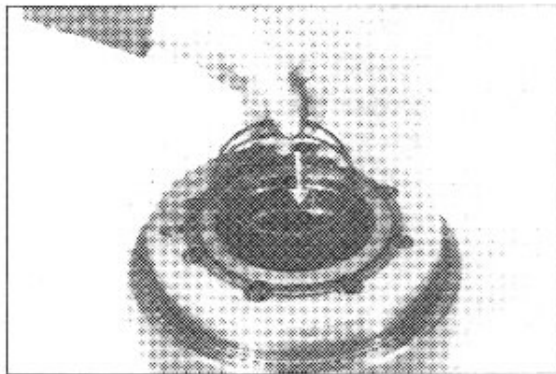
※ Installation position, see drift(Figure top of next page).



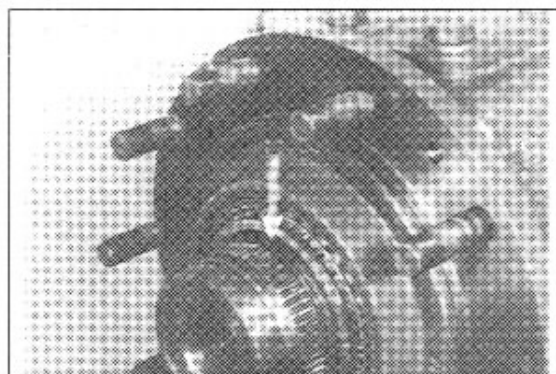
- 1 Internal gear
- 2 Ring gear carrier
- 3 Snap ring



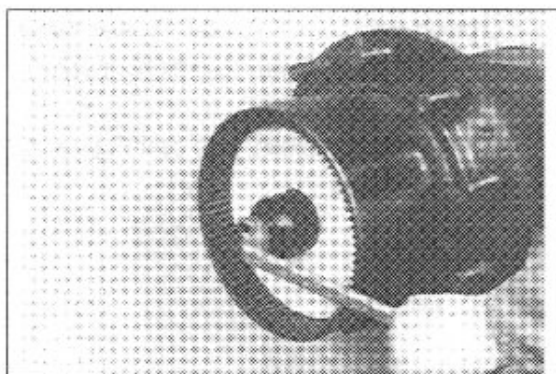
- ⑧ Insert back up ring and O-ring into the recess of the internal gear carrier, see arrow.
- ※ Install O-ring, showing towards the pressure chamber (Towards above).  
Lubricate back up ring and O-ring (Use W10 oil).



- ⑨ Insert split back up ring as well as O-ring (Showing towards the pressure chamber) into the annular groove of the steering knuckle hull, see arrow.
- ※ Both ends of the back up ring must have contact (Use assembly grease) in order to allow a correct installation of the internal gear carrier (Figure ⑩ below).



- ⑩ Guide internal gear (Compl.) over the splines of the steering knuckle hull and pull it carefully by means of slotted nut over the O-ring and the back up ring.
- ※ During the assembly of the internal gear carrier pay attention to a precise overlapping of the pressure oil lines (Steering knuckle hull/Internal gear carrier.)

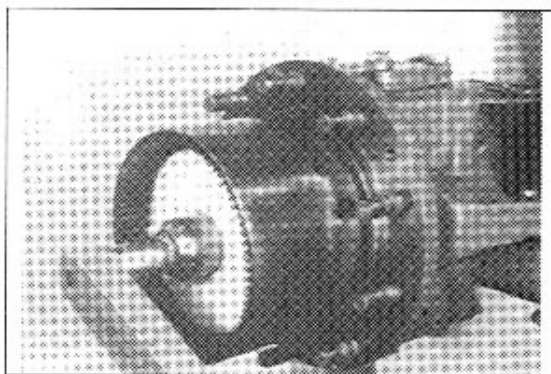


⑪ Tighten slotted nut.

- Torque limit : 122.4~142.8kgf · m  
(885~1033lbf · ft)

※ Within the tolerance envelope of the torque limit, a locking of the slotted nut is possible by means of lock plate(Aim at higher value).

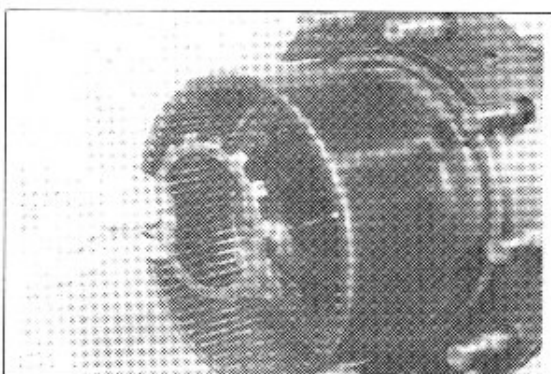
Hook spanner	5870 401 105
Centering disk	5870 912 011



⑫ After location of the two locking lobes to be beaded, by a provisional positioning of the lock plate at the slotted nut, bead the locking lobes in a vise.



⑬ Fix slotted nut by means of lock plate.

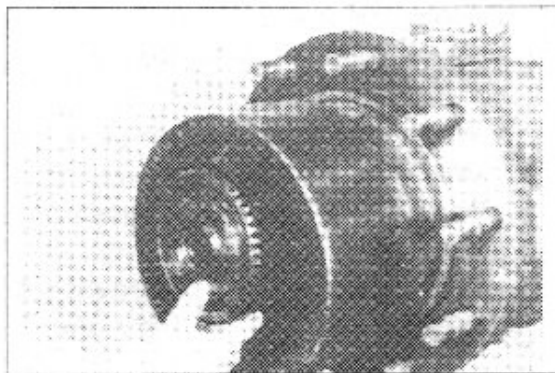


⑭ Make thrust washer adhere with grease.

※ If a correct contact of the thrust washer at the steering knuckle hull has been obtained, both lobes of the lock plate(Inside) have to be reset.



- ⑮ Install inner plate carrier.



## (7) Multi disk brake

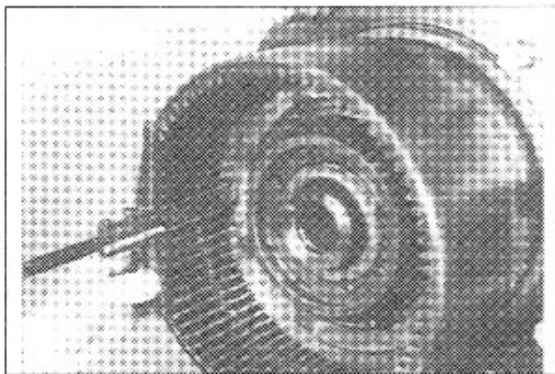
Clearance = Piston stroke to be adjusted according to the following table figure ① to example III :

Number of inner plates	Number of friction surfaces	Clearance piston stroke in mm
2	4	1.6 ~ 2.0
3	6	2.4 ~ 2.8
4	8	3.2 ~ 3.6
5	10	4.0 ~ 4.4

- ① Determine dimension **A** from the end face (Internal gear to the plane face) piston.

• Dimension **A** e.g. .... 90.5mm

- ※ During the determination of the dimension **A** pay attention to a correct contact of the piston with the internal gear carrier.

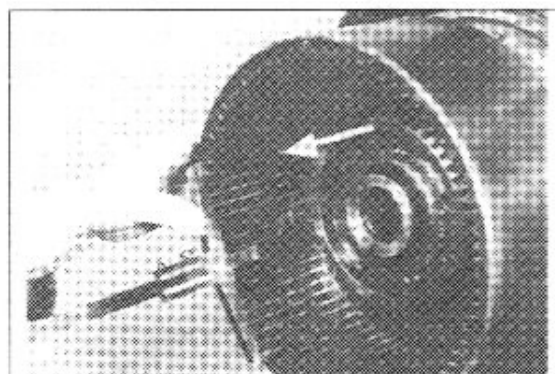


- ② Engage circlip and place it against the outer face of the recess (Direction of arrow) until contact is obtained.

Measure dimension **B** from the end face/ internal gear to the inside shoulder of the circlip.

• Dimension **B** e.g. .... 63.5mm

Afterwards, remove circlip again.



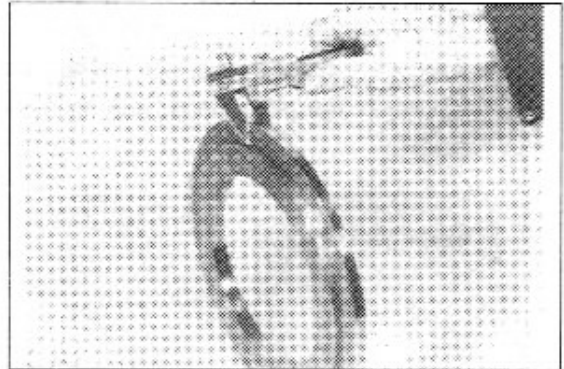


**Example I**

Dimension A	90.5mm
Dimension B	- 63.5mm
Difference = Dimension I	27.0mm

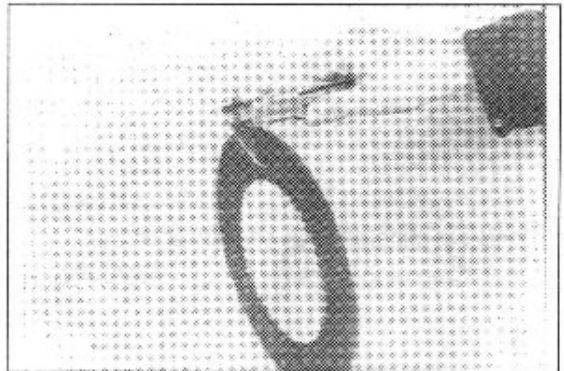
- ③ Determine dimension **C** (Thickness of backing plate).

• Dimension C e.g. 9.5mm

**Determine total thickness of plate pack**

- ④ Measure each of the waved outer plates separately (As illustrated on the adjacent figure).

• Dimension **D** (Plate pack) e.g. 15.5mm

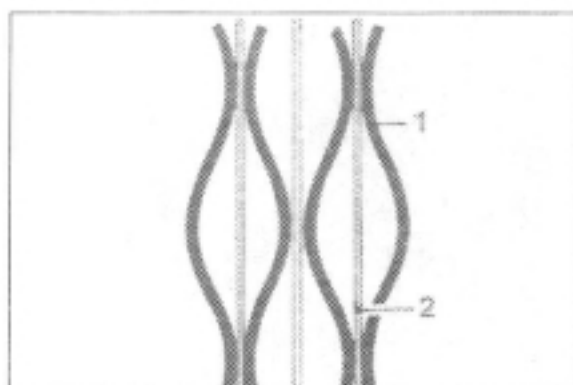
**Example I**

Dimension C	9.5mm
Dimension D	+ 15.5mm
Gives Dimension II	25.5mm

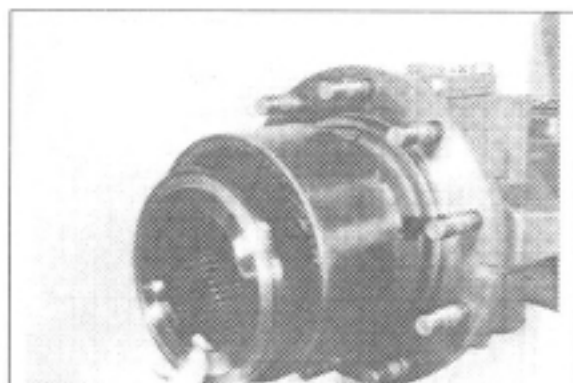
**Example II**

Dimension I	27.0mm
Dimension II	- 25.0mm
Difference = Plate play e.g.	2.0mm

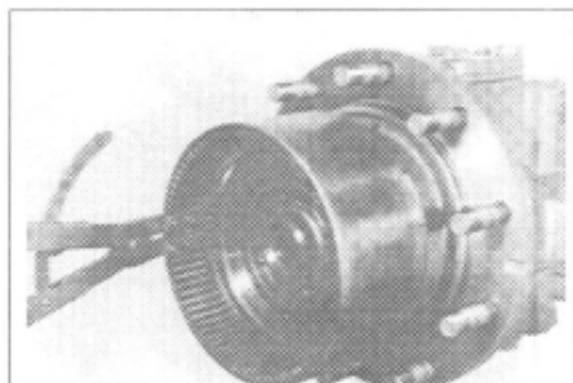
- ※ If the required clearance(See table, page 8-218)is not obtained, correct by means of a corresponding outer plate.
- ⑤ Install alternating outer(1) and inner plates(2).
- ※ Pay attention to the plate arrangement of the waved outer plate, see right figure.
- ※ If required, install thinner outer plates(s = 2.0mm) at the piston and backing plate side.



- ⑥ Insert backing plate.



- ⑦ Fix plate pack by means of circlip.
- Clamping pliers                      5870 900 011



### **Check brake hydraulic system for tightness**

- ※ Bleed brake hydraulic system and actuate it several times prior to start the check.

#### **High pressure test**

Pressurize brake with 120bar. After 5 minutes the pressure drop may not exceed 2%(117bar).

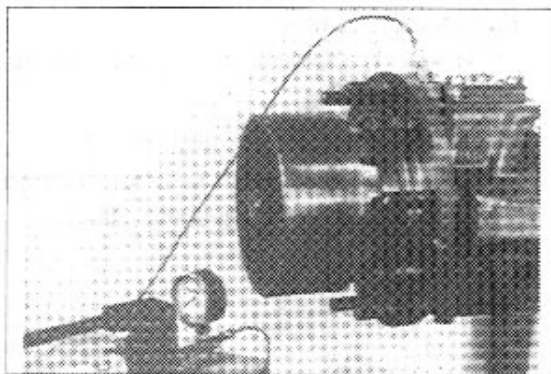
#### **Low pressure test**

Pressurize brake with 5bar. After 5 minutes there may be no visible pressure drop.

#### **Test media**

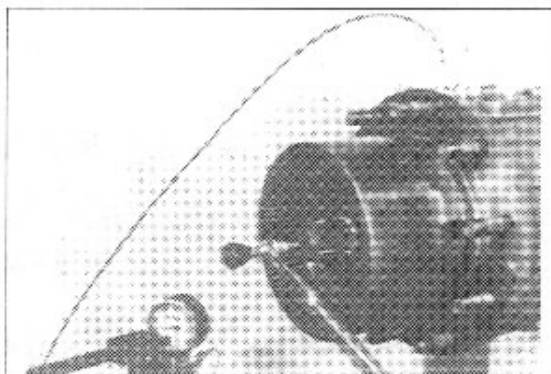
Motor oils SAE 10W, corresponding to MIL-L 2104C ATF-oils, type A suffix A dexron II D.

HP pump compl. 5870 287 007



- ⑧ Whilst the multi disk brake is pressurized insert sun gear shaft and tighten socket head screw.

- Torque limit : 12.2kgf · m(88.5lbf · ft)



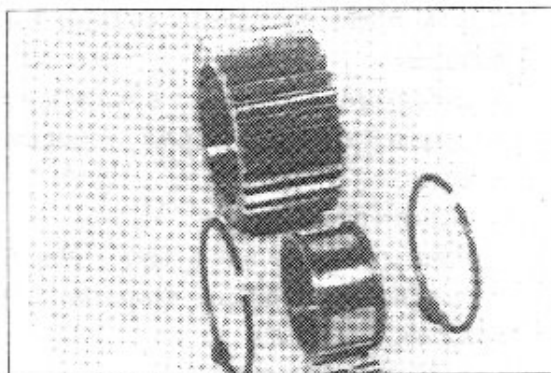
- ⑨ Install shim and engage circlip, see figure.



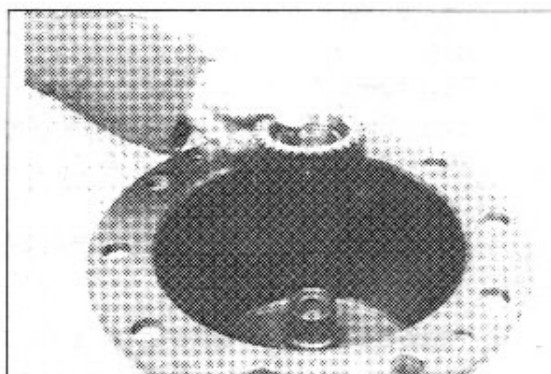


**(8) Planetary carrier**

- ① Install components as illustrated on the adjacent figure.
- ※ Install cylindrical rollers with grease.
  - Broad stop face of L-shaped rings showing towards the bearing rollers.

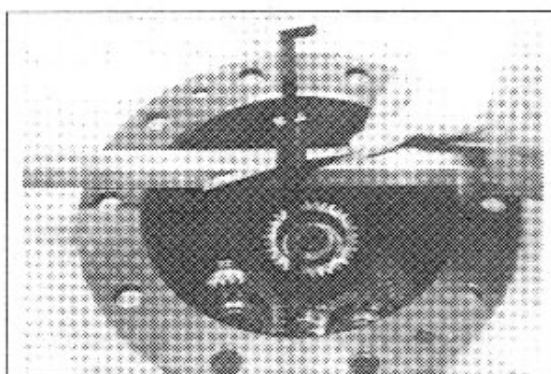


- ② Heat bearing inner race, replace planetary gears firmly against shoulder and fix them by means of circlip.
- ※ Large radius of the bearing inner race is showing towards the planetary carrier (Towards below).

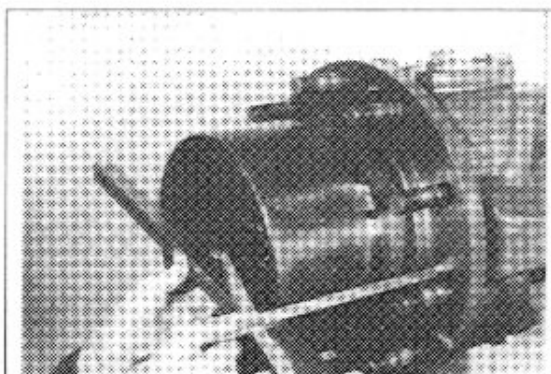


**Adjust end play of the universal shaft (0.4~0.6mm)**

- ③ Measure dimension **A** from the flange facing to the contact face of the thrust washer.
- Dimension **A** e.g. .... 205.2mm



- ④ Slide sun gear, resp. inner plate carrier firmly against shoulder.
- Determine dimension **B** from the end face/sun gear shaft to the flange facing/hub.
- Dimension **B** e.g. .... 202.5mm



**Example**

Dimension A ..... 205.2mm

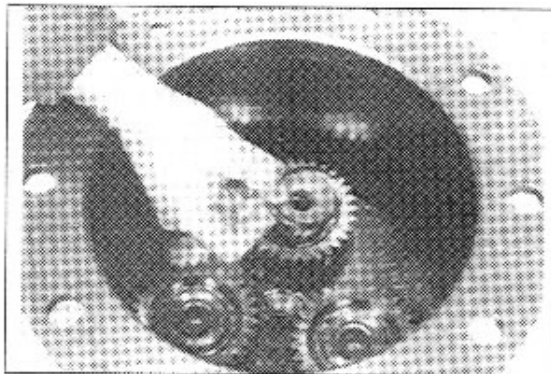
Dimension B ..... - 202.5mm

Difference ..... 2.7mm

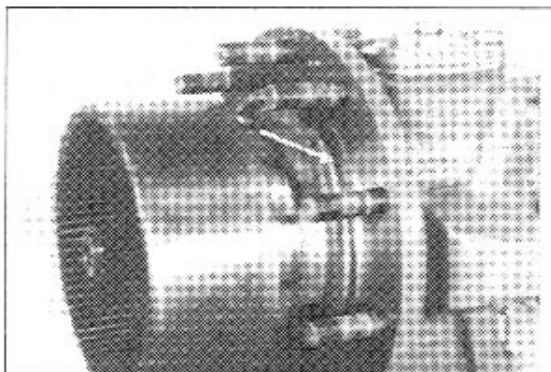
Required end play e.g. .... - 0.5mm

Difference = Thrust washer thickness  
e.g.  $s = 2.2\text{mm}$

- ⑤ Insert thrust washer(e.g.  $s = 2.2\text{mm}$ ) and fix by means of snap ring.



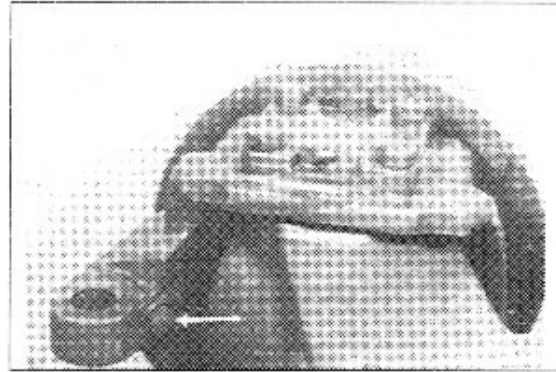
- ⑥ Insert O-ring into the annular groove of the hub, see arrow.



- ⑦ Assemble planetary carrier and fasten by means of two socket head screws.  
• Torque limit :  $8.8\text{kgf} \cdot \text{m}$  ( $63.4\text{lb} \cdot \text{ft}$ )



- ⑧ Tighten stop screws, see arrow.



- ⑨ Engage tie rod, tighten castle nut and secure by means of cotter pin.  
※ Pay attention to the lubrication instructions for at page 8-199.

